P. R. MALLORY & CO. Inc.

MALLORY YAXLEY

RADIO SERVICE ENCYCLOPEDIA

Limited Edition $2.50

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Compiled and Published by

P. R. MALLORY & CO., INC.

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OUR THANKS TO YOU . . .

For years it has been the Mallory-Yaxley pledge to retain leadership in furnishing constructive, helpful information, and assistance to the Radio Service Fraternity—and to make that information worthy of its confidence. In this, the first Radio Service Encyclopedia, there is ample evidence of this pledge.

To boast of the possession and maintenance of the largest service "Morgue," or service library, in the world means little. It does mean much, however, to boast of the thousands of friends in the Radio Service Fraternity who, for almost three years, have helped to "cut and try"—to reject and finally accept only those improvements that were proven helpful and valuable. Their devotion and loyalty to an ideal—their friendship and their help has made the possession and constant maintenance of the service library possible. To them, we are deeply grateful.

Generous, spontaneous, willing help was evidenced at every request.

To RCA Manufacturing Company, Inc., Galvin Mfg. Co., General Radio Company, Radio Retailing, Radio News, The Radio Amateur's Handbook, Gernsback Publications, Inc., and to Radio Engineering Handbook by Keith Henney (Copyright McGraw-Hill Book Company, Inc.), we acknowledge a special debt of gratitude for their permission to use articles, charts, and other valuable information without which it would have been impossible to make the Encyclopedia complete.

In dedicating this Encyclopedia to the Radio Service Fraternity, we are also dedicating it to those who have made it possible.

You are always welcome at the Mallory Factory where you may review and witness the continued research and development work—an activity that warrants your 100% confidence.

First Edition—January, 1937
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IN ORDER THAT YOU MAY UNDERSTAND HOW IT HAPPENED

IN PRESENTING the first real radio service encyclopedia, Mallory-Yaxley venture the hope that it will prove more helpful than any volumes yet published—and the belief that it will receive an enthusiastic reception from the radio service fraternity.

The encyclopedia has only one purpose—to help service men. It is designed to aid its readers in their daily work—to save their valuable time—to give them quickly the correct answer to any and every radio service problem. Conceived over three years ago, its birth now permits a frank exposition of "How It Happened"—and here follows the story.

Early in 1934, Mallory-Yaxley realized the paucity of correct service data. Several manufacturers sincerely were attempting to provide charts and guides for recommending their single product for various radio receivers. Two magazine publishers offered books of schematics for sale. But the radio service profession was dissatisfied because most of this material gave only one point of view—one opinion and only one answer—the answer all too often an incorrect guess. All that was available was a point of view, an opinion not based on actual experience of the radio service fraternity, but on the beliefs of the manufacturer or publisher who had something to sell.

Service men told us they were sick and tired of hunting, of fruitless searching for information—weary of looking through dozens of books to get the "dope" they needed. They told us their problems. They said there seemed to be no solution. "There were too many sets—out of date—obsolete—to ever catch up with." Apparently it was hopeless. "Too many changes in production to watch for." In short, it looked like an impossible task to bring all needed information into handy reference form.

But we had a hunch. We thought, "There is only one way to do it. That way is to get the men who actually service these sets to tell us how they do it, why they do it, and what they use."

So we undertook the job. Clearing houses were established in more than a score of cities where actual field-tested data was collected. After an exhaustive, careful search for the right talent, a group of twelve radio service men, with experience and businesses of their own, were employed full time to produce the work—and the "impossible" was on its way to a permanently helpful solution.

In May, 1936, after almost three years' research, the work was about completed—ready for assembling into three volumes. Then the editor had a bright idea. He remembered one friendly service man who had said, "My soul cries out for one book that will tell me all I have to know to repair a set. I'm mighty near crazy looking at schematics. I'm worn out with hunting for books that will answer my questions. I'm fed up with pawing through dozens of books to get what I want—usually to find no agreement—and no solution. Oh, if I had one reliable book!" We remembered that anguished cry. Said the editor, "We're going to give that young man what he wants. We are not going to print three books, we will print one. We will put together all the information we've collected. We will list under each manufacturer's name, all the models he has ever made. For each model of his make, we will tell, on one line, and on one page, everything we have found out about that model."

That was the big idea—and the idea went big. The boys in the field said it was a "honey"—that such a book would pay for its cost in time saved on the first set repaired.

This MALLORY-YAXLEY RADIO SERVICE ENCYCLOPEDIA is *that Book*. It is a book that will save you countless hours of time—many a headache, and it will help you make real money. This is a practical experience book. It is not theoretical. It has not been written or compiled by a manufacturer, his engineers, or by a staff of "guess artists." It has been written by service men, who have had the actual field experience, for service men who want practical help. Perhaps the Encyclopedia lacks something in academic form, but we think that it is clear and understandable. We believe that it will tell you what you want to know when you want to know it in the quickest, simplest, easiest, and correct way. We are sure that the way it has been compiled represents the way you would do it yourself.

In providing the financial aid that has made the book possible, Mallory-Yaxley will be content and happy if you find this book a real help—so much help that you will use it daily to make your work more effective and more profitable.

...TO MAKE YOUR WORK MORE EFFECTIVE AND MORE PROFITABLE...

To Help You!

THIS BOOK has only one purpose—"*to help you*". It is designed to aid you in your daily work—to save your valuable time—and to give you quickly the correct answer to any and every radio service problem. *It is divided into three major sections—*

Section "A"—Controls
Section "B"—Condensers
Section "C"—Vibrators

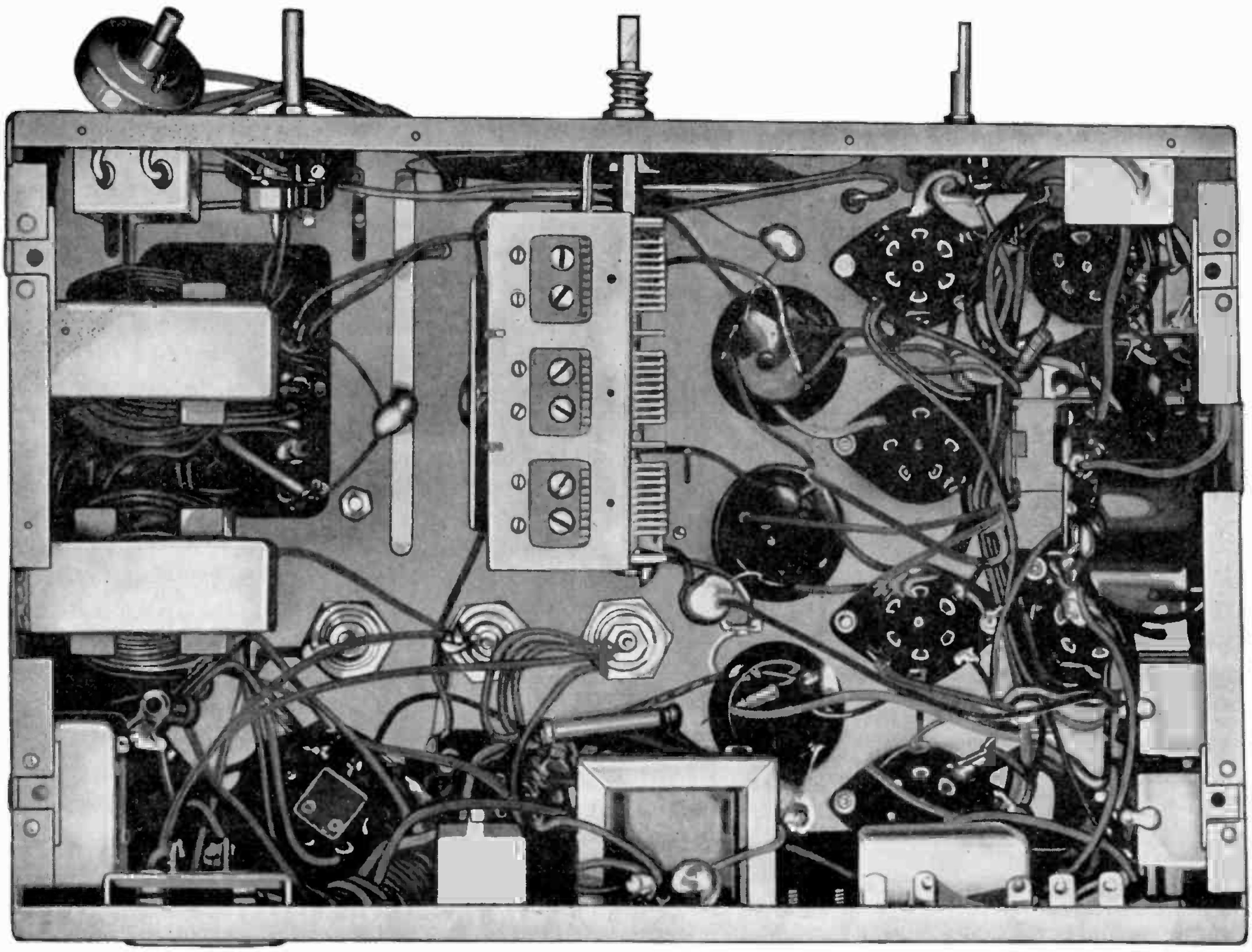
—and supplemented by complete sections covering Tubes, Transformers, and other vital information. Its use is simple.

But let us dispense with the "hooey" and start now to save you time. The best way is to show, through an actual case, how the ENCYCLOPEDIA will help you to repair a set that has gone bad. We are assuming that everything has worn out. The set is in terrible shape. There are many problems. Let's repair it quickly with an expenditure of a minimum amount of your time.

* * *

THE SET—Majestic Model 344 (chassis No. 340), (340-B)—is in your shop and you have turned it on its back to look it over. The illustration below shows what it looks like—exactly what you would see if you were looking at the chassis itself.

Now look at page 46 in this book.



MAJESTIC MODEL 344 (Chassis No. 340-340B)

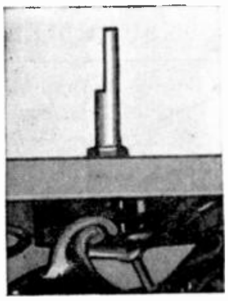
Here is what you see listed for this Majestic set:

MALLORY-YAXLEY RADIO SERVICE ENCYCLOPEDIA

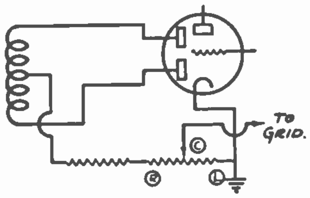
MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
MAJESTIC—Continued 340, 340B (344)...	Vol.	83	M........	....	....	....	8722.......	3	RS213.....	....	....	....	....	56, 58, 57, 59, 82....	175	3
	Tone	22	M........	6	....	....	8721.......	3	RN242.....	B8	....	....	....	....	....	....
	Supp.	12	Y........	....	....	....	7988.......	14	CS123.....	....	....	....	....	....	....	....
							9019.......	19	TS101.....	....	....	....	....	....	....	....
							8118.......	15	TS102.....	....	....	....	....	....	....	....

CONTROLS

You need a new volume control. Looking at the chassis you will see the volume control; i. e.:

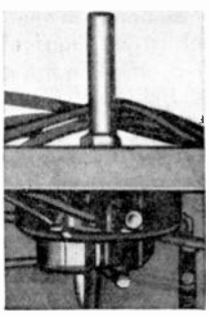


and here is its circuit (No. 83—on page 120).

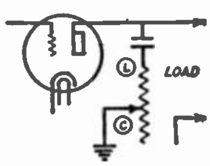


The correct replacement is a 250,000 ohm carbon control with a left-hand taper—Type M (page 100).

The Tone Control is next. Here's the way you see it in the chassis:

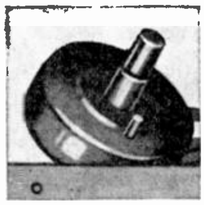


and here is its circuit (No. 22—on page 117).

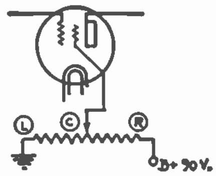


Again, the correct replacement is a 250,000 ohm carbon control with a left-hand taper—Type M (page 100). *But*, wait a minute. The original tone control had a line switch. All you have to do is use a No. 6 attachable switch—just as listed. Simple, isn't it?

Now there's one other control in the set—and it is called a suppressor control. In the set it looks like this:



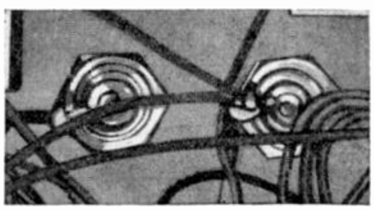
Here's the circuit (No. 12—on page 117).



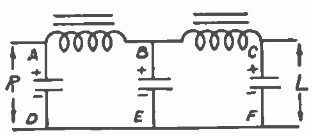
The right replacement is a 20,000 ohm carbon control, left-hand taper—Type Y (page 100), just as listed.

CONDENSERS

Condensers are next, and there are a flock of them. They're just as easy to replace—and quickly too. In the set your eye first lights on two units.



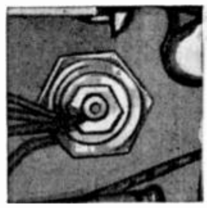
You can tell they are part of the filter circuit the moment you see the circuit (No. 3—on page 142).



Note that the rectifier is to the left and the load is to the right. This is the order of listing the condensers for this circuit.

When you examine the original condensers you will see they are marked with part number 8722. That checks with the listing. The correct replacements are 8 mfd. 450 volt single section round can filter units—Type RS213 (page 148).

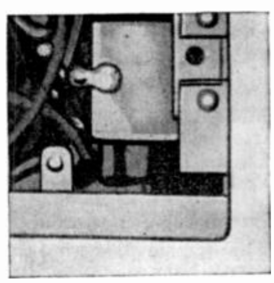
We've left one condenser in the row of three to examine. It looks like the first two—but it isn't.



It is marked with original part number 8721. The circuit is the same as for the first two condensers so it is part of the filter circuit. But, wait a second—there's a Note listed. *Wherever you see a Note specified in the "Note Column" you want to be sure to read it.* Note B8 on page 136 reads—"When a multiple section condenser is recommended to replace an original single section condenser, it is necessary to parallel the sections of the recommended replacement in order to obtain a capacity equal to, or greater than, that of the original."

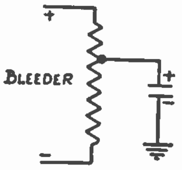
Well, the original part number 8721 proves to be a 16 mfd. 450 volt unit. The right replacement may be either a single 16 mfd. 450 volt unit, Type RS216 (page 148), or following the note, a common negative dual 8 mfd. 450 volt condenser, Type RN242 (page 148) which you may use satisfactorily by connecting the two red leads—paralleling the 8 mfd. sections to obtain a 16 mfd. capacity. We specified the dual 8 mfd. unit because you are more apt to have it on hand. Remember we're trying to save your time.

There are still four more condensers to cover. Let's take them one by one. The first is in the lower right-hand corner of the chassis. Here it is:



You have noticed a lack of screen voltage and sure enough this by-pass condenser has "shorted out."

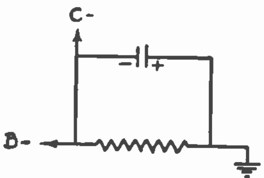
Circuit 14 on page 142 quickly provides the dope that this condenser is connected from a tap on a voltage divider to ground.



The original part is marked number 7988. On checking the listing you quickly find that this condenser is replaced with an 8 mfd. 250 volt single section cardboard carton unit, Type CS123 (page 148).

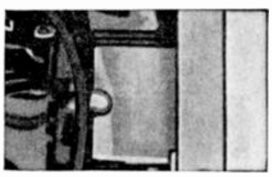
There's one condenser in your set which by-passes the screens of the RF amplifier and first detector, to the cathode of the 57S first audio tube, and boy "how it is leaking." You won't see it by looking at the bottom of the chassis for it's "cleverly" concealed. Get a laugh out of that. You'll find it eventually —and see that is has original part No. 9019.

Circuit 19 on page 142 gives connections.



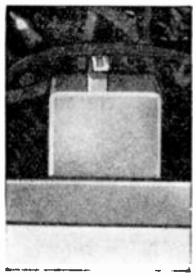
The correct replacement is a 10 mfd. 25 volt single section tubular by-pass unit, Type TS101 (page 148). Don't be alarmed at this low voltage for use in this circuit, for the potential difference of the circuit is not large even though one end of the condenser connects to 80 volts. You see—the actual voltage drop across the condenser is well within its rating.

If you don't know what a "Reactance Dimmer Indicator" is—let this tell you that in your set there's a circuit that dims the pilot light when the receiver is tuned to resonance with the station. The circuit you find is not working because the next to last one of the condensers in your set has "shorted out." This condenser is just above the one in the lower right-hand corner of the chassis and here's how it looks:

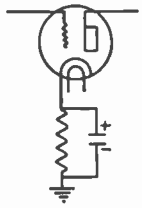


Marked part number 8118 shows it to be a 20 mfd. 25 volts, single section tubular by-pass unit, Type TS102 (page 148). It's a cinch to replace this baby.

Our last condenser check reveals that the bias voltage on the Type 59 driver tube is low. Here again is part No. 8118. The condenser is right in front of you at the almost center of the back of the chassis.



Reference to circuit No. 15 on page 142, clearly shows where the condenser is connected between the cathode of the Type 59 tube and the chassis.



Here the replacement is as simple as before, using a 20 mfd. 25 volt single section tubular by-pass unit, Type TS102 (page 148).

That completes our check on part of this particular Majestic chassis. Let's see what other help is here in the Encyclopedia. Let's start with "Tubes."

TUBES

Types of Tubes Used
39, 38, 85
57, 58, 75, 89, 6Z5
57, 58, 85, 89, 6Y5
57, 58, 75, 89, 6Z5
6E7, 6A7, 6C7, 42, 6Y5
30, 32, 33
30, 32, 33
24, 45, 80
24, 51, 47, 80
27, 51, 24, 45, 80

For your convenience every type of tube used in your set is listed. As a time saver this listing is of the greatest value when making a service call. Ask your customer for the model number of the set and take the right tubes you need with you when you make your call. You'll save yourself repeat trips to the shop. Time, gas, and mileage saved will pay you handsomely. Read pages 193 to 211 for up-to-date tube information. It's all there to help you. Where there have been tube changes from one type to another during production, they are indicated by a hyphen or the word "or;" i.e.: "6Z5-84" or "01A or 12A."

ALIGNMENT

I. F. Peak
456
345
172.5
456

Chances are, that now you have replaced a flock of parts—you'll need to line up the set. In the column headed I. F. peaks on page 46 you'll see that Majestic Model 340 is listed at 175 kc.—and on page 160 there's a swell article that will help you do the job quickly and accurately—that is if there's any doubt in your mind about how to do it. The "I.F. Peak" column is of the greatest benefit because it is a complete list of I.F. peaks, larger by far than any other compilation ever issued.

TRANSFORMERS

Trans. Circuit
MG
3
31

Possibly the transformer is defective. Transformer circuit No. 3 on page 166 shows you the number of windings and their arrangement. Boy—what a help when you need it. And when you need it, is when it saves you time and makes your profit real. The transformer data and circuits on pages 164 to 167 will be found most beneficial because they enable the purchase of a correct replacement and the "straightening out" of receivers on which the wiring has been changed. They also facilitate "re-building" jobs.

PAPER BY-PASS UNITS

On page 134 you'll find a "honey" of an article headed "By-Pass Condenser Circuits" followed by some real meat in an article headed "Capacity of By-Pass Condensers." These tell you how you can free yourself from depending on general schematics—from failure to find the dope you want—and make you certain of getting the right answer always. You don't need to use canned type replacements. Individual (Type TP) units installed at points to be by-passed give better results as proved by modern practice.

RESISTORS

Resistors, in the great majority of cases, are color coded (RMA Standard) and they're simple to replace, as you well know. On pages 168 and 169, the code has been reproduced and there's a valuable resistor wattage chart to help you. In older sets where a color code was not used, you'll find it necessary to figure the value yourself—and here's a good way to do it. Divide the voltage drop (required) across the resistor, by the current (in amperes) flowing through the resistor and the result will be the resistor value.

Example: A screen voltage of 100 is required. The screens will draw one milliampere at 100 volts. The supply voltage is 250 volts. The supply voltage of 250 volts minus the voltage required (100 volts) indicates a voltage drop of 150 volts (required).

Dividing the voltage drop (required) of 150 volts by the current in amperes (.001) gives an answer of 150,000 ohms—or the value of the resistor you want to use. That's simple—isn't it?

You don't have to hunt for the value of the voltage required at different tube elements because this dope is given on pages 193 to 208 in "Complete Tube Charts."

VIBRATORS

Section "C" Vibrators, on pages 151 to 159 is the most direct, simple, and concise article ever published. It answers every vibrator, auto radio, and vibrator power pack problem you will ever have. There's nothing to "Shy away from" in an automobile radio receiver. After reading this section you'll know that, and if you are not serving this fast-growing radio ownership, you'll start now. If you are serving automobile radio owners it will make your work easier and more profitable.

Now, just to be sure you understand, let's go over the whole arrangement again.

GENERAL INFORMATION

The encyclopedia is divided into three major sections: SECTION "A"—CONTROLS
SECTION "B"—CONDENSERS
SECTION "C"—VIBRATORS

Other important sections: Tubes, Transformers, Resistors, Antenna Design, and Useful Service Data are indexed in both the front and rear of this book. To use the encyclopedia is simple. Learn to use it, then use it on every job. Using it continually and faithfully will save your time, your labor, and will increase your profits.

Over 12,000 different radio receivers are listed, and still there are some on which no records are available. Whether listed or not, information in the encyclopedia will enable you to effect a quick satisfactory repair.

ENCYCLOPEDIA—LISTINGS

Receivers are listed either by the manufacturer's name, or the trade-name, according to popular usage. A cross-index in the listings will help you locate the receiver you are looking for. Model numbers precede chassis numbers, with few exceptions. In these cases, model numbers are in parantheses and follow chassis numbers.

MANUFACTURER AND MODEL
SEARS-ROEBUCK—
36
36P
37
37P
39-125
41, 41P, 42
44
47, 48
49, 50
50 AVC
52
53, 54, (Factory Model 94)
56
62

CONTROLS

Use	Circuit	Correct Replacement	Switch	Bias	*Note
Vol.					
Vol.					
Tone					
Supp.					
Vol.					
Tone					
Vol.					
Tone					

USE—Controls are listed with an abbreviation of their most common designation; i. e., "Vol." = volume control; "Supp." = Suppressor Control. A complete list of abbreviations is on page 150.

Use	Circuit	Correct Replacement	Switch	Bias	*Note
	45				
	17				
	22				
	45				
	44				
	45				
	44				

CIRCUIT—Numbers refer to "A" Control Circuits on pages 117 to 121. These schematic circuits enable you to check the receiver on which you are working to make sure the circuit has not been changed during a previous repair or during that particular model's life in its period of manufacture. Often it is advisable to change a circuit to obtain better performance. Complete instructions are given in Section "A" Controls—pages 101 to 125.

Use	Circuit	Correct Replacement	Switch	Bias	*Note
		M			
		N			
		SRP258			
		G			
		L			
		UC508			
		SRP154			
		SRP154			
		SRP154			
		500M No. 1		See No	te A19

CORRECT REPLACEMENT—Here are listed recommended correct replacements. By referring to page 100 an "M" is immediately translated to read "250,000 ohm carbon control with left-hand taper—universal shaft." Where a recommendation reads "500M-No. 1" or is not a definite recommendation, and is followed by a note in the Note Column, it means that the complete or partial value of a control is known. The note referred to gives comprehensive, clear, concise instructions to make a quick satisfactory replacement.

Use	Circuit	Correct Replacement	Switch	Bias	*Note
			6		
			6		

SWITCH—The number of the replacement switch which must be used with the recommended control is listed in this column. Referring to page 123, replacement switch numbers are quickly translated; i. e., No. 6 = single pole—single throw.

Use	Circuit	Correct Replacement	Switch	Bias	*Note
				EX350	
				EX350	
				EX350	

BIAS—This column tells you that the control is used in a cathode or "bias" circuit. The original control contained a fixed resistance which must be duplicated.

All carbon controls which may possibly be used in "bias" type circuits are provided with a separate adjustable resistor of 500 ohms total resistance. This may be adjusted to the value given in the "Bias" column. "EX350" means that the resistor is to be set at 350 ohms and wired between the right-hand terminal of the control and the cathode circuit. This is accurate and is not to be compared to the haphazard use of an arbitrary value of fixed resistance.

Wire-wound controls contain an adjustable section for this purpose. Where a wire-wound control is specified, the bias column will contain a numeral from 1 to 5 designating the correct setting for this adjustable section.

***NOTE—**

See Note A73   See Note B1

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

Use	Circuit	Correct Replacement	Switch	Bias	*Note
				See No	te A19
				See No	te A19
				See No	te A5

On pages 115 and 116 there are eighty-four "A" (control) Notes. These are valuable because they tell what to do and how to do it. They tell how to make a quick and easy replacement when information is impossible to obtain. They permit the selection of a proper control either at your distributors, or to tell him by mail the correct resistance and the right taper which, with a sketch of the shaft that you will make, will enable you to receive the right control without delay, loss of time, or customer dissatisfaction.

The "Note" sections ("A" Controls, "B" Condensers, "C" Vibrators) of the encyclopedia are without doubt the finest and most helpful compilation ever printed.

We strongly advise, for your own benefit, that you read these "Note" sections. They will save you time and worry and will make money for you.

CONDENSERS

CONDENSERS			
Original Part	Cir-cuit	Correct Replacement	*Note
8-8-8.....			
....			
8-8........			
....			
8-8........			
8...........			
8			
8-8			
4-8........			
4-2-4.......			
....			

ORIGINAL PART—Under the heading "Original Parts" is listed either the value of the original condensers or the part numbers originally used. Condensers are listed in the order of their importance. First, filter units, second, by-pass units. Filter units are in most instances listed in their respective order of installation, from the rectifier to the load.

8-8-8 means that there are three 8 mfd. condensers used in the circuit.

CONDENSERS			
Original Part	Cir-cuit	Correct Replacement	*Note
	1		
	1/13		
	15		
	1		
	13/15		
	13/15		
	.....		
	1		
	1		
	13		
	15		
	1		
	1/14		
	1		

CIRCUIT—The use of each condenser section is not given because this is clearly shown in the schematics of condensers circuits. "B" (condenser) Circuits are shown on pages 142 to 144. A double number 1/13 means that sections of the condenser are used in two different circuits; i. e., Circuit No. 1 and Circuit No. 13, both shown on page 142.

CONDENSERS			
Original Part	Cir-cuit	Correct Replacement	*Note
		RN232.....	
		Buffer......	
		CM172.....	
		TS105.....	
		Buffer......	
		RN232.....	
		Buffer......	
		RN232.....	
		Buffer......	

CORRECT REPLACEMENT—Here are listed recommended correct replacements. By referring to page 148 an RN232 is immediately translated to read—a *dual* 8 mfd. 250 volt round can filter condenser. The word "Buffer" refers to the secondary or buffer condenser which is connected across the secondary of the vibrator power transformer, the value being given in the "original part" column.

***NOTE—**

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

CONDENSERS			
Original Part	Cir-cuit	Correct Replacement	*Note
			.B3
			.B66
			......
			......
			......
			......
			......

On pages 136 to 141 there are two hundred and twenty "B" (condenser) NOTES. These are valuable because they tell you what to do and how to do it. They tell how to make a quick and easy replacement when information is impossible to obtain. *They permit the selection of the right condenser without referring to original color coding which may have been obliterated by age, by factory changes during production, or by a previous repair to the receiver. Quick, accurate and wonderfully easy condenser replacements will be effected by reading "B" (condenser) Notes.*

The "Note" sections ("A" Controls, "B" Condensers, "C" Vibrators) of the encyclopedia are without doubt the finest and most helpful compilation ever printed.

We strongly advise, for your own benefit, that you read these "Note" sections. They will save you time and worry and will make money for you.

VIBRATORS

VIBRATORS		
Vibr. Conn.	Replace-ment	*Note
32	287M	C3
32	G287M	C16
......	....	.....
......	....	.....
......	....	.....
32	287M..	C3
32	G287M	C16
......	....	.....
24	273	.....
......	....	.....
20	253	C3
20	G253	C16
......	....	.....
32	287M	C3
32	G287M	C16
35	294	C3

VIBR. CONN.—Vibrator connections are shown on pages 154 to 155. They're easily understood for they show the appearance and the connections of all replacement units.

REPLACEMENT—Here the correct replacement is listed. No guess work for all have been field-tested just as has every other bit of information in the encyclopedia.

NOTE—Clear instructions for installation, or for the proper selection of a unit, are given in 23 concise notes all on page 153.

WARNING!

Always check the circuit of the receiver upon which you are working to make sure that it does not differ from the circuit listed against the replacement part in the Encyclopedia. In case you should find a difference, read the explanation of circuits given in . . .

Section "A" for Controls
Section "B" for Condensers
Section "C" for Vibrators

You'll find the answer you want every time. Now that an explanation of the encyclopedia has been completed, it is only fair to say that every possible help and advice has been compiled "to help you." Make use of this help. Read, learn and consult the encyclopedia daily. You have everything to gain and nothing to lose.

MANUFACTURER AND MODEL	CONTROLS: Use	Circuit	Correct Replacement	Switch	Bias	*Note	CONDENSERS: Original Part	Circuit	Correct Replacement	*Note	VIBRATORS: Vibr. Conn.	Replacement	*Note	Types of Tubes Used	I. F. Peak	Trans. Circuit
A. C. DAYTON																
XL50, XL60, XL61	Vol.	26	UC509											01A, 12A		
AC63	Vol.	14	L				‡		See Note	B1				26, 27, 71A, 80		
AC65	Vol.	14	L				‡		See Note	B7				26, 27, 10, 81		
AC66	Vol.	14	L				‡		See Note	B7				24, 26, 27, 50, 81		
XL 70	Vol.	26	UC509											01A, 12A		
	Fil.	29	Q													
"Navigator" Series	Vol.	32	SRP274				8-8-8	3	MN275					27, 45, 80		1
ACME ELEC. & MFG. CO.																
AC7	Vol.	35	M				2-3	4	See Note	B1				26, 27, 71A, 80		2
SG88	Vol.	12	A5MP				8-8-8	3	MN275					24, 27, 45, 80		3
AC98	Vol.	7	UC500				8-8-8	3	MN275					24, 27, 45, 80		3
"Moto-Midget"	Vol.	33	N	6		See Note A1								39, 36, 37, 41		
	Vol.	6	K12			See Note A2										
ACRATEST PRODUCTS																
37	Vol.	‡	100M No. 1			See Note A3	2-8-8	1	See Note	B2				53, 56, 46, 5Z3		1
							10	15	TS101	B6						
38	Vol.	36	100M No. 1			See Note A3	2-8-8-8	‡	See Note	B2				53, 50, 80, 83		4
							10	15	TS101	B6						
108	Vol.	36	100M No. 1			See Note A3	8-8-1	22	See Note	B3				57, 2B6, 83		1
120	Vol.	16	M				6-6	2	See Note	B3				56, 45, 80		1
126	Vol.	23	100M No. 1			See Note A3	4-4	1	See Note	B2				57, 56, 50, 81		5
196, 197	Vol.	15	L				2-8-8-8	‡	See Note	B2				57, 56, 50, 80, 83		4
198, 199	Vol.	15	L				2-8	1	See Note	B2				57, 56, 46, 80		1
418	Vol.	23	100M No. 1			See Note A3	1-4	‡	See Note	B4				57, 45, RK18, RK19,		
														80		4
728							8-8	1	See Note	B3				2B6, 57, 80		1
739							8-8	1	See Note	B3				80		1
770	Vol.	36	250M No. 1			See Note A3	6714	4	CN152					36, 37, 2A3		
ACRATONE—Also see Federated Purchaser.																
L5	Vol.	18	N	6			P474	32	RS211					5Z4, 6F5, 6F6, 6H6,		
	Tone	34	L				P160	32	CN151	B81				6L7, 6K7	456	1
							P304	15	TS101							
L6	Vol.	18	N	6			P474	32	RS211					5Z4, 6C5, 6F6, 6K7,		
	Tone	44	L				P160	32	CN151	B81				6L7, 6Q7	456	1
							P304	15	TS101							
L7	Vol.	45	N	7			P391	1	RN232	B90	14	245C	C3	1C6, 19, 30, 34	456	10
	Tone	‡	L				.01-.01		Buffer	B14						
X6	Vol.	45	N	7			P391	1	RN232	B90	14	245C	C3	‡	‡	‡
	Tone	‡	L				.01-.01		Buffer	B14						
Z4	Vol.	45	SRP275	7			P391	1	RN232	B90	14	245C	C3	1C6, 19, 30, 32, 34	456	10
	Tone	44	L				.01-.01		Buffer	B14						
Z5	Vol.	45	SRP275	7			P958	1	RN232	B90	14	245C	C3	1C6, 34, 30, 32, 19	456	10
	Tone	44	L				.01-.01		Buffer	B14						
ADDISON																
N655	Vol.	64	N	7			8-4	1	See Note	B3	31	285XS	C3	1C6, 34, 30, 19	‡	10
	Tone	22	‡			See Note A5	.01-.01		Buffer	B14						
ADMIRAL—See Continental.																
ADVANCE ELECTRIC CO.																
"A" Auto	Vol.	33	N			See Note A1	10	15	TS101					36, 41		
Falck "Super B"	Vol.	7	G				6-6	4	See Note	B3				51, 24, 27, 47, 80	‡	1
	Tone	22	M													
Falck "E"	Vol.	7	UC509				6-6	4	See Note	B3				51, 24, 47, 80		1
77, 88, 89	Vol.	7	C				6-6	1	See Note	B3				‡		1
	Tone	22	M			See Note A4										
AERO PRODUCTS—See Chas. Hoodwin.																
AETNA																
4T '36	Vol.	6	G12	6	EX125		16-12	23	See Note	B3				6D6, 6C6, 43, 25Z5		
5T '36	Vol.	18	N				16-12	4	See Note	B3				6A7, 6D6, 75, 43,		
	Tone	22	‡			See Note A5								25Z5	465	
252	Vol.	7	UC509	6	EX120		12-16-5-5	1/15	UR189	B5				6D6, 6C6, 43, 25Z5		
630, 635, 652	Vol.	18	N				8-8	1	See Note	B3				‡	456	1
	Tone	22	K12													
AIRCASTLE																
A31	Vol.	18	N				8-4	23	See Note	B3				6A7, 6D6, 75, 42, 80	456	1
BA41	Vol.	18	N	6			8-8	1	CN152		14	245C	C3	1C6, 34, 30, 32, 33	456	6
							.01-.01		Buffer	B14						
L5	Vol.	18	N	6			P474	32	RS211					5Z4, 6F6, 6H6, 6K7,		
	Tone	34	L				P160	32	CN151	B81				6L7, 6F5	456	1
							P304	15	TS101							
L6	Vol.	18	N	6			P474	32	RS211					5Z4, 6C5, 6F6, 6K7,		
	Tone	44	L				P160	32	CN151	B81				6L7, 6Q7	456	1
							P304	15	TS101							
L7	Vol.	45	N	7			P391	1	RN232		14	245C	C3	1C6, 19, 30, 34	456	10
	Tone	‡	L				.01-.01		Buffer	B14						
X6	Vol.	45	N	7			P391	1	RN232	B90	14	245C	C3	1C6, 19, 30, 32, 34	456	10
	Tone	‡	L				.01-.01		Buffer	B14						
Z4	Vol.	45	SRP275	7			P391	1	RN232		14	245C	C3	1C6, 19, 30, 32, 34	456	10
	Tone	44	L				.01-.01		Buffer	B14						
Z5	Vol.	45	SRP275	7			P958	1	RN232		14	245C	C3	1C6, 19, 30, 32, 34	456	10
	Tone	44	L				.01-.01		Buffer	B14						
511	Vol.	‡	SRP252	6			‡	‡	See Note	B3	‡	‡	‡	‡	‡	‡
AIRKING																
4T "Comet"	Vol.	7	UC509	6	EX300		12-8-5-5	1/15	UR189	B5				78, 77, 43, 25Z5		
Atlas 5T Universal	Vol.	18	N	6			16-8-5-5	6/15	See Note	B5				6A7, 78, 75, 43, 25Z5	456	
6T TRF-LW	Vol.	6	F7				8-8	4	RS213	B66				58, 57, 47, 80		1
	Tone	21	O													
7T BC "Super"	Vol.	6	G12				8-8	4	RS213	B66				58, 57, 47, 80	175	1
	Tone	21	P													
7T TRF-LW	Vol.	6	F7		2		8-8	4	RS213	B66				58, 57, 47, 80		1
	Tone	21	O													
37, 39	Vol.	6	G	6	2		16-8-6	8/15	See Note	B5				77, 78, 43, 25Z5	456	
40	Vol.	6	UC509				8-8	24	CN142					6D6, 6C6, 38, 37		
							5	15	TS101	B6						
50 AC-DC	Vol.	6	UC509				8-8	6	CN142					6D6, 6C6, 43, 25Z5		
							5	15	TS101							
52, 54	Vol.	6	H7	6	3		8-4	1	CN151					57, 58, 47, 80	456	1
66	Vol.	18	N	6			16-8-5-5	6/15	UR189	B5				6A7, 6D6, 75, 43,		
														25Z5	456	
70	Vol.	18	N				16-16	1	See Note	B3				6A7, 6D6, 75, 42, 80	456	1
	Tone	21	N				5	15	TS101	B6						
AIRLINE—See Montgomery Ward.																

‡ Data not substantiated.

*** IMPORTANT: Read Notes in Note Section if specified in Note Column.**

MANUFACTURER AND MODEL	CONTROLS Use	Circuit	Correct Replacement	Switch	Bias	*Note	CONDENSERS Original Part	Circuit	Correct Replacement	*Note	VIBRATORS Vibr. Conn.	Replacement	*Note	Types of Tubes Used	I. F. Peak	Trans. Circuit
ALL AMERICAN MOHAWK																
D	Vol.	24	DRP169				1-1-1.5		See Note	B1				24, 27, 45, 80		3
							.073		On 60 cy.	B9						
							.2		On 25 cy.	B9						
DC	Vol.	25	DRP169				8	4	RS213					22, 12A, 171A		
DC7 110V	Vol.	24	‡		See Note	A5	1.5-2	1	See Note	B7				36, 37, 33	175	
	Tone	22	K12													
DC7 220V	Vol.	24	‡		See Note	A5	1.5-2	1	See Note	B7				36, 37, 33	175	
	Tone	22	‡		See Note	A5										
DC65 110V	Vol.	8	G				3.5		See Note	B11				39, 36, 37, 33	175	
	Tone	22	K12													
DC65 220V	Vol.	8	G	6			1.5-2		See Note	B7				39, 36, 37, 38	175	
	Tone	22	K12													
H	Vol.	24	DRP169				1-1-1.5	1	See Note	B1				24, 27, 45, 80	‡	3
							.073		On 60 cy.	B9						
							.2 Mfd		On 25 cy.	B9						
J	Vol.	6	F7				6900/61366	4	RS213					‡		1
							61278/61356	4	RN242	B8						
K	Vol.	15	N				1-2-4	1	See Note	B1				24A, 27, 45, 80		3
	Tone	22	K12				.1		See Note	B9						
P	Vol.	6	F7				6900/61366	4	RS213					24A, 47, 80		1
							61278/61356	4	RN242							
S6	Vol.	8	G				6900	4	RS213					24, 35, 27, 47, 80	175	1
S7	Vol.	8	G				6900/61366	4	RS213					24, 35, 47, 80	175	1
	Tone	22	K12				16	4	RN242							
S8	Vol.	8	GG				6900	4	RS213					24, 27, 35, 47, 80	175	1
	Tone	22	Z12				61278	4	RN242							
SW8	Vol.	17	N	6			8-8	1	See Note	B3				35, 24, 27, 47, 80	485	1
	Tone	22	G12													
S10	Vol.	13	N				6900/61366	3	RS213					24, 35, 27, 47, 80	175	3
	Tone	41	N													
S40	Vol.	2	Y				8-8	1	See Note	B3				57, 47, 80	175	1
							10	19	TS101	B6						
S50	Vol.	6	F12	6			8-8	1	RS213					57, 58, 47, 80	175	1
	Tone	22	G12				10	19	TS101	B6						
S63	Vol.	42	H				6900	1	RS213					35, 24, 47, 80	175	1
	Tone	22	G12				10	15	TS101							
SA65	Vol.	15	N	6			8-8	1	RS213	B66				58, 57, 55, 47, 80	175	1
	Tone	22	G12				10	16	TS101	B6						
S80	Vol.	8	H	6			8-8	1	RS213	B66				24, 35, 27, 47, 80	175	1
	Tone	39	M													
SW80	Vol.	15	N				8-8	1	RS213	B66				56, 57, 58, 47, 80	485	1
	Tone	22	G12													
SA90	Vol.	18	N	6			8-8	1	RS213	B66				24, 35, 55, 27, 47, 80	175	1
	Tone	21	N				10	15	TS101	B10						
	Sen.	‡	F		See Note	A4										
SA91	Vol.	15	N				8-8	1	RS213	B66				55, 57, 58, 56, 47, 80	175	1
	Tone	21	N				10	15	TS101							
	Sen.	‡	F													
SA110	Vol.	18	N				4-8-4-8	1, 2	See Note	B3				56, 57, 58, 46, 83	175	3
	Tone	21	N				10	15	TS101	B6						
	Sen.	‡	C													
SA130	Vol.	15	N	6			8-8-8	7	RS213	B66				56, 57, 58, 47, 82	175	7
	Tone	39	‡		See Note	A5	5	15	TS101							
	Sen.	8	H12		See Note	A4										
SG 110V DC	Vol.	12	G12				2-2-2	‡	See Note	B11				‡		
U55	Vol.	6	Y				16-5	6	See Note	B5				44, 43, 25Z5	485	
							10	15	TS101							
							12	6	See Note	B12						
7T 110V DC	Vol.	26	UC513				1-1-1-1-3	‡	See Note	B7				‡		
A10 PWR. PK							2-4-4	3	See Note	B13				BH		9
B7	Vol.	25	DRP239											32, 33		
B30, 31	Vol.	25	See Note			A5								30, 31, 32		
C6 Studio	Vol.	6	G7				8-8-8	3	MN275					24, 45, 80		3
60, 61, 62, 65, 66	Vol.	14	SRP170											26, 27, 71A, 80		
70, 73, 75	Vol.	38	See Note			A6	2-2-3	‡	See Note	B1				26, 27, 50, 80		8
	Hum	37	HU75				.002		See Note	B9						
77	Vol.	14	M											26, 27, 71, 80		
B80	Vol.	43	DRP169				8	12	RS203					34, 32, 30	175	
	Tone	21	M													
80, 83, 84, 85, 86, 88	Vol.	14	SRP170											26, 27, 71A, 80		
90 Series to 95	Vol.	6	G7				2-2-2	3	See Note	B1				27, 45, 80		3
	Hum	37	HU20				.1		See Note	B9						
96	Vol.	6	G7				2-2-2-1-1	3	See Note	B1				24, 27, 45, 80		3
	Hum	37	HU20				.1		See Note	B9						
110V DC 8 T	Vol.	14	SRP170				1-1-1-1-1-1	‡	See Note	B7				‡		
ALLIED RADIO CORP.																
5T Auto. 6T Auto.	Vol.	7	G		2	A1								37, 41, 57, 58		
6T Dual Wave	Vol.	15	M				9110-0	1	CN151	B15				47, 55, 57, 58, 80	175	1
							5	17	TS101							
7T	Vol.	7	F				8-8	25	See Note	B3				24, 35, 47, 27, 80	175	1
	Tone	22	K12													
8T (810)	Vol.	46	See Note	6		A5								30, 32, 34, 49	‡	
8/9 AC	Vol.	3	D7				4-2-1	3	See Note	B1				26, 27, 71A, 80		9
12T Class "B" Super	Vol.	45	M				8	3	WE847					46, 56, 57, 58, 83	177.5	1
	Tone	22	K12				8-8	3	See Note	B3						
AC5	Vol.	7	Z				2-1	1	See Note	B1				24, 45, 80		3
A5-30 (Roamer)	Vol.	7	Z		See Note	A1								24A, 12A		
B6-30	Vol.	41	E12		See Note	A1								31, 32		
118	Vol.	15	N				12	34	RS215					24, 27, 35, 47, 80	175	1
	Tone	14	K12				8	34	RS213							
E9830	Vol.	18	M		See Note	A5	8-8	4	See Note	B3				47, 56, 57, 58, 80	177.5	1
	Tone	22	K12													
E9831	Vol.	18	M		See Note	A5	8-8	4	See Note	B3				56, 57, 58, 47, 80	177.5	1
	Tone	22	K12													
F9501	Vol.	6	L		EX 100		20-4-5-5	6/15	See Note	B5				25Z5, 43, 44, 77, 78	456	
F9505	Vol.	15	M				4-4	4	See Note	B3				6A7, 42, 75, 78, 80	456	1
	Tone	22	L	7			5-5	15/19	See Note	B3						
F9511	Vol.	9	Y250MP				5	19	TS101					1A6, 19, 30, 32, 34	456	
	Tone	22	L													
F9515	Vol.	15	M				6-10-5-5	1/15	UR189	B5	34	292	C3	6A7, 42, 75, 78, 84	456	10
	Tone	22	L	7			.05-.05		Buffer	B14						
F9521	Vol.	6	G7		2		4-4	4	CM170	B3				42, 77, 78, 80		1
	Tone	22	L	7												
F9525, F9527	Vol.	6	UC510		EX 100		20-4-5-5	6/15	UR189	B5				25Z5, 43, 44, 77		
F9531	Vol.	15	N	6			8-4-4	5	See Note	B3				37, 42, 78, 80, 85	465	1
	Tone	41	L													
F9541	Vol.	15	500M No. 1		See Note	A1	6-10-5-5	1/15	See Note	B5	34	292	C3	6A7, 41, 75, 78, 84	175	10
							.05-.05		Buffer	B14						
F9551	Vol.	15	250M No. 1		See Note	A1	8-16	4	See Note	B3	34	292	C3	6A7, 37, 41, 78, 84, 85	‡	10
							10-10	15	See Note	B3						

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
ALLIED RADIO CORP.—Continued																
F9555	Vol.	7	G		2		6-6	1	RN242	B16				2A5, 57, 58, 80		1
							10-10	15	TN111							
F9591	Vol.	15	N	6			8-4-4	5	See Note	B3				37, 42, 78, 80, 85	456	1
	Tone	41	L													
F9610, F9612, F9613	Vol.	15	N				8-8	1	RS213					2A5, 56, 57, 58, 80	485	1
	Tone	22	G12	6			10	15	TS101							
F9618, F9619	Vol.	45	N				8-8	1	See Note	B3				46, 56, 57, 58, 80	175	1
	Suppr.	47	F				5-5	15/17	2 TS101	B3						
	Tone	21	N													
F9630, F9635	Vol.	45	N				8-4	4	See Note	B3				56, 57, 58, 2A5, 80	456	1
	Tone	22	K12													
F9640, F9645	Vol.	15	N				8-8	4	See Note	B3				2A5, 56, 57, 58, 80	177.5	1
	Tone	22	K12													
F9650, F9654	Vol.	15	M				8-12	4	See Note	B3				2A5, 55, 56, 57, 58, 80	‡	1
	Tone	22	K12													
F9660, F9665	Vol.	45	M				12	4	RS215					2A5, 56, 57, 58, 80	177.5	1
	Tone	22	K12				8	4	RS213							
F9670, F9675	Vol.	45	M				8	3	WE847					5Z3, 53, 56, 57, 58	‡	1
	Tone	22	K12				12-8	3	See Note	B3						
F9751	Vol.	15	M				4-4	4	See Note	B3				6A7, 42, 75, 78, 80	456	1
	Tone	22	L	7			5-5	15/19	2 TS101	B3						
F9761, F9767	Vol.	15	N				8-4-4	26	See Note	B3				37, 78, 85, 42, 80	456	1
	Tone	41	L													
F9775	Vol.	9	Y250MP				5	19	TS101					1A6, 19, 30, 32, 34	456	
	Tone	22	L	7												
F9777	Vol.	15	M				6-10-5-5	1/15	See Note	B5	34	F292	C3	6A7, 78, 75, 42, 84	456	10
	Tone	22	L	7			.05-.05		Buffer	B14						
G9503	Vol.	6	G12	6	EX200		16-12	27	CM165	B3				6C6, 6D6, 12Z3, 43		
G9505	Vol.	7	UC501	6	EX200		8-4	4	See Note	B3				6C6, 6D6, 42, 80		1
G9511, G9513	Vol.	18	N				8-4	23	See Note	B3				6A7, 6D6, 42, 75, 80	465	1
G9515	Vol.	18	500M No. 1		See Note	A1	6-12	1	See Note	B3	34	292	C3	6A7, 6B7, 6D6, 41, 84	456	10
							10	15	TS101							
							.02-.02		Buffer	B14						
G9517	Vol.	18	500M No. 1		See Note	A1	6-12	1	See Note	B3	34	292	C3	6A7, 6D6, 41, 75, 84	175	10
							10	15	TS101							
							.02-.02		Buffer	B14						
G9533	Vol.	18	N				8-8	4	See Note	B3				6A7, 6D6, 42, 75, 80	465	1
	Tone	22	G12													
G9545, G9547, G9549	Vol.	18	TRP606				8-8	28	RN242					6A7, 42, 76, 78, 80, 85	465	1
	Tone	22	Y				8	28	RS213							
	Suppr.	48	Y10MP													
G9551	Vol.	7	G12	6			4-4	4	See Note	B3				42, 77, 78, 80		1
	Tone	22	L	7												
G9553	Vol.	15	N				8-20-5	11	UR182	B17				6A7, 6D6, 25Z5, 43, 75	456	
							5	15	TS101							
							5	13	CS121							
G9557	Vol.	15	N				5-20-8	6	UR182	B18				6A7, 6D6, 25Z5, 43, 75	456	
							5	15	TS101							
G9561, G9563, G9565, G9567	Vol.	15	N											1C6, 30, 33, 34	456	
	Tone	22	L													
G9561, G9563, G9565, G-9567, (above No. 61700)	Vol.	15	No. 1 Taper			A5								1C6, 19, 30, 32, 34	465	
	Tone	22	No. 1 Taper			A5										
G9599	Vol.	17	500M No. 1		See Note	A1	6-10	1	See Note	B3	47	See Note	C6	6A7, 41, 75, 78, 84	465	10
							5-5	15	2 TS101							
							.05-.05		Buffer	B14						
G9611, G9613	Vol.	45	N											1A6, 30, 32, 33, 34	465	
G9881	Vol.	18	500M No. 1		See Note	A1	6-12	1	See Note	B3	34	292	C3	6A7, 6B7, 6D6, 41, 84	456	10
							10	15	TS101							
							.02-.02		Buffer	B14						
G9882	Vol.	18	500M No. 1		See Note	A1	6-12	1	See Note	B3	34	292	C3	6A7, 6D6, 41, 75, 84	175	10
							10	15	TS101							
							.02-.02		Buffer	B14						
L5	Vol.	18	N	6			P474	32	RS211					5Z4, 6F5, 6F6, 6H6, 6K7, 6L7	456	1
	Tone	34	L				P160	32	CN151	B81						
							P304	15	TS101							
L6	Vol.	18	N	6			P474	32	RS211					5Z4, 6C5, 6F6, 6K7, 6L7, 6Q7	456	1
	Tone	44	L				P160	32	CN151	B81						
							P301	15	TS101							
L7	Vol.	45	N	7			P391	1	RN232	B90	14	245C	C3	1C6, 19, 30, 34	456	10
	Tone	‡	L				.01-.01		Buffer	B14						
P (AC)	Vol.	15	N				4-4	4	See Note	B3				47, 55, 57, 58, 80	175	1
	Tone	22	L				10	19	See Note	B3						
P (Batt.)	Vol.	9	Y10MP	6			8	13	See Note	B3				32, 33, 34	175	
	Tone	22	L				10	‡	TS101							
SG8	Vol.	6	Y	6	See Note	A8	1.8-2.3-2.3	3	See Note	B1				24, 27, 45, 80		3
SG9	Vol.	24	DRP119	9		A9	8-8-8	3	RS213	B66				24, 27, 45, 80		3
	Tone	41	N													
SG10	Vol.	7	Z			A10	2-2.5-2.5	3	See Note	B1				24, 27, 45, 80		3
T (Auto.)	Vol.	17	500M No. 1		See Note	A1	6-10	1	See Note	B3	34	292	C3	6A7, 41, 75, 78, 84	175	10
							5-5	15	2 TS101							
							.05-.05		Buffer	B14						
U	Vol.	7	UC510	6			4-20	6	See Note	B3				25Z5, 43, 44, 77	456	
							5-5	15	2 TS101							
V	Vol.	6	UC510		EX400		20-4	6	See Note	B3				25Z5, 43, 44, 77, 78	‡	
							5-5	15	2 TS101							
W	Vol.	15	N				8-4-4	26	See Note	B3				37, 42, 78, 80, 85	456	1
	Tone	41	L													
Z4	Vol.	45	SRP275	7			P391	1	RN232	B90	14	245C	C3	1C6, 19, 30, 32, 34	456	10
	Tone	44	L				.01-.01		Buffer	B14						
Z5	Vol.	45	SRP275	7			P958	1	RN232	B90	14	245C	C3	1C6, 19, 30, 32, 34	456	10
	Tone	44	L				.01-.01		Buffer	B14						
AMERICAN BOSCH—See United American Bosch.																
AMERICAN TRAN. CORP.																
25A (A Unit)	Vol.	35	N											26, 27		
250	Vol.	35	M				2-4-4		See Note	B4				27, 50, 81		
AMRAD																
AC5	Vol.	29				A11	5-60	3	MN272					01A, 81, 199		1
							D-15-30		MN272							
AC6	Vol.	14	M											26, 27, 71		
DC6, DC6C	Vol.	29	Q											01A, 12A or 71A		
	Vol.	29	S													
DC7, DC7C	Vol.	29	No. 4 Taper			A5								01A, 71A		
AC7, AC7C	Vol.	10	H12				8-8-8-8	1/14	MN277					26, 27, 71A, 80		11
70 (Concerto, Nocturn, Opera, Sonata)	Vol.	‡	H12						See Note	B3				26, 27, 10 or 50, 81		8

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
AMRAD—Continued																
81, (Aria, Minuett, Serenata, Duet, Symphony)	Vol.	12	K12				8-8-18-18	1/22	MN278					24, 27, 45, 80		3
	Hum	75	Y200MP													
	Hum	75	HU20													
84, 84C, 84D	Vol.	15	N				9-9-18	3	MN277	B83				24, 27, 45, 80		3
171ABC							8-8-8-8	3/14	MN277					80		18
3500-1	Vol.	31	A400P											01A		
3500-2	Vol.	14	M											01A		
	Fil.	37	A400P													
	Fil.	29	S													
3590	Fil.	29	T											01A		
7100	Vol.	40	H12											26, 27		
7191 (Power Unit)									See Note	B3				‡		
ANSLEY RADIO LABS																
DC	Vol.	26	UC510				2-2-1		See Note	B4				01A, 71A		
D1	Vol.	50	L				32-8-8	1	See Note	B3				25Z5, 48, 76		
	Hum	51	A3MP													
D3, D4, D6	Vol.	6	SRP263		EX100		16-8	1	CN145	B8				25Z5, 43, 77, 78	175	
							2-4	15	TN110							
MD1	Vol.	12	G12				3		CN142	B11				30, 32, 71A		
U1 AC-DC	Vol.	12	Y				4-8-2	3	CN155					24, 27, 45, 80		‡
	Tone	21	M													
U2 AC-DC	Vol.	8	K				4-8-2		MN275					36, 73, 38, 80		1
	Tone	22	M	6			10	15	TS101							
U3	Vol.	7	H	6	2		8-8-2	3		B3				37, 38, 39, 80	175	1
	Tone	39	M				4	15	TS101							
U8	Vol.	12	M	6			4-4	1		B3				37, 39, 80, 85, 89	‡	1
	Tone	39	M				10-10-2	15		B3						
U10	Vol.	6	E	2			16-16-16	1	See Note	B77				6A7, 6C6, 6D6, 12Z3,		
	Phono.	50	L				10-10	15	See Note	B77				43, 25Z5	456	
APEX—See U. S. Radio & Tel.																
APPEL HENDERSON																
AC	Vol.	6	G7	6	4		8-4-4	3	See Note	B3				24, 27, 47, 51, 80	‡	1
	Tone	22	G12													
DC Comb.	Vol.	6	H7	6	5		.5-1	‡	See Note	B4				33, 36, 37		
	Tone	22	G12													
4 Tube	Vol.	29	T											32, 33, 36		
5 Tube Batt	Vol.	40	See Note			A5								32, 36, 38		
5 Tube AC	Vol.	6	G7	6	4		4-8	1	See Note	B3				‡		3
	Tone	22	G12													
ARBORPHONE																
45	Vol.	10	E12				2-2-2-2	1/14	See Note	B1				26, 27, 71, 80		11
ARCADIA—See Wells Gardner.																
ARGUS																
B125	Vol.	‡	‡			A5	8-8-8	3	MN275					12, 99, BH		1
B195	Vol.	16	M				‡	‡	See Note	B3				99, 10, 81		5
	Sen.	‡	See Note			A5										
ARIEL RADIO																
101	Vol.	3	Y				15-5	6	MN273					‡		3
ARKAY—See R. K. Radio Lab's.																
ARVIN—See Noblitt-Sparks																
ATCHISON RADIO MFG CO.																
5AC	Vol.	6	G7		5		‡	‡	See Note	B3				24, 27, 45, 80		3
5 Tube (DC Speaker)	Vol.	6	G7		5		‡	‡	See Note	B3				24, 27, 45, 80		3
6AC	Vol.	6	G7				‡	‡	See Note	B3				24, 27, 45, 80		3
ATWATER KENT																
37, 37C, 37F, 38	Vol.	5	SRP239		See Note	A12	1.5-1	2	See Note	B1				26, 27, 71A, 80		11
40, 40F	Vol.	5	SRP239		See Note	A12	1-1.5-1	3	See Note	B1				26, 27, 71A, 80		11
41DC	Vol.	5	SRP239		See Note	A12								12A, 71A		
42, 42F	Vol.	5	SRP239		See Note	A12	1-1.5-1	3	See Note	B1				26, 27, 71A, 80		11
43	Vol.	5	SRP239		See Note	A12	‡	3	See Note	B1				26, 27, 71A, 80		11
44, 44F, 45	Vol.	5	SRP239		See Note	A12	1-1-1.5	3	See Note	B1				26, 27, 71A, 80		11
46, 47	Vol.	5	SRP239		See Note	A12	‡	3	See Note	B1				26, 27, 71A, 80		11
52	Vol.	5	SRP239		See Note	A12	‡	3	See Note	B1				26, 27, 71A, 80		11
53	Vol.	5	SRP239		See Note	A12	‡	‡	See Note	B1				26, 27, 71, 80		11
55, 55C (Early)	Vol.	12	SRP241		See Note	A30	2-2.3-2.3	30	See Note	B1				24, 27, 45, 80		3
55, 55C (Late)	Vol.	25	DRP301				2-2.3-2.3	30	See Note	B1				24, 27, 45, 80		1
55F, 55FC (Early)	Vol.	12	SRP241		See Note	A30	1.7-4-1	30	See Note	B1				24, 27, 45, 80		3
55F, 55FC (Late)	Vol.	25	DRP301				1.7-4-1	30	See Note	B1				24, 27, 45, 80		3
56, 57	Vol.	5	SRP239		See Note	A12	‡	2	See Note	B1				26, 27, 71A, 80		11
60, 60C (Early)	Vol.	12	SRP241		See Note	A30	2-2.5-2.5	30	See Note	B1				24, 27, 45, 80		1
60, 60C (Late)	Vol.	52	DRP301				2-2.3-2.3	30	See Note	B1				24, 27, 45, 80		1
60, 60C (3rd Type)	Vol.	25	DRP301				.1-2-1	30	See Note	B1				24, 27, 45, 80		1
61, 61C, (DC)	Vol.	12	SRP241		See Note	A30	4-2	2	See Note	B11				22, 12A, 71A		
66	Vol.	52	DRP301				2.1-2.3-2.3	3	See Note	B2				24, 27, 50, 81		4
67, 67C	Vol.	12	L											22, 12A, 71A		
D1 (70, 74, 76)	Vol.	25	DRP301				.5-4-2-1	2	See Note	B11				22, 12A, 71A		
D2 (70, 74, 76)	Vol.	25	DRP301				4-2-1-.5	2	See Note	B11				22, 12A, 71A		
F (70, 74, 76)	Vol.	25	DRP301				4-1-.5	2	See Note	B1				24, 27, 45, 80		1
L1 (70, 74, 76)	Vol.	25	DRP301				1-2-1-.5	31	See Note	B1				24, 27, 45, 80		1
L2 (70, 74, 76)	Vol.	25	DRP301				2-1-1-.5	3	See Note	B1				24, 27, 45, 80		1
							.225		See Note	B9						
P (75)	Vol.	25	DRP301				2-1-1-.5	‡	See Note	B1				24, 27, 45, 80		1
	Phono.	‡	A				.225		See Note	B9						
H1, H2 (72)	Vol.	53	DRP302				1-2-1	3	See Note	B1				24, 27, 45, 80	130	1
							.225		See Note	B9						
Q (70, 76)	Vol.	25	DRP303											01A, 22, 71A		
80, 80F	Vol.	8	E	6			23146	4	WE847					24, 35, 47, 80	130	1
							22538	4	WE847							
81, 81 (2nd), 81B, 81C	Vol.	54	UC503				22538	12	WE847					36, 37, 38		
82	Vol.	7	A550P	6			23146/22538	4	WE847					24, 35, 47, 80	130	1
82D	Vol.	15	N	6			20049	12	RN235	B8				36, 37, 33	130	
82F	Vol.	7	A550P	6			22538	4	WE847					24, 27, 35, 47, 80	130	1
							23146	4	WE847							
82Q (1st Type)	Vol.	15	N	6			23146/22538	12	WE847					30, 32, 33	130	
82Q (2nd Type)	Vol.	15	L	6			22538									
83, 83F	Vol.	8	E	6			23146	12	WE847					30, 32, 33	130	
							22538	4	WE847					24, 35, 47, 80	130	1
							23146	4	WE847							
							3-4	‡	CN150	B21						

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS Use	Circuit	Correct Replacement	Switch	Bias	*Note	CONDENSERS Original Part	Circuit	Correct Replacement	*Note	VIBRATORS Vibr. Conn.	Replacement	*Note	Types of Tubes Used	I. F. Peak	Trans. Circuit
ATWATER KENT—Continued																
84	Vol.	15	N				22538	4	WE847					24, 47, 80	130	1
							23146	4	WE847							
84 (Late)	Vol.	7	SRP251	6			22538	4	WE847					24, 27, 35, 47, 80	130	1
							23146	4	WE847							
84D	Vol.	15	N				20049	12	RN235	B8				33, 36, 37	130	
84F	Vol.	15	N				22538	4	WE847					24, 27, 47, 80	130	1
							23149	4	WE847							
84F (Late)	Vol.	7	SRP251	6			22538	4	WE847					24, 27, 35, 47, 80	130	1
							23149	4	WE847							
84Q	Vol.	15	N				22538	12	WE847					30, 32, 33	130	
85, 85F, (Early Late)	Vol.	8	A550P		See Note A4		22538	4	WE847					24, 35, 47, 80	130	1
	Vol.	8	Y500MP		See Note A27		3-4	4	CM170	B21						
85Q (1st Type)	Vol.	15	L				22538	12	WE847					30, 32, 33	130	
85Q (2nd Type)	Vol.	15	M				22538	12	WE847					30, 32, 33	130	
86, 86F	Vol.	8	A550P				22538	4	WE847					24, 27, 35, 47, 80	130	1
							3-4	4	CM170	B21						
87	Vol.	8	SRP251	6			2-2.3-2.3	3	See Note	B1				27, 35, 47, 80	130	3
							.25		See Note	B9						
87D	Vol.	25	DRP301				20049	12	RN235	B8				33, 36, 37, 38	130	
89, 89F, 89P	Vol.	15	N	6			2-2.3-2.3	3	See Note	B1				24, 27, 35, 47, 80	130	3
							.25		See Note	B9						
90, 90F	Vol.	8	E	6			22538	4	WE847					24, 27, 35, 47, 80	130	1
							23146	4	WE847							
91, 91B, 91C	Vol.	54	N				22472	12	CS123					36, 37, 38	260	
92	Vol.	13	N	6			22538	4	WE847					24, 35, 47, 80	130	1
							23146	4	WE847							
92F	Vol.	13	N				22538	4	WE847					24, 27, 35, 47, 80	130	1
							23146	4	WE847							
							22397	4	CS133							
93 (SW Converter)							22538	1	WE847					24, 27, 80	1000	1
							19728	1	WE847							
94, 94F	Vol.	7	SRP251				19728	4	WE847					35, 24, 47, 80	130	1
							3-4	4	CS133	B21						
96 (1st Type)	Vol.	13	N	6			19060	4	WE847					24, 27, 35, 47, 80	130	1
							1-2-1-.5	‡	See Note	B1						
							.225		See Note	B9						
96 (2nd Type)	Vol.	13	N				19060	4	WE847					24, 27, 35, 47, 80	130	1
	Tunlgt.	‡	K				1-2-1-5	‡	See Note	B1						
							.225		See Note	B9						
96 (3rd Type)	Vol.	13	N				19060	4	WE847					24, 27, 35, 47, 80	130	1
	ToneB'm	‡	M10MP				1-2-1-.5	‡	See Note	B1						
							.225		See Note	B9						
96F	Vol.	13	N	6			19060	4	WE847					24, 27, 35, 47, 80	130	1
	Tunlgt.	‡	Y50MP				2-2-1-1-.5	‡	See Note	B1						
99 (Types 1 and 2)	Vol.	15	N				2-2.3-2.3	‡	See Note	B1				24, 27, 35, 47, 80	130	3
	Tunlgt.	‡	Y50MP				.25	‡	See Note	B9						
99 (3rd Type), 99F	Vol.	15	N				2-2.3-2.3	‡	See Note	B1				24, 27, 35, 47, 80	130	3
	Tunlgt.	‡	H				.25	‡	See Note	B9						
99P	Vol.	15	N	8			2-2.3-2.3	‡	See Note	B1				24, 27, 35, 47, 80	130	3
	Tunlgt.	‡	H				.25	‡	See Note	B9						
112	Vol.	20	TRP606	6			28031	28	WE847					2A3, 2B7, 5Z3, 56, 57, 58	472.5	3
							27583	28	RN242							
							25385	12	RS203							
							25384	12	CS133							
							25379	15	TS101							
126	Vol.	17	UC512		See Note A1		32136	4	CM172	B25	35	294	C3	6A8, 6F6, 6K7, 6Q7, 6X5	264	10
							25379	15	TS101							
							.003		Buffer	B14						
135Z	Vol.	19	N	6			26995	1	SR605	B23	38	F297	C3	6A7, 43, 75, 78, 84	264	10
							22538	12	WE847							
							25379	15	TS101							
							.05-.05		Buffer	B14						
136	Vol.	17	UC512				32136	4	CM172	B25	35	294	C3	6K7, 6A8, 6Q7, 6F6, 6X5	264	10
							25379	15	TS101							
							.003		Buffer	B14						
145	Vol.	18	N	6			19060	1	WE847					2A7, 58, 2A6, 2A5, 80	264	1
							27585	1	RS213							
							10	15	TS101							
155	Vol.	60	N				24602	9	CM165	B22				77, 44, 75, 43, 25Z5	262.5	
155 (2nd Type)	Vol.	60	N				24602	29	CM162	B33				77, 44, 45, 43, 25Z5	262.5	
							8	12	CS123	B33						
155 (3rd Type)	Vol.	60	N	6			P24955	29	CM165	B32				77, 44, 75, 43, 25Z5	262.5	
165	Vol.	50	N	6			25168	1	WE847					57, 58, 2A6, 2A5, 80	262.5	1
							25167	15	TS101							
165 (2nd Type)	Vol.	55	N	6			25168	1	WE847					57, 58, 2A6, 2A5, 80	264	1
							25167	15	TS101							
165Q	Vol.	27	UC513	7			22472	12	CS123					1A6, 34, 32, 30, 19	264	
184	Vol.	‡	A20MP	‡			28031	‡	WE847					6C6, 42, 80	150	‡
							27583	‡	RN242							
185	Vol.	55	N	6			25168	1	WE847					57, 58, 2A6, 2A5, 80	264	1
							25167	15	TS101							
185A	Vol.	55	N				25168	1	WE847					2A7, 58, 2A6, 2A5, 80	264	1
							25379	15	TS101							
188, 188F	Vol.	13	N	6			22538	25	WE847					58, 57, 47, 66, 80	130	3
188, 188F (2nd Type)	Vol.	13	N	6			22538	25	WE847					56, 58, 55, 57, 47, 80	130	3
	Sil.	12	A20MP													
206	Vol.	17	N				27592	1/15	RN245					2A7, 58, 2A6, 2A5, 80	472.5	1
							22538	1	WE847							
215Z	Vol.	19	N	6			26995	1	SR605	B23	38	F297	C3	6A7, 78, 75, 43, 84	264	10
							22538	1	WE847							
							.05-.05		Buffer	B14						
217	Vol.	55	N	6			22538/25168	1	WE847					58, 55, 56, 2A5, 80	264	1
							25379	15	TS101							
217D	Vol.	55	N	6			23981	39	UR190					78, 75, 43, 37	264	
228	Vol.	13	N	6			22538	4	WE847					27, 24, 35, 47, 80	130	1
228D	Vol	13	N	6			20049	12	RN235	B8				36, 37, 33	130	
228F	Vol.	13	N	6			22538	4	WE847					35, 24, 27, 47, 80	130	1
							22397	4	CS133							
228Q	Vol.	15	L				19728	2	WE847					32, 30, 33	130	
							23146	2	WE847							
							22538	1	WE847							
237Q	Vol.	18	N	6			31552	[illegible]	SR605	B23	35	294	C3	1C6, 34, 1B5, 30, 19, 6Z4	472.5	10
							31551		On order							
							29529	13	RS203							
							.015-.015		Buffer	B14						
246	Vol.	55	N	6			24099	1	RN241	B22				56, 57, 58, 55, 47, 80	262.5	1
260, 260F (Types 1 and 2)	Vol.	15	N	6			22538	2	VE847					58, 56, 47, 80	130	3
	ToneB'm	‡	M15MP													
260, 260F (3rd Type)	Vol.	18	N	6			22538	2	WE847					57, 58, 55, 56, 47, 80	130	3
	ToneB'm	‡	M15MP													
	Sil.	12	A20MP													

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if Specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
ATWATER KENT—Continued																
266	Vol.	18	N	6			22538	1	WE847					57, 58, 55, 56, 47, 80	262.5	1
275	Vol	55	N	6			26158	29	UR190	B72				6A7, 44, 75, 43, 25Z5	264	
285Q	Vol	45	N	7		A13	29529	12	RS203					1C6, 34, 32, 33, 30	450	
286	Vol.	18	N	6			28031	1	WE847					58, 2A7, 2A6, 2A5, 80	472.5	1
							27592	1/14/15	RN241 TS101	B24						
305Z	Vol.	18	N	6			26995	1	SR605	B23	38	F297	C3	6A7, 78, 75, 43, 6Z4-		
							25379	15	TS101					84	264	10
							.05-.05		Buffer	B14						
310	Vol.	45	N	6			22538	3	WE847					58, 56, 2A5, 80	130	1
	Sil.	7	H													
317	Vol.	18	N				8	1	WE847					6K7, 6A8, 6F5, 6F6,		
							8-4-10	1/14/15	RN241 TS101	B24				5Z4	472.5	1
318	Vol.	55	N				28031	1	WE847					58, 2A7, 55, 2A5, 80	472.5	1
325	Vol.	18	N	6			19060	1	WE847					2A7, 58, 2A6, 2A5, 80	264	1
							27585	1	RS213							
							10	15	TS101							
328 (Early)	Vol.	18	N	6			29691	1	WE1647							
							27592	1/14/15	RN241/TS101	B24				6K7, 6A8, 6H6, 6F5,		
328 (Late)	Vol.	18	N	6			31702	1/14/15	RN241/TS101	B24				6F6, 5Z4	472.5	1
							28031	1	WE847					6K7, 6A8, 6H6, 6F5,		
337	Vol.	18	N	6			27592	1/14/15	RN241/TS101	B24				6F6, 5Z4	472.5	1
							28031	1	WE847					6K7, 6A8, 6H6, 6F5,		
356	Vol.	18	N	6			27592	1/14/15	RN241/TS101	B24				6F6, 5Z4	472.5	1
							28031	1	WE847					58, 2A7, 2A6, 2A5, 80	472.5	1
376	Vol.	18	N	6			27592	1/14/15	RN241/TS101	B24				58, 2A7, 2A6, 2A5, 80	472.5	1
							22538	1	WE847							
385Q	Vol.	27	UC509	7	See Note A13		22472	12	WE1647							
387	Vol.	12	N	7			22472	12	CS123					1C6, 34, 32, 30, 19	264	
415Q	Vol.	45	N	7	See Note A13		8	12	RS203					34, 1A6, 32, 30	264	
416	Vol.	17	UC512											1C6, 34, 32, 33	450	
							32136	4	CM172	B25	35	294	C3	6K7, 6A8, 6Q7, 6F6,		
							25379	15	TS101					6X5	264	10
							.003		Buffer	B14						
424	Vol.	55	N				25385	1	RS203		5	222		77, 44, 75, 41	264	
							24379	15	TS101							
							25384	1	CS133							
425	Vol.	55	N	6			25168	1	WE847					57, 58, 2A6, 2A5, 80	264	1
							25379	15	TS101							
							26381	1	RS213							
427	Vol.	55	N	6			25168	1	RS213					58, 55, 2A5, 80	264	1
							25397	15	TS101							
427D	Vol.	55	N	6			23981	39	UR190	B11				78, 75, 37, 43	264	
427Q	Vol.	12	N	7			22472	12	CS123					1A6, 34, 32, 30	264	
435	Vol.	18	N				28031	25	WE847					6A8, 6K7, 75, 6F6, 80	450	1
							27585	25	RS213							
							25379	15	TS101							
446	Vol.	17	UC512				32136	4	CM172	B25	35	294	C3	6K7, 6A8, 6Q7, 6F6,		
							25379	15	TS101					6X5	264	10
447	Vol.	55	N	6			.003		Buffer	B14						
448	Vol.	55	N	6			28031	1	WE847					58, 2A7, 55, 2A5, 80	472.5	1
	Sil.	7	E				22538	3	WE847					58, 55, 47, 56, 80	130	3
465Q	Vol.	27	UC513	7			22472	12	CS123					1C6, 34, 32, 30, 19	264	
467Q	Vol.	18	N	6			31552	1	SR605	B23	35	294	C3	1C6, 34, 1B5, 30, 19,		
							31551		On order					6Z4	472.5	10
							29529	1	RS203							
							.015-.015		Buffer	B14						
469	Vol.	13	N	6			22538	1	WE847					58, 56, 47, 80	130	3
	ToneB'm	‡	SRP267													
469 (2nd Type)	Vol.	18	N	6			22538	1	WE847					56, 57, 58, 55, 47, 80	130	3
	Sil.	12	Y													
	ToneB'm	‡	M20MP													
469D	Vol.	55	N	6			23981	39	UR190	B11				39, 36, 37, 85, 48	130	
	Sil.	12	Y													
469F	Vol.	13	N	6			22538	3	WE847					58, 56, 47, 80	130	3
	ToneB'm	‡	SRP267													
469F (2nd Type)	Vol.	55	N	6			22538	1	WE847					58, 56, 57, 55, 47, 80	130	[illegible]
	Sil.	12	Y													
	ToneB'm	‡	M20MP													
469Q	Vol.	55	N				22472	12	CS123					34, 32, 30	130	
475	Vol.	18	N	6			28031	1	WE847					2A7, 58, 2A6, 2A5, 80	264	1
							27585	1	RS213							
							25379	15	TS101							
480	Vol.	13	N	6			22538	1	WE847					58, 56, 47, 80	472.5	3
	ToneB'm	‡	SRP267													
485Q	Vol.	18	N	7		A13	29529	12	RS203					1C6, 1A4, 1B5, 33	450-	
							28031	12	RS203						472.5	
510	Vol.	45	N	6			22538	1	WE847					58, 56, 2A5, 80	130	1
	Sil.	7	H													
511	Vol.	55	TRP606				22538	1	WE847					58, 2A7, 2B7, 56, 2A3,		
							25385	12	RS203					5Z3	472.5	3
							27911	24	WE1647							
							25384	24	CS133							
							25379	15	TS101							
515Q	Vol.	18	N	7			28031	12	RS203					1C6, 1A4, 1B5, 33	450	
							29529	12	RS203							
525	Vol.	55	N	6			25168	1	WE847					57, 58, 2A6, 2A5, 80	264	1
							25167	15	TS101							
							26381	1	RS213							
525Q	Vol.	27	UC513	7			22472	12	CS123					1A6, 34, 32, 30, 19	264	
531	Vol.	55	N				25385	[illegible]	RS203		5	222		77, 44, 75, 41	450	
							24379	15	TS101							
							25384	1	CS133							
545	Vol.	18	N	6			22538	1	WE847					6A7, 6D6, 75, 42, 80	472.5	
							25384	1	RS203						or 450	1
555	Vol.	55	N	6			24403	1	RN241	B26				47, 55, 57, 58, 80	262.5	1
555 (2nd Type)	Vol.	18	N	6			22538	1	WE847					57, 58, 55, 47, 80	262.5	1
							25184	1	CS131							
556	Vol.	17	UC512				32273	1	CN152		35	294	C3	6K7G, 6A8G, 6Q7G,		
							25379	15	TS101					6X5G, 6F6G	264	10
							.01-.01		Buffer	B14						
557	Vol.	‡	N	6			28031	‡	WE847					58, 2A7, 55, 2A5, 80	472.5	
558	Vol.	55	N	6			22538	4	WE847					58, 55, 56, 57, 47, 80	130	1
	Sil.	12	Y													
558D	Vol.	55	N	6			2398[illegible]	39	UR190	B11				39, 37, 36, 85, 48	130	
	Sil.	12	Y													
558Q	Vol.	55	N				224[illegible]	12	CS123					30, 32, 34	130	
559	Vol.	55	N	6			[illegible]8	3	WE847					58, 55, 2A5, 80	472.5	1
565Z	Vol.	18	N	6			[illegible]5	1	SR605	B23	38	F297	C3	6A7, 78, 75, 43, 6Z4-		
							[illegible]379	15	TS101					84	264	10
							[illegible]-.05		Buffer	B14						
567, 567F	Vol.	8	E	6			[illegible]2538	4	WE847					35, 24, 47, 27, 80	130	1

‡ Data not substantiated.

* IMPORTANT: Rea Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
ATWATER KENT—	Continued															
612	Vol.	55	N	6			22538	1	WE847					58, 56, 57, 55, 46, 83	130	12
	ToneB'm	‡	M20MP				23498	1	WE447							
	Sil.	12	Y				23479	15	TS102							
625Q	Vol.	27	UC513	7	See Note A13		22472	12	CS123					1C6, 34, 32, 30, 19	264	
627	Vol.	55	N	6			22538	1	WE847					58, 56, 55, 47, 80	130	1
636	Vol.	55	N				24298	1	RS203					39, 36, 85, 41	262.5	
649	Vol.	17	N	6			16	1	WE1647					6K7, 6A8, 6H6, 6C5,		
							10	15	TS101					6F6, 5Z4	472.5	1
655Q	Vol.	27	UC513	7			22472	12	CS123					1C6, 34, 32, 30, 19	264	
657Q	Vol.	18	N	7			31552	24	RN232					1C6, 34, 1B5, 30	472.5	
665	Vol.	55	N				25168	1	WE847					57, 58, 2A6, 2A5, 80	264	1
							26381	1	RS213							
							25379	15	TS101							
666	Vol.	55	UC512	6			26995	1	SR605	B23	37	296	C3	6D6, 6A7, 85, 41,		
							25397	15	TS101					6Z4-84	264	10
							.05-.05		Buffer	B14						
667	Vol.	55	N				22538	1	WE847					58, 56, 55, 2A5, 80	264	1
							25397	15	TS101							
667D	Vol.	55	N				23981	39	UR190	B11				78, 37, 75, 43	264	
708	Vol.	55	N	6			22538	1	WE847					58, 2A6, 2A5, 80	472.5	1
							25167	15	TS101							
711	Vol.	55	N	6			22538	28	WE847					58, 55, 56, 2A3, 5Z3	472.5	3
	Sil.	7	H				25384	24	CS133							
							25385	24	RS213							
735	Vol.	18	N	6			28031	1	WE847					2A7, 58, 2A6, 2A5, 80	264	1
							27585	1	RS213							
							25379	15	TS101							
747Q	Vol.	18	N	7			31552	24	RN232					1C6, 34, 1B5, 30	472.5	
756, 756B	Vol.	55	N				24298	1	CS123					39, 36, 85, 41	262.5	
768Q	Vol.	18	N	7			22472	12	CS123					1C6, 34, 30, 32	472.5	
776	Vol.	55	UC512	6			26995	1	SR605	B23	37	296	C3	6A7, 6D6, 41, 84, 85	264	10
							25379	15	TS101							
							.05-.05		Buffer	B14						
788	Vol.	55	N	6			22538	1	WE847					58, 2A6, 2A5, 80	472.5	1
	Sil.	7	H				23579	15	TS101							
808	Vol.	55	N	6			22538	1	WE847					58, 2A6, 2A5, 80	472.5	1
							25379	15	TS101							
808A	Vol.	55	N				22538	1	WE847					58, 2A6, 2A5, 80	472.5	1
							25379	15	TS101							[illegible]
810	Vol.	19	TRP606	6			22538	1	WE847					6K7, 6A8, 6H6, 6C5,		
							27583	1	WE1647					6F6, 5Z4	472.5	1
							29964	15	TN111							
812	Vol.	55	N	6			22538	1	WE847					58, 56, 57, 55, 46, 83	130	12
	ToneB'm	‡	M20MP				23498	1	WE447							
	Sil.	12	Y				23481	1	WE1247							
							23479	16	TS102							
816	Vol.	55	UC512	6			26062	1	SR611	B30	9	226	C3	39, 6A7, 85, 41	264	10
							.05-.05		Buffer	B14						
825 AC-DC	Vol.	55	N	6			26158	29	UR190	B72				6A7, 44, 75, 43, 25Z5	264	
854	Vol.	2	Y	6			22538	1	WE847					57, 2A5, 80	450	1
							27584	1	RS211							
856	Vol.	18	N	6			28031	1	WE847					6A8, 6K7, 6H6, 6F5,		
							27585	1	RS213	B27				6F6, 5Z4	264	1
							27583	1	RN242	B27						
926	Vol.	55	UC512	6			26092	1	CN152					39, 6A7, 85, 41	264	
936	Vol.	55	UC512	6			26092	1	CN152					39, 6A7, 85, 41	264	
944	Vol.	2	Y	6			22538	25	WE847					57, 2A5, 80	450	1
							27584	25	RS211							
976	Vol.	18	N	6			28031	25	WE847					6A8, 6K7, 6H6, 6F5,		
							27585	25	RS213	B27				6F6, 5Z4	264	1
							27583	1	RN242	B27						
978Q	Vol.	55	N	7			22472	12	CS123					1C6, 34, 30, 32	472.5	
AUDIOLA—Also see	Fairbanks-Morse.															
Jr.	Vol.	6	G7	6		A14	1-2	1	See Note	B1				24, 45, 80		3
	Tone	22	G12													
Jr. No. 1	Vol.	6	G7	6		A14	8-8	1	RS213	B3				24, 27, 45, 80		3
	Tone	22	G12													
Jr. No. 2, 6 Tube	Vol.	6	G7	6		A14	8-8	1	RS213	B3				24, 27, 45, 80		3
	Tone	22	G12													
4 Tube Pent. 1931	Vol.	6	G7	6		A14	4-4	1	See Note	B3				35, 24, 47, 80		3
4 Tube, '32	Vol.	6	G7			A14	6-1	4	See Note	B3				35, 24, 47, 80		1
13T5	Vol.	6	G7	6		A14	4-4	1	CN150	B3				35, 24, 47, 80		3
	Tone	22	M													
6 Tube Pent. '31	Vol.	6	G7	6		A14	8-8	1	See Note	B3				35, 24, 27, 47, 80		3
	Tone	22	G12													
7 Tube Sup. Pent.'31	Vol.	6	G7	6			8-8	1	See Note	B3				35, 24, 27, 47, 80	177.5	3
	Tone	22	M													
8 Tube Sup. Pent.'31	Vol.	6	G7		3	A14	8-8	1	See Note	B3				35, 27, 24, 47, 80	177.5	3
	Tone	22	M													
9 Tube Sup. Pent.'31	Vol.	6	G7	6		A14	8-8		See Note	B3				35-51, 27, 24, 47, 80	177.5	3
10 Tube Sup. '31	Vol.	6	G7		3	A14	8-8	1	See Note	B3				24, 27, 45, 80	177.5	3
	Tone	41	O													
B6	Vol.	18	UC512				8-8	25	CM172		38	297	C3	6D6, 6A7, 75, 41, 84	177.5	10
							.02		Buffer	B14						
6T '27	Vol.	26	K12											01A, 12A		
8T27	Vol.	26	K12											01A, 00A, 12A		
9T45	Vol.	6	G7	6	3		8-8	1	RS213					35, 27, 24, 45, 80	177.5	3
	Tone	41	O													
13S6	Vol.	6	G12			A14	8-8	1	RS213					24, 27, 35, 47, 80	‡	3
	Tone	22	See Note			A5										
13S9	Vol.	6	G7				8-4-4	3	See Note	B28				35, 24, 27, 47, 80	177.5	3
	Tone	22	M													
13T5	Vol.	6	G7	6			4-4	1	See Note	B3				35, 24, 47, 80		3
	Tone	22	M													
23S7 Auto	Vol.	15	L				8-8	1	CN152	B42	41	312T	C1	39, 36, 85-Wunder-		
							20	15	TS102		34	292	C1	lich, 79, BH	177.5	
							.05		Buffer	B43						
23S8	Vol.	15	N				8-8	4	RS213					58, 56, 57, 47, 80	177.5	1
	Tone	22	K12													
23S8Q	Vol.	15	L	6			8-8	1	RS213					35, 27, 24, Wunder-		
	Tone	22	See Note			A5	5	17	TS101					lich, 47, 80	177.5	3
23S10	Vol.	45	M	6			8-8	4	RS213					58, 56, 57, 47, 80	177.5	1
	Tone	22	K12													
23S10 (2nd)	Vol.	45	M	6			12	4	RN242	B8				58, 57, 56, 2A5, 80	177.5	1
	Tone	22	K12				8	4	RS213							
							.5	4	See Note	B7						
23S12	Vol.	45	M	6			8	3	WE847					58, 56, 57, 46, 83	177.5	1
	Tone	22	K12				8-8	3	RS213	B3						
23S12 (Revised)	Vol.	45	M	6			8	3	WE847					58, 56, 57, 53, 5Z3	177.5	1
	Tone	22	K12				12	3	RS215							
							8	3	RS213							

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
AUDIOLA—Continued																
23T5	Vol.	6	G7	6		A14	4-4	1	See Note	B3				35, 24, 47, 80		3
23T5 SW	Vol.	6	G12	6	EX300		6-4	4	See Note	B3				35, 24, 47, 80		1
30B	Vol.	12	D12				1-3-3	3	See Note	B1				24, 27, 45, 80		3
31 Series	Vol.	6	G7			A14	8-8-8	3	See Note	B3				24, 27, 45, 80		3
	Tone	41	O		See Note	A4										
31 Super	Vol.	6	G7				8-8-8	3	MN275					24, 27, 45, 80	175	3
	Tone	41	O													
	Tone	22	M		See Note	A4										
32S11	Vol.	48	N				8-8-8	25	RS213	B3				35, 27, 24, 47, 80	‡	3
	Tone	22	K12													
33A6	Vol.	15	L			A15	8-8	1	CN152	B42	8	225	C3	6D6, Wunderlich, 37,		
							5	15	TS101					89	177.5	10
							.02		Buffer	B14						
33S5	Vol.	6	K12	6			16-8	6	See Note	B3				6D6-78, 6C6-77, 43,		
							5	15	TS101					25Z5	456	
33S5 (Rev.)	Vol.	6	K12	6			8	4	RS213					58, 57, 2A5, 80	456	1
33S6	Vol.	15	L	6			8-8	1	CN152	B42	41	312T	C1	39, 36, Wunderlich,		
							20	15	TS102		8	225	C4	89, BR	177.5	
33S6B	Vol.	6	K12											32, 34, 30, 19	450	
33S7	Vol.	45	N	6			8-4	4	See Note	B3				58, 57, 56, 2A5, 80	456	1
	Tone	22	K12													
33S7 Auto	Vol.	15	L				8-8	1	CN152	B42	41	312T	C1	6C6, 6D6, 37, 79, 85,		
											34	292	C1	BR-84	177.5	
33S8 32V	Vol.	15	N				8-8	1	CN152	B42	41	F312	C2	39, 37, 85, 77, 84-BR	‡	
	Tone	22	K12				5	15	TS101			See Note	C2			
							.005		See Note	B44						
							.04		See Note	B44						
33S10 SW	Vol.	15	M				12-8	4	See Note	B3				58, 57, 55, 56, 2A5, 80	456	1
	Tone	22	K12	6			.25		See Note	B7						
33T4	Vol.	6	K12	6			4-4	1	CN140	B3				6D6-78, 6C6-77, 38-		
							5	15	TS101					89, 12Z3-37		
34C5 (AC-DC)	Vol.	17	N	6			16-8	6	See Note	B3				6A7, 6D6, 75, 43,		
							5	15	TS101					12Z3	456	
34S5	Vol.	17	M	6			8-8	4	RS213	B3				2A7, 58, 2A6, 2A5, 80	456	1
							5	15	TS101							
34S5 LW	Vol.	6	K12	6			8-8	4	RS213	B3				2A7, 58, 57, 2A5, 80	456	1
							.25	4	See Note	B7						
51, 52	Vol.	17	N				8-8	4	RS213					2A7, 58, 2A6, 2A5, 80	456	1
	Tone	22	K12				5	15	TS101							
53	Vol.	18	N				8-8	4	RS213					2A7, 58, 2A6, 2A5, 80	456	1
	Tone	22	K12													
346	Vol.	17	UC512	6			8-8	25	CM172		38	297	C3	6D6, 6A7, 75, 41, 84	177.5	10
	Tone	22	K12				.02		Buffer	B14						
347	Vol.	17	N	6			8-8	25	See Note	B3	38	297	C3	6D6, 6A7, 85, 41, 84	177.5	10
	Tone	44	K12				.02		Buffer	B14						
527	Vol.	29	S											01A		
627	Vol.	29	S											01A		
889	Vol.	4	A				1-.5-2-2-2		See Note	B1				26, 27, 71, 80		11
7330	Vol.	12	D				1-3-3		See Note	B1				24, 27, 45, 80		3
8430	Vol.	7	Z				1-3-3-.5		See Note	B1				27, 45, 80		3
	Tone	22	M													
AUSTIN																
A	Vol.	6	F7	6		A14	8-8	1	RS213					24, 45, 80		3
J	Vol.	6	E7	6			8-8	1	RN242					24, 45, 80		3
	Tone	22	H12													
S	Vol.	6	F7	6			8-8	1	RS213					24, 27, 45, 80	175	3
	Tone	39	G12													
SP	Vol.	6	F7	6		A14	8-8	1	See Note	B3				51, 27, 24, 47, 80	175	3
	Tone	39	G12													
AUTOCRAT																
Jr. 4	Vol.	6	G12	6			8-4	25	See Note	B3				57, 47, 80		1
4SA	Vol.	17	G12	6	See Note	A14	12-12	1	See Note	B5				6D6, 6C6, 43, 25Z5		
							10-10	15	See Note	B5						
4LW	Vol.	6	J	6	EX300		8-4-4	8	See Note	B3				6D6, 6C6, 43, 25Z5		
5	Vol.	17	500M No. 1		See Note	A1	8-8	4	See Note	B3	34	292	C3	6A7, 6D6, 6B7, 41, 84	456	10
							10	15	TS101							
							.008-.008		See Note	B14						
5SA (55SA)	Vol.	17	N	6			10-5-25	11	UR182					6A7, 6D6, 75, 43,		
							10	15	TS101					25Z5	456	
6	Vol.	17	N	6			4-4	1	See Note	B3				57, 58, 55, 56, 2A5, 80	175	1
	Tone	22	N													
6 (Revised)	Vol.	6	G7		3		7-4	1	See Note	B3				2A7, 58, 2B7, 2A5, 80	175	1
							10	15	TS101							
6D32	Vol.	18	N				8-4	4	See Note	B3	‡	See Note	C7	6A7, 6D6, 75, 41, 84	175	‡
	Tone	22	K12													
TRF41	Vol.		250M No. 2			A1								39, 36, 37, 41		
57C	Vol.	6	G12	6	EX300		4-4	25	CM170					58, 57, 47, 80		1
80	Vol.	6	G12		See Note	A14	4-4	25	See Note	B3				58, 57, 47, 80		1
90SL	Vol.	15	N				8-8	1	See Note	B3				57, 58, 2B7, 56, 2A5,		
	Tone	21	N											80	175	1
AUTOMATIC																
A1	Vol.	17	N				8-8	4	See Note	B3	45	503	C3	6A7, 6D6, 75, 41,		
							.02		Buffer	B14				6E5, 84		10
Midget Tom Thumb	Vol.	12	Y				8-8	4	See Note	B3				24, 45, 80		3
Tom Thumb SG4	Vol.	31	A400P											22, 99		
P25	Vol.	12	K12	6			8-8	4	See Note	B3				35, 24, 47, 80		1
P35, 34	Vol.	12	K12				8-8	4	See Note	B3				24, 47, 80		1
44, V45, V46, C45, P46	Vol.	7	A5MP				8-8	4	See Note	B3				35-24, 47, 80		1
Tom Thumb (Steering Post)	Vol.	7	G		See Note	A1								78, 77, 41		
JR	Vol.	15	500M No. 1	6	See Note	A1	E1365GL	1	UR189	B29	34	292	C3	6D6, 37, 6C6, 41, 84		10
							.02		Buffer	B14						
AZTEC RADIO CO.																
Aztec	Vol.	6	G12				8-8	1	See Note	B3				24, 47, 80		3
BAIRD—See Gen. Electronics Corp.																
BALDWIN																
45	Vol.	6	H12				2-4	4	See Note	B3				24, 45, 80		1
47	Vol.	6	Y				2-8	4	See Note	B3				35, 24, 47, 80		1
54	Vol.	18	500M No. 1		See Note	A1	6-10	4	See Note	B3	35	294	C3	6A7, 6D6, 75, 42	‡	10
							.02		Buffer	B14						
64	Vol.	18	500M No. 1		See Note	A1	6-10	4	See Note	B3	35	294	C3	6D6, 6A7, 75, 42	‡	10
							.02		Buffer	B14						
80	Vol.	6	H12				2-2	1	See Note	B1				24, 27, 45, 80		1
	Sen.	7	M1MP													

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
BALKEIT																
A3, A5, A7	Vol.	27	K12		See Note	A5	‡	3	See Note	B1				27, 12A, 80		3
B7, B9	Vol.	3	F12				2-3-4	3	See Note	B7				01A, 50, 81, 10		5
C	Vol.	6	H12				2-2-2	3	See Note	B1				27, 45, 80		3
	Sen.	7	M2MP													
D5	Vol.	7	K	6		A10	4-4	4	CM170					58, 56, 47, 80		1
E	Vol.	6	H12				8-4-4	3	See Note	B3				24, 27, 45, 80		3
	Tone	22	G12													
F	Vol.	6	H12				8-8-8	3	MN275					27, 24, 45, 80		3
G16A, G19B	Vol.	18	N				4	32	WE447					6A7, 6K7, 6H6, 6F5,		
	Tone	34	No. 1 Taper		See Note	A5	8-4	32	See Note	B3				6F6, 80	456	1
G20	Vol.	18	N				4	32	WE447					6A8, 6K7, 6H6, 6A6,		
							8-4	32	See Note	B3				6F6, 80	456	1
G200X	Vol.	18	N				4	32	WE447					6A8, 6K7, 6H6, 6A6,		
							8-4	32	See Note	B3				6F6, 80	456	1
GT16A	Vol.	18	UC509		EX300		4-8-12	8	See Note	B3				6C6, 6D6, 75, 43,		
							10-10	15	TN111					25Z5	456	
GT33	Vol.	18	N				18-6	6	See Note	B3				6A7, 6D6, 75, 43,		
							5-5	15	See Note	B5				25Z5	456	
GT156BA	Vol.	48	N	7			8-8	1	CN152		14	245C	C3	1C6, 34, 30, 32, 33	456	6
							.01-.01		Buffer	B14						
KP	Vol.	6	H12				8-8	4	See Note	B3				24, 47, 80		1
	Tone	22	O													
L5	Vol.	18	N	6			P474	32	RS211					5Z4, 6F5, 6F6, 6H6,		
	Tone	34	L				P160	32	CN151	B81				6K7, 6L7	456	1
							P304	15	TS101							
L6	Vol.	18	N	6			P474	32	RS211					5Z4, 6C5, 6F6, 6K7,		
	Tone	44	L				P160	32	CN151	B81				6L7, 6Q7	456	1
							P304	15	TS101							
L7 ('36)	Vol.	45	N	7			P391	1	RN232		14	245C	C3	1C6, 19, 30, 34	456	10
	Tone	‡	L				.01-.01		Buffer	B14						
L7 ('31)	Vol.	6	H12				8-8	4	RS213	B3				27, 51, 24, 47, 80	175	1
	Tone	21	O													
L8	Vol.	7	H	6			4-4-4	3	CM173					51, 27, 47, 80	175	3
	Tone	41	O													
M	Vol.	6	H12		EX300		8-8	4	RS213	B3				24, 47, 80		1
	Tone	22	O													
ML1, ML2	Vol.	18	SRP275				4	7	RS213					6A7, 6K7, 6H6, 6F5,		
							8-4	7	CN151					6F6, 80	456	1
SG6	Vol.	6	H12				8-4-4	3	See Note	B3				24, 27, 45, 80		3
	Tone	22	G12													
Z4	Vol.	45	SRP275	7			P391	1	RN232		14	245C	C3	1C6, 19, 30, 32, 34	456	10
	Tone	44	L				.01-.01		Buffer	B14						
Z5	Vol.	45	SRP275	7			P958	1	RN232		14	245C	C3	1C6, 19, 30, 32, 34	456	10
	Tone	44	L				.01-.01		Buffer	B14						
38	Vol.	7	M	6	EX250		8-8	1	CN142	B3				6D6, 6C6, 38, 12Z3		
							10	15	TS101							
41A	Vol.	6	UC509		EX250		8-4	1	See Note	B3				6A7, 6D6, 6H6, 6F5,		
														80	456	1
42E, 42G	Vol.	6	G12		EX200		4-4	25	CM170	B3				58, 57, 47, 80		1
45	Vol.	6	UC509		EX250		12-8	6	See Note	B3				6D6, 6C6, 43, 25Z5		
							10	15	See Note	B5						
48	Vol.	6	UC509		EX250		16-12	1	See Note	B3				6D6, 6C6, 38, 25Z5		
							10-10	15	TN111	B6						
52-1	Vol.	6	H12				4-4	4	CM170	B3				58, 57, 47, 80		1
	Tone	22	O													
54	Vol.	18	500M No. 1		See Note	A1	6-10	4	See Note	B3	35	294	C3	6A7, 6D6, 75, 42, 84	‡	10
							.02		Buffer	B14						
55	Vol.	6	H12				4-4	4	CM170	B3				57, 58, 47, 80		1
59	Vol.	6	G12	6	EX200		20-20	6	See Note	B3				6A7, 6D6, 75, 43,		
							10-10	15	TN111					25Z5	456	
60	Vol.	18	N				8-4	23	See Note	B3				6A7, 6D6, 75, 42, 80	456	1
64	Vol.	18	500M No. 1		See Note	A1	6-10	4	See Note	B3	35	294	C3	6A7, 6D6, 75, 41, 84	‡	10
							.02		Buffer	B14						
69	Vol.	6	G7	6	2		20-20	6	See Note	B3				6A7, 6D6, 85, 43,		
							3	13	See Note	B3				25Z5	456	
							10		TS101							
70	Vol.	18	N				8-4	23	See Note	B3				6A7, 6D6, 75, 42, 80	456	1
100	Vol.	17	O				4-4-4	3	See Note	B3				58, 55, 56, 45, 82	175	1
	Tone	42	O				20	15	TS102							
BARKER BROS.																
L	Vol.	15	N	6			4	3	UR185	B3				58, 57, 55, 56, 46, 82	262	1
							8-4	3	See Note	B3						
M	Vol.	15	N	6			8-8	1	See Note	B3				57, 58, 56, 55, 59, 82	262	1
	Tone	22	UC502				4	15	See Note	B3						
	Sil.	‡	See Note			A5										
P(2 Types)	Vol.	15	N	6			8-4	1	See Note	B3				57, 58, 56, 55, 59, 82	262	1
	Tone	22	UC502				8-8	1	See Note	B10						
							10	15	TS101							
BEL CANTO—See Amrad.																
BELMONT RADIO CORP.																
40AC	Vol.	7	G		2		4-4	4	See Note	B3				35, 24, 47, 80		1
40A, 41A, 42A	Vol.	7	G				8	4	RS213					58, 57, 47, 80		1
							4	4	RS211							
40DC, 45, 46	Vol.	6	G12				1		See Note	B7				36, 37, 38		
50	Vol.	7	G				6-6	4	RS213					51, 24, 47, 80		1
	Tone	22	G12													
50A, 51A, 52A, 53A, 54A	Vol.	7	G				4-4	4	See Note	B3				35, 24, 47, 80		1
50B, 51B, 52B, 53B, 54B	Vol.	6	G12		See Note	A14	6	4	RS213					24, 35, 47, 80	175	1
							4	4	RS211							
50C, 51C, 52C, 53C, 54C	Vol.	6	G12				8	4	RS213					57, 58, 47, 80	175	1
	Tone	22	K12				4	4	RS211							
							25	17	TS102							
50F, 55F	Vol.	7	Z		See Note	A14	4-8	1	CM161					39, 36, 38		
							5-5	15	TN110							
53	Vol.	20	N	6			C525	11	UR182	B31				6A7, 6D6, 75, 43,		
														25Z5	456	
60, 61, 62, 63, 64	Vol.	6	G12				6	4	RS213					24, 27, 35, 47, 80	175	1
	Tone	22	K12													
65, 66	Vol.	6	G12				4	1	See Note	B11				36, 37, 38		
	Tone	41	N													
70	Vol.	7	G				6	4	RS213					51, 27, 47, 80	175	1
	Tone	22	K12													
70A, 71A, 72A, 73A, 74A	Vol.	17	O				8	4	RS213					58, 57, 56, 55, 47, 80	175	3
	Tone	22	K12				4	4	RS211							
	Supp.	7	K				10	17	TS101							

‡ Data not substantiated.

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MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
BELMONT RADIO CORP.—Continued																
71C	Vol.	56	O				P1047	1	RN241	B91				58, 57, 56, 55, 2A5, 80	175	1
	Supp.	7	K					15	TS101							
	Tone	22	K12	6												
100, 101, 102, 103, 104	Vol.	45	O				8-4-8	5	See Note	B3				58, 57, 56, 59, 83	175	1
	Tone	22	K12	6												
	Supp.	6	K													
110	Vol.	62	O				4-4-4	26	See Note	B3				35, 27, 47, 80	175	3
	Tone	22	L	6												
401	Vol.	8	UC501				P119-10	15	CN145	B34				58, 57, 2A5, 80		1
404	Vol.	6	TRP601											1A6, 32, 33	465	
	Fil.	29	M4R													
420	Vol.	7	Z	6	EX100	A10	8-8-8	1	See Note	B35				6D6, 76, 38, 12Z3		
							8	15	See Note	B35						
425	Vol.	7	Z	6	EX100		C538	11	UR182	B31				6E7, 6D7, 43, 25Z5	456	
430	Vol.	7	Z		EX100		8-16-5-5	6/15	UR189	B36				6D6, 76, 12A5, 12Z3		
440	Vol.	7	Z	6	EX100	A10	P103-1	11	UR182	B31				6D6, 6C6, 43, 25Z5	456	
444	Vol.	8	UC501	6	EX100		10-8	1	CN152					6D6, 6C6, 43, 12Z3		
							4	15	TS101							
522	Vol.	62	O	6			10	19	TS101					1A6, 34, 30, 32, 950	465	
	Batt.	29	M6R													
525	Vol.	17	N	6			C525	11	UR182	B31				6D6, 75, 43, 25Z5	456	
530	Vol.	17	N	6			C525/C538	11	UR182	B31				6A7, 6D6, 75, 43,		
														25Z5	456	
540	Vol.	17	N	6			C525C/C525D	11	UR182	B31				6D6, 75, 43, 25Z5	456	
541	Vol.	82	TRP609	6			P119-7	11	UR182	B31				6D6, 75, 43, 25Z5	456	
544, 545	Vol.	82	TRP609				P103-9	1/15	RN232/TS101					6A7, 6D6, 6B7, 43,		
	Tone	22	K12	6										12Z3	465	
550	Vol.	17	N	6			P1003	4	RM262					2A7, 58, 2A6, 2A5, 80	456	1
555	Vol.	82	TRP609	6			P103-6	4	RS213					6A7, 6D6, 6B7, 42, 80	456	1
							P103-7	4	RS213							
566	Vol.	18	UC512	6			119-20	4	CM171	B93	35	294	C3	6A8, 6K7, 75, 84-		
							.01		Buffer	B14				6Z4, 41	465	10
575	Vol.	6	Z12	6	EX100		P119-6	4	RM262	B37				58, 57, 2A5, 80	175	1
578	Vol.	56	O				P103-6	4	RS213					6A7, 6D6, 6B7, 42, 80	456	1
							P103-7	4	RS213							
580	Vol.	17	N	6			P119-15	4	CM160		35	294	C3	6D6, 6A7, 75, 42, 84	175	10
							.01		Buffer	B14						
580 (Revised)	Vol.	17	N	6			P119-15	4	CM171	B3	37	296	C3	6A7, 6D6, 75, 42, 84	175	10
							.01		Buffer	B14						
585 Series A	Vol.	18	N	6			P119-11	1/15	CM173	B75				6F7, 6D6, 75, 42, 80	370	1
585 Series B and C	Vol.	18	N	6			P103-6	4	RS213					6F7, 6D6, 75, 42, 80	370	
							P103-7	4	RS213						465	1
585 Series D	Vol.	18	N	6			103-6	4	RS213					6F7, 6K7, 75, 6F6, 80	465	1
							103-7	4	RS213							
586 Series A	Vol.	18	O	6			103-6	42	RS213					6A7, 78, 75, 41, 80	465	1
							103-7	42	RS213							
625	Vol.	17	N	6			C525	11	UR182	B31				78, 6A7, 75, 43, 25Z5	175	
							C525B	11	UR182	B31						
							C525C	11	See Note	B38						
							C525D	11	See Note	B38						
640	Vol.	82	TRP609	6			P103-3	4	WE1847					57, 27, 58, 2A6, 2A5,		
							P103-4	4	WE1647					80	370	1
650	Vol.	17	N	6			C525C	11	See Note	B31				6D6, 6A7, 75, 43,		
							C525D	11	UR182	B31				25Z5	175	
660	Vol.	17	N	6			C550	4	CM172		34	292	C3	6D6, 6A7, 75, 89, 6Z4	175	10
666 "A"-"B"	Vol.	18	UC512				119-21	1	CN151	B92	35	294	C3	6K7, 6A8, 6Q7, 6N6,		
							.01		Buffer	B14				84-6X5	465	
670	Vol.	17	N	6			P103-2	4	RM262		37	296	C3	6D6, 6C6, 78, 75, 42,		
							20	15	TS102					84	175	10
							.02		Buffer	B14						
670A	Vol.	17	N	6		A1	P119-4	4	CM172		37	296	C3	6D6, 6C6, 75, 42, 84	175	10
							.015		Buffer	B14						
675	Vol.	18	N	6			P103-4	4	WE1647					57, 27, 58, 2A6, 2A5,		
							P103-3	4	WE1847					80	370	1
680	Vol.	61	UC511				P119-17	4	CM162		37	296	C3	6D6, 6A7, 6B7, 42, 84	175	10
							.01		Buffer	B14						
685 "A," 686 "A,"																
"B"	Vol.	18	O	6			103-6	42	RS213					6L7, 6K7, 6Q7, 6F6,		
	Tone	22	K12				103-7	42	RS213					6C5, 5Y3	465	1
690	Vol.	18	UC511				119-17	4	CM172		37	296	C3	6D6, 6A7, 6B7, 42, 84		
							.01		Buffer	B14						
750	Vol.	18	N				8-8	4	WE847					58, 2A7, 55, 45, 80	175	1
	Tone	21	M				5	14	See Note	B3						
755	Vol.	82	TRP609	6			P103-8	4	WE847					6D6, 6C6, 76, 6B7,		
	Tone	21	M				P103-4	4	RN242	B8				42, 80	465	1
770 "A"	Vol.	56	TRP611	6			103-8	43	RN242	B8				6K7, 6C6, 6C5, 6B7,		
	Tone	21	M				103-4	43	RN242	B8				42, 80	465	1
775	Vol.	18	N	6			P103-4	4	WE1647					58, 2A7, 55, 2A5, 80	370	1
	Tone	21	N				P103-5	4	RS213							
777 Series A	Vol.	18	O	6			P103-4	4	WE1647					6D6, 6C6, 76, 75, 42,		
	Tone	21	M				P103-3	4	WE1847					80	465	1
777 Series B	Vol.	56	O	6			P103-8	4	WE1647					6D6, 6C6, 76, 6B7,		
	Tone	62	M				P103-4	4	WE1647					42, 80	465	1
778 "A"	Vol.	18	‡		See Note	A19	103-8	25	RN242	B8				6K7, 6J7, 6C5, 6Q7,		
	Tone	21	L	8			103-6	25	RS213					6F6, 5Y3-5W4	465	1
786 "A"	Vol.	18	O	6			103-6	42	RS213					6L7, 6K7, 6Q7, 6C5,		
	Tone	22	K12				103-7	42	RS213					6F6, 5Y3, 6G5	465	1
880 (A and B)	Vol.	18	UC511	6			P119-16	1	CN152		37	296	C3	6D6, 6A7, 85, 76,		
							.01		Buffer	B14				6A6, 84	175	10
880 Series C	Vol.	15	UC511				P119-16	1	CN152		37	296	C3	6D6, 6A7, 85, 76,		
							.01		Buffer	B14				6A6, 84	465	10
1050	Vol.	15	‡		See Note	A5	P1048		WE847					58, 2A7, 56, 45, 80	175	1
	Tone	‡	‡	6	See Note	A5	P1038		WE847							
	Supp.	12	‡		See Note	A5										
1070 "A"	Vol.	‡	‡	6	See Note	A19	103-10	1	WE3540					6K7, 6L7, 6C5, 6F6,		
	Tone	22	K12				103-8	1	WE1647					5Z4, 6H6	465	1
							119-19	15	2 TS102							
BLACKHAWK																
6U	Vol.	18	UC511	6			81028	1	CN152		20	253	C3	78, 77, 75, 41, 84	262.5	10
	Tone	22	UC502				81021C	15	TN111							
							.01	2	Buffer	B14						
BOND RADIO CO.																
34-33, 6TA	Vol.	18	N				8-4	1	See Note	B3				2A7, 58, 2A6, 2A5, 80	456	1
B. O. P.—See United Motors Service.																
BOSCH—See United American Bosch.																
BRANDES																
A1	Vol.	40	Y				2-2	1	See Note	B1				24, 27, 45, 80		3
B10	Vol.	40	Y				1-.5-.5-.5	1	See Note	B1				27, 71A, 80		2

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
BRANDES—Continued																
B11, B12	Vol.	40	Y				2-1	1	See Note	B1				27, 71A, 80		2
B15, B16	Vol.	40	Y				2-1-.5	3	See Note	B1				27, 71A-45, 80		2
K48	Vol.	40	Y				2-4	1	CN150	B1				24, 27, 45, 80		3
	Sen.	58	UC500													
K60, K62	Vol.	8	E				8-8	4	RS213					35, 24, 47, 27, 80	175	1
K70, K72	Vol.	59	H12				8-8-8	4	RS213					35, 24, 27, 45, 80	175	1
K80, K82	Vol.	59	H12				8-8-8	4	RS213					35, 27, 24, 45, 80	175	1
K90, K92	Vol.	59	H12				8-8-8	4	RS213					35, 27, 24, 47, 80	175	1
K110, K112, K120	Vol.	15	N				7337	26	CM175					58, 56, 47, 80	175	1
K114	Vol.	15	N				8	12	CS123	B3				34, 30	175	
K130, K132	Vol.	59	H12				7240		CM175	B39				58, 56, 47, 80	175	1
K133, K143	Vol.	15	N				4	4	See Note	B11				39, 37, 38	175	
							4	15	TS101							
BREMER TULLY																
Counterphase 8	Vol.	13	N						See Note	B1				26, 27, 71A		
6-40, 6-41	Vol.	‡	See Notes		No. 1	3/5	1-2-2	3	See Note	B1				26, 27, 71A, 80		11
7-10	Vol.	6	H12				1-2-2	3	See Note	B1				26, 27, 71A, 80		
8-20, 8-20A, 8-21, 8-22	Vol.	‡	E12	6				4	See Note	B7				26, 27, 10, 81		8
80	Vol.	29	R	6										01A, 12A		
81, 82	Vol.	7	J	6			1-1.5	2	See Note	B1				27, 45, 80		3
S81, S82	Vol.	12	A3MP				1-1	1	See Note	B1				24, 27, 45, 80, D110, D126, 25CY		3
	Hum	37	HU30				.275		See Note	B9						
	Hum	30	SRP265				1-2		25 Cycle	B1						
							1		25 Cycle	B9						
83A	Vol.	8	A3MP				2-1-2	3	See Note	B1				24, 27, 45, 80, D126		3
BRETING																
12	Vol.	18	N				16	25	RN242	B8				6B7, 6D6, 6C6, 42, 5Z3	432	1
	M. Vol.	7	J				8	25	RS213							
	Tone	22	UC502				25	19	TS102	B40						
	Meter		CIMP													
BRONSWICK RADIO																
Bronswick	Vol.	6	D12				8-4	4	See Note	B3				58, 57, 47, 80		1
BROWNING DRAKE																
JR	Vol.	8	G	6	See Note A14		8-8	4	See Note	B3				35, 24, 47, 80		1
20	Vol.	7	H	6	1		8-8	4	RS213					24, 47, 80		1
	Tone	22														
MB30	Vol.	12	K12				8-8-8	3	See Note	B3				24, 27, 45, 80		3
34, 36, 38	Vol.	60	B				8-8-8	3	MN275					26, 27, 71A, 80		11
40	Vol.	7	H	6	2		8-8	4	RS213	B3				35, 24, 47, 80	175	1
	Tone	22	G12													
54	Vol.	8	Y10MP				8	1	RS213	B3				24, 27, 45, 80		3
							8-8-8	14	MN275	B3						
69	Vol.	12	G12	6			8-8	4	RS213	B3				24, 27, 45, 80		3
70, 71	Vol.	61	M	6			‡	4	See Note	B3				24, 27, 45, 80		
80	Vol.	7	H	6	2		8-8	4	RS213	B3				35, 24, 47, 80	175	1
	Tone	22	K12													
100	Vol.	43	Y50MP		See Note A5									32, 33		
	Tone	22	K12		See Note A5											
BRUNSWICK RADIO CORP.																
B17 (For PR17-8 2nd Type)	Vol.	1	SRP145				4-4	4	See Note	B1				26, 27, 71, 80		11
PR6							3.5-3.5	1	See Note	B1				80, 71A		1
R1	Vol.	1	SRP144				1-1	2	See Note	B1				26, 27, 71A, 80		11
3KR0, 3KR6	Vol.	1	SRP144				1-1	2	See Note	B1				26, 27, 71, 80		
	Phono.	‡	V													
3K[illegible]	Vol.	1	SRP144				1-1	2	See Note	B1				26, 27		
	Phono.	‡	V													
3NW8	Vol.	59	SRP141				4-4	4	See Note	B7				27, 50, 81	180	
	Sen.	1	D12													
5KR, 5KR0, 5KR6, 2KR0	Vol.	1	SRP144				1-1	2	See Note	B1				26, 27, 71, 80		
	Phono.	63	V													
5NC8	Vol.	‡	SRP138				2-2	2	See Note	B1				27, 71A, 80	180	
5N0	Vol.		SRP138				2-2	2	See Note	B1				27, 71A, 80	180	
10	Vol.	8	A5MP	6	1		1-4	25	See Note	B1				51, 24, 47, 80		1
							.055		See Note	B9						
							2		See Note	B9						
11, 12, 16, 33, "D" Chassis Below No. 25000	Vol.	7	SRP255				7	1	See Note	B3				51, 24, 47, 80		1
							6	1	See Note	B3						
11A, 12A, 16A, 18, 33A, "D" Chassis, Above No. 25000	Vol.	15	SRP273				7	1	See Note	B3				51, 24, 27, 47, 80	175	1
							6	1	See Note	B3						
14, 21, 31 DC	Vol.	11	A5MP	6				‡	See Note	B7				01A, 71A		
S14, S21, S31, S81, S82C	Vol.	12	A3MP				1-1-1	3	See Note	B1				24, 27, 45, 80		3
	Hum	37	HU20				.275		See Note	B9						
S14, S21, S81, S82 (25 Cycle)	Vol.	12	A3MP				2-1-2	3	See Note	B1				24, 27, 45, 80		3
	Hum	37	HU20				1		See Note	B9						
	Hum	30	SRP265													
15B	Tone	22	K12											32, 30, 31		
15, 22, 32, 42 (AC)	Tone	22	E12				2-2	1	See Note	B1				24, 45, 80		
	Phono.	63	See Note			A5	4		See Note	B12						
							.14		See Note	B9						
							.25		See Note	B12						
15DC, 22DC, 32DC, 42DC	Tone	22	K12											32, 30, 71A		
	Phono.	63	See Note			A5										
17, 24, 25, AC	Vol.	9	SRP273				4.5-6	4	See Note	B1				51, 27, 24, 47, 80	175	3
BUCKINGHAM																
80	Vol.	3	C12				2-1-3	3	See Note	B1				26, 27, 71A, 80		11
BUICK MOTOR—Also See United Motors Service.																
980393	Vol.	17	UC512				8-8	1	See Note	B3	4	221	C3	36, 39, 85, 89, 84	262	10
	Tone	44	K12				.015		Buffer	B14						
BULOVA WATCH																
M501	Vol.	8	A5MP				1-4-2	28	See Note	B1				51, 24, 47, 80		1
							.055		See Note	B9						
600, 601, 605, 610	Vol.	8	A5MP		2		1-2-1	3	See Note	B1				51, 24, 47, 80	175	1
							.06/.25		See Note	B9						
							.03		See Note	B9						

‡ Data not substantiated.

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MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
BULOVA WATCH—	Continued															
M701	Vol.	7	G	6			2-2-2.5	28	See Note	B1				51, 24, 27, 47, 80	175	1
	Tone	22	K12				.055		See Note	B9						
C751	Vol.	58	F				8-8	34	RS213					35, 27, 24, 47, 80	175	1
	Tone	22	K12													
G781	Vol.	7	G	6			2-2-2.5	28	See Note	B1				51, 24, 47, 27, 80	175	1
	Tone	22	K12				.055		See Note	B9						
BUSH AND LANE																
10	Vol.	26	A10MP		See Note A18		8-8-8	3	RN245	B11				27, 45, 80		3
12	Vol.	12	A10MP		See Note A18		8-8-8	3	RN245	B11				27, 24, 45, 80		3
C R C																
24-27	Vol.	6	G7	6			4-4	1	See Note	B3				24, 45, 27		13
24-45	Vol.	6	G7				4-4	1	See Note	B3				35, 24, 45, 80		1
24-47	Vol.	6	G7				4-4	23	See Note	B3				35, 24, 47, 80		1
58-47	Vol.	6	H7				4-4	23	See Note	B3				58, 57, 47, 80		1
CABLE-NELSON—See Howard.																
CADILLAC																
06W	Vol.	18	N				P80939	2	CN155		2	210	C5	78, 77, 85, 41	262	10
	Tone	44	UC502				P80965	14	CS121	B3	12	237	C5			
							.01		Buffer	B14						
2029, 2029A, 2030	Vol.	‡	G											36, 37, 47	175	
2721 (072)	Vol.	18	N				P80902	13/15	See Note	B45	‡	‡		39, 36, 37, 38	262	
	Tone	44	UC502													
2722 (072A)	Vol.	18	N				P80902D	15/13	See Note	B45	2	211		39, 36, 37, 41	262	
	Tone	44	UC502													
56V1	Vol.	17	N		See Note A3		4-4-.5	13/15	See Note	B46	4	221	C3	78, 77, 6B7, 41	262	
	Tone	44	UC502													
CALVERT																
A50A	Vol.	6	G12		EX400		658	1	8-8	B3				24, 47, 80		3
A51A, A52A	Vol.	8	UC501				658	1	8-8	B3				35, 24, 47, 80		3
CAPEHART																
CK	Vol.	13	L				8-8-8	1	RS213	B3				58, 57, 56, 47, 80	175	3
	Tone	41	L													
	Phono.	87	M													
	Sil.	8	UC501													
103, 104 (Cosmopolitan) Chassis Z	Vol.	33	See Note			A5	8-8-6	3	See Note	B3				78, 6A7, 75, 77, 37,		
	Tone	22	See Note			A5	8-8	14	See Note	B3				2A5, 80	175	3
400A	Vol.	15	M				8-8-4-2-2	37	See Note	B3				58 56, 57, 55, 47, 80.	180	3
	Tone	41	O				40	15	SR608	B3						
400B	Vol.	33	M				8-8-4-2-2	3	See Note	B3				58, 56, 57, 55, 2A5,		
	Tone	‡	M				40	15	SR608	B3				5Z3	180	7
	Supp.	44	UC501													
400, 401, 402	Vol.	8/87	See Note			A5								51, 27, 47, 80	180	3
	Tone	41	See Note			A5										
400B, 402B, 404B, Tuner	Vol.	33	M				8-8-4-2-2	3	See Note	B3				58, 2A7, 57, 55, 56,		
	Tone	44	M				40	15	SR608	B3				2A5, 5Z3	180	
	Supp.	8	UC501													
400B, 402B, 404B, All-Wave	Vol.	15	M				8-8-4-2-2	3	See Note	B3				58, 57, 56, 2A7, 2A5,		
	Tone	44	M				40	15	SR608	B3				5Z3	465	7
	Supp.	8	UC501		See Note A5											
Standard Amp							8-8-4-2	3	See Note	B3				56, 2A5, 5Z3		3
							40	15	SR608	B3						
CARTER																
Genemotor							4	1	Supplied on Order							
CASE—See U. S. Radio & Tel.																
CAVALCADE																
54	Vol.	18	500M No. 1		See Note A1		6-10	4	See Note	B3	35	294	C3	6A7, 6D6, 75, 42, 84	‡	10
							.02		Buffer	B14						
64	Vol.	18	500M No. 1		See Note A1		6-10	4	See Note	B3	35	294	C3	6D6, 6A7, 75, 42, 84	‡	10
							.02		Buffer	B14						
357	Vol.	18	N	6			8-8	4	See Note	B3				6A7, 6D6, 75, 42, 80	456	1
359	Vol.	18	500M No. 1		See Note A1		6-10-.05	4	See Note	B3	47	See Note	C6	6D6, 6A7, 75, 42, 84	456	10
							.02		Buffer	B14						
3511	Vol.	45	M	6			8-8	1	CN152	B3	14	245C	C3	1C6, 34, 32, 33	456	6
							.01-.01		Buffer	B14						
CENTURY																
4-47	Vol.	6	G12	6	EX200	A5	8-8	1	See Note	B3				35, 24, 47, 80		1
4-78	Vol.	6	See Note	6		A5	8-8	1	See Note	B3				58, 57, 47, 80		1
5-38	Vol.	6	See Note	6		A5										
5-47	Vol.	6	G12	6	EX200	A5		1	See Note	B3						1
7-38 Auto Radio	Vol.	64	N		See Note A5											
"Ace"	Vol.	18	N				16-8-8	3	See Note	B3				58, 56, 46, 47, 80	175	3
	Tone	22	K12													
	Supp.	7	G		2											
"Queen"	Vol.	6	Y	6	EX200		8-4	1	See Note	B3				57, 58, 47, 80	175	1
	Tone	22	K12		See Note A4		10	17	TS101							
CHEVROLET—Also See United Motors Service																
600153	Vol.	17	N				8-8	1	See Note	B3	5	222		78, 6F7, 75, 41	262	10
CLAGO																
Radiochron "B"	Vol.	6	G12				1-2	1	See Note	B1				24, 45, 80		3
	Tone	22	G12													
CLARION—See Transformer Corp.																
CLEARTONE																
110 (Compact)	Vol.	16	N				3-3-2	3	See Note	B1				Kellog, 80		1
	Clr'ty	26	K													
112	Vol.	14	N				2-2	1	See Note	B7				26, 27, 50, 81		9
CLIMAX																
424	Vol.	6	G12		2		4-4	1	See Note	B3				24, 47, 80		1
CLINTON																
803, 1935, 1936	Vol.	‡	‡		See Note A5		8-8	‡	CM172		35	294	C3	‡	‡	‡
							‡		Buffer	B14						
COAST TO COAST																
A14	Vol.		NN				3	3	See Note	B7				37, 42, 82		1
							8-8	3	RS213	B3						

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
COAST TO COAST—Continued																
83	Vol.	15	N				8-8-8		See Note	B3				56, 46, 83		3
							10	15	TS101							
							4-4-4	14	See Note	B3						
51-2'59-2'81	Vol.	15	N				2-2-4	3	See Note	B7				59, 50, 81		5
	Tone	41	M													
525	Vol.	7	E				8-8-8	3	CN155	B3				35, 24, 27, 47, 80		3
	Tone	41	L													
D3008	Vol.		N				16-4	24	See Note	B3				37, 2A3, 82-83		
							4	13	See Note	B3						
							4-4	1	See Note	B3						
							5	15	TS101							
D3031	Vol.	16	N				12-12	9	See Note	B3				37, 43, 25Z5		
	Tone	65	N				8-4	14	See Note	B3						
							5	15	TS106							
4978	Vol.	15	M				2-2-2	3	See Note	B7				24, 45, 50, 81		8
	Tone	41	M													
COLONIAL—Also See Sears Roebuck																
16-5	Fil.	29	Q											01A		
16-6	Fil.	29	Q											01A		
17-5	Fil.	29	Q											01A		
25	Vol.	15	N				2-2-2	3	See Note	B7				01A, 99, 10, 81		1
	Primary		M30R				.085		See Note	B9						
26	Vol.	29	T											01A, 71		
	Fil.	29	HU20		See Note A33											
31AC	Hum	37	C30P				8-8-8	3	MN275					26, 27, 71A, 80		9
31DC	Fil.	‡	M20R											26, 71A		
32AC	Vol.	24	GK				1445P	3	MN275					24, 27, 45, 80		1
Cavalier, Picadilly, Moderne 32 DC	Vol.	24	GK											24, 27, 45		
33, 34, 35							8-8	1	MN272					24, 27, 45, 80		7
36	Hum	66	SRP266				D4758P	1	RS213					24, 45, 80		3
36P							D4758P	1	RS213					24, 45, 80		3
37							R5734A	4	RN242					35, 24, 45, 80		3
37P							R5734A	4	RN242					35, 24, 45, 80		3
38	Hum	66	SRP266				D4758P	1	RS213					24, 45, 80		3
39							4758P	4	RS213					24, 45, 80		1
41, 42							R5734A	4	RN242					35, 24, 45, 80		1
41P							R5734A	1	RN242					35, 24, 45, 80		1
44	Vol.	6	H7		1		4758P	4	RS213					24, 35, 47, 27, 80	175	1
46 (Midget)	Vol.	7	H				R6122	1	CN152					35, 24, 47, 80		1
47, 48	Vol.	6	H7		1		D4758P	4	RS213					35, 24, 27, 47, 80	175	3
49 (Midget)							4758P	4	RS213					35, 24, 47, 80		1
50 (AVC)	Vol.	7	H				D4758P	4	RS213					35, 27, 24, 47, 80	175	7
51	Tone	21	N	6			D4758P	25	RS213					35, 24, 27, 47, 80	175	3
52	Vol.	6	H		1		D4758P	4	RS213					35, 27, 24, 47, 80	175	3
	Tone	21	N													
55							R6645	1	RS211					24, 27, 35, 80	1000	1
56	Vol.	15	N				8	12	CS123					32, 30, 33	175	
	Tone	57	N				5	17	TS101							
62	Vol.	6	H7	6			8	1	RS213					57, 58, 24, 47, 80	175	3
	Tone	57	N				4	13	See Note	B3						
65	Vol.	29	U	6										34-32, 32, 33, Bal.		
69	Tone	22	N				8	12	See Note	B3				32, 30, 33, Bal.	175	
							20	19	TS102							
71	Supp.	7	W	6			D4758P	2	WE847					58, 57, 46, 83	175	7
	Tone	66	N													
73	Vol.	6	H7	6	1		D4758P	23	RS213					57, 58, 24, 47, 80	175	1
76	Vol.	6	H12	6			14	4	WE1647					57, 58, 56, 46, 80	175	3
	Tone	22	N				D4758P	4	RS213							
	Hum	37	HU20				16	13	See Note	B3						
106B	Vol.	17	N				UE115	1	CS123		4	221	C3	36, 39, 85, 41, 84	175	
	Tone	44	N				R7917	17	TS102							
							.02		See Note	B14						
114	Hum	66	SRP266				8	1	RS213					35, 24, 45, 80		3
117	Hum	66	SRP266				D4758P	1	RS213					24, 45, 80		3
125							4758P	4	RS213					24, 45, 80		1
136	Vol.	6	H12	6			R9150	9	CM165	B47				78, 77, 43, 25Z5		
							5	15	TS101							
150	Vol.	18	500M No. 1		See Note A1		R8837	1	CN152		24	271	C3	6A7, 78, 75, 41	480	10
							R9144	15	TS101							
164	Vol.	17	SRP252	6			R9743	1	CN152		3	220B	C3	78, 6A7, 6B7, 41, 84	175	10
	Tone	22	N				R9144	15	TS101							
							.01-.01		See Note	B14						
164B	Vol.	18	SRP252				R9743	1	CN152		37	296	C3	78, 6A7, 6B7, 41, 84	175	10
	Tone	22	N				R9144	15	TS101							
							.01-.01		See Note	B14						
182	Vol.	17	SRP252	6			R9780	4	RM262	B48				78, 6A7, 6F7, 6B7, 41	175	
	Tone	44	N					15	TS101							
250	Vol.	68	D12				R8053	9	CM165	B49				6A7, 6B7, 77, 43,		
							R8058	15	TS101					25Z5	175	
250AC	Vol.	68	D12				R8247	23	RM262	B50				6A7, 6B7, 77, 41, 84	175	1
250AC (Ex. Range)	Vol.	18	N	6			R8749	23	CS133					6A7, 78, 75, 41, 84	175	1
							R8748	23	CS123							
250-300 AC-DC	Vol.	18	N	6			R8053	29	CM165	B51				6A7, 78, 75, 43, 25Z5	175	
279 (A)	Vol.	68	D12				R8053	9	CM165	B49				6A7, 6B7, 77, 43,		
							R8058	15	TS101					25Z5	175	
279AC	Vol.	68	D12				R8247	23	RM262	B50				6A7, 6B7, 77, 41, 84	175	1
279 (B)	Vol.	68	D12				R8053	29	CM165	B51				6A7, 6B7, 77, 43,		
							R8058	15	TS101					25Z5	175	
300 (A)	Vol.	68	D12				R8053	9	CM165	B49				6A7, 6B7, 77, 43,		
							R8058	15	TS101					25Z5	175	
300 (B)	Vol.	68	D12				R8053	29	CM165	B51				6A7, 6B7, 77, 43,		
							R8058	15	TS101					25Z5	175	
300AC, 301AC	Vol.	68	D12				R8247	23	RM262	B50				6A7, 6B7, 77, 41, 84	175	1
300 (Ex. Range)	Vol.	18	N	6			R8749	23	CS133					6A7, 78, 75, 41	175	1
							R8748	23	CS123							
301 (A)	Vol.	68	D12				R8053	9	CM165	B49				6A7, 6B7, 77, 43,		
							R8058	15	TS101					25Z5	175	
301 (B)	Vol.	68	D12				R8053	29	CM165	B51				6A7, 6B7, 77, 43,		
							R8058	15	TS101					25Z5	175	
T345, C399	Vol.	6	H12				D4758P	23	RS213					39, 36, 89, 80	175	1
	Tone	21	N													
T397	Vol.	6	H12				D4758P	23	RS213					58, 24A, 47, 80	175	1
	Tone	21	N													
400	Vol.	19	1 Meg.		See Note A19		R8624	23	RS213					78, 6A7, 85, 41, 84	175	1
	Tone	21	O													
	Power	7	A550P		See Note A14											
C495	Vol.	6	H12				D4758P	23	RS213					58, 24A, 47, 80	175	1
	Tone	21	N													
500 (A)	Vol.	68	D12				R8053	9	CM165	B49				6A7, 6B7, 77, 43,		
							R8058	15	TS101					25Z5	175	
500 (B)	Vol.	68	D12				R8053	29	CM165	B51				6A7, 6B7, 77, 43,		
							R8058	15	TS101					25Z5	175	

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
COLONIAL—Continued																
501	Vol.	18	N	6			R8053	29	CM165	B51				6A7, 78, 75, 43, 25Z5	175	
	Tone	21	N				R9229	29	CS123	B52						
501AC	Vol.	18	N	6			R9345	23	CS133					6A7, 78, 75, 41, 84	175	1
	Tone	21	N				R9344	23	CS123							
C595	Vol.	15	O				R8624	4	RS213					58, 56, 27, 47, 80	175	3
	Tone	21	N	6												
600, 600A	Vol.	18	UC503				R7236	23	WE1647					78, 6A7, 85, 41, 80	175	1
	Tone	22	N				D4758P	23	RS213							
601	Vol.	18	N				R7236	23	WE1647					78, 6A7, 75, 45, 83	175	14
	Power	7	UC500				D4758P	23	RS213							
							R9237	13	CS131							
602	Vol.	15	N				R7236	23	WE1647					6A7, 78, 6B7, 37, 2A3,		
	Tone	22	N				R9344	13	CS133					83	175	15
	Sen.	7	H				R8748	13	CS123							
603	Vol.	18	N				D4758P	23	RS213					78, 41, 75, 42, 80	480	1
	Tone	‡	N													
604	Vol.	18	N				R7236	23	WE1647					78, 6A7, 75, 47, 80	445	14
	Tone	‡	O				R8488	23	RS213							
							R9237	13	CS121							
605	Vol.	18	N	6			8-8	23	RS213					78, 41, 37, 75, 47, 80	175	14
	Tone	22	N													
650	Vol.	18	N	6			R4758P	23	RS213					6A7, 78, 75, 41, 80	175	1
	Tone	‡	N				R7236	23	WE1647							
651	Vol.	18	N	6			R8744	23	CS133					6A7, 78, 75, 41, 84	480	1
							R8748	23	CS123							
652	Vol.	18	N	6			R8624	23	RS213					6A7, 78, 75, 42, 80	480	1
							8	13	CS133	B3						
653	Vol.	6	D7				D4758P	23	RS213					6A7, 78, 37, 41, 80	480	1
654	Vol.	7	D	6			R10689	24	CN142					6A7, 78, 37, 38, 1V	480	
655	Vol.	18	N	6			8-8	23	RS213					78, 41, 75, 84	480	1
656	Vol.	18	N				D4758P	23	RS213					78, 41, 75, 42, 80	175	16
	Tone	‡	N	6												
657	Vol.	18	N	6			R10601	29	UR190	B53				6A7, 78, 75, 43, 25Z5	480	
658	Vol.	18	N	6			D4758P	23	RS213					78, 41, 75, 80	480	1
	Tone	‡	N				8	23	RS213							
659	Vol.	29	U				R10673	13/19	CN142/TS102					951, 30, 32, 33, 30		
	Tone	34	N											Bal.	480	
662	Vol.	18	N	6			R9204	23	RS213					6A7, 78, 51, 41, 84	480	1
							R8748	23	RS213							
C695	Vol.	18	O				D4758P	23	RS213					58, 56, 27, 47, 80	175	3
	Tone	21	N													
700, 701, 702	Vol.	18	N	6			R9397	29	RS203					6A7, 78, 75, 43, 25Z5	175	
700AC, 701AC, 702AC	Vol.	18	N				R8624	23	RS213					6A7, 78, 75, 41, 84	175	1
							R9204	23	RS203							
C995	Tone	22	N				R7236	7	WE1647					58, 24, 57, 46, 82	175	17
							8	7	RS213							
1580	Vol.	6	H7				8-8	25	RS213					57, 58, 56, 57-24, 47,		
	Tone	21	N											80	175	3
COLUMBIA PHONO. CO.																
C1, C2, C3, C4	Vol.	14	L				2-2-2	3	See Note	B1				26, 27, 71A, 80		11
C5 (205)	Vol.	14	L				3-2-2	3	See Note	B1				26, 27, 50, 81		8
C5 (310)	Vol.	14	L				3-4-4	3	See Note	B1				26, 27, 10, 81		8
C6, C7	Vol.	14	L				‡	‡	See Note	B1				01A, 71A		
31, 33	Vol.	7	A5MP	6			1-4-2	25	See Note	B1				51, 24, 47, 80		1
							.055		See Note	B9						
C33, C34	Vol.	7	G				2-2	25	See Note	B1				51, 24, 27, 47, 80		1
							8	25	RS213	B3						
							.08		See Note	B9						
C80A	Vol.	15	M				8-8-10	25/15	CM172/TS101	B6				58S, 56, 4-S, 47, 82	175	1
	Tone	22	K12	6												
C80B	Vol.	15	M				8-8-10	25/15	CM172/TS101	B6				58S, 56, 4-S, 47, 82	175	1
	Tone	22	K12	6												
C90, A, B	Vol.	15	M				7489	2	CN152	B8				58S, 56, 57S, 47, 82	175	3
	Supp.	12	Y				7278	13/14	CM162	B54						
	Tone	22	M	6			7402	15	TS101	B54						
	Hum	37	HU20				7784	15	TS102	B54						
C100	Vol.	15	SRP226				8-8-8	3	MN275					24, 27, 45, 80		3
120B	Vol.	43	GG											30, 32, 33	175	
C800	Vol.	15	M				8-8-10	25/15	CM172/TS101	B6				58S, 56, 4S, 47, 82	175	1
	Tone	22	K12	6												
900, 901	Vol.	87	‡		See Note A5		3-4	1	See Note	B7				26, 10, 81, 876		8
902	Vol.	63	‡		See Note A5		3-4	1	See Note	B7				27, 50, 81		5
920, 930	Hum	37	HU20				2-2-.5	3	See Note	B7				27, 45, 80		3
930-300	Vol.	63	‡		See Note A5		3-4	1	See Note	B7				26, 10, 81		5
931	Vol.	63	‡		See Note A5		3-2	1	See Note	B7				26, 50, 81		5
940	Vol.	40	Y				2-1-.5	3	See Note	B1				26, 27, 45, 80		2
950, 961	Vol.	40	G12				3-2-2	3	See Note	B7				26, 27, 50, 81		8
	Phono.	63	‡		See Note A5											
980	Vol.	14	L				1-1-1	3	See Note	B1				Radio 26, 27, 80		
	Phono.	63	‡		See Note A5		3-4	1	See Note	B7				Phono 27, 50, 81		11/5
990	Hum	37	HU20				2-2-5	3	See Note	B1				27, 45, 80		3
COLUMBIA RADIO CORP.																
SG5 ('30)	Vol.	7	Z				2-1	1	See Note	B1				24, 45, 80		3
SG8	Vol.	69	Y	8		A8	2-2-2	3	See Note	B1				24, 27, 45, 80		3
SG9	Vol.	25	G12	6		A20	8-8-8	3	See Note	B3				24, 27, 45, 80		3
	Tone	41	N													
SG10	Vol.	7	Z		See Note A10		2-2.5-2.5	3	See Note	B1				24, 27, 45, 80		3
COMMONWEALTH																
150	Vol.	17	N				5-18-7	11	UR182	B31				6A7, 6D6, 75, 43, 25Z5	456	
CONSOMELLO																
8 in line	Vol.	10	D7				‡	3	See Note	B3				26, 27, 71A, 80		11
CONTINENTAL																
(Slagle) 9 ('71A)							2-4-2	3	See Note	B1				27, 71A, 80		2
(Slagle) 10, A, B, ('71A)							2-4-2	3	See Note	B1				27, 71A, 80		2
29A, 29B							2-4-2	3	See Note	B7				27, 50, 81		2
(Slagle) 29C ('71)	Phono.	63	K12		See Note A3		2-4-2	3	See Note	B7				27, 71A, 80		2
29C, 29B ('50)	Phono.	63	K12		See Note A3		2-4-2	3	See Note	B7				27, 50, 81		5
"Star Raider" R20, R30, R40							2-4-1-2	37	See Note	B7				484, 585, 81, VR		5
"Admiral" L5	Vol.	18	N	6			P474	32	RS211					5Z4, 6F5, 6F6, 6H6,		
	Tone	34	L				P160	32	CN151	B81				6K7, 6L7	456	1
							P304	15	TS101							
"Admiral" L6	Vol.	18	N	6			P474	32	RS211	B81				5Z4, 6C5, 6F6, 6K7,		
	Tone	44	L				P160	32	CN151					6L7, 6Q7	456	1
							P304	15	TS101							

‡ Data not substantiated.

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MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
CONTINENTAL—Continued																
"Admiral" L7	Vol.	45	N	7			P391	1	CN152		14	245C	C3	1C6, 19, 30, 34	456	10
	Tone	‡	L				.01-.01		Buffer	B14						
"Admiral" U6	Vol.	17	UC514				P759	4	CM172		35	294	C3	‡		10
	Tone	22	Order from	Mfg.			G864	15	TS101							
"Admiral" Z4	Vol.	45	SRP275	7			P391	1	CN152		14	245C	C3	1C6, 34, 30, 32, 19	456	10
	Tone	44	L				.01-.01		Buffer	B14						
"Admiral" Z5	Vol.	45	SRP275	7			P958	1	CN152		14	245C	C3	1C6, 19, 30, 32, 34	456	10
	Tone	44	L				.01-.01		Buffer	B14						
61	Vol.	18	N				8-4	23	See Note	B3				6A7, 6D6, 75, 42, 80	456	1
L2	Vol.	18	SRP275				4	7	RS213					6A7, 6K7, 6H6, 6F5,		
	Tone	34	O	6			8-4	7	CN151	B81				6F6, 80	456	1
L4, ML4	Vol.	18	SRP275				4	7	RS211					6A8, 6K7, 6H6, 6A6,		
	Tone	44	L	6			8-4	7	CN151	B81				6F6, 80	456	1
							5	15	TS101							
ML156, ML266	Vol.	18	SRP275				4	7	RS211					6A7, 6K7, 6H6, 6F5,		
	Tone	34	O	6			8-4	7	CN151	B81				6F6, 80	456	1
137X, 150X, 171X	Vol.	18	N		See Note	A21	8-4	23	See Note	B3				6A7, 6D6, 75, 42, 80	456	1
X541	Vol.	18	N				18-6	6	See Note	B3				6A7, 6D6, 75, 43,		
							5	15	TS101					25Z5	456	
"CRANE" (American Radiator Co.)																
23T8 LW	Vol.	15	N				8-8	4	See Note	B3				58, 56, 57, 47, 80	177.5	1
	Tone	22	K12													
CROSLEY																
Buddy, Chum	Vol.	7	A400P				W4943	24	MN272					24, 71A, 80		2
AC7, AC7C	Vol.	29	A550P				15-15-5	3	MN275					99, 12A, BH		1
A155	Vol.	18	‡		See Note	A5	8-8	1	See Note	B3	15	247	C3	78, 6F7, 6B7, 78, 42	181.5	10
							.005		Buffer	B14						
A156	Vol.	56	UC514				W37020	4	CM171		43	501P	C3	6A7, 6B7, 6D6, 42	262.5	10
							.005		Buffer	B14						
A166	Vol.	17	UC514				W38427	1/15	RN242/TS101	B6	25	273C		6D6, 6A7, 6B7, 76, 41	262	10
							W32904	‡	TS102							
							W38430	‡	TS101							
A255	Vol.	17	‡		See Note	A5	8-8	1	See Note	B3	25	273C		6D6, 6A7, 6B7, 76,		
														6B5	450	10
A266	Vol.	15	UC511				W38786	4	RM262	B73	43	501P	C3	6D6, 6A7, 6B7, 42, 84	262	10
							.005		Buffer	B14						
A355	Vol.	17			See Note	A5	8-8	1	See Note	B3	25	273C		6D6, 6A7, 6B7, 76,		
														6B5	450	10
A366	Vol.	20	‡		See Note	A3	W38427	1/15	RM257	B74	25	273C		6D6, 6A7, 6B7, 76, 41	262.5	10
	Tone	39	M				W38430	15	TS101							
A455, A555	Vol.	18	‡		See Note	A5	8-8	1	See Note	B3	25	273C		6D6, 6A7, 6B7, 6B5	450	10
2C1 (Sampler)	Vol.	6	‡	6	See Note	A3	W34704A	24/15	UR190/TS101	B55				6F7, 12A7		
4A1	Vol.	18	UC512	6			W32759	1	RS213		16	247	C3	6F7, 6B7, 6D6, 42	456	10
							W30419A	13/15	RN242							
							.005		Buffer	B14						
4B1 Batt. (Forty)	Vol.	70	Y10MP	13	See Note	A13								1A6, 34, 33	456	
5A1	Vol.	18	UC512	6			W31631B	1	CS135	B3	6	223	C3	78, 6B7, 41	181.5	10
							W30419A	1/15	RN242							
							.01		Buffer	B14						
5A3 (Roamio)	Vol.	18	UC514	7	See Note	A31	W32759	1	WE847		16	247	C3	78, 6F7, 6B7, 42	181.5	10
							W32802	1/15	SR605	B23						
							.005		See Note	B14						
5B3 (Batt. Fiver)	Vol.	70	Y10MP	13	See Note	A14								1A6, 34, 33	456	
5M3 (Fiver Jr.)	Vol.	6	E7	6	See Note	A14	W29150B	1/15	RN245					6D6, 76, 42, 80	456	1
5V1 (Deluxe Fiver)	Vol.	17	N	6			W30059C	4/14	RM265					6A7, 6D6, 6B7, 42, 80	181.5	1
5V2 (Fiver Deluxe)	Vol.	17	O	6			W30059C	4/14	RM265					6A7, 6D6, 6B7, 42, 80	181.5	1
6B1 (Batt. Six)	Vol.	45	O				W34898	1	RS213		16	247	C3	15, 6A7, 30, 38	456	10
	Tone	22	Z	6			W34899	13	CS123							
							W34896	1/13	CN145							
							.005		Buffer	B14						
6H2 (61, 61LB)	Vol.	17	UC504				W26194B	4	WE1247					6A7, 6D6, 6B7, 76,		
	Tone	22	Z	6			W29097C	4/14	RN245	B7				42, 80	456	1
6H3	Vol.	17	UC504				W26194B	4	WE1247					6D6, 6A7, 6B7, 76,		
	Tone	22	Z	6			W27097D	4/14	RN245	B57				42, 80	456	1
6V2 (Dual Sixty)	Vol.	56	O				B30059B	4/13	RM265	B58				58, 2A7, 55, 2A5, 80	181.5	1
	Tone	22	Z	6												
7H2 (72, 72LB)	Vol.	56	O				W29097C	4/13	RN245	B57				58, 2A7, 2B7, 2A5, 80	456	1
	Tone	22	Z	6			W26194B	4	WE1247							
7H3 (72, 72LB)	Vol.	56	O				W26194B	4	WE1247					6D6, 6A7, 6B7, 6F7,		
	Tone	34	Z	6			W29097C	4/14	RN245	B57				42, 80	456	1
7V2 (Dual Seventy)	Vol.	17	UC504				W26194B	1	WE1247					58, 56, 2A5, 80	181.5	1
	Tone	22	Z	6			W29150B	15/24	RN245	B57						
8B3	Vol.	45	O				W33990	12	See Note	B3				34, 1C6, 30, 31, 19	456	
	Tone	22	Z	14												
8H1 (80, 80LB)	Vol.	56	O				W26194B	1	WE1247					6D6, 6A7, 6B7, 6F7,		
	Tone	44	Z	6			W29097C	3	RN245	B57				42, 80	456	1
7, (Converter)							W23701	1	RS213					24, 27, 80		1
10							W27676	1	CN140					77, 37		
20, 21, 22	Vol.	6	T		See Note	A22								22, 01A, 71A		
26	Vol.	12	L											22, 01A, 12A		
27, 28	Vol.	4	SRP263											32, 31		
30S, 31S, 33S, 34S	Vol.	7	SRP188				W5253	3	MN275					24, 27, 45, 80		3
38 (Field Supply)							W29806A	1	RM257	B59				25Z5		
40S, 41S, 42S	Vol.	89	DRP305	1st type			W5253	3	MN275					24, 27, 45, 80		3
	Vol.	90	DRP305	2nd type												
	Vol.	91	SRP188	3rd type												
41, 41A, 42	Vol.	3	SRP185				W4943	1	MN272					26, 27, 71, 80		11
48	Vol.	6	SRP263				W21459	1	RS213					24, 45, 80		1
50, 50LB (5H1)	Vol.	18	UC504				W26194B	4	WE1247					6A7, 6F7, 6B7, 42, 80	456	1
	Tone	22	Z	6			W29097C	4/14	RN245							
51 (5C2)	Vol.	56	UC503	6			W31992	11/15	RM259/TS101	B56				78, 6F7, 6B7, 43,		
														25Z5	181.5	
53, 54	Vol.	6	SRP263				W4943	1	MN272					24, 45, 80		3
55	Vol.	2	L				W20156	39	See Note	B7				32, 12A, 71A		
							W21292	15	TS102							
56	Vol.	2	SRP263				W20156	39	See Note	B7				32, 12A, 71A		
							W21292	15	TS102							
57, 58	Vol.	6	SRP263				W4943	1	MN272					24, 45, 80		3
59AC	Vol.	6	E7		See Note	A14	W23705	4	RS215					35, 24, 47, 80		1
							W23701	4	RS213							
60S, 61S, 62S, 63S	Vol.	12	SRP188				W5253	3	MN275					22, 12A, 71A		
76	Vol.	15	SRP226				W20156	1	RS213	B16				24, 71A		
							W21292A	‡	TS102							
77-1	Vol.	6	SRP263				W20341A	3	MN277	B60				24, 27, 45, 80		3
77A, 77B, 77L	Vol.	15	SRP226				W20341A	3	MN277	B60				24, 27, 45, 80		3
82S	Vol.	89	DRP305	1st type			W5253	3	MN275					24, 27, 45, 80		3
	Vol.	90	DRP305	2nd type												
	Vol.	91	SRP188	3rd type												
84	Vol.	15	M				W20341	3	MN277	B6				24, 27, 45, 80		3
84C, 84D	Vol.	15	SRP226				W20341	3	MN277	B60				24, 27, 45, 80		3

‡ Data not substantiated.

*** IMPORTANT: Read Notes in Note Section if specified in Note Column.**

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
CROSLEY — Continued																
915	Vol.	‡	O				W36055	‡	WE3540					6D6, 6A7, 6B7, 76, 42, 5Z3	450	‡
	Tone	‡	Z	6			W36057	‡	WE3540							
							W36548	‡	TS102							
916	Vol.	93	DRP304				W36055	1	WE3540					6K7, 6A8, 6R7, 6C5, 6N6, 5Z4MG	450	1
	Tone	34	Z	6			W36057	1	WE3540							
							W37778	15	BN225							
955	Vol.	93	DRP304				W36055	1	WE3540					6K7, 6C5, 6L6, 6Q7, 6F6, 5Z4	450	1
	Tone	34	Z	6			W36057	14	WE3540							
							W37778	15	BN225							
1014 (Centurion)	Vol.	17	O				W26194B	7	WE1247					6D6, 6A7, 6F7, 76, 42, 80	456	1
	Tone	44	Z	6			W34596	7/24	RN245	B57						
1016	Vol.	93	DRP304				W36055	1	WE3540					6K7, 6C5, 6A8, 6R7, 6N6, 5Z4MG	450	1
	Tone	44	Z	6			W36057	1	WE3540							
							W37778	15	BN225							
1055	Vol.	18	O				W36055	30	WE3540					6H7, 6A8, 6C5, 6F6, 6H6, 5Z4	450	1
	Tone	44	Z	6			W36057	30	WE3540							
							W36548	15	BN225	B8						
1155	Vol.	93	DRP304				W36055	1	WE3540					6K7, 6L7, 6C5, 6H6, 6Q7, 6F6, 5Z4	450	1
	Tone	44	Z	6			W36057	1	WE3540							
							37632	15	BN225	B79						
1316	Vol.	93	Order from Mfgr.				W36055	1	WE3540					6K7, 6A8, 6R7, 6J7, 6H6, 6C5, 6N6, 5Z4MG	450	1
	Fidlty.	‡	UC504	6			W36057	1	WE3540							
							W36057	13	WE3540							
							W37632	15	BN225	B79						
5515 (Fiver)	Vol.	6	G12	6	EX200		W36719	1	RN242	B57				6D6, 76, 6B5, 80	450	1
5516	Vol.	6	G12	6	EX200		W41080	1	RS215	B57				6D6, 76, 6B5, 80	450	1
							W41081	1	RN232	B8						
5526	Vol.	‡	DRP304				W36055	1	WE3540					6A8G, 6K7G, 6J7G, 6N6G, 5Z4MG	455	1
	Tone	44	UC510	6			W36057	1	WE3540							
5536	Vol.	6	E7	6	2		W29804A	11	RM259	B78				6K7G, 6J7G, 25A6G, 25Z6G	450	
5555	Vol.	‡	DRP304	6			W36055	1	WE3540					6A8, 6K7, 6J7, 6F6, 5Z4	450	1
							W36057	1	WE3540							
							W36931	15	TS101							
6615	Vol.	17	O				W36057	1	WE3540		15	246	C3	15, 6A7, 6B7, 31, 38	450	10
	Tone	34	Z	6			W34896	1/24	See Note	B80						
							.001		Buffer	B14						
6516	Vol.	6	G12	6	EX200		W41080	1	RS215	B57				6D6, 76, 6B5, 80	450	1
							W41081	1	RN232	B8						
6625	Vol.	‡	DRP304				W36055	1	WE3540					6A7, 6D6, 6C6, 76, 6B5, 80	450	1
	Tone	34	UC510	6			W36057	1	WE3540							
							W40325		Supplied on Order.							
							W37778	15	BN225							
DELCO																
RA-B, RB-B	Vol.	9	Y25MP	6										32, 30, 31		
	Tone	41	‡			See Note A5										
RA3, RB3	Vol.	7	K											36, 38		
	Tone	22	L													
RB1, RC1	Vol.	6	‡			See Note A5	4-4	7	See Note	B3				24, 27, 35, 47, 80	175	1
	Tone	22	‡			See Note A5	8	7	See Note	B3						
3002	Vol.	26	UC513	6										24, 27, 12A		
3026	Vol.	48	‡			See Note A5								36, 37, 47	175	
DELTA																
"Class B Amp."	Vol.	16	N											56, VT1, VT2		
	Mic.	74	M600P													
DETROLA																
4 Tube TRF '32	Vol.	6	Y				941	4	CM170					35, 24, 47, 80		1
"Road Chief"	Vol.	6	G12			See Note A1								39, 36, 37, 41		
"Road Master"	Vol.	56	N											36, 39, 85, 41	175	
"Warwick"	Vol.	15	L	6			8-4	4	See Note	B3				57, 58, 55, 47, 80	175	1
	Tone	21	N				10	17	TS101							
4C	Vol.	6	G12			See Note A14	4-16-8	11	UR182	B3				77, 78, 43, 25Z5		
4D	Vol.	6	G12			See Note A14	4-4	1	See Note	B3				78, 77, 42, 80		1
							10	15	TS101							
4F	Vol.	6	G12	6		See Note A14	4-20-8	11	UR182	B31				77, 78, 43, 25Z5		
4H	Vol.	6	G12	6		See Note A14	8-4	40	CN141					36, 37, 38, 39		
4J	Vol.	6	G12	6		See Note A14	4-4	1	CN140					77, 78, 42, 80		1
							10	15	TS101							
4W	Vol.	6	G12	6		See Note A14	4-20-8	11	UR182	B31				6D6, 6C6, 43, 25Z5		
4Y	Vol.	6	K12	6			4-20-8	11	UR182	B31				6D6, 6C6, 43, 25Z5		
5B	Vol.	17	O				1398	1	RN242					6A7, 78, 75, 42, 80	370	1
	Tone	22	M	6			578	15	TS101							
5D	Vol.	18	O				1014	1	RN242					78, 6F7, 75, 42, 80	455	1
	Tone	22	M	6			595	19	TS101							
5L	Vol.	6	G12	6		See Note A14	1460	11	UR182	B31				77, 78, 43, 25Z5		
5T (Super Midget)	Vol.	6	K12				16-8	11	See Note	B3				78, 44, 77, 43, 25Z5	459	
5W	Vol.	17	O				1624	1	CN152					6A7, 6D6, 75, 42, 80	370	1
	Tone	34	M	6			10	14	TS101							
5X	Vol.	17	O				1624	1	CN152					6A7, 78, 75, 42, 80	370	1
	Tone	34	M	6			578	14	TS101							
5Y	Vol.	6	Y	6		See Note A14	1460	11	UR182	B31				6D6, 76, 43, 25Z5		
6A	Vol.	17	UC512			See Note A25	8-8	1	See Note	B3	3	220B	C3	78, 6F7, 75, 42, 84	262	10
							10	15	TS101							
							.02		Buffer	B14						
6M, 6R	Vol.	17	UC512			See Note A25	1882	1	CN155		35	294	C3	6D6, 6A7, 75, 42, 84	262	10
	Tone	22	L				5-5	15	TN110							
							.0075		Buffer	B14						
6W	Vol.	17	O				1624A	1	CN152					6A7, 78, 75, 42, 80	370	1
	Tone	34	M	6			578	14	TS101							
6X	Vol.	17	O	6			1678	1/15	UR189	B84				6A7, 78, 75, 43, 25Z5	370	
	Tone	34	M	6												
7A	Vol.	17	O				1014	28	RN242					78, 37, 75, 42, 80	262	1
	Tone	22	M	6			1085	28	RS213							
48	Vol.	6	G12	6		See Note A14	8-4	24	See Note	B3				37, 38, 77, 78		
111	Vol.	18	UC512				2994	1	2 CS133	B85	47	See Note	C6	78, 6A7, 75, 6B5, 0Z4	262	10
	Tone	22	Order from Mfgr.				.0075		Buffer	B14						
	Sen.	7	C1MP													
503	Vol.	6	K				8-4	1	CN151					58, 57, 47, 80	456	1
	Tone	22	K12				10	17	TS101							
1000	Vol.	7	K	6			4-4-21	11	UR182	B31				‡		
1200	Vol.	15	M				8-50	4	See Note	B3				6D6, 37, 85, 43, 25Z5	175	
	Tone	44	K12				8	13	See Note	B3						
	Supp.	7	J				10	18	See Note	B3						
DEWALD																
AC-LW15-6	Vol.	6	E7	6	3		2062	4	See Note	B3				35, 24, 27, 47, 80		1
B-A-C	Vol.	6	F7	6	5		2095	4	RM261					58, 57, 47, 82		1
B-A-G	Vol.	6	F7	6	5		2062	4	CS133					24, 27, 35, 47, 80	175	1
							2063	4	CS131							

‡ Data not substantiated.

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MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
DEWALD—Continued																
B-A-H	Vol.	6	F7	6	4		2063	4	CS131					58, 56, 35, 57, 47, 82	175	1
							2062	4	CS133							
B-A-H-9	Vol.	6	F7	6	4		2062	4	CS133					58, 35, 56, 57, 47, 82	175	1
							2063	4	CS131							
B-A-M	Vol.	15	K12				8-8	4	CM172					58, 35, 27, 56, 47, 82	465	1
	Tone	44	Y													
B. L. G.	Vol.	6	F7		4		4-8	4	See Note	B3				58, 56, 57, 47, 82	115	1
K. A. D.	Vol.	6	H12	6	EX700									39, 36, 201A, 71A		
K. A. F.	Vol.	6	H12	6	EX800									36, 39, 37, 33	175	
K. R. E.	Vol.	6	H12		EX700									39, 37, 33		
AC14-45	Vol.	7	E12				3-3-1.5	2	See Note	B1				24, 27, 45, 80		3
AC24-45	Vol.	6	E12				1.5-3-1.5	2	See Note	B3				24, 27, 45, 80		1
40	Vol.	6	F7	6	5		4-4	4	See Note	B3				58, 57, 47, 82		1
41	Vol.	6	G7	6	5		8-5	1	CN141	B3				78, 77, 38, 25Z5		
							10-10	15	TN111							
50	Vol.	6	F7	6	5		2163	4	RM261	B86				24, 58, 57, 47, 82	175	1
51	Vol.	6	F7	6	5		8-4	4	See Note	B3				24, 58, 57, 47, 82	175	1
42, 42R	Vol.	6	F7	6	5		2170	1	CN141	B87				78, 36, 38, 12Z3		
							10-10	15	TN111							
52	Vol.	15	N				‡	‡	See Note	B3	4	221	C3	36, 37, 89	175	
							10	15	TS101							
53	Vol.	6	H12	6	EX800									36, 33		
54	Vol.	7	UC501	6	EX200		2128B	1	CN141	B87				36, 37, 38, 39		
							2129A	15	TN111							
55	Vol.	6	G7		2		2134B	27	CM165	B88				78, 44, 77, 43, 25Z5	456	
							5	15	TS101	B6						
55R, 55X	Vol.	6	G7	6	2		2171	6	UR190	B89				78, 77, 43, 12Z3	‡	
							10-10	15	TS101							
56	Vol.	6	G7		2		12-7	4	See Note	B3				6A7, 44, 77, 43, 25Z5	456	
							5	15	TS101							
58	Vol.	6	‡		See Note	A5	12-12	1	See Note	B3				6D6, 6C6, 43, 12Z3	455	
							4-4	15	TN110							
58L, 59	Vol.	6	J	6			12-12	27	See Note	B3				6A7, 6D6, 6C6, 43, 12Z3	456	
							4-4	15	TN110							
60	Vol.	6	G7		1		14-8	4	See Note	B3				39, 37, 43, 25Z5		
							5	15	TS101							
60EX	Vol.	6	J	6			7-12	4	See Note	B3				78, 77, 37, 43, 25Z5	Early, 455 Late, 175	
							10-10	15	TN111							
61	Vol.	56	500M No. 1		See Note	A1	2147	1	CS133		34	292	C3	6A7, 78, 85, 37, 41	456	10
							2133	15	TS101							
							.025		Buffer	B14						
62 Batt	Vol.	54	O											1A6, 34, 32, 30, 49	175	
80	Vol.	15	N				8-8	1	See Note	B3				6A7, 78, 37, 42, 80	456	1
							10-10	15	TN111							
81	Vol.	15	N	6			8-8	1	See Note	B3				6A7, 78, 37, 42, 80	456	1
	TunLgt.	‡	C15MP				10-10	15	TN111							
81R	Vol.	15	N	6			8-8	1	See Note	B3				6A7, 6D6, 37, 42, 80	456	1
	TunLgt.	‡	C15MP				10-10	15	TN111							
	Tone	22	UC502													
90	Vol.	‡	‡		See Note	A5	2179	‡	CN152					‡	‡	‡
							2180	‡	CS130							
							2181	‡	CS121							
100	Vol.	15	N				8-8	1	See Note	B3				6A7, 78, 37, 42, 80	456	1
							10-10	15	TN111							
AC145	Vol.	10	C12				2-1-2	37	See Note	B1				26, 27, 45, 80		18
AC171-2	Vol.	10	‡		See Note	A5	1-3-1	5	See Note	B1				26, 27, 71A, 80		18
DC173-4	Vol.	10	C12				2-1	2/12	See Note	B1				12A, 71A		
AC245	Vol.	10	‡		See Note	A5	2-2-2	3	See Note	B1				26, 27, 45, 80		18
DC273	Vol.	10	C12				2-1	2	See Note	B1				12A, 71A		
402	Vol.	6	Y		EX500		10-10	6	CN152					6D6, 6C6, 43, 25Z5		
							5-5	15	TN110							
403-4	Vol.	6	G7				2283	1/15	See Note	B5				6D6, 6C6, 43, 12Z3		
403-4 Type 2	Vol.	6	SRP263				2283	24/15	See Note	B5				6D6, 6C6, 38, 1V		
425R, 440	Vol.	6	SRP263				10-12	6	See Note	B3				6D6, 6C6, 43, 12Z3		
							4-4	15	TN110							
AC447M	Vol.	7	A20MP	6	EX250		2-2	4	See Note	B1				35, 24, 47, 80		1
500A	Vol.	6	G7	6	4		16-16	6	See Note	B3				6A7, 6D6, 6C6, 43, 12Z3	130	
							4-4	15	TN110							
501	Vol.	6	G7	6	4		8-8	6	CN142					6A7, 6D6, 6C6, 43, 12Z3	456	
							4-4	15	TN110							
503-4	Vol.	6	‡		See Note	A5	8-4	1	See Note	B3				2A7, 58, 57, 2A5, 80	456	1
	Tone	22	K12				5	15	TS101							
505	Vol.	6	Y		See Note	A14	8-8	6	See Note	B3				6A7, 6D6, 75, 43, 25Z5	456	
							5	15	TS101							
505F	Vol.	6	SRP263		EX800		12-20	27	See Note	B3				6A7, 6D6, 75, 43, 25Z5	456	
							5	15	TS101							
505R	Vol.	6	SRP263		EX800		2272	6/15	UR189					6A7, 6D6, 75, 43, 25Z5	456	
506	Vol.	7	UC509		See Note	A14	10-10	1	See Note	B3				6D6, 76, 43, 12Z3		
							5-5-5	15	See Note	B3						
506R	Vol.	6	SRP263		See Note	A14	2279	27/15	UR189	B94				6D6, 6C6, 43, 25Z5, 185-Bal		
510	Vol.	6	‡	6	See Note	A5	2292	4	CM172					6A7, 6D6, 6C6, 42, 80	456	1
517	Vol.	17	500M No 1		See Note	A3	8-8	1	See Note	B3	35	294	C3	6A7, 6D6, 75, 41, OZ4	456	10
	Tone	22	75M No. 1		See Note	A3	5	15	TS101							
							.01-.01		Buffer	B14						
AC524	Vol.	40	G12				8	4	RS213					24, 45, 80		1
532-3	Vol.	6	E7	6	3		.25-2	1	See Note	B7				36, 33		
	Tone	21	O													
535-6	Vol.	6	E7	6	4		8-4	4	See Note	B3				35, 24, 47, 80		1
547	Vol.	6	E7	6	5		4-4	4	See Note	B3				35, 24, 47, 80		1
547A	Vol.	6	E7	6	3		4-4	4	See Note	B3				35, 24, 47, 80		1
553-4S	Vol.	6	G7	6	2		12-12	6	See Note	B3				6D6, 6C6, 43, 12Z3	456	
							4-4	15	TN110							
555	Vol.	6	Y	6	EX250		1.5-4.5	1	See Note	B3				58, 57, 27, 2A5, 80		1
570	Vol.	6	J	6	EX1000		8-4	1	See Note	B3				2A7, 57, 58, 2A5, 80	455	1
	Tone	22	K12				5	15	TS101							
600	Vol.	6	J	6	EX500		16-16	27	See Note	B3				6A7, 78, 37, 6C6, 43, 25Z5	456	
	Tone	22	K12				4-4	15	TN110							
605	Vol.	17	500M No. 1	6	See Note	A1	8-8	1	See Note	B3	22	253Y	C3	6D6, 6A7, 75, 41, 84	175	10
							5-5	15	TN110							
							.025-.025		Buffer	B14						
607	Vol.	17	500M No. 1	6	See Note	A1	8-8	1	See Note	B3	35	294	C3	6D6, 6A7, 75, 41, 84	456	10
							5-5	15	TN110							
							.0075		Buffer	B14						
609	Vol.	6	‡	6	See Note	A5	2294	27/15	UR182	B95				6A7, 6K7, 6J7, 43, 25Z5	456	
610, 610LW	Vol.	17	‡	6	See Note	A5	2292	4	CM172					6A8, 6K7, 6H6, 6F5, 6F6, 80	456	1

‡ Data not substantiated.

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MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
DEWALD—Continued																
611, 611LW	Vol.	6	‡	6	See Note A5		20-12	27	UR182	B95				6A8, 6K7, 6H6, 6F5, 43, 25Z5	456	
	Tone	21	‡		See Note A5		5	15	TS101							
612, 612LW, 615, 615LW	Vol.	6	‡		See Note A5		2301	27/15	UR182	B95				6A8, 6K7, 75, 43, 25Z5	456	
AC624	Vol.	7	E				8-5	4	See Note	B3				24, 45, 80		1
	Tone	21	M													
630	Vol.	6	H7		5		16-16-8	11	See Note	B96				78, 6A7, 77, 43, 25Z5	456	
	Tone	22	K12				5	15	TS101	B96						
DC632	Vol.	40	G12	6										30, 31, 32		
637-8	Vol.	6	Y											36, 37, 38		
640	Vol.	17	N				2210	1	CN152		47	See Note	C6	6D6, 6A7, 75, 41, 84	175	10
							5-5	15	TN110							
							.025-.025		Buffer	B14						
AC724	Vol.	40	‡		See Note A5		1.5-3-1	3	See Note	B1				24, 27, 45, 80		3
724-1	Vol.	6	F12	6			12-8	1	See Note	B3				24, 27, 45, 80		3
	Tone	41	‡		See Note A5											
DC727	Vol.	40	‡		See Note A5											
746-7M	Vol.	6	E7	6			8-8	4	See Note	B3				24, 27, 45		
802, 803	Vol.	17	N				8-8-8	5	See Note	B3				35, 27, 24, 47, 80	175	1
	Tone	21	O				4-4	15	TN110							
804, 805	Vol.	76	N	6			2282	26	CS133					58, 2A7, 2A6, 2A5, 45, 80	456	1
	Tone	76	N				2286	26	RM262					58, 2A7, 2A6, 2A5, 45, 80	456	1
							2259	15	TN111							
811A	Vol.	45	N				8-8	1	See Note	B3				6D6, 6A7, 37, 42, 80	456	1
	Tone	22	H12				10-10	15	TN111							
EARL																
21, 22AC, 21DC, 22DC, 24DC	Vol.	13/10	DRP240				1-2-4-1	3	See Note	B1				26, 27, 71A, 80		11
31DC, 32DC	Vol.	7	M											01A, 71A		
31AC, 32AC	Vol.	7	K		See Note A10		1-4-2-1	3	See Note	B1				27, 45, 80		3
33S-AC	Vol.	1/7	KK				1-1-4	3	See Note	B1				24, 27, 45, 80		3
41AC, 42AC	Vol.	7	K				1-4-2-1	3	See Note	B1				27, 45, 80		3
ECHOPHONE																
F	Vol.	6	Y				8	4	RS213					24, 45, 80		1
	Tone	44	H12													
S3	Vol.	6	C12				2-1	25	See Note	B1				24, 45, 80		3
4	Vol.	6	Y				6790B	4	RM261	B86				58, 57, 47, 80		1
S4	Vol.	3	D12				1-2	25	See Note	B1				24, 27, 45, 80		1
5	Vol.	77	N				8-8	4	RS213					55, 57, 58, 47, 80	175	1
	Tone	22	Y													
S5 (Dynatron)	Vol.	6	H7				8	4	RS213					24, 45, 80	175	1
	Tone	44	H12													
S5 (Rev.)	Vol.	6	Y				8	4	RS213					24, 27, 45, 80	175	1
10	Vol.	77	N				8-8	1	RS213					58, 55, 57, 47, 80	175	1
	Tone	44	M													
12	Vol.	6	G7	6	2		8	4	See Note	B3				57, 58, 47, 80	175	1
							4	4	See Note	B5						
14	Vol.	77	N				8-8	4	RS213					55, 57, 58, 47, 80	175	1
	Tone	22	Y													
15	Vol.	77	N				8-8	1	RS213	B66				58, 57, 55, 47, 80	175	1
	Tone	44	Y													
16, 17, 18	Vol.	77	N				8-8	1	RS213	B66				55, 56, 57, 58, 47, 80	175	1
	Tone	22	Y													
20	Vol.	77	N				8-8	4	RS213	B66				58, 57, 55, 47, 80	175	1
	Tone	44	Y													
35, 36	Vol.	15	500M No. 1		See Note A3		8-8	1	RS213	B3				55, 56, 57, 58, 46, 80	175	7
	Tone	22	N				8	12	RS213	B3						
	Sen.	‡	M100P													
38	Vol.	6	G7		2		8-4	4	See Note	B3				57, 58, 47, 80	175	1
40 Echoette	Vol.	6	Y	6	EX300		8-4	4	See Note	B3				24, 35, 47, 80		1
44	Vol.	6	Y		EX300		6790B	4	RM261	B86				58, 57, 47, 80		1
50	Vol.	6	H7				8-8	4	RS213					24, 27, 35, 47, 80	175	1
	Tone	22	Y													
60	Vol.	6	Y	6	EX200		8-8	4	RS213	B66				24, 27, 35, 47, 80	175	1
	Tone	22	Y													
70DC	Vol.	6	Y	6	EX200		6	1	See Note	B11				37, 39, 71A	175	
	Tone	22	Y													
80	Vol.	6	Y	6	EX200		8	1	RS213					24, 27, 35, 47, 80	175	1
	Tone	22	Y				4	1	RS211							
81	Vol.	15	N	6			8-8	4	RS213	B66				24, 27, 35, 47, 80	175	1
	Tone	22	Y													
90	Vol.	6	Y	6	EX200		8	1	RS213					24, 27, 35, 47, 80	175	1
	Tone	22	Y				12	1	RS215							
90 (Rev.)	Vol.	6	H7		2		12	1	RS215					24, 27, 35, 47, 80	175	1
	Tone	22	Y				8	1	RS213							
110	Vol.	7	UC509	6			12-5	24	CN145					78, 77, 38, 12Z3		
							10	15	TS101							
111	Vol.	7	UC509		EX350		12-5	24	CN142					78, 77, 38, 12Z3		
							10-10	15	TN111							
119	Vol.	18	N	‡			8-4	1	See Note	B3				2A7, 58, 2A6, 2A5, 80	456	1
	Tone	22	K12	‡			307	15	TS101							
124	Vol.	18	N				8-4	1	See Note	B3				56, 57, 58, 2A6, 2A5, 80	456	1
	Tone	22	K12				10	15	TS106							
126	Vol.	18	N	‡			8-4	1	See Note	B3				2A7, 58, 2A6, 2A5, 80	456	1
128	Vol.	7	UC509		See Note A14		5-12-5	8	UR182					78, 77, 43, 25Z5		
							5	15	TS101							
139, 139C	Vol.	18	N				8-8	1	See Note	B3				6A7, 6D6, 75, 42, 80	456	1
	Tone	22	‡		See Note A5		10	15	TS106							
143	Vol.	18	N	6			156	1	CN151					2A7, 58, 2A6, 2A5, 80	456	1
							307	15	TS101							
180	Vol.	‡	N	6			16	11	CS126					‡	‡	
	Tone	22	K12				8	11	CS123							
1731	Vol.	18	N				8-4	1	See Note	B3				58, 2A7, 2A6, 2A5, 80	456	1
1734, 1734A	Vol.	18	N				8-4	1	See Note	B3				2A7, 58, 2A6, 2A5, 80	456	1
							10	15	TS101							
1800	Vol.	6	SRP263		See Note A14		8-4	1	CN151					58, 57, 2A5, 80		1
							10	15	TS101							
7110	Vol.	7	UC509		See Note A14		12-5	24	CN142					77, 78, 38, 12Z3		
							10-10	15	TN111							
7114	Vol.	6	SRP263		See Note A14		5-16-5	11	UR182	B31				6A7, 6D6, 75, 43, 25Z5	456	
7124	Vol.	18	N				8-4	1	CN151					58, 57, 56, 2A6, 2A5, 80	456	1
	Tone	22	K12				10	15	TS106							
7126	Vol.	7	UC509		See Note A14		5-12-10-10	24/15	See Note	B5				77, 78, 38, 12Z3		
7127	Vol.	18	N	‡			8-4	1	See Note	B3				58, 2A7, 2A6, 2A5, 80	456	1
	Tone	22	K12	‡			10	15	TS106							

‡ Data not substantiated.

*** IMPORTANT: Read Notes in Note Section if specified in Note Column.**

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
EDISON-BELL																
36	Vol.	42	G	6			8-8	4	See Note	B3				24A, 58, 47, 80		1
	Tone	22	K12													
53	Vol.	6	K12	6	EX200		16-8	6	See Note	B3				6C6, 6D6, 43, 25Z5	175	
							4-4	15	TN110							
53LW	Vol.	6	K12	6	EX200		16-8	6	CN145					6A7, 6D6, 6C6, 43,		
							2-4	15	TN110					25Z5	115	
55AW	Vol.	17	N	6			10-16-4-4-2	8/15	See Note	B3				6A7, 6D6, 75, 43,		
														25Z5	456	
63	Vol.	56	N	6			16-16	1	See Note	B3				37, 6A7, 6D6, 75, 43,		
							4-4	1/15	See Note	B3				25Z5	175	
63AW	Vol.	18	N	6			10-16	8	See Note	B3				6D6, 6A7, 75, 43,		
							4-4	8/15	See Note	B3				25Z5	115	
66AW	Vol.	17	N	6			10-16-8-4-4	11	See Note	B3				6D6, 6A7, 75, 43,		
														25Z5	456	
THOMAS A. EDISON																
"Abbey" Battery	Vol.	14	SRP278											01A, 71A		
(Splitdorf) "Abbey" Jr.	Vol.	14	SRP278				1-6	1	See Note	B1				26, 27, 71A, 80		11
C1 (SC)	Vol.	10	SRP277		(Rear)	A35	2.5-2.5-2.5	28	See Note	B2				26, 27, 50, 81		23
	Regen.	10	SRP276		(Front)	A35										
C2, R1, R2 (Jr., Jc. 25 Cy.)	Vol.	10	SRP277		(Rear)	A35	2-1	3	See Note	B1				26, 27, 50, 81		8
	Regen.	10	SRP276		(Front)	A35										
C2, R1, R2, (Jr., Jc. 60 Cy.)	Vol.	10	SRP277		(Rear)	A35	2-1	4	See Note	B2				26, 27, 50, 81		22
	Regen.	10	SRP276		(Front)	A35										
C4, R4, R5 (Chassis 7-R)	Vol.	24	DRP306				2-2-1	3	See Note	B1				27, 45, 80		7
R4, R5, (DC)	Vol.	24	DRP306				1-2-2	1	See Note	B11				27, 71A		
R6, R7	Vol.	20	TRP607				1.5-1-1.5	3	See Note	B1				24, 27, 45, 80		7
(Splitdorf) M5	Vol.	10	SRP277		(Rear)	A35	2-1	4	See Note	B1				26, 27, 50, 81		22
	Regen.	10	SRP276		(Front)	A35										
(Splitdorf) M6	Vol.	10	SRP277		(Rear)	A35	2.5-2.5-2.5	28	See Note	B2				26, 27, 50, 81		23
	Regen.	10	SRP276		(Front)	A35										
(Splitdorf) E-175	Vol.	10	‡		See Note	A36	‡	1	See Note	B1				26, 27, 71A, 80		11
Splitdorf PAD4	Vol.	10	‡		See Note	A36	2-1	4	See Note	B2				26, 27, 50, 81		22
EILEN RADIO LABS.																
5 Tube	Reg.	12	L				8-8	4	See Note	B3				6D6, 6C6, 76, 42, 84		1
	Sen.	7	D		5											
ELEC. AUTO LITE																
No. 11	Vol.	7	UC510											35, 24, 27, 71A		
062A, 3622A	Vol.	45	N				4	15	TS105		1	206	C3	39, 36, 37, 41	262	
	Tone	21	L													
072A, 3722A	Vol.	18	N				4	12	CS123		2	211		39, 36, 37, 41	262	
	Tone	44	L				4	15	TS105							
E & A (Electric & Automotive Products Co.)																
4M	Vol.	6	SRP263	6			8-8	1	See Note	B3				78, 77, 38, 12Z3		
							5-5	15	TN110							
IL-5	Vol.	6	SRP263		EX500		16-10	1	See Note	B3				6A7, 78, 77, 43, 25Z5	125	
							5-5	15	TN110							
6AW	Vol.	17	N				8-8	1	See Note	B3				78, 6A7, 75, 42, 80	456	1
							5-5	15	TN110							
SW-6	Vol.	18	N				10	1	See Note	B3				2A7, 58, 2A6, 2A5, 80	456	1
							5	15	TS105							
25AW	Vol.	17	N				8-8	1	CN152					6A7, 78, 75, 42, 80	456	1
							5-5	15	TN110							
30AW	Vol.	17	N				10-25	1	See Note	B3				78, 6A7, 75, 43, 25Z5	456	
							5-5	15	TN110							
35AW	Vol.	17	N				3-8	1	See Note	B3				78, 6A7, 75, 42, 80	456	1
							5-5	15	TN110							
1L55LW	Vol.	6	SRP263		EX500		25-10	6	UR182					6A7, 78, 77, 43, 25Z5	125	
							5-5	15	TN110							
303	Vol.	6	SRP263		EX500		10	1	CS124					6A7, 6F7, 12A7	456	
							5-5	15	TN110							
303LW	Vol.	6	SRP263		EX500		10	1	CS124					6A7, 6F7, 12A7	456	
							5-5	15	TN110							
303SW	Vol.	6	SRP263		EX500		10	1	CS124					6A7, 6F7, 12A7	456	
							5-5	15	TN110							
405	Vol.	6	SRP263		EX500		16-10	1	See Note	B3				6A7, 6F7, 43, 12Z3	456	
							5-5	15	TN110							
405LW	Vol.	6	SRP263		EX500		16-10	6	See Note	B3				6A7, 6F7, 43, 12Z3	456	
							5-5	15	TN110							
ELECTRICAL RESEARCH LABS.			—See "Erla"													
ELECTRONIC																
331							8-8-20	1	UR190	B97	34	292	C3	84		
							.02-.02		Buffer	B14						
332 32V							8-8-25	1/19	UR190	B97	34	F292	C3	25Z5		
							.02-.02		Buffer	B14						
EL-REY																
4 Tube Midget	Vol.	6	J	6	EX200		4-4	23	CM170					58, 57, 47, 80		1
	Tone	22	Y													
7 Tube AW	Vol.	56	M	6			8-3	1	See Note	B3				55, 56, 57, 58, 2A5, 80	465	1
	Sen.	7	C				10	15	TS101							
	Tone	22	Y													
10, 15	Vol.	6	SRP263		EX300		4-4	23	CM170					58, 57, 17, 80		1
	Tone	22	Y		See Note	A4										
20	Vol.	17	M	6			4-3	4	See Note	B3				57, 58, 59, 55, 80, 56	465	1
	Tone	22	Y				25	15	TS102							
644	Vol.	18	N	6			8-8	23	See Note	B3				6A7, 6D6, 75, 42, 80	465	1
	Tone	22	Y													
845	Vol.	17	N				8-8	1	See Note	B3				55, 56, 57, 58, 2A5, 80	465	1
	Tone	44	Y													
ELEC. SPEC. EXPORT CORP. "Stratfield"																
R502	Vol.	6	G12	6	2		20-20	6	UR190	B3				6A7, 6D6, 75, 43,		
							10-10	15	TN111					25Z5	456	
38	Vol.	6	UC509	6	EX250		8	24	CS123					6D6, 6C6, 38, 12Z3		
							10	15	TS101							
45	Vol.	6	M				8-12-10-10	1/15	See Note	B5				6D6, 6C6, 43, 25Z5		
48	Vol.	6	M		EX250		16-12-10-10	1/15	See Note	B5				6D6, 6C6, 38, 25Z5		
69	Vol.	6	G12	6	EX200		20-20	1	UR190	B3				6A7, 6D6, 85, 43,		
							10	15	TS101					25Z5	456	

‡ Data not substantiated.

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MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
EMERSON																
B-AC-10	Vol.	18	N	6			12-8	1	See Note	B3				58, 55, 56, 57, 46, 82	175	3
	Tone	44	Y													
	Supp.	3	E12													
CS	Vol.	6	‡		See Note	A5	A-404	4	CS131	B3				24, 35, 47, 80	175	1
DC4	Vol.	7	‡	6	See Note	A5	1-1	1	See Note	B7				39, 36, 33		
D5	Vol.	6	Y		EX500		UC-93	4	CM172					58, 57, 47, 80	456	1
F	Vol.	6	H12				8-8-8	3	RS213	B66				27, 24, 45, 80		3
G4	Vol.	7	M				1-1	1	CN140					39, 36, 38, 37		
							5-5	15	TN110							
H5	Vol.	6	Y	6	EX300		KC68	11	UR182	B31				78, 77, 43, 25Z5	172.5	
H5L	Vol.	6	Y	6	EX300		KC68	11	UR182	B31				6A7, 78, 77, 43, 25Z5	132	
J	Vol.	6	‡	‡	See Note	A5	4-4	4	See Note	B3				24A, 35, 47, 80		1
JS	Vol.	6	‡		See Note	A5	A104	4	CS131					24, 35, 47, 80	175	1
KS	Vol.	7	G	6	1		A3	4	CS133					35, 24, 27, 47, 80	175	1
	Tone	22	G12				4	13	See Note	B3						
LA (Early)	Vol.	7	Y		EX300		8-4	4	CM161					78, 77, 38, 1V		
							5	15	TS101							
LA (Revised)	Vol.	7	Y		EX300		8-4	4	CM161					6D6, 6C6, 38, 1V		
							5	15	TS101							
LAC4	Vol.	6	‡		See Note	A5	4-4	4	See Note	B3				58, 57, 47, 80		1
LAC5	Vol.	6	‡		See Note	A5	8	4	See Note	B3				58, 57, 47, 80		1
							4	4	See Note	B3						
MAC7	Vol.	6	E7	6	2		BC9	4	CM172	B3				58, 55, 47, 80	175	1
	Tone	34	Y													
S7	Vol.	6	E7	6			IC42	4	CM172	B3				58, 57, 59, 80	465	1
							IC43	20	TS101							
S50	Vol.	6	E7	6			IC42	4	CM172	B3				58, 57, 59, 80	465	1
							IC43	20	TS101							
T	Vol.	6	G7	6	3		A403	4	See Note	B3				35, 24, 47, 80		1
							A404	4	CS131							
TS	Vol.	6	G7	6	3		A310	4	See Note	B3				35, 24, 47, 80		1
							A404	4	CS131							
V4 (Early)	Vol.	7	Y		EX300		8-4	4	CM171					78, 77, 38, 1V		
							5	15	TS101							
V4 (Revised)	Vol.	7	Y		EX300		8-4	4	CM171					6D6, 6C6, 38, 1V		
							5	15	TS101							
19UV4	Vol.	6	Y		EX300		KKC143	6	CN145					6A7, 6F7, 43, 25Z5	456	
							KKC145	15	TN110							
3LW	Vol.	6	Y	6	EX300		KC68	11	UR182	B31				6A7, 78, 77, 43, 25Z5	132	
5A	Vol.	17	500M No. 1		See Note	A3	8-8	1	See Note	B3	29	277S		78, 6A7, 85, 42	172.5	10
							10-10	15	TN111							
6A	Vol.	17	500M No. 1		See Note	A3	8-8	1	See Note	B3	22	253Y	C3	78, 6A7, 85, 41, 84	172.5	10
							10-10	15	See Note	B3						
							.008		Buffer	B14						
20A	Vol.	6	UC509	6	EX200		HC31	1	CN140					36, 37, 38, 39		
							HC32	15	TN113							
23 (4B)	Vol.	6	Z12	6	EX200		UC93	4	CM172					6A7, 77, 42, 80	456	1
25A	Vol.	6	UC509	6	EX300		HC31	1	CN140					36, 37, 38, 39		
							HC32	15	TN113							
26 (DAC5)	Vol.	6	Y	6	EX500		8-8	4	See Note	B3				58, 57, 47, 80	456	1
28 (5J)	Vol.	6	Y	6	EX300		UC93	4	CM172					6D6, 6C6, 42, 80	456	1
							IC43	15	TS101							
30	Vol.	6	Y	6	EX300		KC68	11	UR182	B31				78, 77, 43, 25Z5	172.5	
30AW	Vol.	6	Y	6	EX300		KC68	11	UR182	B31				25Z5, 43, 77, 78	456	
30LW	Vol.	6	Y	6			KC68	11	UR182	B31				6A7, 78, 77, 43, 25Z5	132	
32U5S	Vol.	17	N				GGC137	6/15	UR189	B98				6A7, 6D6, 75, 43, 25Z5	456	
33AW	Vol.	6	Y	6	EX300		KC68	11	UR182	B31				25Z5, 43, 77, 78	456	
33LW	Vol.	6	Y	6	EX300		KC68	11	UR182	B31				6A7, 78, 77, 43, 25Z5	132	
34C (C6-D6)	Vol.	18	M				8-8	4	See Note	B3				6A8, 6K7, 75, 6F6, 80	456	1
	Tone	22	M	6												
35 (T6)	Vol.	17	N	6			12-12-8	11	See Note	B3				78, 75, 43, 25Z5	172.5	
							5	15	TS101							
36 (B5)	Vol.	6	E12		EX150		8-6	1	See Note	B3				6D6, 76, 42, 80	456	11
							12	15	TS101							
38 (U6)	Vol.	17	N				CCC125	6/13	UR190	B3				6A7, 6D6, 25Z5, 43, 75	456	
	Tone	22	Y				HC32	15	TN110							
38 (U6D)	Vol.	6	Z12	6	EX200		CCC125	6 13	UR190	B3				6A7, 6D6, 25Z5, 43, 75	456	
							HC32	15	TN110							
39 (D-S5)	Vol.	‡	MN	6			8-8	4	CM172					2A7, 2B7, 47, 58, 80	456	11
							4	13	See Note	B3						
							5	15	TS101							
40	Vol.	17	O	6			PC83	11	UR182	B31				6B7, 25Z5, 43, 78	175	
41	Vol.	6	Y		EX500		8-8	4	See Note	B3				58, 57, 47, 80	456	
42 (U6)	Vol.	17	N				CCC125	6/13	See Note	B3				6A7, 6D6, 25Z5, 43, 75	456	
	Tone	22	Y		See Note	A4	HC32	15	TN110							
42 (U6D)	Vol.	6	Z12	6	EX200		CCC125	6/13	See Note	B3				6A7, 6D6, 25Z5, 43, 75	456	
							HC32	15	TN110							
45 (6BD)	Vol.	6	E7	6	4		8-4	4	See Note	B3				6D6, 6A7, 75, 42, 80	456	1
							8	12	See Note	B3						
							5	15	TS101							
49 (U6)	Vol.	17	N				CCC125	6/13	See Note	B3				6A7, 6D6, 25Z5, 43, 75	456	
	Tone	22	Y		See Note	A4	HC32	15	TN110							
49 (U6D)	Vol.	6	Z12	6	EX200		CCC125	6/13	See Note	B3				6A7, 6D6, 25Z5, 43, 75	456	
							HC32	15	TN110							
50L	Vol.	6	E7	6			IC42	4	CM172	B3				55, 56, 58, 59, 80	115	1
	Tone	34	Y				IC43	20	TS101							
50M	Vol.	6	E7				BC9	4	CM172	B3				47, 55, 56, 58, 80	175	1
	Tone	34	Y													
AW55	Vol.	7	H		2		8-4	4	See Note	B3				24, 47, 56, 58, 80	445	1
59 (DS5)	Vol.	‡	MN	6			8-8	4	See Note	B3				2A7, 2B7, 47, 58, 80	456	1
							4	13	See Note	B3						
							5	15	TS101							
65	Vol.	7	UC500				2-1-1	1	See Note	B1				24, 27, 45, 80, 99		24
71 (AW7)	Vol.	17	O	6			8-8	1	See Note	B3				6D6, 6A7, 75, 42, 80	456	1
	Tone	41	Y				4	13	CS121							
77	Vol.	17	O				8-8	4	See Note	B3				2A6, 47, 56, 58, 80	172.5	1
	Tone	34	Y													
101 (C6-D6)	Vol.	18	M				8-8	4	See Note	B3				6A8, 6K7, 75, 6F6, 80	456	1
	Tone	22	M	6												
103 (F5)	Vol.	17	N	7										1C6, 34, 25S, 30, 33, LLL25	456	
105 (A11)	Vol.	20	‡		See Note	A19	2AC-209A	30	UR191	B3				5Z3, 6A8, 6C5, 6F6, 6H6, 6K7	456	1
	Tone	22	N	6			1C43	19	TS101							
106 (U6B)	Vol.	18	N	6			2CC-194	27	CM165					6A7, 6D6, 6H6, 6F5, 43, 25Z5	456	
107 (U6A)	Vol.	18	N	6			ZZC-192A	11/27	UR182	B99				6A8, 6K7, 75, 43, 25Z5	456	
	Tone	22	M				YC98A	11	CS121	B99						
108-110	Vol.	18	N	6			2DC-203	6	CM165	B100				6A7, 6D6, 75, 43, 25Z5	456	
111 (U6A)	Vol.	18	N	6			ZZC-192A	11	UR182	B99				6A8, 6K7, 75, 43, 25Z5	456	
	Tone	22	M				YC-98A	11	CS121	B99						

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
EMERSON—Continued																
250	Vol.	6	Y	6	EX300		KC68	11	UR182	B31				78, 77, 43, 25Z5	172.5	
250AW	Vol.	6	Y	6	EX300		KC68	11	UR182	B31				25Z5, 43, 77, 78	456	
250LW	Vol.	6	Y	6			KC68	11	UR182	B31				6A7, 78, 77, 43, 25Z5	132	
280 (F6D)	Vol.	17/15	LM	‡	See Note	A37								1C6, 34, 1A6, 33,		
														LLL25	456	
300	Vol.	6	Y	6	EX300		KC68	11	UR182	B31				78, 77, 43, 25Z5	172.5	
321AW, 330AW, 350AW	Vol.	6	Y	6	EX300		KC68	11	UR182	B31				25Z5, 43, 77, 78	456	
321LW, 350LW	Vol.	6	Y	6	EX300		KC68	11	UR182	B31				6A7, 78, 77, 43, 25Z5	132	
375	Vol.	17	O	6			PC83	11	UR182	B31				6B7, 25Z5, 43, 78	175	
375LW	Vol.	13	O	6			KC68	11	UR182	B31				78, 6A7, 6B7, 77, 43, 25Z5	125	
409, 410, 411 (A4)	Vol.	6	Y	6	EX300		RC84	1	CN141					78, 6F7, 38, 1V		
							RC85	15	TN110							
415, 416	Vol.	6	Y	6	EX300		8-4	4	CM161	B3				78, 77, 38, 1V		
415, 416 (Revised)	Vol.	6	Y	6	EX300		8-4	4	See Note	B3				1V, 6C6, 6D6, 38		
							8	15	TS101							
420 (A4)	Vol.	6	Y	6	EX300		OC78	4	CM160	B3				78, 77, 38, 1V		
456	Vol.	6	Y	6	EX300		KC68	11	UR182	B31				77, 78, 43, 25Z5	456	
667	Vol.	17	1 Meg. No. 1	6	See Note	A1	6-10	1	See Note	B3	37	296	C3	6A7, 41, 75, 78, 84	172.5	10
							5	15	TS101							
							.015		Buffer	B14						
678 Types 1 and 2	Vol.	‡	See Note			A19	4-8	1	See Note	B3	5	222	C3	78, 6A7, 6B7, 41	172.5	10
	Tone	39	H12				4-8	13	See Note	B3						
	Supp.	‡	CIMP		See Note	A33	5	15	TS101	B6						
							.02		Buffer	B14						
L755	Vol.	6	E7	6	2		IC42	4	CM172	B3				55, 56, 58, 59, 80	115	1
	Tone	34	Y				IC43	20	TS101							
M755	Vol.	6	E7		2		BC9	4	CM172	B3				47, 55, 56, 58, 80	175	1
	Tone	34	Y													
S755	Vol.	6	E7	6	2		IC42	4	CM172	B3				58, 59, 80, 57	465	1
							IC43	19	TS101							
770 (AW7)	Vol.	17	O	6			8-8	1	See Note	B3				6A7, 6D6, 42, 75, 80	456	1
	Tone	41	Y				4	13	CS121							
965	Vol.	17	1 Meg. No. 1		See Note	A19	ZC100	1	See Note	B3	37	296	C3	6A7, 41, 75, 78, 84	172.5	10
							IC43	15	TS101							
							.02		Buffer	B14						
EMPIRE																
10	Vol.	7	UC509	6	EX300		16-8	6	CM165	B3				25Z5, 36, 39, 43		
							2-4	15	TN110	B6						
20	Vol.	7	UC509	6	EX300		16-8	6	CM165	B3				39, 36, 37, 43, 25Z5		
							2-4	15	TN110	B6						
30	Vol.	6	SRP263	6			16-8	6	CM165	B3				77, 78, 43, 25Z5	175	
							2-4	15	TN110							
40	Vol.	18	N	6			16-16	1	UR190	B3				6A7, 78, 75, 43, 37,		
							4-4	18/15	See Note	B3				25Z5	175	
40SW	Vol.	18	N	6			4-16-16-8-4	8/14	See Note	B101				6A7, 6D6, 75, 43,		
														25Z5	456	
51	Vol.	17	N	6			12-8	4	See Note	B3				2A7, 58, 2A6, 2A5, 80	175	1
60	Vol.	17	N	6			8-4	1	See Note	B3	47	See Note	C6	78, 6A7, 75, 41, 84	175	10
							2-4	15	TN110	B6						
							10-10	‡	TN111							
							.02		Buffer	B14						
71	Vol.	18	N	6			16-8	23	See Note	B3				2A5, 2A6, 2A7, 58, 80	175	1
74	Vol.	6	G12	6			8-8	4	See Note	B3				58, 57, 2A5, 80	462.5	1
400AC	Vol.	8	G				6-6	4	See Note	B3				57, 58, 47, 80		1
400DC	Vol.	3	G12		EX200									39, 36, 33		
450A	Vol.	17	N	6			16-4-16-4-2	8/13/15	See Note	B102				6A7, 6D6, 75, 43,		
														25Z5	456	
460B	Vol.	17	N	6			16-4-16-8-4	8/15	See Note	B101				6D6, 6A7, 75, 43,		
														25Z5	456	
470C	Vol.	17	N	6			8-16	1	See Note	B3				58, 2A7, 2B7, 2A6,		
							2	13	See Note	B3				2A5, 80	456	1
							4-4	15	TN110							
480C	Vol.	17	N				16-4-16-8-4	8/15	See Note	B101				6D6, 6A7, 75, 43,		
							6	13	See Note	B3				25Z5	456	
500AC	Vol.	8	G				8-8	4	See Note	B3				58, 57, 47, 80		1
	Tone	22	K12													
500DC	Vol.	6	G12											36, 37, 33		
550AC	Vol.	6	G12	6	EX300		6-6	4	See Note	B3				58, 47, 80		1
	Tone	22	K12													
575	Vol.	6	G7	6			8-8	4	See Note	B3				57, 58, 55, 47, 80	175	1
	Tone	22	K12													
600AC	Vol.	7	G	6			8-8	4	See Note	B3				58, 24, 47, 80		1
	Tone	44	K12													
700DC	Vol.	6	G7	6	EX200									39, 37, 48		
	Tone	44	K12													
ERLA																
R1 (Power Pack "A")	Vol.	13	M				2-1-2	3	See Note	B2				26, 27, 50, 81		8
R2 (Power Pack "A" 2)	Vol.	40	G12				1-2-2	3	See Note	B1				26, 27, 71A, 80		11
30 (248)	Vol.	7	J	6			8-8	1	See Note	B3				24, 27, 35, 47, 80		3
	Tone	22	‡		See Note	A5										
31, 32, 33, A3, R3	Vol.	6	G7				2-2-1	3	See Note	B3				27, 45, 80		3
							.05		See Note	B9						
35, 37, 38, 39 (230)	Vol.	15	M				6638-0	3	RS213					24, 27, 45, 80		3
	Tone	41	O													
61, 62, 63 (250)	Vol.	8	UC501				8-2	1	See Note	B3				24, 27, 35, 47, 80	175	1
							7850-0	1	CS131							
74, 76 (210)	Vol.	‡	‡		See Note	A38								30, 32, 71A		
75, 77 (231)	Vol.	12	Z12	6										30, 32, 71A		
81, 82 (245)	Vol.	7	G	6			8-8	1	See Note	B3				24, 27, 45, 80	175	3
	Tone	41	N													
81P, 82P (248)	Vol.	7	UC501	6			6638-0	1	RS213					24, 27, 35, 47, 80	175	3
	Tone	22	‡		See Note	A5										
224AC	Vol.	12	F12	6			1-2-2-3	3	See Note	B1				24, 27, 45, 80		3
224B	Vol.	12	F12	6			3-2-1-1	3	See Note	B1				24, 27, 45, 80		3
225	Vol.	25	DRP192				6638-0	1	RS213					24, 27, 45, 80		3
	Tone	41	O													
271A	Vol.	25	DRP192				6552-0	1	RS213					24, 27, 45, 80		3
	Tone	57	K12													
335	Vol.	7	UC501	6	See Note	A10	6958-0	1	RS213	B3				35, 24, 45, 80		1
							6938-0	1	RS211							
336	Vol.	6	G12	6			4-4	1	See Note	B11				36, 38		
570X	Vol.	6	K12	6	EX250		4-20-8	11	UR182	B31				6A7, 78, 75, 43, 25Z5	262	
599	Vol.	6	H12	6	EX250		4-20-8	11	UR182	B31				6A7, 78, 75, 43, 25Z5	262	
603	Vol.	17	N	6			1247	1	CN152	B3	34	292	C3	78, 6A7, 75, 41, 84	265	10
							9328	15	TN110							
							.005		Buffer	B14						

‡ Data not substantiated.

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MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
ERLA—Continued																
620, 622, 623	Vol.	17	M	6			8-8	1	RN242					57, 58, 2A6, 2A5, 80	465	1
	Tone	22	K12				5	15	TS101							
630, 634, 635	Vol.	17	M	6			8-8	1	RN242					57, 58, 2A6, 2A5, 80	465	1
	Tone	22	K12				5	15	TS101							
5001, 5002	Vol.	6	H12		See Note	A14	6	12	See Note	B3				78, 37, 77, 38	465	
							5-5	15	TN110							
5700, 5721	Vol.	18	N	6			9659	1	RN242					2A7, 58, 2A6, 2A5, 80	465	1
							1108	12	CS130							
6100	Vol.	6	H7	6	See Note	A14	9925	12	CS133		47	See Note	C9	78, 77, 38, 25Z5, or 84	465	10
							8705	1	CS133							
							9328	15	TN110							
							.02-.02		Buffer	B14						
6300, 6315, 6317, 6323	Vol.	17	M	6			9659	1	RN242					2A7, 58, 2A6, 2A5, 80	465	1
	Tone	22	K12				1110	13	CS131							
							8876	15	TS101							
7700, 7732, 7741	Vol.	18	N	6			1291	12	RS201					1C6, 34, 30, 19	465	
EVEREADY—See National Carbon.																
EVERETTE PIANO—See "Orgatron"																
FADA																
KA60	Vol.	15	O				1-2-4	3	See Note	B1				24A, 27, 45, 80		3
KB (81, 82, 84, 86)	Vol.	15	O				1-2-3-4	3	See Note	B7				24, 27, 71A		
	Sen.	12	E12													
KE (122)	Vol.	12	Y	13										30, 31, 32		
KF (43) KG (761, 762, 764, 766)	Vol.	24	DRP119				1-2-3-4	3/14	See Note	B1				24, 27, 45, 80		3
KO (51) KOC (53, 53)	Vol.	8	D	6	See Note	A39	3-1301-MS.	1	RS213					35, 24, 27, 47, 80	175	3
							3-1313-MS.	17	TS102							
KOC (171, 173) 110 V DC	Vol.	8	F	6										36, 37, 57	175	
KU (45, 45Z)	Vol.	7	F	6	See Note	A40	3-1301-MS.	3	RS213	B10				25, 27, 24, 47, 80	175	3
KW (48, 49)	Vol.	78	N	6			3-1301-MS.	3	RS213					27, 35, 47, 80	175	3
	F.O.G.	‡	F													
KX (61, 66)	Vol.	42	F	6			3-1301-MS.	4	RS213					35, 24, 47, 80		3
							3-1384-MS.	4	RS213							
KY (66) Early, Late	Vol.	64	O	6			3-1301-MS.	1	RS213					24, 35, 27, 47, 80	175	3
NA (14)	Vol.	64	O	6			5-1209-MS.	1	RN242					6A7, 6D6, 37, 42, 77, 80	265	1
	Tone	57	M				4-1343-MS.	15	BN226							
NE (151, 152)	Vol.	15	O	6			5-1209-MS.	1	RN242					6A7, 6D6, 37, 77, 42, 80	265	1
	Tone	21	M				4-1343-MS.	15	BN226							
NF	Vol.	17	O	6			4-1488-MS.	1	RN242					6A7, 6B7, 6D6, 42, 80	125	1
	Tone	57	UC502				4-1314-MS.	15/19	TS101							
RA (74, 76, 83, 88, 89)	Vol.	15	O	6			3-1473-MS.	28	RS213					58, 56, 47, 80	175	3
	F.O.G.	‡	F				3-1384-MS.	28	RS213							
							3-1301-MS.	28	RS213							
							3-1313-MS.	15	TS102							
RC (78, 79)	Vol.	‡	NN	6			3-1473-MS.	28	RS213					58, 56, 57, 47, 80	175	3
	F.O.G.	‡	Y25MP				3-1384-MS.	28	RS213							
							3-1381-MS.	28	RS213							
RE (73, 75, 85, 98)	Vol.	17	O	6			3-1473-MS.	25	RS213					58, 55, 56, 47, 80	175	3
							3-1301-MS.	25	RS213							
							3-1313-MS.	17	TS102							
RG (55)	Vol.	6	G12	6			8-8	1	RS213	B3				57, 58, 47, 80	175	3
RH (74, 76, 83, 87, 88, 89, 97)	Vol.	15	O	6			3-1473-MS.	28	RS213					56, 58, 47, 80	175	3
	F.O.G.	‡	F				3-1384-MS.	28	RS213							
							3-1301-MS.	28	RS213							
							3-1313-MS.	15	TS102							
RK (101 Motoset)	Vol.	17	‡		See Note	A5	4-1254-MS.	1	See Note	B3	4	221	C3	39, 84, 85, 89	175	10
							.01		Buffer	B14						
RL (103 Fadalette)	Vol.	6	G12	6			4-1312-MS.	6	RN231					36, 38, 39, 25Z5		
							4-1314-MS.	15	TS101							
RN (105, 106, 107)	Vol.	17	O	6			8-8-8	8	See Note	B3				6A7, 78, 6B7, 43, 25Z5	470	
							4-1362-MS.	6	RN235	B10						
							4-1343-MS.	15	BN226							
RP (102 Motoset)	Vol.	16	‡	6	See Note	A5	4-1254-MS.	1	See Note	B3	4	221	C3	37, 39, 85, 89, 84	175	10
	Tone	40	L				4-1363-MS.	12	See Note	B3						
							4-1367-MS.	15	TS101							
							.01		Buffer	B14						
RS (112)	Vol.	17	O	6			4-1362-MS.	6	RN235					6A7, 78, 6B7, 43, 25Z5	470	
	Tone	22	L				4-1343-MS.	15	BN226							
RU (131, 132)	Vol.	15	O	6			4-1450-MS.	9	RM257					6A7, 6D6, 25Z5, 37, 43, 77	265	
	Tone	22	L				4-1451-MS.	9	RS203							
							4-1343-MS.	15	BN226							
RV (104B) Auto	Vol.	17	O	6			4-1254-MS.	1	RS213		4	221	C3	6A7, 6B7, 78, 41, 84	175	10
							4-1343-MS.	15	BN226							
							4-1439-MS.	15	TS101							
							.01		Buffer	B14						
RW, 78-10, 79-10, 97-10, 133, 134, 135	Vol.	17	O	6			4-1488-MS.	28	RN242					6D6, 37, 85, 42, 80	265	1
	Tone	21	M				4-1494-MS.	28	RS213							
	F.O.G.	‡	M10MP													
RX 93, 95	Vol.	17	O	6			3-1473-MS.	1	RS213					58, 55, 56, 47, 80	125	3
							3-1384-MS.	1	RS213							
RY (108, 109, 125)	Vol.	17	O	6			4-1362-MS.	6	RN235	B103				6A7, 78, 6B7, 43, 25Z5	470	
							4-1343-MS.	15	BN226							
S, 26-36	Vol.	25	DRP307		See Note	A3								24, 27, 45		
"7AC" (475-UA or CA, 472-UA or CA, SF45/75-UA or CA, SF45/72-UA or CA)	Vol.	14	SRP256			A3								27, 71		
E180, E180Z							2-4-5-6	‡	See Note	B1				80		
E420, E420Z							1-2-3-4-5	‡	See Note	B1				80		‡
M250, M250Z	Vol.	7	SRP257				1-2-3-4-5	‡	See Note	B1				27, 45, 80		3
"Special A. C." (262-UA or CA, 265-UA or CA, RP-62-UA or CA, RP-65-UA or CA)	Vol.	14	SRP256			A3								27, 71		
10, 10Z, 11, 11Z	Vol.	14	SRP256				‡	‡	See Note	B1				27, 71, 80		3
15M, 15MZ	Vol.	11	SRP257				1-2-3-4-5	‡	See Note	B1				27, 24, 45, 80		3
16, 16Z, 17	Vol.	4	SRP256		(Early)	A27	1-2-4-5-6	‡	See Note	B1				27, 71, 80		3
	Vol.	8	SRP257		(Late)	A4										
18DC	Vol.	4	SRP257				1-2-2-1	‡	See Note	B7				12A, 71A		
20, 20Z	Vol.	8	SRP257				1-2-4-5-6	‡	See Note	B1				27, 71, 80		2

‡ Data not substantiated.

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MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
FADA—Continued																
25, 25Z	Vol.	11	SRP257				‡	‡	See Note	B1				27, 24, 45, 80		3
30, 30Z, 31, 31Z	Vol.	35	SRP256				‡	3	See Note	B1				27, 71, 80		2
32, 32Z	Vol.	8	SRP257				‡	‡	See Note	B1				27, 71, 80		2
35B	Vol.	25	DRP307				‡	‡	See Note	B1				27, 24, 45, 81		3
35, 35Z	Vol.	12	D12				1-2-3-4-5-6	‡	See Note	B1				24, 27, 45, 81 (or 80)		3
40	Vol.	25	‡		See Note A47		1-2-3-4-5-6	‡	See Note	B1				24, 27, 45, 80		3
41, 42	Vol.	64	O				1-2-3-4-5	‡	See Note	B1				24, 27, 45, 30		3
43	Vol.	21	DRP119				1-2-3-4	3/14	See Note	B1				24A, 27, 45, 80		3
44	Vol.	64	O				1-2-3-4-5	‡	See Note	B1				24, 27, 45, 30		3
46, 47	Vol.	64	O				1-2-3-4-5	‡	See Note	B3				24, 27, 45, 30		3
48, 49	Vol.	‡	‡		See Note A5									27, 35, 47, 80		
50, 50Z	Vol.	14	SRP256											27, 71A, 80		
66Q							2-3-4	‡	See Note	B1				80		2
70, 71, 72, 70Z	Vol.	14	SRP256											27, 71A, 80		
75	Vol.	12	SRP259				1-2-4-6-7	‡	See Note	B1				24, 27, 40, 81		5
77	Vol.	12	SRP257				1-4-5-7	‡	See Note	B1				24, 27, 40, 81		‡
86V P.P.							‡	‡	See Note	B1				80		
150 (Two Types)	Vol.	17	N	6			20.8	1/15	See Note	B3				6A7, 6F6, 6K7, 75, 80	456	1
155	Vol.	4	G12	6	EX450		20.28	1/15	See Note	B3				6A7, 6D6, 76, 43, 25Z5	456	
156	Vol.	6	G12	6	EX450		20.28	1/15	See Note	B3				6A7, 6D6, 76, 43, 25Z5	456	
157	Vol.	6	G12	6	EX450		20.35	6/15	See Note	B3				6A8, 6C5, 6K7, 43, 25Z5	456	
160	Vol.	17	O	6			20.33A	1/15	See Note	B3				6A8, 6K7, 6H6, 6F5, 6F6, 5Z4	456	1
166 Motoset	Vol.	17	1 Meg No. 1		See Note A3		20.29	1	CN152		22	253Y	C3	78, 6A7, 75, 41, 84	175	10
	Tone	22	100 M No. 1		See Note A3		4-4	15	TN110							
							.01		Buffer	B14						
170	Vol.	17	O	6			20.33A	1/15	See Note	B3				6A8, 6F5, 6F6, 6A6, 6K7, 5Z4	456	1
							20.32	13	See Note	B3						
190	Vol.	17	O				20.7	1	See Note	B3				6A8, 6F5, 6F6, 6H6, 6K7, 5Z4	456	1
							20.4	1	See Note	B3						
							20.34	13	See Note	B3						
							20.6	15	TN110							
192	Vol.	7/17	On order				20.32	‡	See Note	B3				6K7, 6A8, 6H6, 6C5, 43, 25Z5	456	
266, 266SD, 266SG	Vol.	17	1 Meg No. 1		See Note A3		8-8	1	See Note	B3	35	294	C3	78, 6A7, 6K7, 6Q7, 41, 84	175	10
							5-5	15	TN110							
							.007		Buffer	B14						
460A	Vol.	29	S											01A, 71A		
	Fil.	29	R													
475A	Vol.	29	R											001, 01A, 71A		
480A	Vol.	29	R											01A, 71A		
480B	Vol.	29	R	6										01A, 71A		
1462	Vol.	17	N	6			20.1	1/15	See Note	B3				6A7, 6K7, 6C5, 75, 43, 25Z5	456	
1556	Vol.	6	SRP263	6	EX200		20.22	1	See Note	B3				6C6, 6D6, 43, 25Z5	456	
							20.17	15	TN110							
1582	Vol.	17	O				20.7	1	WE1247					6D6, 6A7, 75, 42, 80	456	1
							20.4	1	WE847							
							20.5	12	CS130							
							20.6	15	TN110							
1583	Vol.	17	O				20.7	1	WE1247					6A7, 6D6, 42, 75, 80	456	1
							20.4	1	WE847							
							20.5	13	CS130							
							20.6	15	TN110							
FAIRBANKS-MORSE—Also see Audiola																
B6	Vol.	17	UC512	‡			8-8	25	CM172	B39	38	297	C3	6D6, 6A7, 75, 41, 84	177.5	10
							.02		Buffer	B14						
C6	Vol.	18	Order from	Mfr.			8-8	4	CM172	B3	35	294	C3	6A7, 6D6, 42, 75, 84	177.5	10
							.02		Buffer	B14						
40 (4015)	Vol.	40	Y	6			5026	4	RN242	B8				6C6, 41, 80	456	1
							5025	4	RS213							
41 (4015)	Vol.	27	N	13		A41	5438	12	RS203					1C6, 34, 32, 33	456	
42 (42TOB) (42CIB)	Vol.	79	N	‡			6054	12	CS123					1C6, 1B4, 33	456	
43 (43TIB) (43CIB)	Vol.	79	N	7			6054	12	CS123		15	246	C3	1B4, 1F4, 1C6	456	10
							5612	1	CN152							
							.01-.01		Buffer	B14						
51 (5106, 5107, 5109, 5111, 5112, 5141, 5143); 52 (5212, 5212A, 5241); 53 (5312, 5312A, 5341)	Vol.	17	N	6			EL8	4	RS213					2A7, 58, 2A6, 2A5, 80	456	1
	Tone	22	K12				EL6	15	TS101							
54 (5416, 5445)	Vol.	18	N				5026	4	RN242	B8				6A7, 6D6, 75, 42, 80	456	1
	Tone	22	N	6			5518	4	RN242	B8						
55 (5516, 5545)	Vol.	18	N				5026	4	RN242	B8				6A7, 6D6, 42, 75, 80	456	1
	Tone	22	N	6			5518	4	RN242	B8						
56 (5619, 5645)	Vol.	18	N	6			5025	4	RS213					6A7, 6D6, 75, 42, 80	456	1
							5519	4	RN242	B8						
57 (57TO)	Vol.	18	N	6			5880	4	RS213					6A8G, 6Q7G, 6K7G, 6F6G, 5Y3	456	1
							5881	4	RS203							
58 (58T1, 58T2, 58C1)	Vol.	18	N	6			5825	4	RS213					5Y3, 6A8G 6F6G, 6K7G, 6Q7G	456	1
							5823	4	RS213							
							8	14	RS213							
60 (6010, 6044)	Vol.	18	M				EL8	4	RS213					6D6, 6A7, 6B7, 42, 80	456	1
	Tone	22	K12	6			EL16	4	RN242	B8						
61	Vol.	17	N	6			5-16-10	11	UR182	B31				6A7, 6B7, 6D6, 25Z5, 43	456	
	Tone	22	K12													
62 (6210, 6244)	Vol.	18	M				EL23	8	UR182	B104				6D6, 6A7, 6B7, 43, 25Z5	456	
	Tone	34	K12	6												
63 (6317, 6346)	Vol.	18	N				5025	4	RS213					6D6, 6A7, 75, 42, 80	456	1
	Tone	22	N	6			5026	4	RN242	B8						
							5429	13	RS213							
64 Auto	Vol.	18	250M No. 1		See Note A3		8-8	4	See Note	B3	35	294	C3	6D6, 6A7, 75, 42, 84	177.5	10
							25	15	TS102							
							.02		Buffer	B14						
64 Home	Vol.	18	N				5429	12	RS203					1C6, 34, 30, 19	456	
	Tone	22	K12	13												
65 (6517, 6546)	Vol.	18	M				EL23	8	UR182	B104				6D6, 6A7, 6B7, 43, 25Z5	456	
	Tone	34	K12													
66 (6616, 6645)	Vol.	18	N				5026	4	RN242	B8				6A7, 6D6, 75, 42, 80	456	1
	Tone	22	N	6			5518	4	RN242	B8						
67 (6717, 6746)	Vol.	18	N				5429	13	RS213		15	246	C3	15, 6A7, 75, 19	456	10
	Tone	22	N	6			5317	15	TS101							
							5612	1	CN152	B3						
							.01		Buffer	B14						

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS Use	Circuit	Correct Replacement	Switch	Bias	*Note	CONDENSERS Original Part	Circuit	Correct Replacement	*Note	VIBRATORS Vibr. Conn.	Replacement	*Note	Types of Tubes Used	I. F. Peak	Trans. Circuit
FAIRBANKS-MORSE—Continued																
68	Vol.	18	N				16-16-5	6/15	See Note	B3				6A7, 6D6, 75, 43,		
														25Z5	456	
69	Vol.	6	E12				16-8	27	Note See	B3				6A7, 6D6, 76, 43,		
														25Z5	456	
70 (7014, 7040, 7042)	Vol.	18	M				EL21	4	RN242	B8				6D6, 6A7, 6B7, 42, 80	456	1
	Tone	22	K12	6			EL8	4	RS213							
							EL18	14	CN150							
71	Vol.	18	N				5026	4	RN242	B8				6K7, 6A8, 6F5, 6H6,		
	Tone	22	N	6			5025	4	RS213					6F6, 5Z4	456	1
							5429	13	RS213							
72 (72T3, 72C2, 72C3)	Vol.	80	TRP616				16	4	RN242	B8				5Y3, 6A8G, 6K7G,		
	Tone	80	N				8-8	4/13	RS213					6Q7G, 6L6, 6E5	456	1
73 (73T3B, 73C3B)	Vol.	20	TRP616				5429	13	RS213		15	246	C3	15, 6A7, 75, 76, 19,		
	Tone	21	N				5612	1	CN152					6E5	456	10
							5317	15	TS101							
							.01-.01		Buffer							
74 Auto	Vol.	18	Order from Mfr.				8-8	4	CM172	B39	35	294	C3	6D6, 6A7, 85, 41,		
							8	15	TS106					6A6, 84	177.5	10
81 (8110, 8114)	Vol.	18	N	7			4-4	24	RS201	B3				34, 1C6, 30	456	
	Tone	22	K12													
82 (8218, 8247, 8248)	Vol.	18	M				5026	1	RN242	B8				6D6, 6A7, 85, 42, 80	456	1
	Tone	40	L	6			5317	14	TS101							
90	Vol.	18	M				5026	1	RN242	B8				6K7, 6A8, 6H6, 6C5,		
	Tone	41	L	6			8	14	CS123					6F6, 5Z4	456	1
91 (91T4, 91C4, 91C5)	Vol.	80	‡		See Note A19		5888	4	WE3540					5Z4, 6F5, 6H6, 6K7,		
	Tone	80	N	6			5920	4	RN242	B8				6L6, 6L7	456	1
							5889	13	RS211							
100 (10049, 10050)	Vol.	45	M				5415	31	RS213					6D6, 6A7, 76, 42,		
	Tone	22	L	6			5025	31	RS213					2A3, 5Z3	456	16
							5317	15	TS101							
110	Vol.	18	M				5415	3	RS213					6K7, 6A8, 6H6, 6C5,		
	Tone	22	L	6			5025	3	RS213					6F6, 2A3, 5Z4	456	16
							5317	15	TS101							
120 (12C6)	Vol.	18	N				6035	3	WE1647					6K7, 6L7, 6J7, 6H6,		
	Tone	80	N				5888	3	WE3540					6C5, 6L6, 6E5,		
							5823	3	RS213					5W4	456	1
							5317	15	TS101							
346	Vol.	17	UC512	‡			8-8	25	CM172	B39	38	297	C3	6D6, 6A7, 75, 41, 84	177.5	10
	Tone	22	K12				.02		Buffer	B14						
347	Vol.	18	UC512	‡			8-8	25	CM172	B39	38	297	C3	6D6, 6A7, 85, 41, 84	177.5	10
	Tone	44	K12				.02		Buffer	B14						
816, 840 (32 Volt)	Vol.	15	N				EL9	1	CS123		47	See Note C10		37, 39, 85, 79, 25Z5	177.5	10
	Tone	22	K12				EL-6	15	TS101							
							.01		Buffer	B14						
FEDERAL RADIO CORP.																
D Code 68-070	Vol.	29	S	6										01A		
	Fil.	29	Q													
D Code 79-070	Vol.	11	SRP279				4-4-4	3	See Note	B1				01A		25
E Code 68-060	Vol.	29	‡		See Note A5									01A, 71		
E Code 68-062	Vol.	26	‡		See Note A5									01A, 12A		
	Fil.	29	‡		See Note A5											
E Code 79-060	Vol.	11	SRP279				4-4-4	3	See Note	B1				01A		25
F Code 79-080	Vol.	11	SRP279				4-4-4	3	See Note	B1				01A		25
F (25 Cycles)	Vol.	13	SRP279											01A, 71A, 12A		
G (25 Cycles)	Vol.	14	N				2-4-4	3	See Note	B1				26, 71A, 80		9
H (71-030)	Vol.	14	‡		See Note A5		1-1-2-1	3	See Note	B1				26, 27, 71A, 80		9
K	Vol.	14	UC503				2-4-4	3	See Note	B1				27, 24, 71, 80		2
L	Vol.	‡	‡				‡	3	See Note	B1				27, 71A-45, 80		7
M	Vol.	26	N				1-1-2-1	‡	See Note	B1				27, 80, 45		1
FEDERATED PURCHASER—"Acratone"																
Cathedral Tone	Vol.	12	N	6			8-8	4	See Note	B3				24, 45, 80		1
2	Vol.	6	G7	6			2-2	1	See Note	B1				24, 47, 80		3
5	Vol.	6	H7	6			5-5	4	See Note	B3				24, 51, 27, 47, 80	175	1
							5	4	See Note	B3						
6A	Vol.	15	UC503				12-8	4	See Note	B3				58, 56, 59, 5Z3	175	3
	Tone	21	L				5-5	15	TN110							
	Supp.	12	Y													
7A	Vol.	17	UC503				8-4	4	See Note	B3				58, 56, 2A6, 47, 80	465	1
	Tone	22	L				5	15	TS101							
8A	Vol.	7	J	6			16-8-4	11	UR182	B31				6A7, 78, 77, 43, 25Z5	465	
Royal 9A	Vol.	7	J		EX500		4-4	1	See Note	B3				77, 78, 43, 25Z5		
							5	15	TS101							
10	Vol.	59	Y10MP				8-8	4	See Note	B3				35, 27, 47, 80		3
12A	Vol.	15	UC503				12-8	4	See Note	B3				58, 56, 59, 5Z3	175	3
	Tone	21	L				5-5	15	TN110							
	Supp.	12	Y													
13A	Vol.	17	UC503				8-4	4	See Note	B3				58, 56, 2A6, 47, 80	465	1
	Tone	22	L				5	15	TS101							
14A	Vol.	56	‡		See Note A5		4-4-4	7	See Note	B3				58, 56, 55, 53, 80	175	3
	Tone	22	‡		See Note A5											
17	Vol.	15	N				4-4	4	RM261	B3				57, 58, 56, 55, 47, 80	175	1
	Tone	21	M													
24A	Vol.	17	UC503				8-4	4	See Note	B3				58, 56, 2A6, 47, 80	465	1
	Tone	22	L				5	15	TS101							
26A	Vol.	6	K12				5-16-8	11	UR182	B31				77, 78, 43, 25Z5		
32A	Vol.	15	‡		See Note A19		8-50	4	See Note	B3				6D6, 37, 85, 43, 25Z5	175	
	Tone	44	K12				8	13	See Note	B3						
	Supp.	7	J				10	18	See Note	B3						
35AC	Vol.	8	G				1948	3	RS213					51, 27, 47, 80	175	3
	Tone	41	P	6			1976	3	RS211							
36A	Vol.	15	‡		See Note A19		8-50	4	See Note	B3				6D6, 37, 85, 43, 25Z5	175	
	Tone	44	K12				8	13	See Note	B3						
	Supp.	7	J				10	18	See Note	B3						
38A	Vol.	6	K12				8-4	1	See Note	B3				58, 57, 47, 80	456	1
	Tone	22	K12													
39A	Vol.	15	N				8	1	RS213					57, 56, 58, 2A5, 80	485	1
	Tone	22	G12	6			10	15	TS101							
40AC	Vol.	8	G				1948	3	RS213					51, 27, 47, 80	175	3
	Tone	41	P	6			1976	3	RS211							
40 Auto	Vol.	17	500M No. 1		See Note A3		8-8	1	See Note	B3	35	294	C3	6D6, 6A7, 75, 41, 84	175	10
							5-5	15	TN110							
							.025-.025		Buffer	B14						
43A, 44	Vol.	15	N				8	1	RS213					57, 58, 56, 2A5, 80	485	1
	Tone	22	G12	6			10	15	TS101							
52A	Vol.	6	J	6	EX750		10-10	1	See Note	B3				77, 78, 43, 12Z3		
							5-5	15	TN110							

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
FEDERATED PURCHASER—Continued																
53, 54, 58, 59	Vol.	6	‡		See Note A5		10-12	1	See Note	B3				6D6, 6C6, 43, 12Z3		
							4-4	15	TN110							
65, 66	Vol.	6	‡		See Note A5		12-12	1	See Note	B3				6D6, 6C6, 43, 12Z3	455	
							4-4	15	TN110							
67	Vol.	17	N				8-4	25	See Note	B3				6A7, 78, 75, 42, 80		1
							25	19	TS102	B6						
79, 80	Vol.	62	N				8-8	1	See Note	B3				58, 56, 57, 46, 80	175	1
	Tone	21	N				5	12	See Note	B3						
	QAVC	7	F				5	15	TS101							
86, 87	Vol.	15	N				8	1	RS213					58, 57, 56, 2A5, 80	485	1
	Tone	22	G12	6			10	15	TS101							
88	Vol.	6	D7		2		8-4	1	CN151					2A7, 57, 58, 2A5, 80	455	1
	Tone	22	K12				5	15	TS101							
SW88	Vol.	15	N				8-8	1	RS213	B66				56, 57, 58, 2A5, 80	485	1
	Tone	22	G12	6			10	15	TS101							
92	Vol.	17	N	6			6-8	4	See Note	B3	34	292	C3	6D6, 6B7, 41, 84	175	10
	Tone	22	H12				10	15	TS101							
							.02		Buffer	B14						
92A-94A (Above 500,001)	Vol.	17	500M No. 1	6	See Note A1		8-6	4	See Note	B3	34	292	C3	6D6, 6B7, 41, 84 or		
	Tone	22	H12				.02		Buffer	B14				6Z4	175	10
93, 94, 96, 97	Vol.	18	N				8-8	1	See Note	B3				6D6, 6A7, 76, 75, 41,		
	Tone	22	G12	6			10-10	15	TN111					80	370	1
100	Vol.	6	G12		EX300		4-4	1	See Note	B3				24, 47, 80		1
104	Vol.	7	‡		See Note A5		‡	4	See Note	B3				2A7, 58, 57, 56, 2A5,		
	Tone	57	‡		See Note A5									80		1
107 Midget	Vol.	6	G12	6			2-2	1	See Note	B1				24A, 45, 80		3
117	Vol.	17	M	6			9659	1	CM172					2A7, 58, 2A6, 2A5, 80	465	1
	Tone	22	K12				1110	13	See Note	B3						
							8876	15	TS101							
SA120-SA123	Vol.	64	N				8-8	1	See Note	B3				56, 57, 58, 46, 80	175	1
	Tone	21	N				5	15	TS101							
	Sil.	59	F				5	17	TS101							
120 Amplifier	Vol.	16	M				6-6	2	See Note	B3				56, 45, 80		1
121	Vol.	6	SRP263		EX300		8-8	4	See Note	B3				6A7, 6D6, 6C6, 43,		
							16	13	See Note	B3				25Z5	456	
							4	12	See Note	B10						
125 Amplifier	Vol.	16	L				‡	3	See Note	B2				57, 56, 50, 81		‡
126	Vol.	16	L				4-4	1	See Note	B2				57, 56, 50, 81		5
215	Vol.	6	SRP263		EX400		16-16	4	See Note	B3				6D6, 6C6, 43, 25Z5		
228, 229	Vol.	62	N											1C6, 34, 30, 32, 19	456	
	Tone	22	K12													
424 Climax	Vol.	6	G12		EX300		4-4	1	See Note	B3				24A, 47, 80		1
460	Vol.	17	500M No. 1	6	See Note A1		8-6	4	See Note	B3	34	292	C3	6D6, 6B7, 41, 84 or		
	Tone	22	H12				.02		Buffer	B14				6Z4	175	10
470-474 (600, 001 and up)	Vol.	18	N				8-8	1	See Note	B3				6D6, 6A7, 75, 41, 80,		
	Tone	22	G12	6			10-10	15	TN111					76	370	1
708	Vol.	23	‡		See Note A5		4-4-8	3	See Note	B3				57, 56, 2A3, 83		5
728							8-8	24	See Note	B3				57, 2B6, 80		1
							5-5	15	TN110							
734	Vol.	23	100M No. 1		See Note A3		8	12	See Note	B3				77, 37, 48		
745 Amplifier	Vol.	16	‡		See Note A3		8	12	See Note	B3				77, 37, 46		
749	Vol.	18	N											78, 6A7, 85	175	
1000	Vol.	6	K12				5-16-8	11	UR182					77, 78, 43, 25Z5		
1200	Vol.	15	M				8-50	4	See Note	B3				6D6, 37, 85, 43, 25Z5	175	
	Tone	44	K12				8	13	See Note	B3						
	Supp.	7	J				10	13	See Note	B3						
FENWAY																
Everyman	Vol.	26	L											01A	‡	
Super	Vol.	26	E											‡	‡	
FIRESTONE																
54	Vol.	18	500M No. 1		See Note A1		6-10	4	See Note	B3	35	294	C3	6A7, 6D6, 75, 42, 84	456	10
							.02		Buffer	B14						
64	Vol.	18	500M No. 1		See Note A1		6-10	4	See Note	B3	35	294	C3	6D6, 6A7, 75, 42, 84	456	10
							.02		Buffer	B14						
R1322	Vol.	56	UC511	6							33	289Y	C3	77, 78, 85, 41	177.5	10
	Tone	44	Z12				83803	15	TS101							
							.005		Buffer	B14						
R1332	Vol.	17	UC512	6		A3					35	294	C3	6A7, 6D6, 75, 41, 84	456	10
							83803	15	TS101							
							.03-.03		Buffer	B14						
FORD-LINCOLN																
"Glove Box" (Zenith)	Vol.	17	SRP251	6	See Note A4		8-8	4	CM172	B3	37	296	C3	6D6, 6F7, 75, 42, 84	252.5	10
							10	15	TS101							
							.02		Buffer	B14						
"Glove Box" (Police)	Vol.	17	SRP251				8-8	4	CM172	B3	3	220B	C3	6E7, 6A7, 6C7, 42,		
	Sen.	40	G12				10	15	TS101					6Y5	‡	10
							.008-.008		Buffer	B14						
							20	‡	On order							
"Glove Box" (40-18805)	Vol.	17	SRP251				8-8	4	CM172	B3	3	220B	C3	6E7, 6A7S, 6C7, 42,		
							10	15	TS101					6Y5	‡	10
							.008-.008		Buffer	B14						
Police (Grigsby-Grunow)	Vol.	17	M				8	12	See Note	B3				39, 38, 85	‡	
B18805	Vol.	54	M				8	12	See Note	B3				39, 85, 38	‡	
N "Center Control"	Vol.	20	TRP614	6			30-2030	1	RN241		42	500P	C3	44, 77, 75, 41, 84	260	10
							30-2076	15	TS101							
							.01		Buffer	B14						
111	Vol.	17	SRP251				8-8	1	See Note	B3				39, 38, 85	‡	
FORDSON																
FP (330001 Up)	Vol.	15	M				4-4	4	See Note	B3				6A7, 78, 75, 42, 80	456	1
	Tone	22	L				5	19	TS105							
							5	15	TS101							
FP Batt. (173501 Up)	Vol.	54	M				5	20	TS105					1A6, 34, 32, 30, 19	456	
	Tone	22	L													
FP 32V (350001 Up)	Vol.	15	M	‡			6-10	1	See Note	B3	4	F221	B3	6A7, 78, 75, 42, 84	456	10
	Tone	22	L	7			5	15	TS101							
							.05-.05		Buffer	B14						
FR	Vol.	6	G12	‡	EX100		4-4	4	CM170					58, 57, 2A5, 80		1
	Tone	22	L	7												
FU	Vol.	6	L	6	See Note A14		4-20	6	See Note	B3				78, 44, 77, 43, 25Z5	456	
							5-5	15	TN110							

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS: Use	Cir-cuit	Correct Replacement	Switch	Bias	*Note	CONDENSERS: Original Part	Cir-cuit	Correct Replacement	*Note	VIBRATORS: Vibr. Conn.	Replace-ment	*Note	Types of Tubes Used	I. F. Peak	Trans. Cir-cuit
FORDSON—Continued																
FV	Vol.	7	UC510	6	See Note	A14	4-20	6	See Note	B3				44, 77, 43, 25Z5		
							5-5	15	TN110							
FW	Vol.	17	N	6			4-8-4	26	See Note	B3				78, 37, 85, 42, 80	456	1
	Tone	21	L													
R	Vol.	6	G12	‡			4-4	4	See Note	B3				78, 77, 42, 80 or 57,		
	Tone	22	L	7										58, 2A5, 80		1
U	Vol.	6	L	6	See Note	A14	4-20	6	See Note	B3				78, 44, 77, 43, 25Z5	456	
							5-5	15	TN110							
V	Vol.	7	UC510	6	See Note	A14	20-4	6	See Note	B3				44, 77, 43, 25Z5		
							5-5	15	TN110							
V (All-Wave)	Vol.	15	N	6			10-8	6	See Note	B3				6F7, 77, 43, 25Z5		
							5	15	TS101							
W All Wave	Vol.	17	N	6			4-8-4	5	See Note	B3				37, 78, 85, 42, 80	456	1
	Tone	41	L													
X	Vol.	6	G12	6	EX200		4-4	4	See Note	B3				6D6, 6C6, 42, 80		1
							5-5	15	TN110							
"Warwick"	Vol.	15	L	6			8-4	4	See Note	B3				57, 58, 55, 47, 80	175	1
	Tone	21	N				10	17	TS101							
"Goldentone" 6T	Vol.	15	L	6			6T28	1	CN152					58, 55, 59, 80	456	1
							6T26	15	TS106							
6TA	Vol.	18	N				8-4	1	See Note	B3				2A7, 58, 2A6, 2A5, 80	456	1
FRANKLIN																
6 Tube	Vol.	6	G7	6	5		4-4	1	See Note	B3				27, 24, 35, 47, 80	175	1
	Tone	22	G12													
43AB or CL	Vol.	7	‡		See Note	A5	DS197	1	See Note	B3				37, 39, 38, 36	456	
53	Vol.	6	H12		See Note	A14	8-4	6	See Note	B3				78, 77, 43, 25Z5	456	
							4-4	15	TN110							
54L	Vol.	7	‡		See Note	A5	4-8-4	8	CN145	B3				6A7, 78, 6B7, 43,		
														25Z5	456	
55U	Vol.	56	N	6			8-8-8-8	45	UR190	B105				6A7, 78, 6B7, 43,		
							5	15	TS101					25Z5	456	
63L	Vol.	6	G12				8-8	4	CM172	B3				57, 58, 56, 2A6, 47, 80	130	1
	Tone	21	P													
64	Vol.	6	‡		See Note	A5	8-‡	1	See Note	B3				57, 58, 59, 55, 80	‡	1
	Tone	22	L				5	15	TS101							
65VL, 65VU	Vol.	56	N				8-8-8-8	45	UR190	B105				6A7, 78, 6B7, 43,		
							5	15	TS101					25Z5	456	
94	Vol.	15	M				8-8-8	3	See Note	B3				57, 58, 2B7, 56, 59,		
	Tone	41	N											5Z3	450	3
	Sen.	8	A10MP	6												
100 (Auto)	Vol.	7	UC501		See Note	A3								36, 37, 38	175	
102	Vol.	6	G12				8-4	4	CM172	B3				24, 35, 47, 80	175	1
	Tone	22	G12													
104	Vol.	6	G12		EX500		4-4	1	CN150	B3				35, 24, 47, 80		1
	Tone	22	G12													
105	Vol.	6	G7	6			DS29	1	CN150	B3				58, 57, 47, 80		1
106	Vol.	6	G12				DS23	1	CN150	B3				57, 58, 55, 47, 80	‡	1
	Tone	21	P		See Note	A4										
200 (Auto)	Vol.	15	N		See Note	A3								36, 85, 37, 89	177	
FREED-EISEMANN																
A7	Vol.	17	N				4-4	15	TN110		2	210		6A7, 78, 6B7, 41	456	26
A9	Vol.	15	500M No. 1		See Note	A1	16	1	On order		2	210	C3	6A7, 6D6, 85, 37, 41	456	26
							8-20	1	On order							
							5-5	19	TN110							
							.05		Buffer	B14						
FE63 DC	Vol.	6	Y											39, 36, 89		
	Tone	22	L													
FE96 DC	Vol.	6	H12	6			24.7	1	See Note	B3				36, 37, 38		
	Tone	22	‡		See Note	A5										
FE98	Vol.	7	‡		See Note	A5	24.30	1	See Note	B3				24, 35, 27, 45, 80	175	1
	Tone	22	‡		See Note	A5	24.23	1	See Note	B3						
FE99	Vol.	6	H12											36, 37, 33		
	Tone	22	‡		See Note	A5										
NR55 DC	Vol.	5	M				1-2	1	See Note	B7				01A, 71A		
NR55 AC, NR56 AC	Vol.	81	DRP243				2-1-4	3	See Note	B1				27, 26, 45, 80		18
NR57	Vol.	4	‡		See Note	A5								26, 71, 27		
NR60 AC	Vol.	4	M											26, 27, 71A		
NR60 DC	Vol.	4	M											01A, 71A		
NR70 AC	Vol.	4	M											26, 210, 27		
NR78 AC, NR79 AC	Vol.	7	K				1-1-4-1	3/14	See Note	B1				27, 45, 80		3
NR78 DC, NR79 DC	Vol.	13	M											01A, 71A		
NR80 DC	Vol.	4	C											01A, 12A, 71A		
NR80 AC	Vol.	4	E12											26, 27, 71, 80		11
NR85 AC	Vol.	4	E12											26, 27, 50, 81		8
NR90 S.	Vol.	24	DRP308				1-2-4	3	See Note	B1				24, 27, 45, 80		3
NR95 AC	Vol.	7	K12				1-1-4-1	3/14	See Note	B1				27, 45, 80		3
351, 351P, 351L	Vol.	6	SRP263		EX400		12-8	6	See Note	B3				6D6, 6C6, 43, 25Z5		
							5-5	15	TN110	B6						
357P	Vol.	6	Z12		EX400		8-14	6	See Note	B3				6A7, 6D6, 76, 43,		
							5-5	15	TN110	B6				25Z5	456	
357L, 358L	Vol.	6	Z12		EX300		8-14	6	See Note	B3				6A7, 6D6, 75, 43,		
							5-5	15	TN110	B6				25Z5	132	
369S	Vol.	6	Z12		EX300		8-14	6	See Note	B3				6A7, 6D6, 76, 75, 43,		
							5-5	15	TN110	B6				25Z5	456	
FREED TEL. & RADIO CORP.																
MB5	Vol.	7	‡		See Note	A5	‡	1	See Note	B3				51, 24, 47, 80		1
MB7	Vol.	6	G12				8-4	1	See Note	B3				58, 56, 55, 47, 80	175	1
	Tone	22	L				1	17	TS105							
MB9	Vol.	6	G12				4-8-8	3	See Note	B3				58, 56, 55, 46, 80	175	1
	Tone	22	K12				4	15	TS105							
							4	17	TS101							
51DC	Vol.	6	Y											39, 36, 89	175	
54	Vol.	8	G				8-4	1	CN151	B3				58, 57, 47, 82		1
56	Vol.	8	G				8-4	1	CN151	B3				58, 57, 47, 80		1
58 AC	Vol.	6	Y				8-4	4	See Note	B3				57, 58, 55, 47, 80	175	1
	Tone	22	K12													
59	Vol.	8	G				8-4	1	CN151	B3				58, 57, 47, 82		1
72, 74	Vol.	6	G12				8-4	1	See Note	B3				58, 56, 55, 47, 80	175	1
	Tone	22	L				4	17	TS105							
90	Vol.	6	G12				4-8-8	3	See Note	B3				58, 56, 55, 46, 80	175	1
	Tone	22	K12				4	15	TS105							
91 DC	Vol.	6	H12				‡	1	See Note	B7				36, 37, 33		
92 AC	Vol.	8	‡		See Note	A5	‡	28	See Note	B3				51, 24, 47, 80		1
346	Vol.	6	G12				8-4	1	CN151					78, 77, 42, 80		1
							5	15	TS105							
354	Vol.	6	G12				8-4	1	CN151	B3				6A7, 78, 75, 42, 80	456	1
							5	15	TS105							
355	Vol.	6	G12				25-14	6	See Note	B3				6A7, 78, 75, 43, 25Z5	456	
							5	15	TS105							

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
FREED TEL. & RADIO CORP.—Continued																
360, 360X	Vol.	6	G12	6			8-4	1	CN151	B3				6A7, 78, 75, 76, 42, 80	175	1
							5	15	TS105							
365, 365X	Vol.	6	G12	6			25-14	6	See Note	B3				6A7, 78, 75, 76, 43,		
							5	15	TS105					25Z5	456	
JESSE FRENCH																
"G" Jr.	Vol.	25	DRP119	6			1-2	1	See Note	B1				24, 45, 80		3
H1	Vol.	25	GE	6			8-8-.1	1	CN152/TP418					24, 45, 80		3
H2 AC	Vol.	6	G12				4	1	See Note	B3				24, 47, 51, 80		3
H2 Jr.	Vol.	6	G12				4-4	1	See Note	B3				24, 45, 80		3
	Tone	21	O													
H2 Special 110V DC	Vol.	40	E12				2-2	1	See Note	B11				30, 32, 71A		
S2	Vol.	25	DRP119	6			5483	2	RN242	B3				24, 27, 45, 80		1
	Tone	41	O													
U1	Vol.	7	C	6			8-8	34	See Note	B3				24, 27, 35, 47, 80	175	1
	Tone	22	K12													
5-093	Vol	13	K12				‡	37	See Note	B1				26, 27, 45, 80		11
JESSE FRENCH EXPORT.																
5X, 6X, 7X	Vol.	15	M	6			22-173	30	WE847					58, 57, 56, 59, 80	175	3
	Tone	34	N													
	Sen.	7	‡		See Note A5											
8 Tube AC	Vol.	1	K12				‡	3	See Note	B1				26, 27, 71, 80		9
FRESHMAN																
G (1st Type)	Vol.	35	M				‡	1	See Note	B4				26, 27, 71, 80		11
G (2nd Type)	Vol.	35	M				‡	3	See Note	B4				26, 27, 71, 80		11
G (3rd Type)	Vol.	3	G12				2-2-6-4-2-1	3/14	See Note	B4				26, 27, 71, 80		11
H	Vol.	35	M				‡	1	See Note	B4				26, 27, 210, 81		27
K	Vol.	35	M				‡	1	See Note	B4				26, 27, 12A		7
L DC	Vol.	35	M											01A, 12A		
M	Vol.	60	K12		See Note A43		2-4	1	See Note	B1				71, 26, 27, 80		9
N	Vol.	60	K12		See Note A43		1-4	1	See Note	B2				26, 27, 50, 81		8
Q15, Q16	Vol.	60	G12				2-4	1	See Note	B1				22, 27, 26, 71, 80		11
QD-16-S	Vol.	4	G12				1-2-2	3	See Note	B1				22, 27, 26, 71, 80		8
2N with 2N60S	Vol.	60	K12		See Note A43		1-4	1	See Note	B2				26, 27, 50, 81		8
30-15, 30-16	Vol.	4	G12				1-4	1	See Note	B1				22, 27, 26, 71, 80		8
21AC and 22AC	Vol.	81	DRP240				2-1-4	3	See Note	B1				26, 27, 71A, 80		18
21 DC	Vol.	13	M											01A, 71A		
31, 32, (AC)	Vol.	7	K				1-1-4	3	See Note	B1				27, 45, 80		3
31S, 32S, (AC)	Vol.	58	M				1-1-4	3	See Note	B1				24, 27, 45, 80		3
41 (AC)	Vol.	7	K				1-1-4	3	See Note	B1				27, 45, 80		3
FROST MINTON																
FM4, FM5	Vol.	6	G12				4-4	25	See Note	B3				24, 45, 80		1
4PW	Vol.	6	G12				4-4	25	RM261	B3				24, 47, 80		1
FULTON																
Pre							8-8	4	See Note	B3				76, 84		1
							10	15	TS101							
Z	Vol.	16	M				8-8-8	4/17	RM265	B106				2A3, 2A6, 5Z3, 56		1
							5-5	15	TN110							
13B	Vol.	95	MM				16	1	See Note	B3				2A6, 5Z3, 50, 53, 56		8
	Equal.	‡	M				4	1	See Note	B4						
							8	17	TS106							
							4	13	CS131	B3						
15B	Vol.	95	MM				16-6	‡	See Note	B2				2A3, 5Z3, 6A6, 75, 76		14
	Equal.	‡	M		See Note A3		4	13	See Note	B3						
							8	17	TS106							
35B	Vol.	95	MM				6-16	1	See Note	B3				50, 56, 57, 59, 83		1
	Equal.	‡	M		See Note A3		2-3	1	See Note	B4						
							10	14	TS106							
							8	15	TS101							
GALVIN MFG. CO. "Motorola"																
Super 6	Vol.	56	Order from	Mfr.			8420	1	CN141		23	270B		77, 78, 85, 12A5	456	10
	Tone	44	L													
Dual 6	Vol.	77	Order from	Mfr.			8825	1	SR611		20	253	C3	78, 77, 75, 42, 84	262	10
	Tone	22	Order from	Mfr.			.01		Buffer	B14						
JB	Vol.	7	K				32-16-16	11	SR613					6D6, 6A7, 75, 43,		
	Tone	22	K12				10	15	TS101					25Z5	‡	
J8	Vol.	7	K		EX150		21632	11	SR613					6D6, 6A7, 75, 43,		
	Tone	22	K12											25Z5	175	
S10	Vol.	83	N				8-8-12	3	See Note	B3				78, 77, 85, 56, 45, 83	175	1
	Tone	22	K12				25	15	TS102							
Twin "8"	Vol.	15	Order from	Mfr.			8825	1/19	SR611		20	253	C3	LA, 37, 77, 78, 84, 85	262	10
	Tone	22	Order from	Mfr.			.01		Buffer	B14						
Auto Set	Vol.	7	UC509											24, 01A, 12		
"Golden Voice"	Vol.	18	UC515	6			2326	1	SR612		35	294	C3	6K7, 6A8, 6R7, 6H6,		
	Tone	22	Order from	Mfr.			.005		Buffer	B14				6C5, 6F6, 0Z4	262	6
	Sen.	7	Order from	Mfr.												
5 Tube, "Split Case"	Vol.	7	UC510		See Note A3									01A, 24, 71A		
5T 71	Vol.	7	UC510		See Note A3		8	12	See Note	B3				24, 38, 71A		
6T-12PL	Vol.	7	UC510		See Note A3		50	‡	See Note	B3				24, 01, 12		
7T-38	Vol.	15	L											24, 37, 38		
7T-38A	Vol.	62	N											51, 37, 38		
7T-47A	Vol.	62	N				10	19	TS105					37, 39, LA	175	
34	Vol.	77	UC515	6			8426	1	CN151		35	294	C3	78, 77, 75, 42, 84	456	10
							R2520	19	TS102							
							.02		Buffer	B14						
44	Vol.	17	SRP280				1823	1	SR601		11	235	C3	12A5, 75, 77, 78	456	10
							10	15	TS101							
							.01		Buffer	B14						
50	Vol.	18	UC515	6			2317	1	SR602		35	294	C3	6A7, 78, 75, 41, 84	262	10
							.01		Buffer	B14						
51	Vol.	83	N											36, 39, 85, 41	175	
55	Vol.	56	SRP280	7			88300	24	CN152		11	231	C3	77, 78, 75, LA	456	26
							830	1/19	SR603							
							.01		Buffer	B14						
57	Vol.	17	UC515	6			1540	1/19	SR604		21	253T	C3	6A7, 41, 75, 78, 84	456	10
							.01		Buffer	B14						
60	Vol.	18	Order from	Mfr.			2188	1	SR605		35	294	C3	78, 6A7, 75, 6B5, 84	262	10
							.008		Buffer	B14						
61	Vol.	83	N				8200 L or W	1	CS123		39	303S	C3	36, 39, 85, 41	175	26
							.1		Buffer	B14						
62	Vol.	17	UC515	6			1540	1/19	SR604		21	253T	C3	6A7, 41, 75, 78, 84	456	10
							.01		Buffer	B14						
66	Vol.	17	Order from	Mfr.			8420	1	CN141		23	270B		77, 78, 85, 12A5	456	10
	Tone	44	L													
75	Vol.	56	UC515	6			1465 or 1468	1/19	SR607		21	253T	C3	78, 77, 75, 41, 81	262	10
							.01		Buffer	B14						

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS Use	Circuit	Correct Replacement	Switch	Bias	*Note	CONDENSERS Original Part	Circuit	Correct Replacement	*Note	VIBRATORS Vibr. Conn.	Replacement	*Note	Types of Tubes Used	I. F. Peak	Trans. Circuit
GALVIN MFG CO.—Continued																
77	Vol.	17	SRP280				8300A	4	CS123		10	230	C3	39, 77, 75, LA	456	26
							8300B	4	CS123							
							6530	19	SR608							
							.01		Buffer	B14						
77A	Vol.	56	SRP280				8420	1	CN141		23	270B		12A5, 77, 78, 85	456	10
	Tone	44	L													
78	Vol.	15	N											36, 38, 39, 85, 37	175	
79	Vol.	56	UC515	6			1468 or 1465	1/19	SR607		21	253T	C3	78, 77, 75, 41, 84	262	10
							.01		Buffer	B14						
80	Vol.	55	UC515	6			2185	1	SR609		35	294	C3	6K7, 6A8, 6H6, 6C5,		
	Tone	76	Order from	Mfr.			.005		Buffer	B14				6N6, 0Z4	262	10
88	Vol.	15	N				8200 L or W	1	CS123		39	302S	C3	36, 39, 85, 37, 38	175	10
							.05		Buffer	B14						
100	Vol.	77	UC515	6			1388	1/19	SR610		21	253T	C3	78, 77, 85, 76, LA, 84	262	10
							.01		Buffer	B14						
110	Vol.	18	UC515				1388	1/19	SR610		21	253T	C3	78, 77, 85, 37, LA, 84	262	10
							.01		Buffer	B14						
GAMBLE SKOGMO																
20C7, 20C8	Vol.	45	P	6			P81039	2	WE1647					6D6, 76, 45, 80	456	1
	Tone	41	UC504				P81018	12/13	CM173	B107						
26S1	Vol.	17	UC514	6			45X204	1	CN152	B3	20	253	C3	6D6, 6C6, 75, 41, 84	175	10
	Tone	22	M				45X203	15	TN111							
							.01		Buffer	B14						
27C1, 27C5	Vol.	45	O				P81014	40	UR190					34, 30, 19	175	
77	Vol.	15	N	7										1C6, 19, 30, 32, 34	‡	
430	Vol.	2	G12				17080	19	TS101					1A6, 19, 33	456	
540	Vol.	17	N	6			C525C/C525D	11	UR182	B31				6D6, 25Z5, 43, 75	456	
550	Vol.	15	N				17080	19	TS101					1A6, 34, 30, 32, 33	456	
575	Vol.	6	Z12	6	EX100		P119-6	4	RM262	B73				58, 57, 2A5, 80	175	1
670	Vol.	17	N	6			P103-2	4	RM262		37	296	C3	6D6, 6C6, 78, 75, 42,		
							20	15	TS102					84	175	10
							.02		Buffer	B14						
675	Vol.	18	N	6			P103-4	4	WE1647					2A5, 2A6, 27, 57, 58,		
							P103-3	4	WE1847					80	370	1
680, 680B	Vol.	62	N	7			E17355	12	See Note	B3				1C6, 34, 30, 1B5, 19	456	
GAROD																
EA	Mod.	16	N		See Note A3		4-4	1	See Note	B2				112, 199, 210, 216B		1
	Fil.	29	R													
	Fil.	29	S													
	Vol.	‡	C200P													
EM	Vol.	16	N				4-4	1	CN150	B3				‡		3
25	Vol.	17	N	6			8-8	4	See Note	B3				‡	‡	1
	Tone	34	L													
27	Vol.	64	N				12-12	4	See Note	B3				6D6, 6A7, 76, 42, 80	456	1
	Tone	34	L													
33 and 33LW	Vol.	18	N				20-12-8	11	UR182	B3				6A7, 6D6, 75, 43, 76,		
	Tone	22	L				5-5	15	TN110					25Z5	456	
58	Vol.	7	D				8-20-12	8	UR182	B3				6A7, 6D6, 25Z5, 43,		
	Tone	22	L				5	15	TS105					85	456	
66	Vol.	18	N				20-12	6	See Note	B3				6A7, 6D6, 75, 43,		
	Tone	22	L				10-10	15	TN111					25Z5	456	
83 and 83LW	Vol.	18	N				25-12-20	6/12	UR182	B3				6A7, 6D6, 25Z5, 43,		
	Tone	44	L											85	456	
GENERAL ELECTRIC																
A52	Vol.	18	N				16	1	RN242	B8				6A8, 6K7, 6Q7, 6F6,		
							8	1	RS213					5Z4	465	1
							10-10	15	TN111							
A53	Vol.	8	A5MP				RC402	1	RS213					5Z4, 6A8, 6F6, 6J7,		
							RC403	1	RS213					6K7	465	1
							RC511	15	TN111							
A54	Vol.	18	N				25-16	8	RM259	B108				6A8, 6K7, 6Q7, 25A6,		
							10-7	8/15	RN232	B108				25Z6	465	
A55	Vol.	18	N				16	1	RN242	B8				6A8, 6K7, 6Q7, 6F6,		
							8	1	RS213					5Z4	465	1
							10-10	15	TN111							
A60—See RCA—Victor M-32																
A63	Vol.	62	M	6			RC409	1	RN242	B8				6A8, 6K7, 6H6, 6C5,		
							RC403	1	RS213					6F6, 5Z4	465	1
							RC501	13/15	CN152							
A64	Vol.	19	TRP603				RC404	1	RS215					6A8, 6K7, 6H6, 6J7,		
	Tone	34	G12				RC407	1	RN242	B8				6F6, 5Z4	465	1
							RC501	13/15	CN152	B109						
							RC502	13/14	CN150	B109						
A65	Vol.	62	M	6			RC409	1	RN242	B8				6A8, 6K7, 6H6, 6C5,		
							RC403	1	RS213					6F6, 5Z4	465	1
							RC501	13/15	CN152	B109						
A67	Vol.	19	TRP603				RC404	1	RS215					6A8, 6K7, 6H6, 6J7,		
	Tone	34	G12				RC407	1	RN242	B8				6F6, 5Z4	465	1
							RC501	13/15	CN152	B109						
							RC502	13/14	CN150	B109						
A70	Vol.	19	TRP603				RC404	1	RS215					5Z4, 6A8, 6C5, 6F6,		
	Tone	34	L	6			RC407	1	RN242	B8				6H6, 6K7	465	1
							RC502	13/14	CN150							
							RC503	15	TN111							
A75	Vol.	19	TRP603				RC404	1	RS215					5Z4, 6A8, 6C5, 6F6,		
	Tone	34	L	6			RC407	1	RN242	B8				6H6, 6K7	465	1
							RC502	13/14	CN150							
							RC503	15	TN111							
A81—See RCA—Victor P31																
A82	Vol.	‡	DRP311				RC405	1	RS215					6K7, 6A8, 6H6, 6C5,		
	Tone	34	L				RC408	1	RN242	B8				6F6, 5Z4	465	1
	Sen.	7	C				RC502	13/14	CN150							
							RC504	15	TS101							
A87	Vol.	‡	DRP311				RC405	1	RS215					6K7, 6A8, 6H6, 6C5,		
	Tone	34	L				RC408	1	RN242	B8				6F6, 5Z4	465	1
	Sen.	7	C				RC502	13/14	CN150							
							RC504	15	TS101							
H91, H91R	Vol.	8	K		See Note A16		G5020	4	CS133					24, 27, 35, 47, 80	175	1
	Tone	‡	K		See Note A16											
N60	Vol.	17	2 Meg. No. 1		See Note A1		8-5-4	4/15	CM175	B3	35	294	C3	6F6, 6J7, 6K7, 6Q7,		
							.0075		Buffer	B14				6X5	175	10

For all other General Electric Models see the Cross Reference on the next page.

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

CROSS REFERENCE OF GENERAL ELECTRIC—RCA VICTOR MODELS

A-90—See RCA Victor M30
BX—See RCA Victor R17M
B40—See RCA Victor M34
B52—See RCA Victor M116
B81—See RCA Victor 142B
B86—See RCA Victor 241B
C30—See RCA Victor 91B
C41—See RCA Victor M105
C60—See RCA Victor M107
C61—See RCA Victor M123
C62—See RCA Victor 126B
C67—See RCA Victor 223
C70—See RCA Victor 135B
C75—See RCA Victor 235B
D50—See RCA Victor M101
D51—See RCA Victor M104
D52—See RCA Victor M108
D72—See RCA Victor M109
E52—See RCA Victor T5
H31—See Radiola 80
H32—See RCA Victor R50
H51—See Radiola 82
H51R—See Radiola 82R
H71—See Radiola 86
H71R—See Radiola 86R
H72—See RCA Victor RAE 59
H91, H91R—See Previous Page
J70—See RCA Victor R4
J72—See RCA Victor R70 and R70N
J75—See RCA Victor R6
J80—See RCA Victor R8
J82—See RCA Victor R71
J83—See RCA Victor R-73 with 47's
J83A—See RCA Victor R73 with 2A5's
J85—See RCA Victor R12
J86—See RCA Victor R72
J87—See RCA Victor R75 (47's)
J87A—See RCA Victor R75 (2A5's)
J88—See RCA Victor R71
J100—See RCA Victor R100
J105—See RCA Victor R76
J107—See RCA Victor R77
J109—See RCA Victor RE81
J125—See RCA Victor R78
J125A—See RCA Victor R78 (2)
JZ30—See RCA Victor SW2
JZ822—See RCA Victor R24
JZ822A—See RCA Victor R24A (47)
JZ826—See Victor R24
JX828-J88 with SW adapter
JZ835—See RCA Victor RO23
K40—See RCA Victor R27
K40A—See RCA Victor R18W
K41—See RCA Victor R17M
K43—See RCA Victor 100
K48—See RCA Victor 300
K50—See RCA Victor R28
K50P—See RCA Victor R28P
K51—See RCA Victor R28
K51P—See RCA Victor R28P
K52—See RCA Victor 110
K53—See RCA Victor 111
K53M—See RCA Victor 115
K54—See RCA Victor RE40
K54P—See RCA Victor RE40P
K55—See RCA Victor 210
K58—See RCA Victor 310
K60—See RCA Victor R37
K60P—See RCA Victor R37P
K62—See RCA Victor R11
K63—See RCA Victor 120
K64—See RCA Victor 121
K64D—See RCA Victor 127
K65—See RCA Victor R38
K65P—See RCA Victor R38P
K66—See RCA Victor 220
K66M—See RCA Victor 222
K78—See RCA Victor 330
K79—See RCA Victor 331
K80—See RCA Victor 140 and 140E
K80X—See RCA Victor 141 and 141E
K82—GE K62 in clock cabinet
K85—See RCA Victor 240
K88—See RCA Victor 340
K88X—See RCA Victor 34E
K105—See RCA Victor 261
K106—See RCA Victor R90
K106P—See RCA Victor R90P
K107—See RCA Victor R260
K126—See RCA Victor 280
KZ-62P—See RCA Victor RE18, RE18A
L50—See RCA Victor R22S
L51—See RCA Victor R22W
L52—See RCA Victor 112
L52A—See RCA Victor 112A
L53—See RCA Victor 114
M40—See RCA Victor 102
M41—See RCA Victor 101
M42—See RCA Victor 103
M49—See RCA Victor 301
M50—See RCA Victor 117
M51—See RCA Victor 118
M51—See RCA Victor 118 (mod)
M52—See RCA Victor 119
M55—See RCA Victor 214
M56—See RCA Victor 211
M61—See RCA Victor 128
M62—See RCA Victor 125
M63—See RCA Victor 124
M65—See RCA Victor 221
M66—See RCA Victor 226
M67—See RCA Victor 224
M68—See RCA Victor Duo 321
M69—See RCA Victor 322
M81—See RCA Victor 143
M85—See RCA Victor 243
M86—See RCA Victor 242
M89—See RCA Victor 341
M106—See RCA Victor 262
M107—See RCA Victor 263
M125—See RCA Victor 281
M128—See RCA Victor Duo 380
M128R—See RCA Victor 380HR
M129—See RCA Victor 381
N60—See Previous Page
S22—See RCA Victor R7
S22X—See RCA Victor R7
S22D—See RCA Victor R7 DC
S42—See RCA Victor R9
S42B—See RCA Victor R43
S42D—See RCA Victor R9 DC
S132—See RCA Victor R10
SZ42P—See RCA Victor RE16
T12—See RCA Victor R5
T11D—See RCA Victor R5 DC
T12E—See RCA Victor R5X
T41—See RCA Victor Radiola 48

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
GENERAL ELECTRONICS																
AW50	Vol.	17	N				8-8 25	1 17	See Note TS102	B3				58, 55, 47, 56, 80	465	1
GENERAL FIREPROOFING																
P	Vol.	7	‡		See Note A5		A407 A408	1 15	CN140 TN110					77, 78, 38, 6Z3, or 1V		
GENERAL HOUSEHOLD UTILITIES—See Grunow																
GENERAL MOTORS—"Day-Fan"																
"Little General"	Vol.	24	DRP309				8	4	RS213					24, 45, 80		1
	Tone	22	G12		See Note A45		12	4	RS215							
"Day-Fan" 5AC	Vol.	11	A400P				2-2-1	3	See Note	B1				27, BH		
"Day-Fan" 25, 26, 27, 28	Vol.	5	K12				‡	3	See Note	B1				26, 27, 71, 80		11
"Day-Fan" 43, 48	Vol.	5	K12				‡	3	See Note	B1				26, 27, 71, 80		11
110	Vol.	24	DRP309				8	4	RS213					24, 45, 80		1
	Tone	22	G12		See Note A45		12	4	RS215							
120, 130, 140, ("A", "B") Below serial 29100A-1700B	Vol.	25	DRP310				3-2-4-4-5	‡	See Note	B1				24, 27, 45, 80		3
	Tone	41	K12													
120, 130, 140 ("A", "B") Between serials 29100A & 62100A, & 1700B & 1964B	Vol.	24	DRP309				3-2-4-4-5	‡	See Note	B1				24, 27, 45, 80		3
	Tone	41	G12													
120, 130, 140 ("A", "B") Above serial 62100A, 1964B	Vol.	25	DRP309				8-8-8	3	RS213	B66				24, 27, 45, 80		3
	Tone	41	G12													
170E	Vol.	29	SRP268											32, 30, 31		
	Tone	41	M													
180, 190	Vol.	24	DRP309				8	4	RS213					24, 45, 80		1
	Tone	22	G12		See Note A45		12	4	RS215							
200-201 (E2)	Vol.	54	Y25MP	6										32, 30, 31		
	Tone	41	M													
211 (S9A, S9B)	Vol.	6	K12	6			8-8	1	CN152					24, 35, 27, 47, 80	175	1
216, 217, 219, (S1A, S1B)	Vol.	6	K12				1203346	7	RN241					24, 35, 27, 47, 80	175	1
	Tone	22	‡		See Note A5		8	7	RS213							
220 (S10A, S10B)	Vol.	8	Y10MP				206566	1	CN152					35, 27, 24, 47, 80	175	1
250 (S1A, S1B)	Vol.	6	K12				1203346	28	RN241					24, 35, 27, 47, 80	175	1
	Tone	22	‡		See Note A5		8	28	RS213							
251 (S2A, S2B)	Vol.	14	G	6			C6629	28	RS211					24, 35, 27, 47, 80	175	1
	Tone	22	K12				8	28	RS213							
252, 253, 254, 255, 256, 257, 258, (S3A, S3B)	Vol.	84	G	6			8-8-8	28	RS213	B3				24, 27, 35, 45, 80	175	1
	Tone	22	K12													
281 (R1A)	Vol.	‡	G7		See Note A44									36, 37	535	
292, 293 (S4A, S4B)	Vol.	7	G	6			8-8	1	RS213	B66				24, 27, 35, 45, 80	175	1
	Tone	22	‡		See Note A5											
A5003	Vol.	2	K12				5-3-3-1	3	See Note	B1				26, 27, 45, 80		8
A5005	Vol.	12	K12				1-3-5-4	3	See Note	B1				24, 27, 80, 45		3
A5010	Vol.	5	K12				1-3-3-5	3	See Note	B1				26, 27, 45, 80		8
A5020	Vol.	12	K12				1-3-4-5	3	See Note	B3				24, 27, 45, 80		3
5051, MG Set	Vol.	26	L				2-12-4	3	See Note	B3				01A		
5052	Vol.	26	K12											01A		
5057	Vol.	26	Y				2-2-2	3	See Note	B1				Kellog, BH		‡
5060	Vol.	26	Y											01A		
5065 AC	Vol.	26	K12											01A		
5066	Vol.	26	K12											01A		
5077	Vol.	2	K12				‡	3	See Note	B1				26, 27, 71, 80		11
5080	Vol.	2	K12				‡	‡	See Note	B1				26, 27, 71, 80		11
5091	Vol.	2	K12				5-3-1-2	3	See Note	B1				26, 27, 45, 80		8
GENERAL TELEVISION																
"A," "B," "C," "E," "SW"	Vol.	6	K12	6			20-4-10	6/15	UR182	B110				12Z3, 43, 44, 77		
	Tone	22	L	7												
"G," "GSW," "M," "MSW"	Vol.	6	G12				4-4	4	See Note	B3				58, 57, 47, 80		1
	Tone	22	L													
GILFILLAN																
GN6	Vol.	29	Q											01A		
4T	Vol.	6	G12				4-4	4	CM170	B3				2A5, 57, 58, 80		1
5C, 5T	Vol.	17	N	6			8-4	4	CM171	B3				2A5, 2A6, 57, 58, 80	175	1
	Tone	22	K12													
5X	Vol.	6	H12				8-16	6	CN145					25Z5, 36, 39, 43	450	
6C, 6T	Vol.	15	N	6			8-8	4	See Note	B3				2A5, 2A7, 55, 58, 80	262.5	1
	Tone	22	K12													
7A	Vol.	15	500M No. 1		See Note A1		8-8 10	1 15	CN152 TS101	B3	37	296	C3	76, 77, 78, 85, 42, 84	175	10
8C, 8T	Vol.	15	N	6			8-8	36	See Note	B3				2A5, 2A7, 55, 56, 58	262.5	1
	Tone	85	K12													
30	Vol.	6	G12				4-4	4	CM170					2A5, 57, 58, 80		1
32	Vol.	17	N	6			8-4	4	CM171	B3				2A5, 2A6, 57, 58, 80	175	1
	Tone	22	K12													
33	Vol.	3	G12				‡	3	See Note	B4				27, 12, 80		2
34	Vol.	6	H12				16-8	6	CN145					25Z5, 36, 39, 43	450	
35 with 71's	Vol.	7	K				2-2-4	3	See Note	B1				27, 71, 80		2
35 with 2A5	Vol.	18	N	6			8-4	4	CM171	B3				57, 58, 2A6, 2A5, 80	175	1
	Tone	22	K12													
41	Vol.	17	N	6			8-4	4	CM171	B3				2A5, 2A6, 57, 58, 80	175	1
	Tone	22	K12													
42A	Vol.	6	H7				5-5	23	See Note	B3				42, 77, 78, 80		1
43A	Vol.	6	G12				4-4	4	CM170	B3				2A5, 57, 58, 80		1
44	Vol.	3	G12				‡	3	See Note	B3				27, 12, 80		2
47, 50	Vol.	15	N	6			8-8	36	See Note	B3				2A5, 2A7, 55, 56, 58, 80	262.5	1
	Tone	85	K12													
52A, 54A	Vol.	6	H12				4-4	4	CM170	B3				77, 78, 42, 80	460	1
55A, 55B	Vol.	6	H12				16-8	6	CN145					25Z5, 36, 39, 43	450	
60	Vol.	86	J				2-2-3	3	See Note	B1				26, 27, 71, BH		18
62BX	Vol.	17	N	6			2-4	23	See Note	B3				5Z4, 6F5, 6F6, 6H6, 6J7, 6K7	175	1
	Tone	22	K12													
63B, 63X (AC)	Vol.	17	M	6			8-8 10	1 19	See Note TS106	B3				5Z4, 6A8, 6F5, 6F6, 6H6, 6K7	460	1
66	Vol.	3	E12				‡	3	See Note	B1				10, 27, 81		5
77	Vol.	3	G12				‡	3	See Note	B4				12, 27, 80		2

‡ Data not substantiated.

*** IMPORTANT: Read Notes in Note Section if specified in Note Column.**

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
GILFILLAN—Continued																
78B, 78X	Vol.	17	N				8-8	1	See Note	B3				5Z4, 6A8, 6F5, 6F6, 6H6, 6K7	460	1
	Tone	76	K12				10	19	TS101							
100 with PP 71's	Vol.	58	K				2-2-4	3	See Note	B1				27, 71, 80		2
100 with 45's	Vol.	6	G12				2-2-2	3	See Note	B1				27, 45, 80		1
105, 106 (1st Type)	Vol.	6	H12				2-2	1	See Note	B1				24, 45, 80		1
	Tone	22	H12													
116B, 116X, 117B, 117X	Vol.	46	N	6			16	1	RN242	B8				6K7, 6A8, 6H6, 6C5, 6F6, 5Z4	460	1
	Tone	76	M				18	1	RN242	B8						
	Sen.	7	UC500				10	19	TS106							
410	Vol.	6	G12				4-4	23	CM170	B3				57, 58, 2A5, 80		1
510	Vol.	18	N	6			8-4	23	CM171	B3				57, 58, 2A6, 80	175	1
	Tone	22	K12													
515	Vol.	18	M	6			8-4	1	CN151	B3				6A7, 78, 75, 42, 80	460	1
							10	19	TS101							
520	Vol.	18	N	6			8-4	23	CM171	B3				57, 58, 2A6, 2A5, 80	175	1
	Tone	22	K12													
525	Vol.	18	M	6			8-4	1	CN151	B3				6A7, 78, 75, 42, 80	460	1
							10	19	TS106							
615	Vol.	15	N	6			8-8	4	See Note	B3				2A7, 58, 55, 2A5, 80	262.5	1
	Tone	22	K12				10	15	TS101							
625	Vol.	15	N	6			8-8	4	See Note	B3				2A7, 58, 55, 2A5, 80	262.5	1
	Tone	22	K12				10	15	TS101							
700	Vol.	15	500M No. 1		See Note A1		8-8	1	CN152	B3	37	296	C3	42, 76, 77, 78, 84, 85	175	10
							10	15	TS101							
							.015		Buffer	B14						
715, 725	Vol.	18	M	6			8-8	1	See Note	B3				6A7, 78, 75, 42, 80	460	1
							10	19	TS106							
815, 825	Vol.	15	N	6			8-8	36	See Note	B3				2A7, 58, 55, 56, 2A5, 80	262.5	1
	Tone	22	K12													
GLORIATONE—See U. S. Radio & Tel.																
GOLDENTONE																
L5	Vol.	18	N	6			P471	32	RS211					5Z4, 6F5, 6H6, 6K7, 6L7	456	1
	Tone	34	L				P160	32	CN151	B81						
							P304	15	TS101							
L6	Vol.	18	N	6			P474	32	RS211					5Z4, 6C5, 6F6, 6K7, 6L7, 6Q7	456	1
	Tone	44	L				P160	32	CN151	B81						
							P304	15	TS101							
L7	Vol.	45	N	7			P391	1	RN232	B90	14	245C	C3	1C6, 19, 30, 34	456	10
	Tone	‡	L				.01-.01		Buffer	B14						
Z4	Vol.	45	SRP275	7			P391	1	RN232	B90	14	245C	C3	1C6, 19, 30, 32, 34	456	10
	Tone	44	L				.01-.01		Buffer	B14						
Z5	Vol.	45	SRP275				P958	1	RN232	B90	14	245C	C3	1C6, 19, 30, 32, 34	456	10
	Tone	44	L				.01-.01		Buffer	B14						
GOLD MEDAL																
L5	Vol.	18	N	6			P471	32	RS211					5Z4, 6F5, 6F6, 6H6, 6K7, 6L7	456	1
	Tone	34	L				P160	32	CN151	B81						
							P304	15	TS101							
L6	Vol.	18	N	6			P474	32	RS211					5Z4, 6C5, 6F6, 6K7, 6L7, 6Q7	456	10
	Tone	44	L				P160	32	CN151	B81						
							P304	15	TS101							
L7	Vol.	45	N	7			P391	1	RN232	B90	14	245C	C3	1C6, 19, 30, 34	456	10
	Tone		L				.01-.01		Buffer	B14						
Z4	Vol.	45	SRP275	7			P391	1	RN232	B90	14	245C	C3	1C6, 19, 30, 32, 34	456	10
	Tone	44	L				.01-.01		Buffer	B14						
Z5	Vol.	45	SRP275	7			P391	1	RN232	B90	14	245C	C3	1C6, 19, 30, 32, 34	456	10
	Tone	44	L				.01-.01		Buffer	B14						
GOODYEAR																
570	Vol.	17	N	6			C525C, D.	11	UR182	B31				6D6, 75, 43, 25Z5	456	
575	Vol.	6	Z12	6	EX100		P119-6	4	RM261	B37				2A5, 57, 58, 80	175	1
670	Vol.	17	N	6			P103-2	4	RM262		35	294	C3	6C6, 6D6, 42, 75, 78, 84	175	10
							20	15	TS102							
							.02		Buffer	B14						
675	Vol.	18	N	6			P103-4	4	RN242	B8				2A5, 2A6, 27, 57, 58, 80	370	1
							P103-3	4	RN242	B8						
GRAYBAR ELECTRIC CO.																
GB4 (Graybarette)—See RCA Model R5																
GB8 (Midget)—See RCA Model R7																
GB8A—See RCA Model R7A																
GB9—See RCA Model R11																
GB100—See RCA Model R55																
GB300—See RCA Model Rad. 16																
GB310—See RCA Model Rad. 18																
GB311—See RCA Model R33																
GB320—See RCA Model Rad. 51																
GB330—See RCA Model Rad. 60																
GB340—See RCA Model R62																
GB500—See RCA Model R44																
GB550—See RCA Model R46																
GB600—See RCA Model R66																
GB678—See RCA Model R48																
GB700—See RCA Model R80																
GB770—See RCA Model R82																
GB900—See RCA Model R86																
GB989—See RCA Model R10																
GC13—See RCA Model R6																
GC14—See RCA Model R12																
GG15—See RCA Model R6																
GT7—See RCA Model R4																
GT8—See RCA Model R8																
GT8-56—See RCA Model R71																
GT8-69—See RCA Model R72																
GT10-69—See RCA Model R74																
GT10-88—See RCA Model R76																
GT10-99—See RCA Model R77																
GREBE																
AH1	Vol.	8	A1MP	6			‡	1	See Note	B4				24, 27, 45, 80		7
	Tone	34	L				.01		See Note	B9						
HS3	Vol.	6	G12	6			8-8	4	See Note	B3				24, 35, 47, 80	175	1
	Tone	22	L													
HS4 1 Pentode	Vol.	7	E	6			8-8-8	3	RS213	B66				35, 24, 27, 47, 80	175	1
	Tone	22	L													
HS4 with 45PP	Vol.	6	F12	6			8-8-8	3	RS213	B66				24, 27, 45, 80	175	3
	Tone	22	L													

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

3

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
GREBE—Continued																
HS5	Vol.	7	E.	6			8-8-8	3	RS213	B66						
	Tone	22	L.											27, 35, 24, 45, 80	175	3
HS6	Vol.	15	N.	6			8-8-8	3	RS213	B66						
	Tone	‡	Y100MP			See Note A46								27, 24, 35, 47, 80	175	3
HS7	Vol.	7	E.	6			6-6	3	RS213	B66				24, 27, 35, 47, 80	175	1
HS8	Vol.	64	N.	6			8-8-8	5	RS213	B66				37, 27, 47, 80	175	1
	Tone	22	L.													
HS11	Vol.	18	N.	6			6-6	3	RS213	B66				35, 27, 47, 80	175	3
	Sil.	12	A5MP			See Note A11										
	Tone	34	L.													
HS12	Vol.	62	N.	6			8-8-8	3	RS213	B66				27, 35, 24, 47, 80	175	3
	Supp.	12	A400P													
Synchrophase SK4	Vol.	8	A3MP				‡	3	See Note	B4				24, 27, 45, 80		3
61R	Vol.	56	N.				8-8	1	CN152		34	292	C3	6A7, 37, 41, 78, 84, 85	456	10
							5	15	TS101							
							.025		Buffer	B14						
89	Vol.	6	E12				8-8	4	RS213	B66				56, 58, 59, 80	175	1
111B	Vol.	18	M.				16	35	RN242	B8				46, 55, 56, 58, 57, 82	175	1
	Supp.	8	UC500				8	35	RS213							
428 Console	Vol.	26	‡			See Note A5	‡	1	See Note	B4				26, 27, 71A, 80, 50		11
GRIGSBY - GRUNOW—See Majestic																
DAVID GRIMES																
RGS Inverse Duplex 1927	Vol.	54	M.											01A		
"New Yorker" 110 V. DC	Vol.	26	K.													
	Fil.	29	S.											12, 71		
GRUNOW																
2A (1101)	Vol.	‡	P.				27710	28	WE847							
	Tone	41	O.				27711	28	WE847					78, 6F7, 6B7, 85, 37, 45, 5Z3	262	14
							27715	28	CM171							
4A (450, 451)	Vol.	6	G7	6			29168	1	CN152					6F7, 42, 84	455	1
							24789	15	TS101							
4B (460, 461)	Vol.	6	F7	6	3		31208	4	CM172					6A7, 6F7, 42, 80	455	1
4C (470)	Vol.	6	F7		3		31208	4	CM172					6A7, 6F7, 41, 80	465/490	1
4NB (410, 411)	Vol.	18	M.	6			10-10	1	CN152	B3	13	245	C3	1A6, 1A4, 75, 41	465	10
							.0075		Buffer	B14						
5A (500)	Vol.	18	O.	6			27713	1	RS213					6F7, 78, 75, 47, 80	455	14
							27712	1	RS213							
							27838	13	TS101							
							27489	17	TS101							
5B (501, 520, 530, 550)	Vol.	17	N.	6			27151	11/15	UR182/TS101							
5C (502, 503)	Vol.	6	G12											6F7, 25Z5, 43, 75, 78	455	
	Fil.	29	R.											32, 30, 34, 33	455	
5D (570, 571)	Vol.	17	O.	6			29562	4	RN242	B8				6A7, 6D6, 75, 42, 80	455	1
							27711	4	RS213							
							31477	24	RS215							
							24789	15	TS101							
5E (560)	Vol.	17	N.	6			31849	1	CN152							
							31857	15	TN110					6A7, 6D6, 75, 42, 80	455	1
5G (580, 581)	Vol.	18	TRP604	6			31424	4	RS215							
							33469	4	RN242	B8				6A7, 6D6, 42, 75, 80	465/490	1
							33371	14	RS205							
							32987	15	TS101							
5H (532)	Vol.	7	E.	6	2		35181	4	RS213					6A7, 6D6, 76, 41, 80	465	1
							34744	4	RS215							
5J (542)	Vol.	18	M.	6			34813	4	RS213							
							34669	4	RS215					6A8, 6K7, 6Q7, 6F6,		
5K (551, 553)	Vol.	18	250M No. 1	6		See Note A19	33469	4	RN242	B8				5W4	465	1
							33369	4	RS215					6A8, 6K7, 6Q7, 6F6,		
5L (555, 572)	Vol.	18	250M No. 1	6		See Note A19	33369	4	RS215					5W4	465	1
							33469	4	RN242	B8				6A8, 6K7, 6Q7, 6F6,		
5NB (510)	Vol.	18	M.	13										5W4	465	1
5Q (573)	Vol.	18	250M No. 1	6		See Note A19	33469	4	RN242	B8				1A4, 1A6, 1B5, 33	465	
							33369	4	RS215					6A8, 6K7, 6Q7, 6F6,		
5R (564)	Vol.	7	E.	6			36350	4	RM262	B73				5W4	465	1
6A Early (650, 651)	Vol.	17	TRP610	6			29557	4	CS133					6A7, 6D6, 76, 41, 80	465	1
	Tone	22	M.				29086	4	RN242	B8				6A7, 6D6, 42, 75, 80	262	1
6C Early (660, 661, 662)	Vol.	17	TRP610	6			29562	23	RN242	B8						
	Tone	22	M.				29557	23	CS133					6D6, 6A7, 75, 42, 80	262	1
6D (670, 671)	Vol.	17	O.				30091	4/13								
	Tone	22	L.	6				15/19	SR614					6D6, 6A7, 75, 42, 80	455	1
6F 690, 691)	Vol.	17	1 Meg. No. 1	6		See Note A19	30091	4/13								
	Tone	22	L.					15/19	SR614					6D6, 6A7, 75, 42, 80	455	1
6G (680, 681)	Vol.	18	TRP604	6			33369	4	WE1247					6A8, 6K7, 6H6, 6F5,		
							33469	4	RN242	B8				6F6, 5Z4	465	1
							33371	14	RS215							
							32987	15	TS101							
6HB (620, 621)	Vol.	15	P.	7			33943	12	RS203					1C6, 34, 30, 32, 19	465	
6J (640, 641)	Vol.	17	TRP604	6			33369	4	WE1247					6A7, 6D6, 42, 75, 80	465/490	1
							33370	4	RN242	B8						
							33371	14	RS205							
							33469	‡	RN242	B8						
							32987	15	TS101							
6M (631, 643)	Vol.	18	250M No. 1	6		See Note A19	33469	4	RN242	B8						
							33369	4	RS215					6A8, 6K7, 6Q7, 6F6,		
7A (700, 701)	Vol.	20	TRP610				27414	1	WE847					5W4	465	1
	Tone	22	M.				27413	23	RS213					78, 37, 75, 42, 80	262	1
7B (750, 751, 752, 753)	Vol.	17	TRP610	6			29558	1	CS135					6D6, 6A7, 6F7, 75,		
	Tone	22	N.				29562	1 23	RN242	B8				76, 42, 80	262	1
							31052	23	CS133	B8						
							29559	23	CS133							
7C (760, 761)	Vol.	20	1 Meg. No. 1			See Note A19	33369	1	RS215					6K7, 6A8, 6H6, 6F5,		
							33371	1	RS205					6F6, 5Z4	175	1
							33469	14	RN242	B8						
							33169	15	TN111							
7DB (720, 721)	Vol.	15	P.	7			33943	12	RS203							
8A (801)	Vol.	17	1 Meg. No. 1	6		See Note A19	27414	1	WE847					1C6, 34, 30, 32, 19	465	
	Tone	34	M.				27413	1/23	RS213					78, 37, 85, 6B7, 42, 80	262	1
8B (821)	Vol.	17	O.				27414	1	WE847							
	Tone	22	‡			See Note A5	27413	1/23	RS213					78, 6A7, 85, 37, 42, 80	262	1
							29562	23	RN242	B8						
							27668	15	TS101							

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS Use	Circuit	Correct Replacement	Switch	Bias	*Note	CONDENSERS Original Part	Circuit	Correct Replacement	*Note	VIBRATORS Vibr. Conn.	Replacement	*Note	Types of Tubes Used	I. F. Peak	Trans. Circuit
GRUNOW—Continued																
8D (861)	Vol.	17	1 Meg. No. 1		See Note	A19	29562	23	RN242	B8				6D6, 6A7, 76, 75, 42, 80	455	1
	Tone	22	N	6			29558	23	CS135							
							30152	13	CS133							
8E (871)	Vol.	17	1 Meg. No. 1		See Note	A19	33852	24	WE1247					6K7, 6A8, 6H6, 6C5, 6F6, 5Z4	455	1
							33598	1	RS215							
							33469	1	RN242	B8						
							33371	13	RS215							
							32987	15	TS101							
9A Early (901, 902)	Vol.	17	TRP610	6			27710	1	WE847					78, 37, 85, 45, 6B7, 80.	262	14
	Tone	41	O				27711	1/23	RS213							
							27670	14/15	RM262							
							28400	‡	RN242							
9A (901, 902) Revised	Vol.	17	TRP610	6			8	1	RS213					78, 37, 6B7, 85, 45, 80	262	14
	Tone	41	O				8-8	24	RN242							
							27670	14/15	RM262							
9B (1101)	Vol.	‡	P				27710	1	WE847					78, 6F7, 6B7, 85, 37, 45, 5Z3	262	14
	Tone	41	O				27711	1	WE847							
							27715	24	CM171							
9C (921)	Vol.	17	‡	6	See Note	A19	27710	28	WE847					78, 6A7, 85, 76, 45, 80.	262	14
	Tone	41	‡		See Note	A5	27711	28	RS213							
							29562	28	RN242	B8						
							27670	14/15	RN242							
							24789	15	TS105							
11A Type 1 (1151, 1152)	Vol.	17	O	6			27710	1	WE847					6D6, 6A7, 76, 85, 45, 5Z3	262	14
	Tone	41	O				27711	1/23	RS213							
							27715	14/19	CM171							
							29632	13	CS133							
							24789	15	TS101							
11A Type 2 (1151, 1152, 1161, 1162)	Vol.	17	O	6			31743	1	WE1247					6D6, 6A7, 76, 85, 45, 5Z3	262	14
	Tone	41	O				31629	1/23	RN242	B8						
							27715	14/19	CM171							
							29632	13	CS133							
							24789	15	TS101							
11B (1151, 1152, 1161, 1162)	Vol.	17	O	6			31743	28	WE1247					6D6, 6A7, 76, 85, 45, 5Z3	262	14
	Tone	41	O				31629	28	RN242	B8						
							27715	4/19	CM171							
							29632	13	CS133							
							24789	15	TS101							
11C (1171)	Vol.	17	1 Meg. No. 1		See Note	A19	33645	4	WE847					6K7, 6A8, 6H6, 6C5, 6F5, 6F6, 5Z4	455	1
							33768	4	RS215							
							34466	1	RN242	B8						
							33371	13	RS203							
							33169	15	TN111							
							33646	19	TS105							
11G (1191)	Vol.	17	1 Meg. No. 1	6	See Note	A19	36719	46	RN242	B8				6G5, 6K7, 6A8, 6H6, 6C5, 6F6, 5Z3	465	1
							36752	46	RN245	B8						
							36720	46	WE3540							
							36721	46	RS215							
12A (1241)	Vol.	20	1 Meg. No. 1		See Note	A19	33947	33	WE847					5Z4, 6A8, 6C5, 6F5, 6F6, 6H6, 6K7	455	1
							33946	33	WE1247							
							34466	33	RS213							
							33646	33	TS105							
							33169	15	TS101							
12B (1291), 12W (1297)	Vol.	18	1 Meg. No. 1	6	See Note	A19	36752	46	RN245	B8				6K7, 6A8, 6J7, 6C5, 6H6, 6L6, or 6F6, 5Z3	465	1
							36720	46	WE3540							
							36721	46	RS215							
							33371	14	RS205							
							33169	15	TN111							
							36776	15	TS101							
15W (1541)	Vol.	18	1 Meg. No. 1		See Note	A19	36290	31	HD680					6K7, 6L7, 6J7, 6H6, 6R7, 6C5, 6F6, 5Z4	455	1
							36596	31	RS215							
							36466	31	RN242	B8						
							36597	14	RS205							
							33646	19	TS105							
30 Apex Auto Set	Vol.	7	UC501											24, 26, 01A, 71A		
99 and 99A	Vol.	6	G12				8-4	1	CN151	B3				24, 35, 47, 80	175	1
513	Vol.	6	Y				4-12-4	11	UR182					6F7, 78, 75, 43, 25Z5	455	
614-618	Vol.	18	Order from	Mfr.			35390	1/15	CN155/TN111	B111	35	294	C3	6K7G, 6A8G, 6Q7G, 6F6G, 6X5G	262	10
	Tone	22	O				.005		Buffer	B14						
625	Vol.	17	Order from	Mfr.			34119	1/15	CN152/TN110	B111	26	273D		6K7G, 6A8G, 6R7G, 6C5G, 6A6	262	10
	Tone	22	O													
GULBRANSEN (Also see Wells-Gardner)																
Champion Jr.	Vol.	6	G12				1-1-1	28	See Note	B7				24, 27, 45, 80		
	Tone	41	O													
V6Z2	Vol.	17	N	6			P80956	25	CM172/TS102	B112	34	292	C12	77, 78, 75, 41, 84	262	
							P80937	1/12	CN140							
							‡		Buffer	B14						
Z6Z1	Vol.	17	N	6			P80956	25	CM172/TS102	B112	34	292	C12	77, 78, 75, 41, 84		
							P80937	1/12	CN140							
05A	Vol.	6	G12	6	EX300		5-15-8	11	UR182	B31				77, 78, 43, 25Z5		
							4	20	TS105							
06W	Vol.	56	N				16-8	1	CN155		2	210	C3	78, 77, 85, 41		
							4	15	TS101							
062A	Vol.	45	N				4	15	TS105		1	206	C3	39, 36, 37, 41.		
	Tone	34	UC502				4	13	CS123							
9 in line (Club)	Vol.	1	E12				2-1-1-1-.5	3	See Note	B1				26, 24, 45, 8		
	Vol.	1/15	DRP241													
10 Series, 13	Vol.	7	F		1		80848	23	RS213					35, 24, 2		
	Tone	22	O	6			80849	23	RS213							
20 Series	Vol.	‡	N				8-8-8	28	RS213	B66				35, 27		
	Tone	41	P	6												
23	Vol.	‡	N				8-8-8	28	RS213	B66				35.		
	Tone	41	P	6												
53 Battery	Vol.	6	H7		2											
	Tone	21	O	6												
53 AC	Vol.	59	SRP272				80894	23	CM172							
	Tone	34	UC502				80891B	13	CS121							
60, 63	Vol.	6	TRP600				P80849	25	RS213							
							P80848	25	RS213							
80A 60 Cycles	Vol.	6	D7				1-1-1	5	See Note	B1						
	Tone	41	O													
80A 25 Cycles	Vol.	24	GG				2.5-4-2	28	See Note	B1						
	Tone	41	O													
92, 93	Vol.	2/10	DRP243													
160, 161, 60 Cycles	Vol.	24	GG				1-1-1.5-1.5	28	See Note	B1						
	Tone	41	O	6												

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

HAM
HiQ
HiQ
HiQ
HiQ 3
HATRY
H-Y "7
H-Y "7B
H-Y Short
"7" Ball
HETRO
6 Tube AC..
6 Tube AC-DC
‡ Data not substanti
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MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
GULBRANSEN—Continued																
160, 161, 25 Cycles	Vol.	24	GG				2.5-4-2	28	See Note	B1				27, 45, 80, 24		3
	Tone	41	O													
162	Vol.	‡	TRP600				1-1-1.5-1.5	28	See Note	B1				24, 27, 45, 80		3
	Tone	41	O	6												
200, 291, 292, 295	Vol.	1/15	DRP243				2-1-1-1-.5	‡	See Note	B7				26, 24, 45, 80		9
322	Vol.	64	Z12				8	30	WE847					58, 56, 37, 46, 82	175	3
	Tone	41	L	6			8-4	30	CN151							
	Supp.	8	A5MP				4	19	CS121							
351	Vol.	6	H7	6			80894	4	CM172							
362	Vol.	45	N											57, 35, 47, 80	262	1
392	Vol.	18	N											39, 36, 37, 38	262	
	Tone	22	UC502											34, 30	175	
742	Vol.	40	‡		See Note A5		1.5-1-3	3	See Note	B1				24, 27, 45, 80		3
872	Vol.	59	SRP271				80894B	23	CM172					58, 57, 47, 80	175	7
	Tone	34	L				80891	13	CS121							
9950	Vol.	1/15	DRP243				2-1-1-1-.5	‡	See Note	B7				26, 24, 45, 80		9
HALLICRAFTERS																
5PA "Sky Buddy"	Vol.	18	N	6			4214	23	RM261	B3				6A7, 6F7, 75, 42, 80		1
"Ultra Sky Rider"	Vol.	45	500M No. 1		See Note A19		4216	1	RN242	B8				6K7, 6L7, 6C5, 6R7, 6J7, 6Q7, 6F6, 5Z4	1600	1
	Tone	‡	O	6			4203	15	TS106							
	Sil.	8	G													
	BFO.	‡	N													
HALSON																
"Dual Range"	Vol.	7	G	6			8-8	4	RS213	B3				35, 24, 47, 80		1
	Tone	22	O													
"Roadmaster"	Vol.	15	N				8-8	1	CN152	B3	3	220B		6A7, 78, 75, 42, 84	456	10
							5	15	TS101							
NS40	Vol.	6	UC509	6	EX150		4-16-4	8	UR182					78, 77, 43, 25Z5		
							5	15	TS101							
NS50	Vol.	7	G	6	1		4-16-8	8	UR182					6A7, 78, 75, 43, 25Z5	456	
NS60	Vol.	7	G		2		4-16-16	8	UR182					78, 6A7, 75, 43, 25Z5	456	
							5	15	TS101							
20A	Vol.	6	G7	6	1		8-4	6	CN141	B3				78, 77, 43, 25Z5		
							5	15	TS101							
20B, 20B "European"	Vol.	7	G	6	1		8-8	6	CN142	B3				6A7, 78, 77, 43, 25Z5	456	
							5	15	TS105							
45	Vol.	6	SRP263	6			1408	6/15	UR189	B98				6D6, 6C6, 43, 12Z3		
52	Vol.	6	SRP263	6			1437	25	CS133	B3				6D6, 6C6, 41, 76, 80		1
54	Vol.	6	SRP263	6			1440	38	UR190	B3				6D6, 6C6, 43, 25Z5		
66AW	Vol.	8	‡	6	See Note A5		6606	8	UR182	B3				6A7, 6D6, 75, 43, 25Z5	456	
							6611	16	TS105							
410	Vol.	6	Y	6	EX300		1194	25	CS133	B3				6D6, 6C6, 42, 80		1
515	Vol.	6	G12				8	4	See Note	B3				35, 24, 47, 80		1
							6	4	See Note	B3						
515SW	Vol.	6	G12	6			8	4	See Note	B3				35, 24, 47, 80		1
							6	4	See Note	B3						
516	Vol.	3	G12	6										39, 38, 33		
520	Vol.	6	Y	6	EX100		1194	25	RS213	B3				6A7, 6D6, 6C6, 42, 80	456	1
530	Vol.	6	SRP263	6			1320	7	CM175	B3				6A7, 6D6, 6C6, 43, 12Z3	456	
535	Vol.	6	SRP263	6			1392	38	UR190					6A7, 6D6, 6C6, 43, 25Z5	456	
580	Vol.	6	SRP263	6			1381	‡	CM175	B3				6A7, 6D6, 6C6, 43, 12Z3	456	
610	Vol.	18	N	6			1088	3	CN155	B3				6A7, 6D6, 75, 42, 80	456	1
615	Vol.	26	G12											01A, 33		
620, 630	Vol.	18	L	6			1230	38	UR190	B3				6A7, 6D6, 75, 43, 25Z5	456	
HAMMARLUND MFG. CO.																
"Comet Pro" Battery	Vol.	7	H											77, 78, 42	465	
	Tone	22	Y	6												
"Comet Pro" Dec. 1931	Vol.	7	H				8-8	1	RS213	B66				24A, 35, 47, 80	465	3
	Tone	34	Y	6			8	16	TS101							
"Comet Pro" July 1932	Vol.	7	H				8-8-8	3	RS213	B66				24A, 35, 37, 80	465	1
	Tone	34	Y	6			8	15	TS101							
"Comet Pro" Feb. 1932	Vol.	7	H				8-8-8	3	RS213	B66				57, 58, 2A5, 80	465	1
	Tone	34	G12	6			8	18	TS101							
"Comet Pro" Sept. 1932	Vol.	7	H				8-8-8	3	RS213	B66				57, 58, 47, 80	465	1
	Tone	34	G12	6			8	19	TS101							
"Comet Pro" Oct. 1932	Vol.	7	H				8-8-8	3	RS213	B66				57, 58, 47, 80	465	1
	Tone	34	G12	6			8	19	TS101							
"Comet Pro" Standard Model	Vol.	7	H				8-8-8	3	RS213	B66				57, 58, 2A5, 80	465	1
	Tone	34	G12	6			8	19	TS101							
"Comet Pro" (Crystal)	Vol.	7	H				8-8-8	3	RS213	B56				57, 58, 2A5, 80	465	1
	Tone	34	Y	6			8	19	TS101							
"Comet Pro" AVC Model	Vol.	15	M				8-8-8	3	RS213	B56				57, 58, 2B7, 2A5, 80	465	1
	Gain	7	H	6			8	19	TS101							
MARLUND ROBERTS																
30 AC	Vol.	12	Y				‡	‡	See Note	B1				24, 27, 45, *80		7
30 Battery	Vol.	12	Y											22, 12A, 71A		
30 DC	Vol.	12	Y											24, 27, 45		
1 AC	Vol.	12	H12				‡	‡	See Note	B1				24, 27, 45, 80		3
& YOUNG																
"	Vol.	12	Y											24, 27	175	
	Sens.	9	E12													
"	Vol.	12	K12				‡	3	See Note	B1				24, 27, 45, 80	175	2
	Sens.	7	E													
-Wave 6 ery	Vol.	12	L											01A, 12A, 22	175	
	Sens.	9	K12													
	Vol.	17	N	6			8	4	RS213					6D6, 6A7, 6B7, 42	456	1
	Tone	34	K12				10	15	TS101							
'	Vol.	17	N	6			C2092	6/15	UR182, TS101	B114				6A7, 6D6, 6B7, 42	456	
	Tone	34	K12				10	15	TS101							

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* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
HETRO—Continued																
8 Tube Superhet	Vol.	15	P				622	3	RS213					2A7, 58, 55, 56, 2A5, 80	456	1
	Tone	41	N	6			604	3	RN242							
							490	15	TS101							
9 Tube Air Ace	Vol.	18	N	6		•	30	1	WE3540					6D6, 6A7, 85, 42, 80	456	1
	Tone	44	K12				14	1	RN242	B8						
							10	15	TS101							
6 LB, 6 SB	Vol.	18	N											1C6, 34, 1B5, 30	456	
	Tone	21	O													
22	Vol.	6	H12		EX200		8-8	1	See Note	B3				58, 57, 47, 56, 80	115	1
	Tone	22	Y													
31	Vol.	77	N				8-8	1	See Note	B3				57, 58, 55, 47, 80	175	1
	Tone	41	Y													
71	Vol.	56	N				10-25-10	11	UR182	B31				6D6, 75, 43, 25Z5	456	
207	Vol.	17	N	6			623	4	CM172	B3				2A7, 58, 2A6, 2A5, 80	456	1
							490	15	TS101							
209	Vol.	17	N	6			623	4	CM172	B3				2A7, 58, 2A6, 2A5, 80	456	1
							490	15	TS101							
251	Vol.	6	H12		EX250		428	4	CM171	B3				57, 58, 2A5, 80		1
	Tone	22	Y	6												
257, 259	Vol.	17	N	6			623	4	CM172	B3				2A7, 58, 2A6, 2A5, 80	456	1
							490	15	TS101							
295	Vol.	17	N	6			466	11	UR182	B31				6D6, 75, 43, 25Z5	456	
							490	15	TS101							
297	Vol.	17	N	6			466	11	UR182	B31				6A7, 6D6, 75, 43, 25Z5	456	
							490	15	TS101							
412, 466	Vol.	17	N				659	6/15	UR182/TS101	B114				6D6, 6A7, 75, 43, 25Z5	456	
	Tone	22	L	6			10	15	TS101							
HIGH FREQUENCY LABS.																
A. C. Special	Vol.	7	UC509				5-9-9	24/1	See Note	B1				24, 27, 71A, 80	‡	3
Isotone 10	Vol.	16	See Note			A5								22, 01A, 12A, 71A		
	Sen.	12	See Note			A5										
L	Vol.	7	H				4-4	4	See Note	B3				24, 35, 47, 80		1
"Mastertone" 1929	Vol.	12	K12				5-15-5	3	MN277	B60				24, 27, 45, 80		7
"Mastertone" Super 10, 1931	Vol.	12	G12				8-8-8	3	See Note	B3				24, 27, 45, 80		3
"Nine in Line"	Vol.	33	M											01A, 12A	175	
4 Tube Pentode	Vol.	7	J				4-4	1	See Note	B3				51, 24, 47, 80		1
117-4	Vol.	7	H				8-8	4	See Note	B3				27, 24, 35, 47, 80	175	1
	Tone	22	N													
160-6 (280)	Vol.	7	H				4-4	4	See Note	B3				35, 24, 47, 80		1
200	Vol.	7	H				8-8	25	See Note	B3				27, 35, 47, 80		1
	Tone	41	N													
208-1	Vol.	7	H				4-4	4	See Note	B3				24, 35, 47, 80		1
	Tone	22	N													
222	Vol.	7	H				4-4	4	See Note	B3				24, 27, 35, 47, 80	‡	1
	Tone	22	N													
HI-LO																
34TDDA 4 Tube AC-DC	Vol.	7	UC509		See Note	A10	12-6	6	See Note	B3				39, 36, 41, 25Z5		
							10-10	15	TN111	B6						
HOODWIN																
Aero A. F. Amplifier							4-4	25	See Note	B3				56, 57, 47, 80		1
							8	14	See Note	B3						
6 Tube Super (DC)	Vol.	33	L				20	15	TS102					36, 38	175	
	Tone	22	L													
Aero Auto Radio	Vol.	26	H12											24, 27, 45		
Aero Auto Pent. "A"	Vol.	7	H											36, 38		
Aero Auto Pent. "B"	Vol.	7	H		3									‡		
International Aero	Vol.	15	L				8-8-6	3	See Note	B3				56, 58, 55, 47, 80	485	3
	Tone	95	L													
4 Tube AC	Vol.	7	H				6-8	25	See Note	B3				‡		1
4 Tube DC	Vol.	7	G				20	15	TS102					36, 38		
4 T.R.F.	Vol.	6	G12				8-8	1	See Note	B3				58, 57, 47, 80		1
5 Tube (Midget)	Vol.	7	H	6			4-8	25	See Note	B3				57, 58, 47, 80		1
5 Tube T.R.F.	Vol.	88	P				8-8	1	See Note	B3				57, 58, 47, 80		1
5 Tube 110V, 220V DC	Vol.	7	H				6-6	12	See Note	B3				36, 38		
							20	15	TS102							
6 Tube Super	Vol.	33	L				4-8	25	See Note	B3				55, 56, 57, 58, 47, 80	175	1
6 Tube Batt. Super	Vol.	54	Y100MP											32, 33, 34	175	
6 Tube 32V DC	Vol.	15	L											36, 37, 38	175	
	Tone	22	L													
6-33 AVC	Vol.	33	N				8-8	25	See Note	B3				58, Wunderlich, 47, 80		1
	Tone	21	N													
6 Tuber Superhet 110V DC Super	Vol.	15	L				8-8	1	See Note	B3				36, 37, 38	175	
	Tone	22	L				10	15	TS101							
HERBERT H. HORN	"Tiffany	Tone"														
5	Vol.	6	SRP263				4-4	23	CM170	B3				57, 58, 56, 2A5, 80	465	1
5MT	Vol.	6	SRP263				5-5	23	See Note	B3				6J7, 6K7, 6C5, 6F6, 5Z4	465	1
7MT	Vol.	56	N				8-8	23	See Note	B3				6A8, 6K7, 6H6, 6C5, 6F6, 5Z4	465	1
	Tone	22	Y													
9MT, 9MTC	Vol.	46	N				16-16	23	See Note	B3				6K7, 6A7, 6H6, 6C5, 6F6, 5Z4	465	1
	Tone	22	Y													
15	Vol.	6	‡		See Note	A5	8-8	4	RS213	B66				24, 45, 80		3
	Tone	22	‡		See Note	A5										
15M	Vol.	6	D7				8-8	4	RS213	B3				27, 47, 80, 35		3
	Tone	22	G12													
21	Vol.	6	G12	6			4-8	23	CM171	B3				57, 58, 47, 82		3
	Tone	22	G12													
24	Vol.	6	SRP263				4-4	4	CM170	B3				2A7, 57, 2A5, 80	465	1
25	Vol.	6	G12	6			8-4	23	CM171	B3				57, 58, 47, 80		1
	Tone	22	G12													
36	Vol.	17	N	6			4-4	4	See Note	B3				6A7, 78, 6B7, 42, 80	465	1
	Tone	22	N													
49	Vol.	6	C12				8-8	1	See Note	B3				35, 24, 45, 80		1
55	Vol.	56	N				8-8	23	See Note	B3				57, 58, 2A6, 2A5, 80	465	1
	Tone	22	Y													
58	Vol.	15	N	6			8-8	1	See Note	B3				2A7, 58, 56, 57, 2A5, 80	465	1
	Tone	76	N				10	15	TS101							
58 (1933)	Vol.	15	N				8-8	1	See Note	B3				2A7, 58, 56, 2A5, 80	465	1
	Tone	21	N				10	15	TS101							
59	Vol.	7	G				8-8	1	See Note	B3				24, 27, 51, 47, 80	175	3
	Tone	39	M													
66	Vol.	15	N				8-8	23	See Note	B3				‡	465	1
66MT	Vol.	18	N				5-5	23	See Note	B3				6A8, 6K7, 6H6, 6J6, 6F6, 5Z4	465	1
	Tone	22	Y													

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS: Use	Cir-cuit	Correct Replacement	Switch	Bias	*Note	CONDENSERS: Original Part	Cir-cuit	Correct Replacement	*Note	VIBRATORS: Vibr. Conn.	Replace-ment	*Note	Types of Tubes Used	I. F. Peak	Trans. Cir-cuit
HERBERT H. HORN—Continued																
69	Vol.	7	G				8-8	1	See Note	B3				24, 27, 51, 47, 80	465	1
	Tone	39	M													
70, 71	Vol.	6	G12	6			8-8	4	RS213	B66				35, 24, 27, 47, 80	175	3
77	Vol.	83	N				8-8	23	See Note ‡	B3				2A7, 58, 55, 2A5, 80	465	1
	Tone	22	Y													
	Sen.	7	J													
79	Vol.	6	G12				8-8	4	See Note	B3				27, 51, 47, 80	175	3
	Tone	22	M													
90	Vol.	7	G				8-8	1	See Note	B3				24, 27, 51, 47, 80	175	3
	Tone	39	M													
99	Vol.	6	G12				8-8	4	See Note	B3				27, 51, 47, 80	175	3
	Tone	22	M													
101	Vol.	15	M				8-8	4	See Note	B3				27, 35, 47, 80	175/	
	Tone	39	N													
	Tunlgt.	‡	A10MP												550SW	3
101B, 102B	Vol.	15	N	6			8-8	1	See Note	B3				24, 27, 35, 47, 80	175	3
	Tone	39	N													
	Tunlgt.	‡	A10MP													
109	Vol.	6	G12				8-8	4	See Note	B3				27, 51, 47, 80	175	3
	Tone	22	M													
110	Vol.	15	N				8-8	4	See Note	B3				27, 35, 47, 80	175/	
	Tone	39	N													
	Tunlgt.	‡	A10MP												550SW	3
112A	Vol.	15	N				8-8-4	32	See Note	B3				58, 2A7, 56, 2A3, 5Z3	175	1
	Tone	22	N													
156	Vol.	56	N				4-4	23	See Note	B3				2A7, 2B7, 58, 2A5, 80	465	1
	Tone	22	N													
156AW	Vol.	56	N	6			4-4	23	See Note	B3				2A7, 58, 2B7, 2A5, 80	465	1
	Tone	22	N													
158 (1933)	Vol.	15	N				8-8	1	See Note	B3				2A7, 58, 56, 57, 2A5,		
	Tone	21	N											80	465	1
1934	Vol.	17	N				4-4	1	See Note	B3				6A7, 78, 6B7, 42	172	MG
	Tone	22	K12													
HOWARD																
AA25	Vol.	6	H12	‡	EX300		16-12	4	See Note	B3				6D6, 6C6, 43, 25Z5		
AP	Vol.	16	‡	‡	See Note A5		2335	3	CS123					55, 56, 58, 42, 80	175	3
	Tone	41	P	6			1948	3	RS213							
							2209	3	CS133							
							1976	3	RS213							
A SW Converter							1859	1	RS211					24, 35, 27		1
AVH (45, 60)	Vol.	94	N				1883	3	RN245					27, 35, 47, 80	175	7
	Tone	44	N	6												
AVO (35-A)	Vol.	35	N				1883	3	RN245					35, 27, 47, 80	175	7
	Tone	34	‡	6	See Note A5		2282	16	TS101							
A12	Vol.	6	H12	‡	EX300		16-12	4	See Note	B3				6D6, 6C6, 43, 12Z3		
B13	Vol.	17	N				8-16-12	27	UR182	B115				6A7, 6D6, 75, 43,		
														25Z5	456	
CC23, CC24	Vol.	17	N				8-8	1	See Note	B3				6D6, 75, 42, 76, 80	456	1
							10	15	TS101							
D4 (Cable-Nelson)	Vol.	8	‡	6	See Note A5		1869	1	CS133					51, 24, 47, 80		1
							2209	1	CS133							
D8	Vol.	19	TRP606	6			3004	28	RN242					78, 6A7, 85, 76, 42, 80	465	1
	Tone	22	Y				1948	28	RS213							
	Supp.	9	G													
EX (Dual Range)	Vol.	8	‡		See Note A5		1869	3	CS133					27, 51, 47, 80	140	3
	Tone	44	N	6			2209	3	CS133							
E14, E107	Vol.	18	N	6			8-4	23	See Note	B3				6C6, 6D6, 75, 42, 80	456	1
E57 (Long Wave)	Vol.	18	N	6			8815	11	CN145	B3				6A7, 6D6, 75, 43,		
							8816	11	CS123	B3				25Z5	456	
F	Vol.	15	N				3288	1	CN152					6A7, 78, 85, 76, 42, 80	465	1
	Tone	22	Y				3004	25	RN242							
	Sen.	7	G				1948	25	RS213							
F (with 45's)	Vol.	24	‡		See Note A5		1748	1	See Note	B3				24, 27, 45, 80		3
	Tone	41	UC504	6												
Series 1 (Grand)	Vol.	15	N				8-8	1	RN242					76, 6C6, 78, 80, 85, 42,		
	Tone	15	N				8-8	24	RN232					84, 5Z3	175	1
	Hum	30	A10MP				5	15	TS105							‡
							25	15	TS102							
							8-8	12	RN242							
"Green Diamond" 8 Mag. Speaker	Vol.	1	D12				‡	‡	See Note	B4				26, 27, 71A, 80		11
	Phono.	10	K12													
"Green Diamond" 8 Dyn. Speaker	Vol.	1	D12				P1727	3	See Note	B3				26, 27, 71A, 80		11
	Phono.	10	K12				P1728	3	See Note	B3						
"Green Diamond" 8 Dyn. Speaker 45's	Vol.	1	D12				SA1090	3	MN275					26, 27, 45, 80		11
	Phono.	10	K12													
G26	Vol.	6	H12		EX300		8-8	24	CN142	B3				39, 36, 38, 37		
							10-10	15	TN111	B6						
H (with 45's) (35, 40)	Vol.	8	G				1948	1	RS213					51, 27, 45, 80	175	3
	Tone	41	N	6												
H (35, 40) (with 47's)	Vol.	8	G				1948	3	RS213					51, 27, 47, 80	175	3
	Tone	41	N	6			1976	3	RS211							
Auto (Series 1)	Vol.	18	500M No. 1	6	See Note A1		8-8	1	See Note	B3	48	See Note C8		6D6, 76, 75, 42, 6L7	465	10
	Tone	22	100M No. 1		See Note A1		.005		Buffer	B14						
HA1 (670A)	Vol.	17	N	6	See Note A1		P119-4	4	CM172		35	294	C3	6C6, 6D6, 75, 42, 84	175	10
							.015		Buffer	B14						
HA2 (52, 502)	Vol.	18	500M No. 1		See Note A1		8-8	4	See Note	B3	47	See Note C6		6A7, 6D6, 75, 41, 84	456	10
							10-10	15	TN111							
							.008-.008		Buffer	B14						
HA3	Vol.	17	500M No. 1		See Note A1		8-8	4	See Note	B3	47	See Note C6		6A7, 6D6, 75, 41, 84	456	10
							5-5	15	TN110							
							.015-.015		Buffer	B14						
HA4	Vol.	18	UC512		See Note A3		8-8	4	CM172	B3	35	294	C3	6D6, 6A7, 75, 41, 84	175	10
							10	15	TS101							
							.015-.015		Buffer	B14						
HA6	Vol.	‡	UC512		See Note A3		8-8	‡	See Note	B3	19	249	C3	‡	‡	10
"Highwayman"	Vol.	17	UC512	6			P103-2	4	CM162		37	296	C3	6D6, 6C6, 78, 75, 42,		
							.02		Buffer	B14				84	175	10
J3	Vol.	8	G	6			2178A	1	CN150					78, 77, 43, 84	456	1
							2427	12	CS131							
							2177	15	TN110							
K (400)	Vol.	13	L				1869	28	CS133					56, 57, 58, 47, 80	175	7
	Tone	41	P	6			2335	28	CS133							
L (410)	Vol.	13	M				2335	3	CS133					55, 56, 58, 42, 80	175	7
	Supp.	56	M				1869	3	CS133							
	Tone	41	P	6												

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
HOWARD—Continued																
M (420)	Vol.	13	M				2335	3	CS133					55, 56, 58, 42, 84	175	7
	Supp.	18	M	6												
	Tone	41	P	6												
O (20, 25, 30, 32)	Vol.	8	‡		See Note A5		1858	1	RM262					51, 27, 47, 80	175	3
	Tone	21	‡		See Note A5		1859	1	CS131							
Q	Vol.	15	M				2303	28	CM172					78, 6A7, 76, 12A5, 80	170	1
	Tone	22	M	6			2427	28	CS133							
R9	Vol.	15	M				2803	3	CM172					76, 77, 78, 6B7, 42, 80	465	1
	Tone	22	‡	6	See Note A5		2427	3	CS131							
SG "A," "C," (R.F. chassis)	Vol.	24	DRP244											24, 27		
SG "A", SG "C," (A.F. Chassis)							P1080	3	MN275					45, 80		3
SG "B"	Vol.	8	G				1748	1	RS213					24, 27, 45, 80		3
	Tone	21	P	6												
SG "T"	Vol.	8	F	6	3		1868	1	CN152					51, 24, 47, 80		3
S2, S7	Vol.	15	‡	7	See Note A5									1A6, 30, 32, 34, 49	175	
W 1st Type	Vol.	15	N											56, 57, 58, 2A7	465	
	Tone	22	N	6												
	Supp.	8	G													
	AVC	‡	Y1000MP													
W 2nd Type	Vol.	15	N											56, 57, 58	465	
	Tone	22	N	6												
	Supp.	12	G12													
	Tunlgt.	‡	O													
W 2nd Revision	Vol.	17	N				8	13	CS133	B3				2A7, 56, 58, 2A5, 83V	465	7
	Tone	22	N	6			10	15	TS106							
	Sen.	8	G													
W (Power Amplifier)							2851	3/14	HS692/UR191	B116				83V, 2A5, 56		7
							2850	4	CM162							
							2127	15	TS101							
X2, X3, X8	Vol.	17	N	6			1948	3	RS213					6A7, 6B7, 78, 77, 12A5, 80	175	1
							1976	3	RS213							
							2427	15	TS101							
Z4	Vol.	15	N	6			1948	3	RS213					6A7, 6B7, 78, 77, 2A5, 80	175	14
							2209	3	CS133							
47A	Vol.	6	H12	6	EX300		16-12	4	CM165	B117				6D6, 6C6, 43, 25Z5		
50SW	Vol.	6	H12	6			8812	4	CM165	B117				6D6, 6J7, 43, 25Z5		
							3003	15	TS101							
50 (Series 2)	Vol.	6	H12	6	EX300		16-12	4	CM165	B117				6D6, 6J7, 43, 25Z5		
							5	15	TS101							
57A, 57AUS	Vol.	18	N	6			8815	11	CN145	B3				6A7, 6D6, 75, 43, 25Z5	456	
							8816	11	CS123	B3						
60 (Series 1), 60 (Short Wave)	Vol.	18	N	6			8815	11	CN145	B3				6A7, 6D6, 6H6, 6F5, 43, 25Z5	456	
							8816	11	CS123	B3						
67	Vol.	18	N	6			8817	1	RN242					6A7, 6D6, 6H6G, 6F6G, 42, 80	465	1
							3003	15	TS101							
77C, 77T	Vol.	18	N	6			3004	1	RN242					6A8, 6K7, 6H6, 6F5, 6F6, 5Y3	465	
							8814	14	CS131							
							3003	15	TS105							
99C, 99T	Vol.	15	N	6			3004	1	RN242					6K7, 6A8, 6H6, 6C5, 6F6, 5Z4	465	1
	Tone	41	N				8814	14	CS131							
							3003	15	TS105							
135AC (395, 445, 470, 495)	Vol.	10	GK				P1603A	3	See Note	B2				26, 27, 10, 81		5
135 D. C.	Vol.	10	E12											01A, 71A		
626	Vol.	18	N	6			8817	1	RN242					6A7, 6D6, 6H6, 6F5G, 42, 80	465	1
							3003	15	TS101							
1626	Vol.	18	N	6			8817	1	RN242					6A7, 6D6, 6H6G, 6F5G, 42, 80	465	1
							3003	15	TS101							
HUDSON-ROSS																
38	Vol.	6	SRP226		EX250		8-8	24	CN142	B3				6D6, 6C6, 38, 12Z3		
							10	15	TS101							
48	Vol.	6	SRP226		EX250		16-12	1	See Note	B3				6D6, 6C6, 38, 25Z5		
							10	15	TS101							
59	Vol.	6	G7	6	2		20-20	6	See Note	B3				6A7, 6D6, 75, 43, 25Z5		
							10	15	TS101							
69	Vol.	6	G7	6	2		20-20	6	See Note	B3				6A7, 6D6, 85, 43, 25Z5	456	
							3	13	CS121							
							10	15	TS101							
80	Vol.	18	N	6			701	23	CM171	B3				6A7, 6D6, 75, 42, 80	456	1
"Legion"	Vol.	6	SRP226		EX250		8-8	24	CN142	B3				6D6, 6C6, 38, 12Z3		
							10	15	TS101							
HUDSON-TERRAPLANE (Also see R. C. A.-Victor, Zenith.)																
Hudson 116	Vol.	56	250M No. 1		See Note A1		8	1	RS213		35	294	C3	6D6, 6A7, 6B7, 41, 84	260	10
							4	1	RS211							
							.02-.02		Buffer	B14						
IMPERIAL FURNITURE																
14	Vol.	6	Y				8-8-8-16	6/15	UR189	B98				‡		
3SB5	Vol.	76	N				8-4	25	See Note	B3				6A7, 78, 75, 42, 80	456	1
	Tone	76	M				25	19	TS102							
INSULINE CORP.																
"Classic"	Vol.	17	N	6			32-16	27	See Note	B3				6A7, 78, 6B7, 43, 25Z5	132	
							5-5	15	TN110							
"Conquerer"	Vol.	8	D				2-4-4	3	See Note	B3				51, 27, 47, 80		3
AVC Super Seven, AVC Long Wave 110V DC	Vol.	6	G7		2		8	39	See Note	B11				39, 85, 37, 43	175/115	
"Elite"	Vol.	17	N	6			32-16	27	See Note	B3				6A7, 78, 6B7, 43, 25Z5	132	
							5-5	15	TN110							
"Envoy"	Vol.	8	G				4-4	1	See Note	B3				51, 24, 47, 80		1
"Envoy Midget"	Vol.	8	C	6			8-4	1	See Note	B3				51, 24, 47, 80		1
"Envoy Midget" DC	Vol.	8	C	6			8	39	See Note	B11				36, 33		
	Tone	21	M													
"Envoy DC" Broadcast—Long Wave	Vol.	6	E12	6			8	39	See Note	B11				36, 33		
"Envoy AC" Broadcast—Long Wave	Vol.	8	A2MP	6	2		8-4	1	See Note	B3				51, 24, 47, 80		1
"Envoyette" AC	Vol.	8	G	6	2		8-4	1	See Note	B3				58, 56, 47, 80		1
"Envoyette" DC 5T Rec.	Vol.	8	G	6	2									39, 37, 43		
"Envoyette" AC 5T Receiver—Long Wave	Vol.	8	G	6	2		8-4	1	See Note	B3				58, 57, 47, 80		1
							25	17	TS102							
"Icasix"	Vol.	17	N	6			8-8	1	See Note	B3				6D6, 6A7, 80, 75, 42	462.5	1
							5-5	15	TN110							

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS: Use	Circuit	Correct Replacement	Switch	Bias	*Note	CONDENSERS: Original Part	Circuit	Correct Replacement	*Note	VIBRATORS: Vibr. Conn.	Replacement	*Note	Types of Tubes Used	I. F. Peak	Trans. Circuit
INSULINE CORP.—Continued																
LW 4 Tube Midget AC	Vol.	8	G	6	2		4-4	1	See Note	B3				51, 24, 47, 80		1
"Insulette & Mascot" 4 Tube Midget AC	Vol.	8	G	6	2		4-4	1	See Note	B3				51, 24, 47, 80		1
"Super-Conqueror" Short and Long Wave AC	Vol.	8	G	6			8-8-8	3	See Note	B3				57, 58, 55, 47, 80	115	1
	Tone	22	Z12				25	17	TS102							
"Super-Conqueror" AC 108-250 V w/ Noise Suppressor	Vol.	18	N				8-8-8	3	See Note	B3				55, 57, 58, 47, 80	115	1
	Supp.	32	A5MP				5	17	TS105							
Super Six AVC LW	Vol.	6	G7		2		8-8	1	See Note	B3				55, 57, 58, 47, 80	115	1
							25	17	TS102							
Super Six AVC Broadcast	Vol.	6	G7	6	2		8-8	1	See Note	B3				55, 57, 58, 47, 80	175	1
							25	17	TS102							
"Super Seven" AC LW	Vol.	17	N	6			8-8	1	See Note	B3				55, 57, 58, 47, 80	115	1
							25	17	TS102							
							10	‡	TS106							
"TransPacific"	Vol.	15	N	6			6-6-6	3	CN155					6A7, 78, 6B7, 77, 45, 80	1580	14
	Sen.	7	G				5-5	15	TN110							
"Universal Companion" "AC-DC Battery Portable"	Vol.	8	E				4-8	1	CN141	B3				36, 37, 38		
"Universal Mascot" AC-DC	Vol.	7	SRP226	6	EX300		8-8-4	8	CN145	B3				39, 37, 36, 43, 25Z5		
							5-5	15	TN110							
"Universal Companion" AC-DC Battery Portable (Revised)	Vol.	4	C				4-4	1	CN140	B3				36, 37, 33		
"Trans-Atlantic"	Vol.	15	N	6			6-6-6	3	CN155	B3				6A7, 78, 6B7, 77, 45, 80	1580	14
	Sen.	7	G		2		5-5	15	TN110							
"Americus" 5T Unaradio Super AC-DC	Vol.	17	N	6			32-16	27	See Note	B3				6A7, 78, 6B7, 43, 25Z5	132	
"Aiglon" 5T Unaradio Super. AC-DC	Vol.	17	N	6			4-8-8	8	CN145	B3				6A7, 78, 6B7, 43, 25Z5	132	
							5-5	15	TN110							
"Bijou" 5T Unaradio Super. AC-DC	Vol.	17	N	6			4-8-8	8	CN145	B3				6A7, 78, 6B7, 43, 25Z5	132	
							5-5	15	TN110							
"Atlantic" 5T Unaradio Super. AC-DC	Vol.	17	N	6			32-16	27	See Note	B3				6A7, 78, 6B7, 43, 25Z5	132	
							5-5	15	TN110							
"Latinic" 5T Unaradio Super. AC-DC	Vol.	17	N	6			32-16	27	See Note	B3				6A7, 78, 6B7, 43, 25Z5	132	
							5-5	15	TN110							
"Mignon" 5T Unaradio Super. AC-DC	Vol.	18	N	6			4-8-8	8	CN145	B3				6A7, 78, 6B7, 43, 25Z5	132	
							5-5	15	TN110							
"Uni-Nine"	Vol.	18	N	6			32-16	27	See Note	B3				78, 6A7, 85, 77, 43, 25Z5	115	
	Sil.	‡	E													
"Gnome" 5T Unaradio Super AC-DC	Vol.	17	N	6			4-8-8	8	CN145	B3				6A7, 78, 6B7, 43, 25Z5	132	
							5-5	15	TN110							
"Pacific" 5T Unaradio Super. AC-DC	Vol.	17	N	6			32-16	27	See Note	B3				6A7, 78, 6B7, 43, 25Z5	132	
							5-5	15	TN110							
"Superheterodyne" 6T AC	Vol.	6	G7	6	2		8-8	1	See Note	B3				35, 24, 47, 80	175	1
"Superheterodyne" 7T 220V DC	Vol.	6	G7	6	2		8	39	See Note	B11				39, 36, 37, 71	175	
"Envoyette" ICA-ette	Vol.	6	H12	6			24-12	6	UR182	B3				6A7, 6D6, 6C6, 43, 12Z3	456	
							10-10	15	TN111							
INTERNATIONAL RADIO CORP.—"Kadette"																
A, B Kadette	Vol.	77	M	6			A424	11	UR182	B31				6A7, 6D6, 6B7, 43, 25Z5	262.5	
	Tone	22	K12													
All Wave Duo	Vol.	6	UC501				8-8	4	See Note	B3				24, 27, 35, 47, 80		1
	Tone	22	M													
Chassis D, DSP, (DA8, DA9, DA10, D11, D12, D14)	Vol.	56	M	6			A430	11	UR182	B31				6A7, 6D6, 6B7, 43, 25Z5	262.5	
CB (Battery)	Vol.	9	M	6			A416	19	TS102					1A6, 32, 30, 31, 33	262.5	
CM	Vol.	6	M	6			A414	27	CM162	B3				6D6, 73, 38, 12Z3	262.5	
CMS	Vol.	6	M	6			A414	27	CM162	B3				6A7, 6D6, 76, 38, 12Z3	262	
CS	Vol.	6	G7		2		A404	4	CM170	B3.				35, 24, 47, 80	175	1
DAC (A7, BW, CD)	Vol.	56	M	6			A429	27	CM165	B88				6A7, 6D6, 6B7, 43, 25Z5	262.5	
DAS (A8, A9, A10, AD11, AD12)	Vol.	56	M	6			A430	11	UR182	B31				6A7, 6D6, 6B7, 43, 25Z5	262.5	
ES (ES19, ES20, ES25)	Vol.	56	M				A412	27	UR182	B115				6A7, 6D6, 6B7, 43, 25Z5	262.5	
	Tone	22	K12													
Kadette	Vol.	7	UC509	6	EX150		A407	1	CN140					39, 36, 38, 1V		
							A408	15	TN110							
"F" Kadette Jr							A427	1/15	UR183					6F7, 12A7		
"J," "JS"	Vol.	6	‡		See Note A5		A404	4	CM170	B3				35, 24, 47, 80	175	1
	Tone	22	‡		See Note A5											
"KS"	Vol.	7	G	6	1		A-3	4	CS133	B3				35, 24, 27, 47, 80	175	1
	Tone	22	K12				A18	4	CS133	B3						
							A20	14	CS131	B3						
"K6" (K60St. Regis)	Vol.	17	500M No. 1	6	See Note A3		A402	1	CN152	B3	37	296	C3	6D6, 6F7, 75, 42, 84	262.5	10
							A417	15	TS101							
							.02		Buffer	B14						
"M" (K40 Regal)	Vol.	6	G12				A3	4	CS133	B3				35, 24, 47, 80		1
	Tone	22	G12				A4	‡	CS131							
"P"	Vol.	7	‡		See Note A5		A407	1	CN140					78, 77, 38, 1V or 39, 36, 38, 6Z3		
							A408	15	TN110							
"T"	Vol.	6	‡		See Note A5		A404	4	CM170	B3				35, 24, 47, 80		1
"TS"	Vol.	6	G12				A404	4	CM170	B3				35, 24, 47, 80		1

‡ Data not substantiated.

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MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
INTERNATIONAL RADIO CORP.—Continued																
25	Vol.	88	UC513		EX100		A437	1/15	CN155					6D6, 6C6, 41, 80		1
26	Vol.	88	UC513		EX200		A438	1/15	CN155	B3				6J7G, 6F6G, 5Z4		1
40 (Jewel)	Vol.	88	UC513	6	EX200		A421	1/15	UR183					6C6, 12A7		
50	Vol.	6	UC509	‡	EX250		A419	4	CM172					57, 47, 80		1
52	Vol.	88	UC513	6	EX200		A438	4/15	CN155	B3				6A8G, 7K6G, 6J7G, 6F6G, 5Z4	448	1
53 (Early, Late)	Vol.	6	UC509		EX250	A27	A439	1	CN152	B3				6A8G, 6K7G, 75 or 6J7G, 5Z4	448	1
	Vol.	17	N			A4	A417	15	TS105							
	Tone	31	K12	6												
55	Vol.	6	UC509		EX250		A419	4	CM172	B3				57, 47, 80		1
"AW" 55	Vol.	7	H	6	2		8-4	4	CM171	B3				24, 56, 58, 47, 80	445	2
56	Vol.	88	UC513		EX100		A437	1/15	CN155	B3				6D6, 6C6, 41, 80		1
60	Vol.	56	M				A412	27	UR182	B115				6A7, 6D6, 6B7, 43, 25Z5	262	
	Tone	22	K12													
61	Vol.	56	N				A440	6	UR190	B3				6A8G, 6K7G, 6B7, 43, 25Z5	448	
	Tone	22	K12	6			A417	15	TS105							
65	Vol.	56	M				A412	27	UR182	B115				6A7, 6D6, 6B7, 43, 25Z5	262	
	Tone	22	K12													
66	Vol.	6	UC509	6	EX150		A422	4	UR182	B113				6D6, 76, 43, 25Z5	448	
66X	Vol.	6	L	6	EX250		A443	4	UR182	B113				6D6, 6C6, 43, 25Z5, 165R4 Ballast Tube	448	
70	Vol.	40	K12				A416	19	TS102					1A6, 32, 30, 33	262	
	Tone	22	K12													
71	Vol.	56	N				A416	19	TS102					1A6, 34, 25S, 30, 33	456	
	Tone	22	K12													
71C	Vol.	56	N				A431	12	CS121					1C6, 34, 25S, 30, 33	456	
72	Vol.	17	N				A442	12	CS121					1C6, 34, 25S, 30, 19	448	
76	Vol.	6	SRP263	6	EX300		A450	4	UR182	B113				6D6, 6C6, 43, 25Z5, 165R4 Ballast Tube		
77 (777, 778, 779)	Vol.	6	UC509	6	EX250		A444	4	UR182	B113				6A7, 6D6, 76, 43, 25Z5	448	
85	Vol.	56	M	6			A412	27	UR182	B115				6A7, 6D6, 6B7, 43, 25Z5	456	
86	Vol.	6	L	6	EX250		A443	4	UR182	B113				6D6, 6C6, 43, 25Z5, 165R4 Ballast Tube	448	
87 Series	Vol.	17	N	6			A444	4	UR182	B113				6A7, 6D6, 75, 43, 25Z5, 878R48 Ballast Tube	448	
90	Vol.	17	M				A425	1/15	UR183					6D6, 6C6, 75, 12A7	262/45	
96	Vol.	6	L	6	EX250		A443	4	UR182	B113				6D6, 6C6, 43, 25Z5, 165R4 Ballast Tube	448	
105, EL105	Vol.	56	N				A435	1	RS213	B3				6A7, 6D6, 85, 76, 42, 80	456	1
	Tone	22	K12	6			A436	1	RS213	B3						
							A417	15	TS101							
120	Vol.	17	N				A439	1	CN152	B3				6K7G, 6A8G, 6H6G, 6C5G, 6F6G, 5Z4	448	1
	Tone	22	K12	6			A417	15	TS101							
226	Vol.	88	UC513		EX200		A438	1/15	CN155	B3				6J7, 6F6, 5Z4		1
400	Vol.	17	N	7										1C6, 34, 25S, 950	448	
500	Vol.	17	N	7										1C6, 34, 25S, 33	448	
553 (Early, Late)	Vol.	6	UC509		EX250	A27	A439	1	CN152	B3				6A8G, 6K7G, 6J7 or 75, 6F6G, 5Z4	448	1
	Vol.	17	N			A4	A417	15	TS105							
	Tone	22	K12	6												
661	Vol.	56	N				A440	6	UR190	B3				6A8G, 6K7G, 6B7, 43, 25Z5	448	
	Tone	22	K12	6			A417	15	TS105							
666	Vol.	6	UC509	6	EX250		A422	4	UR182	B113				6D6, 76, 43, 25Z5	448	
676	Vol.	6	SRP263	6	EX300		A450	4	UR182	B113				6D6, 6C6, 43, 25Z5, 165R4 Ballast Tube		
1050	Vol.	56	N				A435	1	RS213	B3				6A7, 6D6, 85, 76, 42, 80	456	1
	Tone	22	K12	6			A436	1	RS213	B3						
							A417	15	TS101							
1200, 2200	Vol.	17	N				A439	1	CN152	B3				6K7G, 6A8G, 6H6G, 6C5G, 6F6G, 5Z4	448	1
	Tone	22	K12	6			A417	15	TS101							
INTEROCEAN RADIO CORP.—Also See Zenith																
520, 521, Chassis 2035	Vol.	10	TRP606				22-167	28	WE847					56, 57, 58, 59, 80	175	3
	Tone	41	N				22-169	15	TS106							
	Sen.	7	‡		See Note A5											
530, 531, 533, Chassis 2038	Vol.	20	TRP606				22-167	28	WE847					56, 57, 58, 59, 80	175	3
	Tone	41	N				22-169	15	TS106							
JACKSON BELL CO. LTD.																
S	Vol.	4	C	6			4-2	1	See Note	B1				26, 27, 71, 80		9
	Reg.	‡	A													
5	Vol.	10	B				4-4-2	1/13	See Note	B1				01A, 27, 12, BH		1
5A	Vol.	10	C				2-2	1	See Note	B1				26, 27, 71A, 80		11
8	Vol.	3	C	6			4-2	1	See Note	B1				26, 27, 71, 80		9
	Reg.	‡	A													
8 (45 Output)	Vol.	6	C	6			4-1-2	3	See Note	B1				26, 27, 45, 80		11
	Reg.	‡	A													
24	Vol.	6	G12	6			4-4	23	See Note	B3				57, 47, 80	175	1
	Tone	22	M													
25	Vol.	6	G7	6	1		4-4	4	See Note	B3				35, 24, 47, 80	175	1
25A, 25U	Vol.	6	G12	6			4-4	4	See Note	B3				24, 58, 47, 80	175	1
26	Vol.	6	G7	6	2		8-8	4	See Note	B3				35, 24, 47, 80		1
26S, B, L	Vol.	6	G7	6	3		8-4	23	See Note	B3				56, 57, 58, 47, 80	175	1
27 Type 1	Vol.	6	G12				8-8	4	See Note	B3				51, 24, 27, 47, 80	175	1
27 Type 2	Vol.	6	G12	6			8-8	23	See Note	B3				24, 27, 35, 47, 80	175	1
	Tone	22	G12													
28	Vol.	6	G12				8-8	4	See Note	B3				‡	175	1
	Tone	22	G12													
29	Vol.	‡	N	6			8-8	23	See Note	B3				24, 27, 35, 47, 80	175	1
	Tone	22	G12													
33							4-4	1	See Note	B3				24, 27, 80		1
50	Vol.	6	D12	6			8-8	4	See Note	B3				24, 45, 80		1
	Tone	22	G12													
59	Vol.	6	C12				2-4	1	See Note	B1				26, 27, 71, 80		11
60	Vol.	6	C				8-8	1	See Note	B3				24, 26, 27, 71A, 80		9
62, 63, 64	Vol.	6	D7				8	41	RS213					24, 45, 80		3
	Tone	22	G12				2-4	41	See Note	B3						
68	Vol.	6	D7	6			8-8	4	See Note	B3				24, 27, 45, 80		3
	Tone	22	G12													
69 DC	Vol.	12	H12				8-8	1	See Note	B3				32, 30, 31		
	Tone	22	G12													
79	Vol.	7	D	6			8-8	4	See Note	B3				35, 24, 27, 45, 80	175	3
	Tone	41	N													
84 "Peter Pan"	Vol.	6	G12		EX300		4-4	23	See Note	B3				24, 47, 80		1
86	Vol.	6	G12	6	2		4-4	23	See Note	B3				24, 27, 35, 47, 80	175	1
87	Vol.	6	D7	6	1		4	23	RS211					27, 35, 47, 80	175	1
	Tone	22	N				8	23	RS213							

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
JACKSON BELL CO. LTD.—Continued																
88	Vol.	6	G7	6	1		8-8	23	See Note	B3				24, 27, 35, 47, 80	175	3
	Tone	22	N													
89	Vol.	6	D7	6	2		4-4-4	3	See Note	B3				27, 24, 35, 47, 80	175	3
	Tone	41	N													
89A	Vol.	6	G7	6	1		4-4	1	See Note	B3				24, 27, 35, 47, 80	175	3
	Tone	39	N													
96	Vol.	6	Y		EX300		4-4	1	See Note	B3				24, 27, 47, 80		1
99	Vol.	6	D7	6	1		8-4	1	See Note	B3				24, 27, 35, 47, 80	175	3
	Tone	39	N													
205 Auto	Vol.	15	M	6			5	19	TS105					55, 57, 58, 47	465	
645M	Vol.	6	C	6			4-2	1	See Note	B1				27, 45, 80		3
	Tone	22	N													
845S	Vol.	6	C	6			4-1	1	See Note	B1				27, 45, 80		3
	Tone	39	N													
JACKSON RADIO & TELEVISION CO.																
447, J104, 401A	Vol.	6	G12	6	EX250		4-4	1	See Note	B3				24, 47, 80		1
SF547, 501B, J105, LK447, J104, 401A	Vol.	3	G7				4-4	1	See Note	B3				57, 47, 80 or 82		1
JACKSON RESEARCH																
NJ8	Vol.	12	K12				2-2	1	See Note	B1				24, 27, 45, 80	175	3
KADETTE—See International																
KARADIO CORP.																
56	Vol.	17	250M No. 1		See Note A1									77, 78, 6F7, 75, 41	456	
57B	Vol.	18	250M No. 1		See Note A1		8-4	1	See Note	B3	37	296	C3	6F7, 41, 75, 77, 78, 84	456	10
	Tone	44	250M No. 1		See Note A1		.01		Buffer	B14						
KELLER FULLER MFG. CO. LTD.—"Radiette"																
F	Vol.	6	E12				3-3	1	See Note	B1				24, 27, 45, 80		3
F12	Vol.	6	C12	6			4-2-2	3	See Note	B1				27, 24, 45, 80		3
F14	Vol.	6	C12	6			4-2-2	41	See Note	B1				24, 45, 80		3
F14A	Vol.	6	C12	6			8-8	1	See Note	B3				24, 27, 45, 80		3
F14B	Vol.	6	C12	6			8-8	4	See Note	B3				‡		1
M	Vol.	3	C12				4-2	1	See Note	B1				01A, 27, 71A, 80		20
20	Vol.	8	A10MP				8-8	1	See Note	B3				36, 37, 38, 71A		13
Radiette "30"	Vol.	8	A10MP				8-8	1	See Note	B3				36, 37, 38, 71A		13
Radiette "40"	Vol.	7	A2MP	6	2		8-4	23	See Note	B3				24, 47, 80		1
	Tone	21	N													
Radiette "50"	Vol.	6	H12				8-8	4	See Note	B3				24, 45, 80		1
	Tone	22	G12													
Radiette "60"	Vol.	6	H12				8-8	4	See Note	B3				24, 45, 80		1
	Tone	22	N													
Radiette "70"	Vol.	8	G				8-8	1	See Note	B3				24, 51, 47, 80	175	1
	Tone	21	N													
80	Vol.	8	E				8-8	4	See Note	B3				24, 27, 45, 80	175	1
	Tone	41	N													
KELLOGG SWITCHBOARD & SUPPLY CO.																
"A" AC7 Tube	Vol.	8	G				10-7	1	See Note	B1				401, 403 (Kellogg) 80		1
"B"	Vol.	8	‡		See Note A5		10-7	1	See Note	B1				401, 403, (Kellogg) 80		1
523, 524, 525, 526, 527, 528	Vol.	40	K12				5-2	1	See Note	B1				24, 27, 45, 80 or 24, 27, 50, 81		5
533, 534, 535, 536	Vol.	8	Y50MP				5-2	1	See Note	B1				24, 27, 45, 80		3
COLIN B. KENNEDY CORP.																
5T AC-DC	Vol.	6	K	6	See Note A34		D324	11	UR182	B118				6E7, 6D7, 43, 25Z5		
Royal	Vol.	11	A10MP		See Note 18/26		8-8-8	3	RN245	B41				‡		3
10	Vol.	11	A10MP		See Note A26		302	3	RN245	B41				27, 45, 80		3
20	Vol.	11	A10MP		See Note A26		317	3	RN245	B41				24, 27, 45, 80		3
22	Vol.	25	GG				6-6	24	See Note	B11				22, 12A, 71A		
	Tone	22	K12													
26	Vol.	25	GK				8-8-8	3	RN245	B41				24, 27, 45, 80		3
	Tone	22	K12													
30, 32	Vol.	12	A10MP				8-8-8	3	RN245	B41				24, 27, 45, 80		3
	Tone	22	K12													
34	Vol.	12	G12											24		
36, 38, 40	Vol.	25	GK				6-6	24	See Note	B11				22, 12A, 71A		
	Tone	22	K12													
42 "Coronet"	Vol.	40	G12	6			6-16	1	See Note	B3				24, 27, 45, 80		3
42B	Vol.	6	G7	6	1		8-8	1	See Note	B3				51, 27, 47, 80		3
44	Vol.	40	G12				8-16	1	See Note	B3				24, 27, 45, 80		3
48	Vol.	12	G12				8-8-8	3	See Note	B3				24, 27, 45, 80		3
	Tone	22	K12	6												
50	Vol.	6	G7		1		15302	1	RS213					35, 24, 47, 80		1
							16302	1	RS213							
52	Vol.	6	G7		1		16302	1	RS213					35, 27, 47, 80	175	1
	Tone	22	K12	6			17302	1	RS215							
55	Vol.	6	G7		1		1-10-302	1	CN152					58, 57, 47, 80		1
56	Vol.	6	G7	6	1		16302	1	RS213					51, 24, 27, 47, 80	175	1
	Tone	22	K12				17302	1	RS215							
"Royal" 60	Vol.	35	N				1.5-4-4	3	See Note	B1				26, 27, 71A, 80		11
62	Vol.	‡	N	6			16302	3	RS213					35, 27, 47, 80	175	1
	Tone	22	K12				27302	3	RS213							
							48302	3	CS133							
62A	Vol.	14	N	6			16302	3	RS213					27, 35, 47, 80	175	3
	Tone	22	K12				27302	3	RS213							
							48302	3	CS133							
62D (882)	Vol.	15	N	6			8	3	RS213	B3				55, 57, 56, 58, 47, 80	175	3
	Tone	44	K12				8	3	CS133	B3						
	Sil.	8	G													
63, 63A (563A)	Vol.	17	N	6			110302	1	CN152					55, 57, 58, 47, 80	175	1
64	Vol.	6	G7	6			10	1	RS215					24, 35, 27, 47, 80	175	1
	Tone	22	K12													
64B (164B)	Vol.	6	G7	6	1		10	1	RS215					56, 57, 58, 47, 80	175	1
	Tone	22	K12													
64C (882)	Vol.	15	N	6			8	3	RS213	B3				55, 56, 57, 58, 47, 80	175	3
	Tone	44	K12				8	3	CS133	B3						
	Sil.	8	G													
66, 66A	Vol.	94	N	6			16302	3	RS213					24, 27, 35, 47, 80	175	3
	Tone	22	K12				27302	3	RS213							
							48302	3	CS133							
66B (266B, 366B)	Vol.	94	N				16302	3	RS213					56, 57, 58, 80, 47	175	3
	Tone	22	K12	6			27302	3	RS213							
							48302	3	CS133							
80	Vol.	35	N				1.5-1.5-4	3	See Note	B1				26, 27, 71, 80		11
826B	Vol.	25	GK				8-8-8	3	RN245	B41				24, 27, 45, 80		3
	Tone	22	K12													
	Reg.	12	G12													

‡ Data not substantiated.

*** IMPORTANT: Read Notes in Note Section if specified in Note Column.**

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
KING MFG. CORP.—Also See Sears Roebuck																
FF	Vol.	4	G12				‡	1	See Note	B1				27, 26, 12A, 80		11
H	Vol.	4	F12				1-1-2	3	See Note	B1				26, 27, 71A, 80		11
J	Vol.	4	F12				3-2-3	1/14	See Note	B1				26, 27, 71A, 80		11
82	Vol.	10	E12				4-4	1	See Note	B2				99, 26, 10, 81		20
97 "Royal"	Vol.	6	G12				1-2-2	3	See Note	B1				26, 27, 71A, 80		3
98 "Imperial"	Vol.	6	G7				1-2-1	3	See Note	B1				27, 45, 80		3
101 "Monarch"	Vol.	6	G12				1-2-1	3	See Note	B1				24, 27, 45, 80		3
218	Vol.	6	G12				8-8-8	3	MN275					24, 27, 45, 80		3
	Tone	34	K12													
KINGSTON PRODUCTS CORP.																
"Gypsy"	Vol.	6	G7	6	3		8-8	1	CN142	B3				77, 78, 38, 1V	456	
							5-5	15	TN110							
55	Vol.	6	G12	6			12-8-12-12	6/15	CN145/TS102	B119				78, 77, 38, 12Z3	456	
							10	15	TS101							
500, 500A	Vol.	18	N	6			6-6	1	CN152	B3				6A7, 6D6, 75, 42, 80	456	1
							E-17080	15	TS101							
600A, 600B, 610B	Vol.	18	N				6-6	1	CN152	B3				78, 6A7, 75, 42, 80	Early	
	Tone	21	N	6			10	15	TS101						182.5	
															Late	
															172.5	1
700, 700A, 700B	Vol.	18	N				E17125	1/15	CN152					76, 6D6, 75, 42, 80	456	1
	Tone	34	L	6			E17217	1	RS213							
							12	15	TS101							
KNIGHT—Also see "Allied"																
A31	Vol.	18	N				8-4	23	See Note	B3				6A7, 6D6, 75, 42, 80	456	1
KOLSTER RADIO, Inc.																
6F, 6J, 6K, 6L, 6M, 6R	Vol.	29	‡		See Note A48		2-2-2	30	See Note	B1				26, 27, 71, 80		11
7 Tube (60∽ & 25∽)	Vol.	5	‡		See Note A5		2-2-2	30	See Note	B1				26, 27, 71A, 80		7
K20	Vol.	10	H12				2-2-2	30	See Note	B1				26, 27, 71, 80		8
K21, K22, K23	Vol.	10	H12				2-2-4	30	See Note	B1				26, 27, 71A, 80		8
K24 (210 O.P., 250 O.P.)	Vol.	4	H12				3-4-2	30	See Note	B2				26, 27, 10 or 50, 81		8
K25, K27, K28	Vol.	10	H12				2-2-1	30	See Note	B1				26, 27, 71A, 80		11
K30, K32	Vol.	10	Y											01A, 71A		
K38	Vol.	14	K12				3-2-2	30	See Note	B2				27, 50, 81, 886		8
K42	Vol.	40	Y	6			2-2-2	30	See Note	B1				26, 27, 71, 80		11
K43, K43A	Vol.	25	DRP244				2-1-5	30	See Note	B1				24, 27, 45, 80		3
K44	Vol.	25	DRP244				2-2	1	See Note	B2				24, 27, 45, 81		8
K45	Vol.	‡	‡		See Note A3		2-2	1	See Note	B2				24A, 27, 50, 81		5
K48	Vol.	40	Y				2-2-1	41	See Note	B3				24, 27, 45, 80		3
	Equal	7	A1MP		See Note A3											
K60, K62	Vol.	8	A5MP				8-8-8	26	See Note	B3				24, 35, 47, 80	175	1
K63	Vol.	40/42	DRP239				4	12	See Note	B11				36, 37, 38	175	
K70, K72	Vol.	59	H12				8-8-8	26	See Note	B3				24, 27, 35, 47, 80	175	1
K73	Vol.	40/42	DRP239				4	12	See Note	B11				36, 37, 38	175	
K80, K82	Vol.	59	H12				8-8-8	26	See Note	B3				24, 27, 35, 47, 80	175	1
K83	Vol.	40/42	DRP239				‡	12	See Note	B11				36, 37, 38	175	
K90, K92	Vol.	59	H12				8-8-8	26	See Note	B3				24, 27, 35, 47, 80	175	1
K93, K103	Vol.	40/42	DRP239				4	12	See Note	B11				36, 37, 38	175	
K110	Vol.	15	N				6-6-6	26	CM175					56, 58, 47, 80	175	1
K113	Vol.	15	N				4	12	See Note	B11				37, 38, 39	175	
K114	Vol.	15	N				8	12	See Note	B3				30, 34	175	
K120, K122	Vol.	15	N	6			6-6-6	26	CM175					56, 58, 47, 80	175	1
K123	Vol.	15	N				4	12	See Note	B11				37, 38, 39	175	
K130, K132	Vol.	15	N	6			6-6-6	5	CM175					56, 58, 47, 80	175	1
K133	Vol.	15	N				4	12	See Note	B11				37, 38, 39	175	
							4	15	TS101							
K140, K142	Vol.	15	N	6			8-8-8	26	CM175					56, 58, 47, 80	175	1
K143	Vol.	15	N				4	12	See Note	B11				37, 38, 39	175	
							4	15	TS101							
K165 "Intern't'l"	Vol.	15	K12				6-6-6	40/23	CM175					56, 58, 47, 80	535	1
K175 "Intern't'l"	Vol.	15	N	6			6-6-6	40/23	CM175					56, 58, 47, 80	505	1
S.W. "Converter"	Vol.	11	K12											56, 57, 58		
KROHLER																
93B Viking	Vol.	7	G	6			8	4	RS213					27, 35, 47, 80	175	1
	Tone	22	Y													
KYLECTRON—See United Reproducers																
R. E. LECAULT																
LR4	Vol.	31	A400P											01A	175	
	Sen.	29	T													
L2 Ultradyne	Vol.	31	A400P											01A	175	
LAFAYETTE RADIO & TELEVISION CO																
A7	Vol.	6	G	6	2		533	4	CM170	B3				56, 57, 58, 47, 80	115	1
	Tone	21	M				721	4	CS133	B3						
AM8	Vol.	18	N	‡			1085/1295	8	UR182	B3				75, 76, 78, 43, 25Z5	175	
	Tone	21	M													
AM10	Vol.	6	G12	6			1085/1295	8	UR182	B3				76, 77, 78, 43, 25Z5	115	
	Tone	22	M				928	15	TS102							
A11	Vol.	6	G12	6			965	8	UR182	B3				77, 78, 43, 25Z5	175	
							928	15	TS102							
A12	Vol.	76	N	6			496	4	CM170	B3				6A7, 78, 75, 42, 80	175	1
	Tone	76	M				928	19	TS102							
A14	Vol.	18	N	6			1085	8	UR182	B3				78, 6A7, 75, 43	175	
	Tone	21	M				928	15	TS102							
A15	Vol.	6	G12	6			1085	8	UR182	B3				77, 78, 43, 25Z5	175	
							928	15	TS102							
A19	Vol.	6	G12	6			1085	8	UR182	B3				77, 78, 43, 25Z5	115	
	Tone	22	M				928	15	TS102							
A20	Vol.	18	N				8-8-8	4	RS213	B3				56, 58, 2A6, 2A5, 80	175	1
	Tone	21	M													
AM20	Vol.	18	500M No. 1		See Note A1		6-6	2	See Note	B3	37	296	C3	75, 77, 78, 41, 84	175	10
							25	15	TS102							
							.015		Buffer	B14						
AM25	Vol.	6	G12	6			1295	8	UR182	B3				77, 78, 43, 25Z5	115	
							928	15	TS102							
AM26	Vol.	17	N	6			721	25	See Note	B3				6A7, 75, 58, 42, 80	175	1
							1379	25	See Note	B3						
							928	19	TS102							
B51, B52, B53, B54	Vol.	17	P	6			P80984	2/13	CN155/CN112	B120				55, 56, 58, 45, 82	175	21
	Tone	41	UC504													
B60	Vol.	15	O				P80968	12	CS121					30, 34	175	
	Tone	44	UC502													
B62	Vol.	17	2 Meg. No. 1	6	See Note A1		P82002	2/15	CM173		32	286S	C3	6C6, 6D6, 75, 41	175	10
							.007		Buffer	B14						

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
LAFAYETTE RADIO & TELEVISION CO.—Continued																
C60	Vol.	17	500M No. 1		See Note A1		8-8	1	See Note	B3	35	294	C3	6A7, 6D6, 75, 41, 84	175	10
							5	15	TS105							
							.0015		Buffer	B14						
L1, L2, L3, L4	Vol.	45	Z12				8	33	RS213					56, 57, 58, 46, 82	175	3
	Tone	41	UC502				4	33	See Note	B3						
	Sen.	8	E				4	19	CS121							
L11, L12	Vol.	45	N											30, 34	175	
	Tone	22	UC502													
	Fil.	29	R	7												
L16, L17, L18, L19	Vol.	59	SRP271				P80894B	23	CM172					57, 58, 47, 80	175	7
	Tone	34	UC502				P80891B	23	CS121							
L30	Vol.	18	M	6			8-8	1	CN152		20	253	C3	75, 77, 78, 84, 41	262.5	10
	Tone	34	UC502				10-10	15	TN111							
							.01		Buffer	B14						
LW10	Vol.	17	N				2210	1	CN152		35	294	C3	6D6, 6A7, 75, 41, 84	175	10
							2212	15	BN226							
							2211	15	TS101							
							.025-.025		Buffer	B14						
M14-20	Vol.	12	K12				‡	1	See Note	B4				78, 37, 43		
							5	15	TS101							
M35, 37	Vol.	15	N				4-8-4	4	See Note	B3				55, 56, 58, 47, 80	175	1
	Tone	22	M													
M47	Vol.	18	N	6			4-4-8	26	See Note	B3				55, 56, 58, 47, 80	520	3
	Sen.	8	G12													
M69, 70	Vol.	6	G	6	2		533	4	CM170	B3				56, 57, 58, 47, 80	115	1
	Tone	21	M				721	4	CS133	B3						
S17762	Vol.	17	N				8-16	1	CN155		2	210	C3	77, 78, 85, 41	262	10
							4	15	TS101							
							.01		Buffer	B14						
10C10	Vol.	18	N				P80900	30	RS213					27, 35, 47, 80	175	1
	Tone	41	P	6			P80901	30	RS213							
53	Vol.	15	N	‡			4-8-4	4	See Note	B3				55, 56, 58, 47, 80	175	1
	Tone	22	M													
80M (2 Types)	Vol.	8	A5MP		See Note A27		80873B	30	CS131	B3				24, 27, 35, 47, 80	175	3
	Vol.	14	N		See Note A4		80874	30	CS130	B3						
	Tone	34	UC502				80875	30	CS131							
							80878	30	CS121							
100A	Vol.	‡	NN				8	2	See Note	B3				57, 59, 83		3
102A	Vol.	15	N				8	2	See Note	B3				57, 53, 2A3, 83		3
	Tone	21	N				5-5	1	CN140							
							5-5	15	TN110							
106A	Vol.	15	N				8-8	2	See Note	B3				53, 56, 6B5, 83		3
	Tone	21	N				25	15	TS102							
115A	Vol.	15	N				8-8	2	See Note	B3				53, 2A3, 45, 83		3
							10-10-10	26	See Note	B3						
120A	Vol.	15	O				8-4-16	2/12	See Note	B3				6C6, 6A6, 6B5		3
	Tone	21	N				25	15	TS102							
158P	Vol.	6	G12		See Note A28		8	2	See Note	B3				53, 55, 57, 58, 2A5, 83		3
	Vol.	15	N		See Note A29		32	2	See Note	B3						
							25	15	TS102							
							5	15	TS101							
"Orthotone"	Vol.	15	‡		See Note A19		6-4-4	3	See Note	B3				56, 57, 58, 47, 80		3
	Supp.	12	J	6			8	17	TS106							
LANG RADIO CO.																
BA5	Vol.	49	D12				8	4	RS213	B3				24A, 45, 80		1
							4	4	RS211	B3						
BA5P	Vol.	49	D12				8-8	4	RS213	B3				24A, 47, 80		1
	Tone	22	K12													
BD5P	Vol.	40	D12											36, 37, 33		
	Tone	22	K12													
BD6	Vol.	49	D12											30, 31, 32		
BD6P	Vol.	40	D12											36, 37, 33		
	Tone	22	K12													
DC6	Vol.	6	G12											39, 37, 48		
	Tone	44	K12													
F7 110V DC	Vol.	10	D12											12A, 71A		
F9	Tone	34	L											12A, 71A		
J7	Tone	34	L											22, 12A, 71A		
M7	Vol.	12	A5MP				2-4	1	See Note	B1				24, 45, 80		3
	Tone	34	L													
MA7	Vol.	6	G7	6	2		8-8	4	RS213	B66				24, 27, 35, 47, 80	175	1
	Tone	22	K12													
MA8	Vol.	62	N	6			8-8	4	See Note	B3				24, 27, 35, 47, 80	175	1
	Tone	22	K12				5	15	TS101							
MD7	Vol.	6	G7	6	3									36, 37, 33	175	
	Tone	22	K12													
MD8	Vol.	15	N	8										33, 36, 37, 39	175	
	Tone	22	K12													
SA7	Vol.	6	G12				16-8	4	CM175	B3				24, 35, 47, 80	175	1
	Tone	22	K12													
SA8	Vol.	6	G12				4-8-4	26	See Note	B3				24, 27, 35, 47, 80	175	1
	Tone	22	K12													
UG5B	Vol.	6	G12	6	EX200		12-8-10-10	6/15	UR189	B98				6C6, 6D6, 43, 12Z3	456	
UG5H	Vol.	7	E		2		12-8-10-10	6/15	UR189	B98				6A7, 6D6, 6C6, 43, 12Z3	456	
40UL	Vol.	6	G12	6	EX120		E1153A	6/15	UR189	B98				6A7, 6C6, 43, 25Z5	470	
50AS	Vol.	6	G12		EX120		4-8-12	4/12	See Note	B3				6A7, 6D6, 76, 38, 80	470	1
50UP	Vol.	6	G12	‡			12-8-10-10	6/15	UR189	B98				6A7, 6D6, 76, 43, 25Z5	470	
50US	Vol.	6	G12	6	EX120		E1153A	6/15	UR189	B98				6A7, 6D6, 76, 43, 25Z5	470	
60AA	Vol.	18	N				8-8	4	See Note	B3				6D6, 6A7, 75, 41, 80	470	1
							4-4	12	CN140	B3						
							5	15	TS101							
60UP	Vol.	6	G12	‡			12-8-10-10	6/15	UR189	B98				6A7, 6D6, 76, 43, 25Z5	470	
80UA	Vol.	17	N				16-16-16	8	See Note	B3				6D6, 6A7, 75, 43, 25Z5	470	
502UA	Vol.	7	E		2		12-8-10-10	6/15	UR189	B98				6A7, 6D6, 6C6, 43, 12Z3	456	
502US	Vol.	14	E	6	2		E1153A	6/15	UR189	B98				6A7, 6D6, 6C6, 43, 12Z3	456	
503AS	Vol.	17	N				12-8-5	4/15	See Note	B3				2A7, 58, 2A6, 2A5, 80	175	1
503US	Vol.	7	E	6	2		8-12-10-10	6/15	UR189	B98				6A7, 6D6, 6C6, 43, 25Z5	470	
503UT, 523UT	Vol.	17	O				8-16-8	6	UR190	B3				6A7, 6D6, 75, 43, 25Z5	470	
							10	15	TS101							
703US	Vol.	17	N				16-8-8	11	UR190	B3				6A7, 6D6, 85, 43, 12Z3	175	
							6	12	CS123	B3						
							5	15	TS101							

‡ Data not substantiated.

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in 0; Koslo, 0 in 3. Hit by pitch (Seminick). Winner—Koslo. Umpires—Goetz, Dascoli, Donatelli. Time—2:45.

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
LARKIN CO.																
88	Vol.	42	G				8-8	4	See Note	B3				24, 27, 35, 47, 80	175	1
	Tone	21	O				5	15	TS101							
90	Vol.	17	N				5	15	TS101					77, 78, 85, 41	175	
91	Vol.	17	N				6-10	1	See Note	B3	34	292	C3	6A7, 78, 85, 41, 84	175	10
							5	15	TS101							
							.015		Buffer	B14						
LEAR-WUERFUL CO.																
Suprex Six	Vol.	6	Y				8-8	4	See Note	B3				24, 27, 47, 51, 80	175	1
	Tone	22	M													
C. R. LEUTZ INC.																
"C"	Vol.	12	K											22, 01A, 71A		
"Seven Seas Console"	Vol.	16	M				8-8	1	See Note	B2				24, 27, 10 or 50, 81		5
	Sen.	12	UC513													
"Silver Ghost"	Vol.	33	‡		See Note	A5	2-4-2	3	See Note	B3				22, 01A, 40, 12A, 10, 81		
"Trans-Oceanic"	Vol.	15	N											01A, 12A		
LEWOL MFG. CO.																
LW4, LW4DW	Vol.	6	SRP263		EX300		110	27	UR182	B115				6D6, 6C6, 43, 25Z5		
60MS	Vol.	20	‡		See Note	A19	8-16-4	11	UR182	B31				78, 6A7, 85, 43, 25Z5	456	
63	Vol.	20	‡		See Note	A19	8-16	4	See Note	B3				78, 6A7, 85, 42, 80	262.5	1
64	Vol.	20	‡		See Note	A19	12-16-6	11	UR182	B31				78, 6A7, 85, 43, 25Z5	262.5	
9682	Vol.	64	N	7			8-4	1	See Note	B3	31	285XS	C3	1C6, 34, 30, 19	465	10
	Tone	22	‡		See Note	A5	.01-.01		Buffer	B14						
LINCOLN RADIO CORP.																
"Hollister" AC8	Vol.	12	D12											24, 27, 50	‡	
DCSW8	Vol.	12	K12											30, 31, 32	‡	
R9	Vol.	16	N				8	1	RS213					56, 58, 45, 80	480	3
	Sen.	12	K													
"DeLuxe" 10	Vol.	58	F				2-2-2	3	See Note	B1				24, 27, 45, 80	‡	3
31	Vol.	7	K				2-4	1	See Note	B1				24, 27, 45, 80	‡	3
SW32	Vol.	7	K	6			4	1	RS211					27, 24, 45, 80	‡	3
SW33	Vol.	23	NN				8	4	RS213					35, 56, 45, 80	‡	3
	Sen.	‡	K													
LONG RADIO CORP.																
70	Vol.	6	G12				8-8	1	See Note	B3				24, 27, 45, 80		3
R. H. MACY & CO.																
MB5	Vol.	6	‡		See Note	A5	8	1	See Note	B3				24, 51, 47, 80		1
56, 58	Vol.	6	‡		See Note	A5	8-8	4	See Note	B3				55, 57, 58, 47, 80		1
	Tone	22	‡		See Note	A5										
MB92	Vol.	6	G12				2	3	See Note	B2				55, 56, 58, 46, 80		1
	Tone	22	M				8-8	3	See Note	B3						
							4	15/17	TS101							
MB710	Vol.	6	G12				8-4	1	See Note	B3				55, 58, 56, 47, 80	175	3
	Tone	22	L				4	17	TS105							
MAJESTIC																
7BP3, 7BP6							3-1-3-3	47	See Note	B121				80		27
							2-3-3-2	47	See Note	B121						
7P3, 7P6							2-6-2-2-1	47	See Note	B121				80		27
8P3, 8P6							2-2-3-1-1	47	See Note	B121				81		5
9P3, 9P6							4-4-1-2	47	See Note	B121				80		3
10 (11)							6433	1	CN150					24, 80	1000	1
15 Below 65149	Vol.	6	G7	6			5414	4	CS133					24, 47, 51, 80	175	1
	Tone	22	K12				8385	4	CM172							
15, 15B (151, 153, 154, 155, 156) Above 65150	Vol.	6	G12				5414	4	CS133					24, 51, 47, 80	175	1
	Tone	22	K12				8385	4	CM172							
20 (21, 22, 23)	Vol.	8	E				2-2	1	See Note	B1				27, 51, 45, 80	175	3
							.07		See Note	B9						
25 (251, 253, 254)	Vol.	8	F	6	2		4713	2	CS133					27, 51, 47, 80	175	3
	Tone	44	L				5414	3	CS133							
25B (251B, 253B, 254B)	Vol.	15	F12	6			5608	3	CS131					27, 51, 47, 80	175	3
							4713	3	CS133							
							.15 mf		See Note	B9						
							.35 mf		See Note	B12						
30 (31)	Vol.	24	DRP122	6	See Note	A24	2-3	1	See Note	P1				24, 45, 80		3
							.1		See Note	B9						
35 (351, 353)	Vol.	15	F12	6			4713	1	CS133					27, 51, 45, 80	175	3
	Tone	22	G12				5806	1	CS131	B1						
							.15		See Note	B9						
							.35		See Note	B12						
50 (51, 52)	Vol.	24	DRP122				3-2	1	See Note	B1				27, 24, 45, 80	175	3
							.09		See Note	B9						
F50	Vol.	15	M	6			16-16-10-20	2/15	UR191, TN111	B3				56, 58, 47, 82	175	7
	Tone	22	M													
55 (56, 57, 58)	Vol.	6	H7	6	2		6501	4	CM172					24, 27, 35, 47, 80	175	1
	Tone	22	K12													
60 (61, 62)	Vol.	7	SRP223				2-2-2-1	3	See Note	B1				27, 51, 24, 45, 80	175	3
							4-3-3-1	3	See Note	B1						
							.07		See Note	B9						
							.25		See Note	B12						
65, 66 ('37)	Vol.	18	O	6			B16466	4	RN242	B8				6K6G, 6Q7G, 6K7G, 6A8G, 5Y3, 6G5	456	1
	Tone	22	UC502				B16467-2	4	RS213							
66	Vol.	17	M	6			9979	4	CM172		3	220B	C3	6E7, 6A7, 6C7, 89, 6Y5	175	10
	Tone	22	K12				10067	15	TS101							
							.008-.008		Buffer	B14						
67 (68, 69)	Vol.	18	M				16	1	RN242	B8				58, 2A7, 55, 2A5, 80	175	1
	Tone	22	M				8	1	RS213	B3						
							10	15	TS101							
70, 70B (71, 72)	Vol.	40	G12											26, 27, 71, 80		11
75, 76 ('37)	Vol.	18	O	6			B16466	4	RN242	B8				6L7G, 6K7G, 6Q7G, 6F6G, 6G5, 5Y3, 6C5G	456	1
	Tone	22	UC502				B16467	4	RS213							
85, 86	Vol.	18	O	6			A15236-3	25	RN245	B8				6A8G, 6K7G, 6Q7G, 6F6G, 5C5G, 5Y3	456	1
	Tone	22	UC502				A15237-2	25	RS215							
90, 90B (91, 92, 93)	Vol.	7	Z				2-2-2-1	2	See Note	B1				27, 45, 80		3
	Equal	7	SRP160				4-4-2-1	2	See Note	B1						
100 (101)	Vol.	7/63	DRP222		See Note	A49	See the		9P3, 9P6					27, 45		
	Equal	7	SRP160													
100B (102, 103)	Vol.	7/16	DRP312				2-2-2-1	2	See Note	B1				27, 45, 80		3
	Equal	7	SRP160				4-4-2-1	2	See Note	B1						
110	Vol.	15	Y100MP											36, 37, 38		

‡ Data not substantiated.

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MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
MAJESTIC—Continued																
114	Vol.	8	M				8 8286 7784-2	1 15 15	See Note TS101 TS102	B3				39, 38, 85	175	
116 (Type 1)	Vol.	17	M				9337	4	CM162		3	220B		57, 58, 75, 89, 6Z5	175	10
116 (Type 2, 3)	Vol.	17	M				9337	4	CM162		3	220B		57, 58, 85, 89, 6Y5	175	10
116 (Type 4)	Vol.	17	M				9979	4	CM172		3	220B		57, 58, 75, 89, 6Z5	175	10
118, 118P	Vol.	17	SRP251				10369 10488 11794	4 15	CM172 TS101 On Order		3	220B		6E7, 6A7, 6C7, 42, 6Y5	175	10
120 (121)	Vol.	24	GG	7										30, 32, 33	175	
120B (123)	Vol.	24	GG											30, 32, 33	175	
130A (131, 132, 133)	Vol.	8	A1MP				2-2-2 4-4-2	3 3	See Note See Note	B1 B1				24, 45, 80		3
150	Vol. Tone Phono.	6 22 63	G7 K12 W	6	3		5414 8385	4 4	CS133 CM172					24, 51, 47, 80	175	1
160 (163)	Vol.	8	SRP223				2-2-2-1 4-3-3-1 .07 .25	3 3	See Note See Note See Note See Note	B1 B1 B9 B12				27, 51, 24, 45, 80	175	3
180 (181)	Vol.	7	DRP222		See Note A49									27, 50, 81		5
200 (201, 203, 204)	Vol. Tone	15 22	N K12	 6			6277	28	CM175					35, 27, G2S, 47, 80	175	1
210 (211, 214, 215)	Vol. Tone	15 44	M L	 6			4713 6324	3 3	CS133 CS133					35, 27, 47, 80	175	3
220 (221, 223)	Vol. Tone	15 22	M K12	 6			4713	3	CS133					27, 35, 50, 81	175	5
230A (233 Comet)	Vol.	8	DRP313				2-2-2 4-4-2	3 3	See Note See Note	B1 B1				24, 45, 80		3
290 (291, 293, 294)	Vol. Tone Supp.	15 22 12	M K12 E12	 6			7173 7278 7102	2 14 15	CS133 CM162 TS101					58, 56, 57, 47, 80	175	1
300, 300A (303, 304, 307)	Vol. Tone Supp. Hum	15 22 12 37	M M Y HU20	 6			7489 7278 7402 7781	2 14 15 15	CS136 CM162 TS101 TS102					58, 56, 57, 47, 82	175	3
310A (311)	Vol. Tone	15 22	M K12	 6			7824 8118	1 16	CN155 TS102					58, 55, 56, 47, 80	175	1
310B (314, 315)	Vol. Tone Hum	15 22 37	M K12 HU20	 6			7824 8118 7402	1 16 15	CN155 TS102 TS101					58, 56, 55, 47, 80	175	1
320 (324)	Vol. Tone Supp. Hum	15 22 12 37	M M Y HU20	 6			7489 7988 7784 7402	2 14 15 19	CS136 CS123 TS102 TS101					58, 56, 57, 47, 82	175	7
330 (331, 336, 77)	Vol. Tone	15 22	M M	 6			8721 8722 8118	1 1 15	RN242 RS213 TS102	B8				58, 56, 55, 59, 80	175	1
340, 340B (344)	Vol. Tone Supp.	83 22 12	M M Y	 6			8722 8721 7988 9019 8118	3 3 14 19 15	RS213 RN242 CS123 TS101 TS105	 B8				56, 58, 57, 59, 82	175	3
360 (363)	Vol. Tone Supp. Hum	45 22 12 37	M M Y HU20	 6			8721 7988 8118 9019	2 14 18 19	RN242 CS123 TS102 TS101	B8				58, 56, 57, 59, 82	175	3
370 (371, 373)	Vol.	6	Y	6	EX250		9219 9019	1 15	CN152 TS101					57, 58, 59, 80	456	1
380 (381)	Vol.	6	K12	6	EX250		8755 8774	1 15	CN151 TS101					57, 58, 89, 84		1
390 (393)	Vol. Tone	17 22	M M	 6			8722 8721 8118	1 1 15	RS213 RN242 TS102	 B8				56, 58, 55, 53, 80	175	1
400 (411, 413)	Vol.	6	Y	6	EX250		9661	6/15	CN145/TS101	B122				57, 58, 43, 25Z5	456	
400A (411A, 413A)	Vol.	6	Y	6	EX250		9661	6/15	CN145/TS101	B122				6D7, 6E7, 43, 25Z5	456	
440 (44, 94, 194)	Vol.	6	F7	6	3		10536	1/15	CN151/TS101	B123				6A7, 6F7, 41, 6Z5	456	1
460 (461, 463)	Vol. Tone	56 22	M M	 6			10207 10193 10208	1 1 15	RN242 RS213 TN111	B8				58, 2A7, 55, 2A5, 80	175	1
490 (491, 493)	Vol. Tone	18 22	M M	 6			10630 10946 .008-.008	4/15 18	CM172/TS101 TN111 Buffer	 B14	3 35	F220C F294	C11 C11	6E7, 6A7, 85, 42, 6Y5	175	10
500 (55, 59, 75, 195, 560, 566)	Vol.	17	M	6			10827	1/15	CN152/TS101					6A7, 6F7, 6B7, 42, 80	456	1
520 (95, 105)	Vol.	18	M	7										34, 1A6, 25, 33	175	
570	Vol. Tone	18 22	M M	 6			12038-1 12039-1 12026-2	25 25 15	RN242 RS213 TS102/TS101	B8				58, 2A7, 55, 2A5, 80	175	1
600 AC-DC	Vol.	17	M	6			16-8 10	6 15	CN145 TS101	B124				6A7, 6E7, 6C7, 43, 25Z5	456	
650	Vol. Tone	18 22	O UC502	6			B16466 B16467-2	4 4	RN242 RS213	B8				6A8G, 6K7G, 6Q7G, 6K6G, 6G5, 5Y3	456	1
750	Vol. Tone	18 22	O UC502	6			B16466 B16467	4 4	RN242 RS213	B8				6C5G, 6L7G, 6K7G, 6Q7G, 6F6G, 6G5, 5Y3	456	1
800 (85, 86, 998)	Vol. Tone	18 22	M M	 6			11017 11200 11099	25 24 15	RN242 RN241 TS102	B8				58, 2A7, 56, 53, 80	175	1
850	Vol. Tone	18 22	O UC502	6			A15236-3 A15237-2	25 25	RN245 RS215	B8				6A8G, 6K7G, 6Q7G, 6C5G, 6G5, 6F6G, 5Y3	456	1
1050	Vol. Tone	17 22	‡ UC502	6	See Note A19		B16554-2 B15427 B16551-3	1 1 15	WE3540 RN242 TN111	 B8				6K7G, 6L7G, 6Q7G, 6F6G, 5Z3	456	1
1250	Vol. Tone	17 22	‡ ‡	6	See Note A19 See Note A5		B16613-2 B16614-3	1 14/15	UR191 CN152	B128 B128				6K7G, 6L7G, 6H6G, 6F5G, 6L6G, 5Z3	456	1
MAJOR LABORATORIES																
ML 210 Amp	Vol. Mon. Bias	16 ‡ ‡	N M200MP M2MP				4-2-4	3	See Note	B4				27, 10, 81		5
250 Amp	Vol.	16	N											27, 26, 50		
P. R. MALLORY & CO.																
"B" Eliminator (Types 1 to 6 incl.)							15233 .05	3	CN145 Buffer	B125 B14	1	201-206	C3	BR		26
"B" Eliminator 10 to 14 incl. 1933-34							16736 16737 16738	3 3 3	CS123/TS102 CS123 CN142	B125 B125 B125	2	210-214				26

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
MARTI																
T	Vol.	4	‡		See Note	A5	6-2	3	See Note	B1				27, 10, 81		1
							.02		See Note	B9						
2R10	Vol.	3	‡		See Note	A5	2-6	3	See Note	B1				Kellogg plus '10, 81		5
							.02		See Note	B9						
MASTER																
Mighty Midget (50, 70)	Vol.	6	‡	6	See Note	A5	2-2	1	See Note	B1				26, 24, 45, 80		11
424	Vol.	6	F12				2-2	1	See Note	B1				24, 45, 80		7
McMILLAN RADIO CO.																
8 (Two Types)	Vol.	5	K12				‡	3	See Note	B1				26, 27, 71A, 80		11
900 Series	Vol.	13	K12				1-2-3-5	3	See Note	B1				26, 27, 45, 80		11
MID-WEST RADIO CORP.—"Miraco"																
AC6 '33 Model	Vol.	83	N	6			4-4	25	See Note	B3				55, 56, 58, 59, 80	175	
AC6 Midget	Vol.	6	G7	6	2		8-8	1	See Note	B3				24, 27, 45, 80		3
	Tone	22	G12													
AC8 ('32)	Vol.	83	N				8-8	1	RS213	B66				55, 56, 57, 58, 2A5, 80	‡	1
	Tone	22	K12													
AC8 ('33)	Vol.	83	N				8-8	1	See Note	B3				55, 56, 57, 58, 59, 80	175	1
	Tone	22	K12													
AC9 (1SG, 227 Type)	Vol.	7	‡		See Note	A5	2-2-2	3	See Note	B3				24, 27, 45, 80		3
							.1		See Note	B9						
AC9-4SG	Vol.	6	G12				8-8-8	28	RS213	B66				24, 27, 45, 80		3
	Tone	22	G12													
AC9 Pentode Super (2 Types)	Vol.	62	N				8-8	4	See Note	B3				24, 27, 35, 47, 80	175	1
	Tone	22	N		See Note	A27										
	Tone	22	L		See Note	A4										
AC9 T.R.F.	Vol.	14	‡		See Note	A5	4-2-2-4	3	See Note	B1				26, 27, 71A, 80		11
AC10	Vol.	6	G12				8-8	1	See Note	B3				24, 27, 45, 80	175	3
	Tone	14	G12													
AC11 '32	Vol.	‡	N				8-8	4	See Note	B3				‡	175	3
	Tone	14	Y													
AC12	Vol.	45	N				8	3	RS213					55, 58, 42, 80	456	3
	Sen.	7	UC500				8-8	3	See Note	B3						
Battery 6 Super	Vol.	15	N											30, 34, 19	456	
Battery 7, (2 Volt Model)	Vol.	10	M											30, 31, 32		
Battery 8 (Super-2 Volt)	Vol.	76	M				24	12	See Note	B3				30, 34	‡	
	Tone	76	M													
Miraco 1SG-226	Vol.	25	DRP240				4-2-2-4-4	3	See Note	B1				24, 26, 27, 71, 80		11
Miraco 16 Tube ('32)	Vol.	15	N				4	1	HD681	B3				55, 56, 57, 58, 42, 76, 80, 82	456	1/7
	Tone	22	K12				8	1	HD683	B3						
	Supp.	7	UC500				4-4-8	3	See Note	B3						
							8	13	RS213							
Z4 Short Wave Converter							8-8	1	See Note	B3				24, 27, 80	‡	1
6DC (110 Volt)	Vol.	56	N											37, 78, 85, 43	175	
6-34	Vol.	83	N				8-8	25	See Note	B3				58, 2A7, 2B7, 2A5, 80	456	1
	Tone	22	K12													
9-34	Vol.	83	N				8-8	1	See Note	B3				55, 56, 57, 58, 2A5, 80	175	1
	Tone	22	K12													
	Sen.	7	UC500													
9-34 (RT9, G9, F9, H9)	Vol.	83	N				8-8	1	RS213	B3				58, 57, 56, 55, 2A5, 80	456	1
	Tone	45	K12				1	12	CS130	B3						
	Sen.	7	UC500													
10A-33-34	Vol.	45	N				8-8	1	RS213	B3				56, 58, 2A5, 80	456	1
	Tone	22	K12				1	12	CS130	B3						
	Sen.	7	UC500													
10-34	Vol.	83	N				8-8	1	RS213	B3				56, 57, 58, 2A5, 80	456	1
	Tone	22	K12				2	12	CS130	B3						
	Sen.	7	UC500													
10-35	Vol.	45	N				8	1	RS213	B3				56, 58, 2A5, 80	456	1
	Tone	22	K12				16	1	RN242	B8						
	Sen.	7	UC500				1	12	CS130							
14-37	Vol.	18	N				16	25	RN242	B66				6K7, 6H6, 6C5, 6F6, 5Z3	456	1
	Tone	21	N				20	25	RN245	B66						
							8	13	RS213							
							25	15	TS102							
16-33	Vol.	18	N				4	3	HD681	B3				56, 55, 42, 46, 80, 83	456	1/7
	Tone	22	K12				4	3	RS211	B3						
	Sen.	7	UC500				8	3	RS213	B3						
							25	15	TS102							
16-34 (RT16, A16, B16, D16, PR16, RM16)	Vol.	15/22	MN				8-8-8	26	RS213	B66				6D6, 6C6, 78, 6B7, 37, 45, 5Z3	456	7
	Tone	22	K12				25	19	2-TS106							
	Supp.	‡	K12				10	19	TS106							
							12	15	TS101							
16-35 1935 Deluxe (J-16, L-16, M-16, S16), (EP16)	Vol.	‡	MN				8	3	See Note	B3				6D6, 76, 6B7, 2A5, 45, 6C6, 5Z3	465	3
	Tone	‡	Order from	Mfr.			16	3	RN242	B3						
							10	17	TS106							
							25	15	TS102							
							10	15	TS101							
35-5-SW AC DC Super	Vol.	7	G	‡			12-20	6	UR182	B98				6A7, 6D6, 6C6, 12Z3	456	
	Tone	22	L				5-5	15	TN110							
746M & 747M ('31-'32)	Vol.	6	E12		‡		8-8	4	See Note	B3				24, 27, 35, 47, 80	175	1
MISSION BELL RADIO CO.																
4A	Vol.	96	50M No. 1		See Note	A1	10	15	TS106					39, 38		
6A	Vol.	61	250M No. 1		See Note	A1								39, 37		
10A	Vol.	15	250M No. 1		See Note	A1	4-4	1	See Note	B3	34	292	C3	36, 39, 84, 85, 41	252	10
							25	15	TS102							
							.02		Buffer	B14						
11, 12	Vol.	18	250M No. 1		See Note	A1	4-4	1	See Note	B3	34	292	C3	75, 77, 78, 42, 84	252	10
							25	15	TS102							
							.05		Buffer	B14						
14	Vol.	18	500M No. 1		See Note	A1	4-8	1	See Note	B3	34	292	C3	77, 78, 75, 42, 84	456	10
							25	15	TS102							
							.05		Buffer	B14						
16	Vol.	18	500M No. 1	6	See Note	A1	4-4	23	See Note	B3	34	292	C3	6A7, 6D6, 75, 41, 84	465	10
							.02-.02		Buffer	B14						

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
MISSION BELL RADIO CO.—Continued																
19, 19A	Vol.	15	500M No. 1		See Note A1		4-8	1	See Note	B3	Order from Mfr.			57, 58, Wunderlich, 41, 1V	252	
							10	15	TS101							
25A	Vol.	15	500M No. 1		See Note A1		4-8	1	See Note	B3	34	292	C3	77, 78, 75, 42, 84	252	10
	Tone	22	L				25	15	TS102							
							.05		Buffer	B14						
35	Vol.	6	G12		EX300		4-4	4	See Note	B3				6D6, 76, 42, 80		1
40	Vol.	18	N	6			4-4	4	See Note	B3				2A7, 58, 2A6, 2A5, 80	456	1
40 All-Wave	Vol.	18	N	6			4-4	4	See Note	B3				2A7, 58, 2A6, 2A5, 80	465	1
41AW, 41 Skip Band	Vol.	18	N				4-4	4	See Note	B3				6A7, 6D6, 75, 42, 80	465	1
MONARCH																
L5	Vol.	18	N				P474	32	RS211					5Z4, 6F5, 6F6, 6H6, 6K7, 6L7	456	1
	Tone	34	L				P160	32	CN151	B81						
							P304	15	TS101							
L6	Vol.	18	N	6			P474	32	RS211					5Z4, 6C5, 6F6, 6K7, 6L7, 6Q7	456	1
	Tone	44	L				P160	32	CN151	B81						
							P304	15	TS101							
L7	Vol.	45	N	7			P391	1	RN232		14	245C	C3	1C6, 19, 30, 34	456	10
	Tone	‡	L				.01-.01		Buffer	B14						
Z4	Vol.	45	SRP275	7			P391	1	RN232		14	245C	C3	1C6, 19, 30, 32, 34	456	10
	Tone	44	L				.01-.01		Buffer	B14						
Z5	Vol.	45	SRP275	7			P958	1	RN232		14	245C	C3	1C6, 19, 30, 32, 34	456	10
	Tone	44	L				.01-.01		Buffer	B14						
A31	Vol.	18	N				8-4	4	See Note	B3				6A7, 6D6, 75, 42, 80	456	1
54	Vol.	18	500M No. 1		See Note A1		6-10	4	See Note	B3	35	294	C3	6A7, 6D6, 75, 42, 84	456	10
							.02		Buffer	B14						
64	Vol.	18	500M No. 1		See Note A1		6-10	4	See Note	B3	35	294	C3	6D6, 6A7, 75, 42, 84	456	10
							.02		Buffer	B14						
MONTGOMERY WARD & CO. (Airline)																
Note: The prefix "62-" or form of "62-" indicates Radio Division in Montgomery-Ward Catalog.																
Auto Radio	Vol.	45	N				4	15	TS101		1	206		36, 37, 39, 38	262	
Troubadour (32W)	Vol.	6	G7		3		8-8-8	31	RS213	B66				24, 27, 45, 80		1
AE10 (Two Types)	Vol.	60	E12		(Early)		1-1-2	3	See Note	B1				24, 26, 27, 45, 80		9
	Vol.	60/15	DRP243		(Late)											
AE11	Vol.	8	A400P				1-1.5-1-1	3/13	See Note	B1				27, 71, 80		2
AE51, 52, 53, 54	Vol.	8	A400P				1-1.5-1-1	3/13	See Note	B1				27, 71, 80		2
062	Vol.	45	N				4	15	TS101		1	206		36, 37, 38, 39	262	
7GM	Vol.	7/56	DRP314	6			44X10	23	WE1647					6K7, 6B7, 76, 6F6, 80	456	1
	Tone	34	UC502				44X11	23	RN242	B8						
13, 15, 16, 16X, 17, 18, 18X	Vol.	6	G12				4-8	1	CN151	B3				24, 35, 47, 80	262	1
17 ('31) "Turret Cond."	Vol.	59	SRP273				927	4	See Note	B1				24, 35, 47, 27, 80	175	3
							928	4	See Note	B1						
							972	14	See Note	B1						
20W	Vol.	6	G7				8-8	25	See Note	B3				24, 71A, 80		2
22	Vol.	6	G7				8	3	RS213					24, 27, 45, 80	‡	1
	Tone	22	‡		See Note A5		8-6	3	CN152							
26P, 26PX	Vol.	6	G7		3		8-8	1	See Note	B3				‡		1
	Tone	22	UC502													
26W	Vol.	6	G7		3		8-8	1	See Note	B3				24, 45, 80		1
27W, 27WX (1500, 15000, Collegian)	Vol.	6	G7		3		8-8	1	See Note	B3				24, 27, 45, 80		1
	Tone	22	K12													
49	Vol.	6	G7											24, 26, 01A, 71A, or 36, 01A, 12A		
62	Vol.	45	N				4	15	TS101		1	206		36, 37, 38, 39	262	
77	Vol.	97	TRP602				4	12	See Note	B3				30, 32, 34, 19	175	
87	Vol.	17	N				P80956	25/19	RM262/TS102	B126	34	292	C12	75, 77, 78, 41, 84	262	10
							P80937	14/15	RN231	B127						
95	Vol.	97	TRP602				4	12	See Note	B3				30, 32, 34, 19	175	
102	Vol.	17	N	6			P103-2	4	RM262		37	296	C3	6D6, 6C6, 78, 75, 42, 84	175	10
							20	15	TS102							
							.02		Buffer	B14						
123 (Series 7D)	Vol.	56	N	6			P80916	23	WE847					6D6, 6B7, 76, 42, 80	456	1
	Tone	22	UC502				P81043	23	WE1647	B10						
							P81032	23	WE847							
							P81042	23	WE1647							
131 (7D), 133 (7D), 142 (7D), 144 (7D)	Vol.	56	N	6			P80916	23	WE847					6D6, 6B7, 76, 42, 80	456	1
	Tone	22	UC502				P81043	23	WE1647	B10						
							P81032	23	WE847							
							P81042	23	WE1647	B10						
181	Vol.	7	D				1-1-1	3	See Note	B1				24A, 27, 45, 80		1
	Tone	41	O													
187	Vol.	7	D	(1st	Type)		1-2-3	26	See Note	B1				24A, 27, 45, 80		1
	Vol.	6	D7	(2nd	Type)	A4	.53		See Note	B9						
500 Dictator	Vol.	8	A400P				1-1.5-1-2	3	See Note	B1				24, 27, 45, 80		3
							.1		See Note	B9						
811 Solo (62-1711)	Vol.	7	F		1		8-8	23	RS213					24, 27, 35, 47, 80	175	3
	Tone	95	O	6												
839, 921, 923, 924	Vol.	12	K12	13										22, 12A, 71A		
1111 Fantasy (62-1611)	Vol.	7	F		1		8-8	23	RS213					24, 27, 35, 47, 80	175	3
	Tone	95	O	6												
1238, 1238X	Vol.	15	O				2803	1	CN152					27, 35, 47, 80	262	3
	Tone	34	UC502				2852	19	CS123							
1355 Minstrel (62-1955)	Vol.	15	O				2803	1	CN152					27, 35, 47, 80	262	3
	Tone	44	UC502				2719	13	CS133							
							2852	15	CS123							
1522 (12A or 01A Det.)	Vol.	6	G12		See Note A32									24, 12A-01A, 71A		
1522 ('26 Det.)	Vol.	6	G12		See Note A32									24, 26, 01A, 71A		
1562 (12A or 01A Det.)	Vol.	6	G12											01A, 24, 12A, 71A		
	Tone	21	O													
1562 ('26 Det.)	Vol.	6	G12		See Note A32									24, 26, 01A, 71A		
	Tone	21	O													
1922	Vol.	6	G12											36, 01A, 12A		
	Tone	21	O													
2655	Vol.	1/15	DRP243				‡	‡	See Note	B4				24, 26, 27, 45, 80		11
2822, 2827 (Balboa), 2895, 2897 (DeSoto)	Vol.	8	A400P				1-1.5-1-2	3	See Note	B1				24, 27, 45, 80		3
	Tone	41	N				.1		See Note	B9						
2955, 2955X, 2957, 2957X	Vol.	24	GG				2.5-4-2	28	See Note	B1				24, 27, 45, 80		3
	Tone	41	O													

‡ Data not substantiated.

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MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
MONTGOMERY WARD & CO.—Continued. Note: The prefix "62-" or form of "62-" indicates Radio Division in Montgomery-Ward Catalog.																
3035, 3037, 3065, 3067	Vol.	6	G7				8-8-8	28	RS213	B66				24, 27, 45, 80		1
	Tone	41	N													
10,000 Serenader	Vol.	8	A400P				1-1.5-1-2	3	See Note	B1				24, 27, 45, 80		3
							.1		See Note	B9						
11,000 Challenger (2 Types)	Vol.	6	G7		3		1-1	1	See Note	B1				24, 27, 45, 80		1
	Tone	41	O													
14,000 Commander, 62,090 Cavalier	Vol.	6	F7		3		8-8-8	28	RS213	B3				24, 27, 45, 80		1
	Tone	41	N													
62-010	Vol.	8	Y25MP				1.5-1.5-.5	3	See Note	B1				24, 45, 80		1
							.6		See Note	B9						
62,020 (51)	Vol.	8	Y25MP				1.5-1.5-1.5	3	See Note	B3				24, 27, 45, 80		3
62-030	Vol.	6	G7		3		8-8-3	28	RS213	B3				24, 27, 45, 80		1
62-040 Commodore	Vol.	7	D				1-1-1	26	See Note	B7				24, 27, 45, 80		1
62-055	Vol.	6	G7	6	2									24, 26, 01A, 71A or 36, 01A, 12A		
	Tone	21	O													
62-060 Challenger, Jr., 62-070 Princess, (1800)	Vol.	6	G7	6	3		3-8	1	RS213	B3				24, 45, 80		1
62-078	Vol.	6	H7	6	3		8-8	4	See Note	B3				57, 35, 47, 80		1
62-080	Vol.	6	G7				8	3	RS213					24, 45, 27, 80	‡	1
	Tone	22	‡		See Note A5		8-6	3	CN152							
62-090	Vol.	6	G7				8	3	RS213					24, 27, 45, 80	‡	1
	Tone	22	‡		See Note A5		8-6	3	CN152							
62-1, 62-2	Vol.	15	L	6			8-8	25	RS213	B66				27, 35, 47, 80	175	3
	Tone	44	L													
62-7, 62-8	Vol.	7	H	6			8-8	4	RS213	B3				24, 27, 47, 80	175	3
	Tone	22	Y													
62-9	Vol.	7	H	6			8-8	4	RS213	B3				24, 27, 35, 47, 80	175	3
	Tone	22	L													
62-11, 62-12, 62-14, (1st Type)	Vol.	8	A5MP				1-2-6	30	See Note	B3				24, 27, 35, 47, 80	175	1
	Tone	34	UC502				4	19	CS121							
62-11, 62-14, (2nd Type)	Vol.	14	N				4-2-4	30	See Note	B3				24, 27, 35, 47, 80	175	3
	Tone	34	UC502				1	19	CS121							
62-16	Vol.	13	O	6			62-A12	4	RS213	B3				24, 27, 35, 47, 80	175	3
	Tone	22	L													
62-19 (1st Type)	Vol.	8	Y5MP				4-2-6	30	See Note	B3				24, 27, 35, 47, 80	175	3
	Tone	34	UC502				4	19	CS121							
62-19 (2nd Type)	Vol.	14	N				4-2-6	30	See Note	B3				24, 27, 35, 47, 80	175	3
	Tone	34	UC502				4	19	CS121							
62-20, 62-20X	Vol.	59	SRP272				8-8	43	RS213	B66				24, 27, 35, 47, 80	175	7
	Tone	34	UC502				4	13	CS121	B3						
62-21, 62-22	Vol.	15	N				4-2-4	28	See Note	B3				24, 27, 35, 47, 80	262	3
	Tone	22	UC502													
	Sen.	42	Y200MP													
62-23	Vol.	2/10	DRP241				4	12	CS121	B3				32, 33	175	
62-25	Vol.	59	SRP272				8-8	13	RS213	B66				24, 27, 35, 47, 80	175	7
	Tone	34	UC502				4	13	CS121	B3						
62-26	Vol.	15	O				8-8	1	CN152					27, 35, 47, 80	262	3
	Tone	34	UC502				8	19	CS123	B3						
62-27 (1st Type)	Vol.	8	A5MP				4-2-4	30	See Note	B3				24, 27, 35, 47, 80	175	3
	Tone	34	UC502				4	19	CS121	B3						
62-27 (2nd Type)	Vol.	14	N				4-2-6	30	See Note	B3				24, 27, 35, 47, 80	175	3
	Tone	34	UC502				4	19	CS121							
62-29 (1st Type) (Models 11, 12, 16 and 33)	Vol.	7	H				928	1	RS213	B3				24, 35, 47, 80	175	1
	Tone	22	Y200MP				929	1	RS213	B3						
62-29 (11, 12 2nd Type)	Vol.	15	N				923	1	RS213	B3				24, 27, 35, 47, 80	175	1
	Tone	22	Y200MP				929	1	RS213	B3						
62-30	Vol.	15	N				4-2-4	28	See Note	B3				24, 27, 35, 47, 80	262	3
	Tone	22	UC502													
	Sen.	7	Y200MP													
62-34 (Washington)	Vol.	15	O				8-8	1	CN152	B3				35, 27, 47, 80	262	3
	Tone	22	UC502				8	19	CS123	B3						
62-35	Vol.	15	N				928	1	RS213	B3				24, 27, 35, 47, 80	175	1
	Tone	22	Y200MP				929	1	RS213	B3						
62-36	Vol.	15	O				8-3	1	CN152	B3				35, 27, 47, 80	262	3
	Tone	22	UC502				8	19	CS123	B3						
62-38, 62-40, 62-38X, 62-40X	Vol.	15	O				8-3	1	See Note	B3				27, 35, 47, 80	262	3
	Tone	41	M				8	19	CS123	B3						
							8	14	CS123	B3						
62-41	Vol.	45	N				4	12	CS121					30, 34	175	
	Tone	22	UC502													
62-42	Vol.	15	N				4-2-4	28	See Note	B3				24, 27, 35, 47, 80	262	3
	Tone	22	UC502													
	Sen.	42	Y200MP													
62-43, 62-43X	Vol.	6	H7	6	3		8-8	4	See Note	B3				35, 57, 47, 80	262	1
62-PC43	Vol.	6	E12	6	EX200		SW1319	4	CM170					56, 57, 58, 47, 80	‡	1
62-44	Vol.	15	O				8-8	1	See Note	B3				27, 35, 47, 80	262	3
	Tone	41	M				8	19	CS123	B3						
							8	14	CS123	B3						
62-45	Vol.	6	G7				8-8	1	See Note	B3				56, 57, 58, 47, 80	455	3
	Tone	34	Y200MP				8	19	TS106							
62-46	Vol.	15	O				8-8	1	CN152					35, 27, 47, 80	262	3
	Tone	34	UC502				8	19	CS123							
62-47	Vol.	6	G7				8-8	1	See Note	B3				56, 57, 58, 47, 80	455	3
	Tone	34	Y200MP				8	19	TS106							
62-49	Vol.	15	M				8-8-8	28	RS213	B3				56, 57, 58, 46, 80	262	7
	Tone	22	L				4	19	TS105							
	Supp.	7	F													
62-50, 62-50X	Vol.	15	O				8-8	1	CN152	B3				27, 35, 47, 80	262	3
	Tone	41	Y200MP				8	13	CS123	B3						
							8	14	CS123	B3						
62-51	Vol.	45	Z12				8	30	HD682					56, 57, 58, 46, 82	175	3
	Tone	41	UC502				8	30	RS213							
	Supp.	8	E				4	30	RS211							
							4	19	CS121							
62-52	Vol.	15	N				4-2-6	30	See Note	B3				24, 27, 35, 47, 80	175	1
	Tone	21	O				4	14	CS121							
62-53	Vol.	59	SRP271				8-8	23	CM172	B3				57, 58, 47, 80	175	7
	Tone	34	UC502				4	14	CS121	B3						
62-PC55	Vol.	56	O	6			8-4	4	CM171					55, 56, 58, 47, 80	465	1
	Tone	22	L													
62-57	Vol.	6	H7	6	3		8-8	4	See Note	B3				57, 35, 47, 80	262	1

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
MONTGOMERY WARD & CO.—Continued.																
Note: The prefix "62-" or form of "62-" indicates Radio Division in Montgomery-Ward Catalog.																
62-64, 62-64X	Vol.	45	Z12				8	30	HD682					56, 57, 58, 46, 82	175	3
	Tone	41	UC502				8	30	RS213							
	Supp.	8	E				4	30	RS211							
							4	19	CS121							
62-PC64	Vol.	45	N				PC642	7	RM262	B3				56, 58, 57, 46, 82	175	3
	Tone	22	L				PC613	7	RM261	B3						
	Supp.	8	Y100MP				PC6442	15	TS101							
62-67	Vol.	17	N				8-8	1	RN242	B3				55, 56, 57, 58, 47, 80	175	1
	Tone	22	K12													
62-68, 62-68X	Vol.	15	M				8-8	28	RN242	B3				56, 57, 58, 46, 80	262	7
	Tone	22	L				8	28	RS213	B3						
	Supp.	7	F				4	19	TS105							
62-PC68	Vol.	15	L	6			8-8-8	3	RS213	B66				55, 56, 57, 58, 46, 82	175	3
	Tone	22	L													
	Sen.	7	H													
62-69	Vol.	15	M				8-8	28	RN242	B3				56, 46, 58, 80	262	7
	Tone	22	K12				8	28	RS213	B3						
							8-8	13 19	UR180							
62-70, 62-70X	Vol.	6	G7				8-8	1	See Note	B3				56, 57, 58, 47, 80	455	3
	Tone	34	M				8	19	TS106							
62-71	Vol.	59	SRP271				8-8	23	CM172	B3				57, 58, 47, 80	175	7
	Tone	34	UC502				4	14	CS121							
62-72, 62-72X	Vol.	6	G7				8-8	1	See Note	B3				56, 57, 58, 47, 80	455	3
	Tone	34	M				8	19	TS106							
62-74, 62-74X	Vol.	59	SRP271				8-8	23	CM172	B3				57, 58, 47, 80	175	7
	Tone	34	UC502				4	14	CS121							
62-75	Vol.	45	N				4	12	CS121					30, 34	175	
	Tone	22	UC502													
62-76	Vol.	15	N				12-4-4	30	See Note	B3				56, 57, 58, 47, 80	175	1
	Tone	21	O				4	13	See Note	B3						
62-79	Vol.	15	M				8-8	28	RN242	B3				56, 58, 46, 80	262	7
	Tone	22	K12				8	28	RS213	B3						
							8	13/19	UR180							
62-80	Vol.	17	N				8-8	1	RN242	B3				55, 56, 57, 58, 47, 80	175	1
	Tone	22	K12													
62-81	Vol.	40	Y				8-8	1	CN152					57, 47, 80	455	1
							4	19	TS105							
62-82	Vol.	17	N				8-8	1	CN152					55, 57, 58, 47, 80	175	1
62-83	Vol.	15	N				4	13	CS121					36, 39, 41	175	
	Tone	22	K12													
62-84, 62-84X	Vol.	15	M				8-8	28	RN242	B3				56, 58, 46, 80	262	7
	Tone	22	K12				8	28	RS213	B3						
							8-8	13/19	UR180							
62-86, 62-86X	Vol.	15	‡			See Note A19	4-8-8	3	See Note	B3				58, 56, 57, 46, 82	262	7
	Tone	22	N				8	18	TS106							
	Supp.	‡	DRP316													
62-88	Vol.	15	M				8-8-8	28	See Note	B3				57, 58, 56, 46, 80	262	7
	Tone	22	L				4	19	TS105							
	Supp.	7	F													
62-89	Vol.	17	P	6			P80984	2/13	CN155/CN142	B120				55, 56, 58, 45, 82	175	21
	Tone	41	UC501													
62-90	Vol.	6	G7				8-8	1	See Note	B3				56, 57, 58, 47, 80	455	3
	Tone	34	M				8	19	TS106							
62-91	Vol.	17	O				P80988	12	CS121					30, 34	175	
	Tone	44	UC502													
62-92	Vol.	6	H7	6	3		8-8	4	See Note	B3				57, 35, 47, 80	262	1
62-93	Vol.	15	O				P80989	12	CS123					6D6, 6C6, 37, 41	175	
	Tone	34	K12													
62-94, 62-94X	Vol.	15	M				8-8	28	RN242	B3				56, 58, 46, 80	262	7
	Tone	22	K12				8	28	RS213	B3						
							8	13/19	UR180							
62-96	Vol.	6	G7	6	3		P80944	11	UR182	B31				77, 78, 43, 25Z5	262	
							P80788C	20	CS121							
							P80936C	15	TS105							
62-97, 62-97X	Vol.	17	N				8-8	1	CN152					55, 56, 58, 2A5, 80	262	1
	Tone	22	K12				8	15	TS101							
62-98	Vol.	6	G7	6	3		P80944	11	UR182	B31				77, 78, 43, 25Z5	262	
							P80878C	12	CS121							
							P80936C	15	TS105							
62-99, 62-99X	Vol.	17	N				8-8	1	CN152					55, 56, 58, 2A5, 80	262	1
	Tone	22	K12				8	15	TS101							
62-100	Vol.	6	G7				8	3	RS213					24, 27, 45, 80	‡	1
	Tone	22	‡			See Note A5	8-6	3	CN152							
62-101, 62-101X	Vol.	15	N	6			8-8-4	28	CM175	B3				58, 56, 45, 80	262	1
	Tone	41	N													
62-103	Vol.	15	O	6			P80916	25	WE847					6D6, 6C6, 37, 42, 80	175	1
	Tone	22	UC502				P80990	25	RN242	B8						
							8	15	TS101	B10						
62-104	Vol.	6	H7	6	3		P80944E	11	UR182	B31				6C6, 6D6, 43, 25Z5	262	
62-105	Vol.	15	O	6			P80916	25	WE847					6D6, 6C6, 37, 42, 80	175	1
	Tone	22	UC502				P80990	25	RN242	B8						
							8	15	TS101	B10						
62-106, 62-107	Vol.	15	P	‡			16	2	CN152	B3				56, 58, 45, 80	175	1
	Tone	41	‡			See Note A5	8	2	CS133	B3						
62-114, 62-116	Vol.	64	O				P81014	40	2-CS126					34, 30, 19	175	
62-118	Vol.	18	UC511	6			81028	1	SR601	B125	20	253	C3	75, 77, 78, 41, 84	262.5	10
	Tone	22	UC502				81021	15	TN111							
.							.01		Buffer	B14						
62-120	Vol.	97	TRP602				P80968	12	CS121					30, 32, 34, 19	175	
62-121	Vol.	15	P	‡			16	2	CN152	B3				56, 58, 45, 80	175	1
	Tone	41	‡			See Note A5	8	2	CS133	B3						
62-122	Vol.	97	TRP602				80968	12	CS121					30, 32, 34, 19	175	
62-124	Vol.	15	P				P82001	12/13	CN141					30, 34, 19	456	
	Tone	44	K12													
62-126, 62-128	Vol.	97	TRP602				80968	12	CS121					30, 32, 34, 19	175	
62-129	Vol.	15	P				P82001	12/13	CN141					30, 34, 19	456	
	Tone	44	K12													
62-132	Vol.	15	P	6			P81039	2	RN242	B8				6D6, 76, 45, 80	456	3
	Tone	41	UC504				81018	2/13	CM173							
62-134, 62-134X	Vol.	15	P	6			P81058	48	WE1647					6D6, 76, 42, 80	456	1
	Tone	21	UC502				P81039	48	RN242	B8						
							P81056	48	CN141							
							P82000	48	On Order	B125						
62-135, 62-135X	Vol.	18	N	6			P103-4	4	WE1647					57, 27, 58, 2A6, 2A5,		
							P103-3	4	RN242	B8				80	370	1
62-136	Vol.	56	N				P81016	23	CM172		20	F253	C3	6F7, 6D6, 6B7, 12A5,		
	Tone	34	UC502				.015		Buffer	B14				12Z3	175	10
62-137	Vol.	15	P	6			P81039	2	RN242	B8				6D6, 76, 45, 80	456	3
	Tone	41	UC504				81018	2/13	CM173							
62-138	Vol.	56	N				P81016	23	CM172		20	F253	C3	6F7, 6D6, 6B7, 12A5,		
	Tone	34	UC502				.015		Buffer	B14				12Z3	175	10

‡ Data not substantiated.

*** IMPORTANT: Read Notes in Note Section if specified in Note Column.**

MANUFACTURER AND MODEL	CONTROLS: Use	Circuit	Correct Replacement	Switch	Bias	*Note	CONDENSERS: Original Part	Circuit	Correct Replacement	*Note	VIBRATORS: Vibr. Conn.	Replacement	*Note	Types of Tubes Used	I. F. Peak	Trans. Circuit
MONTGOMERY WARD & CO.—Continued																
Note: The prefix "62-" or form of "62-" indicates Radio Division in Montgomery-Ward Catalog.																
62-139, 62-139X	Vol.	15	P	6			P81058	48	WE1647					6D6, 76, 42, 80	456	1
	Tone	21	UC502				P81039	48	RN242	B8						
							P81056	48	CN141							
							P82000	48	On Order	B125						
62-140, 62-140X	Vol.	6	Z12	6	EX100		BE119-6	4	RM262	B37				57, 58, 2A5, 80	175	1
62-147 Series "A"	Vol.	18	N	6			P119-11	1/15	CM173	B75				6F7, 6D6, 75, 42, 80	370	1
62-147, 62-147X Series "B" & "C"	Vol.	18	N	6			P103-6	4	RS213					6F7, 6D6, 75, 42, 80	370/465	1
							P103-7	4	RS213							
62-148, 62-148X	Vol.	6	Z12	6	EX100		BE119-6	4	RM262	B37				57, 58, 2A5, 80	175	1
62-150, 62-154, 62-150X, 62-154X	Vol.	18	N	6			P103-4	4	WE1647					27, 58, 2A6, 2A5, 80	370	1
							P103-3	4	RN242	B8						
62-156, 62-164, 62-156X, 62-164X Series "A"	Vol.	18	N	6			P119-11	1/15	CM173	B75				6F7, 6D6, 75, 42, 80	370	1
62-156, 62-156X, 62-164, 62-164X Series "B" & "C"	Vol.	18	N	6			P103-6	4	RS213					6F7, 6D6, 75, 42, 80	465	1
							P103-7	4	RS213							
62-166	Vol.	17	P	6			P45X201	1	CN152		20	253	C3	6D6, 6C6, 75, 41, 84	175	10
	Tone	22	M				P45X203	15	TN111							
							.01		Buffer	B14						
62-173, 62-175, 62-176, 62-177	Vol.	56	N	6			44X10	23	RN242	B8				6D6, 6B7, 76, 42, 80	456	1
	Tone	34	UC502				44X11	23	RN242	B8						
62-178	Vol.	97	TRP617	14			4	12	CS121					30, 32, 34, 19	175	
62-179	Vol.	7/15	DRP315	6		A59	44X10	4	RN242	B8				76, 6K7, 45, 80	456	16
	Tone	65	UC504				44X11	4	RN242	B8						
							44X18	13	RS201							
62-181 (Battery Super)	Vol.	6	TRP617	14			4	12	CS121					30, 32, 34, 19	175	
62-181 "Sovereign"	Vol.	7	D				1-1-1	26	See Note	B1				24, 27, 45, 80		1
	Tone	41	O													
62-185, 62-187	Vol.	7/56	DRP314	6		A59	44X10	23	RN242	B8				76, 6K7, 6B7, 6F6, 80	456	1
	Tone	34	UC502				44X11	23	RN242	B8						
62-188	Vol.	56	N	6			44X10	23	RN242	B8				6D6, 6B7, 76, 42, 80	456	1
	Tone	34	UC502				44X11	23	RN242	B8						
62-189	Vol.	6	TRP617	14			4	12	CS121					30, 32, 34, 19	175	
62-190	Vol.	7/56	DRP314	6		A59	44X10	23	RN242	B8				76, 6K7, 6B7, 6F6, 80	456	1
	Tone	34	UC502				44X11	23	RN242	B8						
62-193	Vol.	56	N	6			44X10	23	RN242	B8				6D6, 76, 6B7, 42, 80	456	1
	Tone	34	UC502				44X11	23	RN242	B8						
62-194	Vol.	7/15	DRP315	6		A59	44X10	4	RN242	B8				76, 6K7, 45, 80	456	16
	Tone	65	UC504				44X11	4	RN242	B8						
							44X18	13	RS201							
62-196	Vol.	7/56	DRP314	6		A59	44X10	23	RN242	B8				76, 6K7, 6B7, 6F6, 80	456	1
	Tone	34	UC502				44X11	23	RN242	B8						
62-199	Vol.	17	2 Meg. No. 1	6	See No	te A3	P82002	1/15	CM173	B75	32	286S	C3	6D6, 6C6, 75, 41	175	10
							.007		Buffer	B14						
62-203, 62-205	Vol.	45	O	13			44X17	12	RN232	B8				1C6, 34, 30, 19	456	
	Tone	44	UC502													
62-206	Vol.	7/15	DRP315	6		A59	44X10	4	RN242	B8				76, 6K7, 45, 80	456	16
	Tone	65	UC504				44X11	4	RN242	B8						
							44X18	13	RS201							
62-208	Vol.	45	O	13			44X17	12	RN232	B8				1C6, 34, 30, 19	456	
	Tone	44	UC502													
62-211	Vol.	6	TRP617	14			P45X28	12	CS121					30, 32, 34, 19	175	
62-212	Vol.	45	O	13			44X17	12	RN232	B8				1C6, 30, 34, 19	456	
	Tone	44	UC502													
62-216	Vol.	7/15	DRP315	6		A59	44X10	4	RN242	B8				76, 6K7, 45, 80	456	16
	Tone	65	UC504				44X11	4	RN242	B8						
							44X18	13	RS201							
62-217	Vol.	45	O	13			44X17	12	RN232	B8				1C6, 34, 30, 19	456	
	Tone	44	UC502													
62-218	Vol.	7/15	DRP315	6		A59	44X10	4	RN242	B8				76, 6K7, 45, 80	456	16
	Tone	65	UC504				44X11	4	RN242	B8						
							44X18	13	RS201							
62-219	Vol.	45	O	13			44X17	12	RN232	B8				1C6, 34, 30, 19	456	
	Tone	44	UC502													
62-226, 62-228	Vol.	17	2 Meg. No. 1	6	See No	te A19	44X10	23	RN242	B8				6K7, 6C5, 6Q7, 6F6,		
	Tone	34	Order from	Mfr.			44X11	23	RN242	B8				5Z4MG, 6G5	456	1
							44X209	15	TS101							
62-229 (32 Volt DC)	Vol.	18	N	6			P44X25	1	WE3540					6D6, 6A7, 85, 43, 6A6	175	
	Tone	44	Z12				P45X207	15	TS101							
62-230 (2 Volt—Wet Battery)	Vol.	56	O	6			BE119-22	19	TS101					1A6, 34, 30, 32, 950	465	
62-232	Vol.	6	G7		3		8-8-8	28	RS213	B66				24, 27, 45, 80		1
62-240 (2 Volt) Dry Battery)	Vol.	56	O	6			BE119-22	19	TS101					1A6, 34, 30, 32, 19	465	
62-249	Vol.	18	O	6			BE103-6	23	RS213					6L7, 6C5, 6K7, 6Q7,		
	Tone	22	K12				BE103-7	23	RS213					6F6, 5W4, 6G5	465	1
62-251, 62-255	Vol.	62	M				BE103-11	12	RS203					1A6, 1A4, 30, 34, 19	465	
	Tone	21	M													
62-259	Vol.	17	2 Meg. No. 1	6	See No	te A19	44X10	23	RN242	B8				6K7, 6C5, 6Q7, 6F6,		
	Tone	34	Order from	Mfr.			44X11	23	RN242	B8				6G5, 5Z4MG	456	1
							44X209	15	TS101							
62-261	Vol.	62	2 Meg. No. 1	6	See No	te A19	44X10	25	RN242	B8				6K7, 6C5, 6G5, 6F6,		
	Tone	65	Order from	Mfr.			44X11	25	RN242	B8				5Z4MG	456	1
							44X213	13/15	CS121/TS101							
62-307	Vol.	18	O	6			P103-6	23	RS213					6L7, 6C5, 6K7, 6Q7,		
	Tone	22	K12				P103-7	23	RS213					6F6, 5W4, 6G5	465	1
62-310	Vol.	64	2 Meg. No. 1	13	See No	te A19	4	12	CS121	B3				30, 32, 34	456	
	Tone	44	L													
62-311	Vol.	62	2 Meg. No. 1	6	See No	te A19	44X10	25	RN242	B8				6K7, 6C5, 6G5, 6F6,		
	Tone	65	Order from	Mfr.			44X11	25	RN242	B8				5Z4MG	456	1
							44X213	13/15	CS121/TS101							
62-313	Vol.	17	2 Meg. No. 1	6	See No	te A19	P44X21	30	WE3540					6K7, 6C5, 6G5, 6H6,		
	Tone	65	Order from	Mfr.			P44X11	30	RN242	B8				6L6, 5Z4	456	1
							P45X216	13	CS121							
							P45X209	19	TS101							
62-315	Vol.	18	O	6			BE103-6	23	RS213					6A7, 78, 75, 41, 80	465	1
							BE103-7	23	RS213							
62-316	Vol.	18	O	6			BE103-6	23	RS213					6L7, 6C5, 6K7G,		
							BE103-7	23	RS213					6Q7G, 6F6G, 5Y3	465	1
62-317	Vol.	18	O	6			BE103-6	23	RS213					6L7, 6C5, 6K7, 6Q7,		
	Tone	22	K12				BE103-7	23	RS213					6F6, 5W4, 6G5	465	1
62-326	Vol.	18	O	13			4	12	CS121					1B5, 1C6, 30, 34	456	
62-327	Vol.	45	O	6			4-18-18	1/13	RM259		Order	from M	fr.	34, 1C6, 30, 19	456	10
	Tone	44	UC502				20	1	RN235	B8						
							.01		Buffer	B14						

‡ Data not substantiated.

* **IMPORTANT: Read Notes in Note Section if specified in Note Column.**

MANUFACTURER AND MODEL	CONTROLS Use	Circuit	Correct Replacement	Switch	Bias	*Note	CONDENSERS Original Part	Circuit	Correct Replacement	*Note	VIBRATORS Vibr. Conn.	Replacement	*Note	Types of Tubes Used	I. F. Peak	Trans. Circuit
MONTGOMERY WARD & CO.—Continued.																
Note: The prefix "62-" or form of "62-" indicates Radio Division in Montgomery-Ward Catalog.																
62-328	Vol.	62	M	6			BE103-11	12	RS203					1A6, 1A4, 30, 34, 19	465	
	Tone	21	M													
62-332 (32 volt DC)	Vol.	18	N	6			12	15	TS101					6K7, 6A8, 85, 43, 6A6	456	
	Tone	44	Z12													
62-336	Vol.	18	O	13			4	12	CS121					1B5, 1C6, 30, 34	456	
62-337	Vol.	45	O	6			4-18-18	1/13	RM259		Order	from M	fr.	34, 1C6, 30, 19	456	10
	Tone	44	UC502				20	1	RN235	B8						
							.01		Buffer	B14						
62-338	Vol.	62	M	6			BE103-11	12	RS203					1A6, 1A4, 30, 34, 19	465	
	Tone	21	M													
62-360, 62-367	Vol.	6	TRP600				6-8	25	RS213	B66				24, 45, 80		1
62-407	Vol.	18	O	6			P103-6	23	RS213					6L7, 6C5, 6K7, 6Q7,		
	Tone	22	K12				P103-7	23	RS213					6F6, 5W4, 6G5	465	1
62-410	Vol.	64	2 Meg. No. 1	13	See No	te A19	4	12	CS121	B3				30, 32, 34	456	
	Tone	44	L													
62-411	Vol.	62	2 Meg. No. 1	6	See No	te A19	44X10	25	RN242	B6				6K7, 6C5, 6G5, 6F6,		
	Tone	65	Order from	Mfr.			44X11	25	RN242	B8				5Z4MG	456	1
							44X213	13 15	CS121/TS101							
62-413	Vol.	17	2 Meg. No. 1	6	See No	te A19	P44X21	30	WE3540					6K7, 6C5, 6G5, 6H6		
	Tone	65	Order from	Mfr.			P44X11	30	RN242	B8				6L6, 5Z4	456	1
							P45X216	13	CS121							
							P45X209	19	TS101							
62-415	Vol.	18	O	6			BE103-6	23	RS213					6A7, 78, 75, 41, 80	465	1
							BE103-7	23	RS213							
62-416	Vol.	18	O	6			BE103-6	23	RS213					6L7, 6C5, 6K7G,		
							BE103-7	23	RS213					6Q7G, 6F6G, 5Y3	465	1
62-425	Vol.	18	O	6			5-5	23	See Note	B3				6A7, 78, 75, 41, 5Z4	465	1
62-426	Vol.	18	O	13			4	12	CS121					1B5, 1C6, 30, 34	456	
62-427	Vol.	15	O	6			4-18-18	1/13	RM259		Order	from M	fr.	34, 1C6, 30, 19	456	10
	Tone	11	UC502				20	1	RN235	B8						
							.01		Buffer	B14						
62-428	Vol.	62	M	6			BE103-11	12	RS203					1A6, 1A4, 30, 34, 19	465	
	Tone	21	M													
62-432 (32 volt DC)	Vol.	18	N	6			12	15	TS101					6K7, 6A8, 85, 43, 6A6	456	
	Tone	11	Z12													
62-436	Vol.	18	O	13			4	12	CS121					1B5, 1C6, 30, 34	456	
62-437	Vol.	15	O	6			4-18-18	1/13	RM259		Order	from M	fr.	34, 1C6, 30, 19	456	10
	Tone	41	UC502				20	1	RN235	B8						
							.01		Buffer	B14						
62-520	Vol.	6	G7		3		8-8	25	RS213	B3				24, 71A, 80		1
62-1010	Vol.	8	G				4-4-4	3	CM173					24A, 27, 45, 80	‡	1
	Tone	41	N													
62-1838	Vol.	15	O				8-8	1	CN152					27, 35, 47, 80	262	3
	Tone	34	UC502				8	14	CS123							
MOTO-METER GAUGE & EQUIPMENT CO.																
Moto-vox 10A																
(Above 500)	Vol.	17	N				76458	15	TS101					36, 85, 41	175	
Moto-vox 10E	Vol.	15	N											36, 41	175	
	Sen.	‡	Y1000MP													
MOTOROLA—See Galvin.																
WILLIAM J. MURDOCK CO.																
8-Tube AC	Vol.	10	‡		See No	te A5	4-4-2	2, 14	See Note	B1				‡		3
MUSETTE																
52, 53	Vol.	6	F12	6	2		A203	4	RS213					24A, 27, 45, 80		1
	Tone	22	‡		See No	te A5										
310	Vol.	6	See Note	‡	‡	A5	8	25	RS213	B3				24A, 27, 45, 80		1
	Tone	22	K12													
NASSAU RADIO																
DLPS	Vol.	16	N				2-4-4	3	See Note	B2				99, 10, 81		‡
	Sen.	26	Y200MP													
NATIONAL CARBON CO (Eveready)																
1, 2, 3	Vol.	13	SRP179				2-4	1	See Note	B1				26, 27, 71A, 80		11
31, 32, 33, 34	Vol.	8	A550P				4-2-4-4	3 14	See Note	B1				27, 71A, 80		2
42, 43, 44	Vol.	8	A550P				4-2-4-4	3 14	See Note	B1				27, 45, 80		2
52, 53, 54 (Three Types)	Vol.	13/12	DRP117	Type	s 1, 2	A50	‡	3 15	See Note	B1				24, 27, 45, 80		3
	Vol.	13 7	DRP242	Type	3	A50										
THE NATIONAL CO.																
AC-SW 3	Vol.	7	D											58, 27		
	Regen.	12	K12													
AC-SW 58	Vol.	40	D12											58, 56, 45		
	Regen.	12	K12													
AC "Thrill Box"	Vol.	‡	E12											24A, 27		
AGS with GRDPU (Power Supply)	Vol.	7	A550P				8-8-8	3	See Note	B3				35, 37, 89		1
AGSX	Vol.	7	A550P				8-8-8	3	See Note	B3				77, 78, 37, 36, 89, 80		1
Auto-Box	Vol.	12	K12											24, 12A		
DC-SW-3	Vol.	7	D											36, 37		
	Regen.	12	K12	7												
DC-SW-34 (Batt.)	Vol.	40	D12											34, 30, 31		
	Regen.	12	K12													
FBX & FBXA	Vol.	7	G											24, 57, 56, 58, 59		
MB-29	Vol.	12	G12				8-8-8	3	MN275					24, 27, 45, 80		3
MB-30	Vol.	12	K12											24A, 27		
Screen Grid SW (71)	Vol.	12	K12											24A, 27, 71A		
NATIONAL TRANSFORMER CO.																
Midget 6	Vol.	6	H12				8-8	1	See Note	B3				27, 45, 80		3
	Tone	22	F12													
Screen Grid 8	Vol.	6	H12				8-8-8	3	See Note	B3				24, 27, 45, 80		3
	Tone	22	F12													
NOBLITT-SPARKS (Arvin)																
7	Vol.	15	UC512	6			17-4787	1	RN241		35	294	C3	6F7, 6A7, 6B7, 41, 84	170	10
							17-4786	15	TS101							
							.02-.02		Buffer	B14						
10A (Two Types)	Vol.	15	SRP251	6			8-16	1	CN155		34	292	C3	6A7, 6B7, 78, 41, 84	175	10
							12-12-4	‡	TN144							
							.02-.02		Buffer	B14						
15	Vol.	15	SRP251	6			17-4184	1	RN245		37	296	C13	78, 6A7, 6B7, 41, 84	175	10
							17-2082	15	TS101		34	292	C14			
							.02-.02		Buffer	B14						
16	Vol.	17	SRP251	6			17-4201	1	CN155	B3	34	292	C3	6D6, 6A7, 75, 41, 84	175	10
							17-2082	15	TS101							
							.02-.02		Buffer	B14						

‡ Data not substantiated.

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MANUFACTURER AND MODEL	CONTROLS Use	Circuit	Correct Replacement	Switch	Bias	*Note	CONDENSERS Original Part	Circuit	Correct Replacement	*Note	VIBRATORS Vibr. Conn.	Replacement	*Note	Types of Tubes Used	I. F. Peak	Trans. Circuit
NOBLITT-SPARKS—Continued																
17	Vol.	17	UC512	6			17-4703	1	RN245		35	294	C3	78, 6A7, 75, 41, 84	175	10
							17-4707	15	TN111							
							.02-.02		Buffer	B14						
18	Vol.	17	UC512	6			12-4	1	RN245	B3	35	294	C3	75, 78, 6A7, 41, 84	170	10
							12-12	15	TN111							
							.01		Buffer	B14						
20A (Two Types)	Vol.	15	SRP251		See Note A4		8-8	1	CN152		34	292	C3	75, 77, 78, 41, 84	181.5	10
	Vol.	17	SRP251		See Note A27		5	15	TS101							
							.02-.02		Buffer	B14						
20B	Vol.	17	SRP251	‡			16-8	1	CN155		34	292	C3	75, 77, 78, 6A7, 41, 84	175	10
							17	15	TS102							
							12-12-12	‡	See Note	B3						
							.02-.02		Buffer	B14						
25	Vol.	17	SRP251	6			17-4201	1	CN155		37	296	C13	78, 6A7, 6B7, 41, 84	175	10
							17-2082	15	TS101		34	292	C14			
							17-2253	‡	TN111							
27	Vol.	56	UC512	6			17-4703	1	RN245		35	294	C3	75, 78, 6A7, 41, 84	175	10
							17-4707	15	TN111							
							.02-.02		Buffer	B14						
28	Vol.	17	UC512	6			12-4	1	RN245		35	294	C3	6A7, 78, 75, 42, 84	170	10
	Tone	34	L				.005		Buffer	B14						
30A (Three Types)	Vol.	15	SRP251	6	See Note A27		16-8-5	1/15	CN155/TS101		34	292	C3	77, 78, 79, 41, 84	181.5	
	Vol.	17	SRP251	6	See Note A4		.02-.02		Buffer	B14					175	10
	Tone	22	L													
35 (Two Types)	Vol.	15	SRP251	6			17-4181	1	RN245		37	296	C13	77, 78, 79, 6B7, 41, 84	175	10
							.02-.02		Buffer	B14	34	292	C14			
37	Vol.	15	UC512	6			17-4716	1	RN245		35	294	C3	76, 78, 6A7, 6B7, 41,		
							17-4710	13	RS211					84	175	10
							17-4707	15	TN111							
							.02-.02		Buffer	B14						
38	Vol.	17	UC512	6			17-14050	1	RN242	C3	35	294	C3	78, 6A7, 75, 76, 6A6,		
	Tone	34	100M No. 1		See Note A3		17-4710	15	TN111					0Z4	170	10
							.005		Buffer	B14						
41	Vol.	6	G12	6			17-14001	1	RS213					6A7, 6F7, 41, 80	456	1
							17-14002	1	RN242	B8						
							17-14005	15	TS101							
45 (Two Types)	Vol.	17	SRP251	6			17-4184	1	RN245		37	296	C13	37, 75, 77, 78, 41, 84	175	10
							.02-.02		Buffer	B14	34	292	C14			
51	Vol.	17	N	6			17-14000	1	RS215					6A7, 6D6, 75, 41, 80	456	1
							17-14002	1	RN242	B8						
							17-14707	15	TN111							
51B	Vol.	17	N	6			17-14053	‡	RM252					1C6, 34, 1B5, 33, 1A1	456	
							17-14004	‡	TS101							
61, 62	Vol.	17	N				17-14002	1	RN242	B8				6A7, 6D6, 75, 42, 80	456	1
	Tone	34	L	6			17-14003	1	RN245	B8						
							17-14004	15	TS101							
61B, 62B	Vol.	17	N				17-4703	1	RN245		13	245	C3	78, 6A7, 6B7, 41	175	10
							17-4707	15	TN111							
							.005		Buffer	B14						
61M, 62M	Vol.	17	N				17-14002	1	RN242	B8				6K7, 6A8, 6H6, 6F5,		
	Tone	34	L	6			17-14003	1	RN245	B8				6F6, 5Z4	456	1
							17-14004	15	TS101							
81	Vol.	15	N				17-14002	3	RN242	B8				6D6, 6A7, 6B7, 76,		
	Tone	34	L	6			17-14003	3	RN245	B8				6B5, 80	456	1
							17-14000	3	RS215							
							17-14004	15	TS101							
81M	Vol.	15	N				17-14002	3	RN242	B8				6K7, 6A8, 6C5, 6H6,		
	Tone	34	L	6			17-14003	3	RN245	B8				6B5, 5Z4	456	1
							17-14000	3	RS215							
							17-14004	15	TS101							
417, 467	Vol.	6	G12	‡			17-14069	1/15	RN242/TS10					6A7, 6F7, 41, 80	456	1
517, 527	Vol.	17	N	6			17-14002	1	RN242	B8				6A7, 78, 75, 42, 80	456	1
							17-14000	1	RS215							
							17-4707	15	TN111							
517B, 527B	Vol.	17	N	6			17-14082	1	RN245		13	245	C3	6A7, 15, 75, 76, 19	456	10
							17-14005	15	TS101							
							.01		Buffer	B14						
617, 627	Vol.	17	N				17-14003	1	RN245	B8				6K7G, 6A8G, 6Q7G,		
	Tone	34	L				17-14002	1	RN242	B8				6F6G, 5Y3	456	1
							17-14001	13	RS213							
							17-14075	15	TN111							
617B, 627B	Vol.	17	N				17-14082	1	RN245		13	245	C3	15, 6A7, 75, 76, 19	456	10
	Tone	44	L				17-14084	13	RS203							
							17-14075	15	TN111							
							.01		Buffer	B14						
927	Vol.	17	500M No. 1		See Note A19		17-14003	3	RN245	B8				6K7G, 6A8G, 6R7G,		
	Tone	44	L				17-14002	3	RN242	B8				6C5G, 6N6G, 5Y3,		
							17-14000	3	RS215					6G5	456	1
							17-14075	15	TN111							
1127	Vol.	17	500M No. 1		See Note A19		17-14003	3	RN245	B8				6K7G, 6A8G, 6C5G,		
	Tone	21	N				17-14001	3	RS213					6N6G, 5Z3, 6G5	456	1
	Supp.	7	E	6			17-14000	3	RS215							
							17-14086	14	RN235	B8						
							17-14087	14	RN235	B8						
							17-14075	15	TN111							
NORCO MFG. CO.																
4 Super	Vol.	14	N	6			8-4	4	See Note	B3				57, 47, 80	250	1
4 Combination (Dual Wave)	Vol.	6	H12	6			8-4	4	See Note	B3				58, 24A, 47, 80		1
NORDEN-HAUCK, INC.																
Super DX-5A	Vol.	35	M											24, 27		
"Admiralty" Super 12	Vol.	23	MM				2-2-2-2	3/14	See Note	B4				24, 27, 50, 81		5
	Supp.	8	C													
Super 15	Vol.	23	MM				2-2-2-2	3/14	See Note	B4				56, 58, 50, 81		5
	Sen.	7	K													
	Supp.	8	C													
	Osc. Adj.	7	G													
OPERADIO MFG. CO.																
484, 484A, 484B	Vol.	15	N											864		
478B, 478AH, 2478A	Vol.	15	N				8	2/25	WE847					56, 53, 2A3, 5Z3		1
							8-8	2/25	RN242	B3						
							10	15	TS101							
							20	19	CN145	B3						
							75	14	SR608	B3						
483A, 2483A, 5-483-A, 5-2483-A							8-8	2	RN242	B3				2A3, 5Z3		1
							50	19	See Note	B125						

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS: Use	Circuit	Correct Replacement	Switch	Bias	*Note	CONDENSERS: Original Part	Circuit	Correct Replacement	*Note	VIBRATORS: Vibr. Conn.	Replacement	*Note	Types of Tubes Used	I. F. Peak	Trans. Circuit
ORGATRON (Everett Piano)																
LS-2	Quality	Order	from Mfr.				Main and Pre-Amp.							56, 53, 45, 83V		7/25
	Pedal		N				8-8-8	3	RS213							
	S. Flute		NN				10	15	TS101							
	U. Flute		NN				Echo Field Supply									
	String		NN				8-8	1	RS213							
	Horn		N													
	Bril.		Order from Mfr.													
MD-1							Pre-Amplifier							77 or 6C6, 79, 56, 45, 80, 83V		
							8-8	13	RN242						1st	1
							25	15	TS102						2nd	‡
							10	15	TS101							
							Main Amplifier									
							30	13	WE3540							
							25	15	TS102							
							Power Supply									
							30	2	WE3540							
							50	19	See Note	B125						
							Echo Field Supply									
							8-8	1	RS213							
OZARKA, INC. (Viking)																
V-16	Vol.	‡	J				‡	4/25	See Note	B2				35, 27, 45, 80	‡	‡
	Tone	‡	Supply on Order													
89AC	Vol.	4	G12				1-1-.5-2	1/14	See Note	B1				26, 27, 12A, 80		9
90	Vol.	10	F12				4-3-2	1/14	See Note	B1				24, 26, 27, 45, 80		9
91-Battery	Vol.	12	Y													
91AC	Vol.	24	‡		See Note A5		2-2-2	3	See Note	B1				‡		
"Viking" 91AC	Vol.	12	A5MP				8-8	1	CS133	B129				24, 27, 45, 80		3
92AC	Vol.	12	G12				8-8	1	RS213	B66				24, 27, 45, 80		3
93-Battery	Vol.	12	‡		See Note A5									24A, 27, 45, 80		3
	Tone	22	‡		See Note A5									30, 32, 33	175	
93A, 93B	Vol.	58	G	6			8-8	4	RS213	B66				27, 35, 47, 80	175	1
	Tone	22	Y													
94-AVC	Vol.	‡	‡		See Note A5		‡	4	See Note	B3				27, 35, 47, 80	175	1
	Tone	22	‡		See Note A5											
95-WD1	Vol.	24	‡		See Note A5		2-2-2	3	See Note	B1				24A, 27, 45, 80		3
PACIFIC RADIO (Aetna, Knight, Manchester, etc.)																
37-61	Vol.	18	N		See Note A5		16-12	27	UR182	B95				6A7, 6D6, 75, 43, 6G5, 25Z5	456	
37-321	Vol.	18	N		See Note A5		8-4	23	See Note	B3				6A7, 6D6, 75, 42, 80 or 6A7, 6K7, 75, 6F6, 80	465	1
	Tone	22	‡		See Note A5											
37-6320	Vol.	45	N		See Note A5		8-4	23	See Note	B3				6A8, 6K7, 6H6, 6F5, 6F6, 5Z4	465	1
	Tone	34	‡		See Note A5											
37-6322	Vol.	45	N		See Note A5		16-12	27	UR182	B95				6A7, 6D6, 76, 6F5, 43, 6G5, 25Z5	465	
	Tone	34	‡		See Note A5											
37-7370	Vol.	15	‡		See Note A19		12-14	23	See Note	B3				6K7, 6A8, 6H6, 6F5, 6F6, 6G5, 5Y3	465	1
	Tone	34	‡		See Note A5		10	15	TS101							
37-14370	Vol.	45	2 Meg. No. 1		See Note A19		12	25	RS215	B3				6K7, 6A8, 6H6, 6C5, 6G5, 6F6	465	1
	Tone	34	‡		See Note A5		18	25	RN242	B8						
							8	13	See Note	B3						
							10	19	TS106							
101	Vol.	18	‡	6	See Note A1		6-12	1	CN155	B3	34	292	C3	6A7, 6D6, 6B7, 41, 84	456	10
							10	15	TS101							
							.02-.02		Buffer	B14						
101B, 101C	Vol.	18	SRP281	6	See Note A3		8-8	4	CM172	B3	35	294	C3	6A7, 6D6, 75, 41, OZ4	456	10
							.01-.01		Buffer	B14						
102 (Knight 6 tube)	Vol.	18	SRP281	6			6-12	1	CN155	B3	34	292	C3	6D6, 6A7, 75, 41, 84	175	10
							10	15	TS101							
							.02-.02		Buffer	B14						
102B	Vol.	18	SRP281	6	See Note A3		8-8	4	CM172	B3	35	294	C3	6K7, 6A8, 6Q7, 6F6, 0Z4	262	10
	Tone	22	‡		See Note A5		.01		Buffer	B14						
682	Vol.	18	N				8-4	1	CN151	B3	31	285XS	C3	1C6, 34, 30, 19	465	10
	Tone	22	K12				.01-.01		Buffer	B14						
PACIFIC RADIO EXCHANGE																
Spero Four	Vol.	6	G12	6			4-4	23	RS211	B66				58, 57, PZ, 82		1
	Tone	22	K12													
Spero Super	Vol.	18	N	6			8-8	1	RS213	B3				56, 58, W, 47, 82	175	3
	Tone	41	M				4	1	RS211	B3						
PACKARD BELL CO.																
25 (Two Types)	Vol.	18	500M No. 1	6	See Note B1		8-8	25	See Note	B3	35	294		6A7, 6D6, 85, 42, 84	460	10
34	Vol.	6	G12	6	EX300		5-5	23	See Note	B3				6D6, 76, 42, 80		1
35	Vol.	6	G12	6	EX300		5-5	23	See Note	B3				6C6, 6D6, 76, 42, 80	460	1
	Tone	22	K12													
35A	Vol.	6	G12	6	EX300		4-4	23	CM170	B3				57, 58, 56, 2A5, 80	460	1
36	Vol.	15	N				4-4	23	CM170	B3				2A7, 58, 55, 2A5, 80	460	1
45M	Vol.	6	F12		EX175		8-8	23	CM172	B3				6A8, 6K7, 6F5, 6F6, 5Z4	460	1
	Tone	22	K12													
65	Vol.	6	G12	6	EX300		4-4	23	CM170	B3				56, 57, 58, 2A5, 80	465	1
	Tone	21	M													
76	Vol.	15	M				4-4	23	CM170	B3				2A7, 2B7, 57, 2A5, 80	465	1
	Tone	21	M													
	Supp.	12	Y250MP													
86	Vol.	15	N				4-4	23	CM170	B3				2A7, 2B7, 57, 2A5, 80	465	1
	Tone	21	M													
	Supp.	‡	Y50MP													
4 tube Superhet	Vol.	‡	G12				4-4	23	See Note	B3				57, 47, 80	‡	1
	Tone	22	‡		See Note A5											
4	Vol.	‡	G12	6			4-4	23	CM170	B3				57, 47, 80	235	1
	Tone	22	M													
5 Auto Set	Vol.	11	200M No. 1		See Note A3		5	19	TS105					55, 57, 58, 47	465	
6 tube Auto	Vol.	18	N	‡			4-4	1	CN150	B3	35	294	C3	6D6, 6A7, 75, 41, 84	470	10
							.05-.05		Buffer	B14						
11, 13	Vol.	6	G7	6	3		4-4	23	CM170	B3				58, 57, 2A5		1
24, 24C	Vol.	‡	G12	6			4-4	23	CM170	B3				57, 47, 80	235	1
	Tone	22	M													
85	Vol.	6	G7	6	3		4-4	23	CM170	B3				55, 57, 58, 47 or 2A5, 80	470	1
	Tone	22	M													
PARAMOUNT RADIO CO.																
Laurel Tone	Vol.	6	G7	‡	2		7-7	1	CN152	B3				57, 58, 47, 80		1
							10	19	TS101							
PATTERSON RADIO CO.																
Pre-Selector	Vol.	6	D12											58		
PR10	Vol.	15	N	6			8-8	35	RS213	B66				55, 56, 57, 58, 59, 5Z3	467.5	1
	M. Vol.	7	D12	6			10	15	TS101							
	Sen.	7	C1MP													
	Meter	‡	C1MP													

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
PATTERSON RADIO CO.—Continued																
PR16	Vol.	15	N	6			16-16-16	4	RN242	B66				76, 6A6, 6A3, 6F7, 6C6, 6D6, 5Z3	458	16
	Tone	21	K12				8	13	RS213							
	M. Vol.	15	N	6			10	15	TS101							
	Sil.	7	UC500													
	Meter	‡	CIMP													
50AW	Vol.	83	N	6			8-8	1	See Note	B3				55, 56, 57, 58, 59, 5Z3	262.5	1
	Tone	22	UC502													
	Sen.	8	UC500													
60 Series	Vol.	15	N	6			8-8	1	See Note	B3				2A7, 58, 55, 2A5, 80	465	1
	Tone	22	UC502				10	15	TS101							
70AW (without rear fuse and cover)	Vol.	15	N	6			8-8	1	See Note	B3				56, 57, 58, 55, 59, 82	262	1
	Tone	34	UC502				10	15	TS101							
70AW, 74AW (with rear fuse and cover)	Vol.	15	N	6			8-8	35	See Note	B3				56, 57, 58, 55, 89, 82	262	1
	Tone	22	UC502				10	15	TS101							
80AW, 84AW	Vol.	83	N	6			8-8	1	See Note	B3				55, 56, 57, 58, 59, 5Z3	262	1
	Tone	22	UC502													
	Sen.	8	UC500													
104AW (46 power tubes)	Vol.	15	N	6			4-8-4	3	See Note	B3				55, 56, 57, 58, 46, 83	262	1
104AW (59 power tubes)	Vol.	15	N	6			8-8	35	See Note	B3				55, 56, 57, 58, 59, 82	262	1
	Tone	22	UC502				4	19	CS121							
	Supp.	‡	UC502		See Note	A5										
107AW (without rear fuse and cover)	Vol.	15	N	6			8-4	1	See Note	B3				57, 58, 56, 55-Wunderlich, 59, 82	262	1
	Tone	22	UC502				10	15	TS101							
186AW	Vol.	15	N	6			16	4	RN242	B8				6A7, 6B7, 6A6, 6D6, 42, 5Z3	458	1
	Tone	21	K12				10	19	TS106							
	Sil.	7	UC500													
207AW, 210AW (without rear fuse and cover)	Vol.	15	N	6			8-4	1	See Note	B3				55, 56, 57, 58, 59, 82	262	1
	Tone	22	UC502				10	15	TS101							
286AW, 386AW	Vol.	15	N	6			16	4	RN242	B8				6A7, 6A6, 6B7, 6D6, 42, 5Z3	458	1
	Tone	21	K12				10	19	TS106							
	Sil.	7	UC500													
507AW (with rear fuse and cover)	Vol.	15	N	6			8-8	35	See Note	B3				55, 56, 57, 58, 59, 82	262	1
	Tone	22	UC502				10	15	TS101							
508AW	Vol.	83	N	6			8-8	1	See Note	B3				55, 56, 57, 58, 59, 5Z3	262	1
	Tone	22	UC502													
	Sen.	8	UC500													
510AW (46 power tube)	Vol.	15	N	6			4-8-4	3	See Note	B3				55, 56, 57, 58, 46, 82	262	1
510AW (59 power tubes)	Vol.	15	N	6			8-8	35	See Note	B3				55, 56, 57, 58, 59, 82	262	1
	Tone	22	UC502				4	19	CS121							
	Supp.	‡	UC502		See Note	A5										
1106AW	Vol.	15	N	6			16	4	RN242	B8				6A6, 6A7, 6D6, 76, 6C6, 42, 5Z3	458	16
	Tone	21	K12				10	19	TS106							
	Sil.	7	UC500													
1126AW	Vol.	15	N	6			16	4	RN242	B8				6A6, 6A7, 6C6, 6D6, 6A3, 5Z3	458	16
	Tone	21	K12				10	19	TS106							
	Sil.	7	UC500													
2106AW	Vol.	15	N	6			16	4	RN242	B8				6A6, 6A7, 6C6, 6D6, 76, 42, 5Z3	458	16
	Tone	21	K12				10	19	TS106							
	Sil.	7	UC500													
2126AW	Vol.	15	N	6			16	4	RN242	B8				6D6, 6A7, 6C6, 6A6, 76, 6A3, 5Z3	458	16
	Tone	21	K12				10	19	TS106							
	Sil.	7	UC500													
3106AW	Vol.	15	N	6			16	4	RN242	B8				6A6, 6A7, 6D6, 6C6, 76, 42, 5Z3	458	16
	Tone	21	K12				10	19	TS106							
	Sil.	7	UC500													
3126AW	Vol.	15	N	6			16	4	RN242	B8				6D6, 6A7, 6C6, 6A6, 76, 6A3, 5Z3	458	16
	Tone	21	K12				10	19	TS106							
	Sil.	7	UC500													
9507AW (with rear fuse and cover)	Vol.	15	N	6			8-8	35	See Note	B3				55, 56, 57, 58, 59, 82	262	1
	Tone	22	UC502				10	15	TS101							
PEERLESS—See United Reproducers.																
PERFECTONE, INC.																
4 tube receiver	Vol.	15	N		See Note	A3	10	15	TS101					36, 41		
PHILCO																
A (Packard)	Vol.	16	O	7										36, 85, 37, 79	260	MG.
AC206 (Studebaker)	Vol.	18	N	6			4-8-10	1/15	CN151/TS101	B130	42	500P	C3	44, 77, 75, 42, 84	260	10
							.01		Buffer	B14						
AC206 code 122 (Studebaker)	Vol.	18	TRP605	6	FS252	A52	4-8	1	CN151	B131	42	500P	C3	44, 6A7, 75, 42, 84	260	10
							20	15	TS102							
							01		Buffer	B14						
AC236 (Studebaker Jr.)	Vol.	18	N	6	FS251	A51	4-8-10	1	CN151	B131	42	500P	C3	44, 77, 75, 42, 84	260	10
							10	15	TS101							
							.01		Buffer	B14						
AC266*(ST3) (Studebaker DeLuxe)	Vol.	17	TRP605	6	FS251	A51	4-8	1	CN151	B131	42	500P	C3	36, 77, 44, 75, 42, 84	260	10
							10-10	15	BN226							
AC989 (Nash)	Vol.	19	TRP603	6	FS252	A52	4-8	1	CN151	B131	42	500P	C3	44, 6A7, 75, 41, 84	260	10
							20	15	TS102							
							.006		Buffer	B14						
AC989 (Code 122) (Nash)	Vol.	18	TRP605	6	FS252	A52	4-8	1	CN151	B131	42	500P	C3	44, 6A7, 75, 41, 84	260	10
							20	15	TS102							
							.006		Buffer	B14						
AC1089 (Nash)	Vol.	18	N	6			4-8-10	1/15	CN151/TS101	B130	42	500P	C3	44, 77, 75, 42, 84	260	10
							.01		Buffer	B14						
AC1289 (Nash Jr.)	Vol.	18	N	6	FS251	A51	4-8	1	CN151	B131	42	500P	C3	44, 77, 75, 42, 84	260	10
							10	15	TS101							
							.01		Buffer	B14						
B	Vol.	16	N	7			4-8	1	RN241	B132	42	500P	C3	36, 85, 41, 84	260	10
							.25-.5-8	14/15	See Note	B133						
							.006		Buffer	B14						
B6	Vol.	16	N	7			.25-.5-8	14/15	See Note	B133				36, 85, 41	260	MG.
C (Nash) (AC989)	Vol.	19	TRP603	6	FS252	A52	4-8	1	CN151	B131	42	500P	C3	44, 6A7, 75, 42, 84	260	10
							20	15	TS102							
							.006		Buffer	B14						

‡ Data not substantiated.

*** IMPORTANT: Read Notes in Note Section if specified in Note Column.**

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
PHILCO—Continued																
C6 (Chrysler) CT2, CT5	Vol.	17	TRP614	6			4-8	1	RN241	B132	42	500P	C3	36, 77, 44, 75, 42, 84	260	10
							10-10	15	TN111							
							.01		Buffer	B14						
CT2 (Chrysler DeLuxe)	Vol.	17	TRP614	6			4-8	1	RN241	B132	42	500P	C3	36, 77, 44, 75, 42, 84	260	10
							10-10	15	TN111							
							.01		Buffer	B14						
CT5 (Chrysler Airflow DeLuxe)	Vol.	17	TRP614	6			4-8	1	RN241	B132	42	500P	C3	36, 77, 44, 75, 42, 84	260	10
							10-10	15	TN111							
							.01		Buffer	B14						
CT11 (Chrysler)	Vol.	17	SRP282				4-8	4	CM171		42	500P	C3	78, 6A7, 75, 41, 84	260	10
	Sen.	7	UC500				.01		Buffer	B14						
CU & CV (Chrysler) (Code 122)	Vol.	17	TRP614	6			4-8	1	RN241	B132	42	500P	C3	44, 77, 75, 42, 84	260	10
							10-10	15	TN111							
							.01		Buffer	B14						
CZ (Chrysler) (CT2, CT5)	Vol.	17	TRP614	6			4-8	1	RN241	B132	42	500P	C3	36, 77, 44, 75, 42, 84	260	10
							10-10	15	TN111							
							.01		Buffer	B14						
D (Nash) (AC989)	Vol.	19	TRP603	6			4-8	1	CN151	B131	42	500P	C3	44, 6A7, 75, 41, 84	260	10
							20	15	TS102							
							.006		Buffer	B14						
D (Code 122) (AC989 Code 122)	Vol.	18	TRP605	6	FS252	A52	4-8	1	CN151	B131	42	500P	C3	44, 6A7, 75, 41, 84	260	10
							20	15	TS102							
							.006		Buffer	B14						
DP (Code DP121, DP122) Police	Vol.	18	N	6			4-8-10	1/15	CN151/TS101	B130	42	500P	C3	44, 77, 75, 41, 84	260	10
							.006		Buffer	B14						
DPV	Vol.	17	N	6	FS251	A51	4-8-10	1/15	CN151/TS101	B130	42	500P	C3	44, 6A7, 75, 42, 84	260	10
							.01		Buffer	B14						
DU (Dodge) (CT2, CT5)	Vol.	17	TRP614	6			4-8	1	RN241	B132	42	500P	C3	36, 77, 44, 75, 42, 84	260	10
							10-10	15	TN111							
							.01		Buffer	B14						
E-(10) (Pierce-Arrow)	Vol.	19	TRP603	6	FS251	A51	4-8	1	CN151	B131	42	500P	C3	44, 6A7, 75, 42, 84	260	10
							20	15	TS102							
							.01		Buffer	B14						
EA Dynamotor							8	12	CS123							MG.
EF Eliminator							4-8	1	CN141		42	500P	C3	84		10
							.006		Buffer	B14						
FT6	Vol.	17	TRP614	6			4-8	1	RN241	B132	42	500P	C3	44, 77, 75, 42, 84	260	10
							10-10	15	TN111							
							.01		Buffer	B14						
FT9 (Ford)	Vol.	18	SRP282		See Note	A67	4-8	4	CM171		42	500P	C3	78, 6A7, 75, 41, 84	260	10
							.01		Buffer	B14						
G	Vol.	18	UC512	6			4-8	1	RN241	B132	42	500P	C3	44, 6A7, 75, 41, 84	260	10
							20	15	TS102							
							.006		Buffer	B14						
G (Code 122)	Vol.	17	TRP614	6			4-8	1	RN241	B132	42	500P	C3	44, 77, 75, 42, 84	260	10
							10-10	15	TN111							
							.01		Buffer	B14						
G1418	Vol.	18	SRP282		See Note	A67	4-8	4	RM261	B86	43	501P	C3	78, 6A7, 75, 41, 84	260	10
							.0075		Buffer	B14						
G1436	Vol.	18	SRP282		See Note	A67	4-8	4	RM261	B86	43	501P	C3	78, 6A7, 75, 41, 84	260	10
	Tone	22	‡		See Note	A71	.008		Buffer	B14						
H	Vol.	18	N	6	FS251	A51	4-8	1	CN151	B131	42	500P	C3	44, 6A7, 75, 37, 79, 84	260	10
							.25-8-10	14/15	CN152/TP420	B135						
							.01		Buffer	B14						
H (Code 122)	Vol.	18	TRP605	6	FS251	A51	4-8	1	CN151	B131	42	500P	C3	44, 6A7, 75, 37, 79, 84	260	10
							.25-8-10	14/15	CN152/TP420	B135						
							.01		Buffer	B14						
J (Nash)	Vol.	18	N	6	FS251	A51	4-8	1	CN151	B131	42	500P	C3	44, 77, 75, 42, 84	260	10
							10	15	TS101							
							.01		Buffer	B14						
J (Code 122)	Vol.	18	N	6	FS251	A51	4-8-10	1/15	CN151/TS101	B130	42	500P	C3	44, 77, 75, 42, 84	260	10
							.01		Buffer	B14						
LT14X3, LT14X4	Vol.	18	SRP282				4-8	4	CM171		42	500P	C3	78, 6A7, 75, 41, 84	260	10
							.01		Buffer	B14						
ME (Pierce-Arrow)	Vol.	19	TRP603	6	FS252	A52	4-8	1	CN151	B131	42	500P	C3	44, 6A7, 75, 42, 84	260	10
							20	15	TS102							
							.01		Buffer	B14						
MT3 (Pierce-Arrow DeLuxe)	Vol.	17	TRP605	6	FS251	A51	4-8	1	CN151	B131	42	500P	C3	36, 77, 44, 75, 42, 84	260	10
							10-10	15	BN226							
							.01		Buffer	B14						
MT14X4 (Pierce-Arrow)	Vol.	18	SRP282				4-8	4	CM171		42	500P	C3	78, 6A7, 75, 41, 84	260	10
							.01		Buffer	B14						
N (Ford Center-Control)	Vol.	17	TRP614	6			4-8	1	RN241	B132	42	500P	C3	44, 77, 75, 42, 84	260	10
							10-10	15	TN111							
							.01		Buffer	B14						
NT12X, NT12X2	Vol.	18	SRP282		See Note	A67	4-8	4	CM171		42	500P	C3	78, 6A7, 75, 41, 84	260	10
	Sen.	7	UC500				.01		Buffer	B14						
NT15 (Nash)	Vol.	18	SRP282		See Note	A67	4-4	4	CM170		42	500P	C3	78, 6A7, 75, 41, 84	260	10
							.01		Buffer	B14						
N1418	Vol.	18	SRP282		See Note	A67	4-8	4	RM261	B86	43	501P	C3	78, 6A7, 75, 41, 84	260	10
							.0075		Buffer	B14						
N1433	Vol.	18	SRP282		See Note	A67	4-8	4	RM261	B86	43	501P	C3	78, 6A7, 75, 41, 84	260	10
							.008		Buffer	B14						
P1417	Vol.	18	SRP282		See Note	A67	4-8	4	RM261	B86	43	501P	C3	78, 6A7, 75, 41, 84	260	10
							.0075		Buffer	B14						
P1430, P1432H	Vol.	18	SRP282				4-8	4	RM261	B86	43	501P	C3	78, 6A7, 75, 41, 84	260	10
	Sen.	7	UC500				.008		Buffer	B14						
PA (Packard DeLuxe)	Vol.	16	N	7										38, 85, 37, 79, 84	260	MG.
PB (Packard)	Vol.	16	N	7			4-8	1	RN241	B132	42	500P	C3	36, 85, 41, 84	260	10
							.25-.5-8	14/15	See Note	B133						
							.006		Buffer	B14						
PHD, PHXD (Packard)	Vol.	18	TRP605	6	FS251	A51	4-8	1	CN151	B131	42	500P	C3	44, 6A7, 75, 37, 79, 84	260	10
							.25-8-10	14/15	CN152/TP420	B135						
							.01		Buffer	B14						

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS: Use	Circuit	Correct Replacement	Switch	Bias	*Note	CONDENSERS: Original Part	Circuit	Correct Replacement	*Note	VIBRATORS: Vibr. Conn.	Replacement	*Note	Types of Tubes Used	I. F. Peak	Trans. Circuit
PHILCO—Continued																
PJ (Plymouth) (CT2, CT5), PT5 (120) (Packard DeLuxe)	Vol.	17	TRP614	6			4-8 10-10 .01	1 15 	RN241 TN111 Buffer	B132 B14	42	500P	C3	36, 77, 44, 75, 42, 84	260	10
PT14 (Packard)	Vol. Sen.	18 7	SRP282 UC500				4-8 .01	4	CM171 Buffer	 B14	42	500P	C3	78, 6A7, 75, 41, 84	260	10
Q (Nash)	Vol.	18	N	6			4-8-10 .01	1/15	CN151/TS101 Buffer	B130 B14	42	500P	C3	44, 77, 75, 42, 84	260	10
R	Vol.	18	N	6	FS251	A51	4-8 10 .01	1 15	CN151 TS101 Buffer	B131 B14	42	500P	C3	44, 77, 75, 42, 84	260	10
R (Code 122)	Vol.	18	N	6	FS251	A51	4-8-10 .01	1/15	CN151/TS101 Buffer	B130 B14	42	500P	C3	44, 77, 75, 42, 84	260	10
RT3 (Reo DeLuxe)	Vol.	17	TRP605	6	FS251	A51	4-8 10-10 .01	1 15	CN151 BN226 Buffer	B131 B14	42	500P	C3	36, 77, 44, 75, 42, 84	260	10
RT14X (Reo DeLuxe)	Vol.	18	SRP282		See Note	A67	4-8 .01	4	CM171 Buffer	 B14	42	500P	C3	78, 6A7, 75, 41, 84	260	10
S1431	Vol.	18	SRP282		See Note	A67	4-8 .008	4	RM261 Buffer	B86 B14	43	501P	C3	78, 6A7, 75, 41, 84	260	10
SE (DeSoto)	Vol.	17	TRP614	6			4-8 10-10 .01	1 15	RN241 TN111 Buffer	B132 B14	42	500P	C3	44, 77, 75, 42, 84	260	10
SF, SG (DeSoto) (CT2, CT5)	Vol.	17	TRP614	6			4-8 10-10 .01	1 15	RN241 TN111 Buffer	B132 B14	42	500P	C3	36, 77, 44, 75, 42, 84	260	10
ST12 (Studebaker)	Vol.	18	SRP282		See Note	A67	4-8 .01	4	CM171 Buffer	 B14	42	500P	C3	78, 6A7, 75, 41, 84	260	10
ST15 (Studebaker)	Vol.	18	SRP282		See Note	A67	4-4 .01	4	CM170 Buffer	B3 B14	42	500P	C3	78, 6A7, 75, 41, 84	260	10
T2	Vol.	17	TRP614				4-8 10-10 .01	1 15	RN241 TN111 Buffer	B132 B14	42	500P	C3	36, 77, 44, 75, 42, 84	260	10
T3	Vol.	17	TRP605	6	FS251	A51	4-8 10-10 .01	1 15	CN151 BN226 Buffer	B131 B14	42	500P	C3	36, 77, 44, 75, 42, 84	260	10
T5	Vol.	17	TRP614	6			4-8 10-10 .01	1 15	RN241 TN111 Buffer	B132 B14	42	500P	C3	36, 77, 44, 75, 42, 84	260	10
T6	Vol.	17	TRP614	6			4-8 10-10 .01	1 15	RN241 TN111 Buffer	B132 B14	42	500P	C3	44, 77, 75, 42, 84	260	10
T7, T8 (Nash)	Vol. Tone	18 22	TRP605 L		FS251	A51	8-4 .01	4	CM171 Buffer	B3 B14	42	500P	C3	78, 6A7, 75, 41, 84	260	10
3 Transitone	Vol.	15	O											24A, 71A, 01A		
4 Converter							6	1	RS213					27, 24A, 80	1000	1
5 Transitone	Vol.	17	N	6	EC240	A72	4-8 .25-.25/.5-20 .006	1 ‡	CN151 See Note Buffer	B131 B136 B14	42	500P	C3	6A7, 78, 75, 41, 84	460	10
5 (AC Home Receiver)	Vol.	2	‡		See Note	A5	‡	34	See Note	B3				26, 27, 71A, 80		9
6, 6F	Vol.	16	N	7			.25-.5-8	14/15	See Note	B133				36, 85, 41	260	
7 Transitone	Vol.	15	L	7			.25-.5-8	14/15	See Note	B133				36, 38	175	
8	Vol.	16	N	7										36, 38, 41	175	
9 Transitone	Vol.	16	N	7										36, 85, 37, 79	260	
10 Transitone	Vol.	18	TRP603	6	FS252	A52	4-8 20 .01	1 15	CN151 TS102 Buffer	B131 B14	42	500P	C3	39, 6A7, 75, 42, 84	260	10
10 (Code 122) C-(Studebaker) E-(Pierce-Arrow)	Vol.	18	TRP605	6	FS251	A51	4-8 20 .01	1 15	CN151 TS102 Buffer	B131 B14	42	500P	C3	39, 6A7, 75, 42, 84	260	10
11 Transitone	Vol.	18	N	6	FS251	A51	4-8 10 .01	1 15	CN151 TS101 Buffer	B131 B14	42	500P	C3	44, 77, 75, 42, 84	260	10
11 (Code 122)	Vol.	18	N	6	FS251	A51	4-8-10 .01	1/15	CN151/TS101 Buffer	B130 B14	42	500P	C3	44, 77, 75, 42, 84	260	10
12	Vol.	15	N	7										36, 38, 41	175	
12 (122)	Vol.	15	N	7										36, 85, 37, 79	260	
14 (Code 121 & 122) (Runs 1-4)	Vol.	64	TRP605	6			8-8 10 1-1-2	1 19 13/14	RS213 BN226 UR181	B66 B8 B137				78, 6A7, 37, 77, 42, 80	175	1
14 (Codes 121, 122) (Runs 5 & after)	Vol.	64	TRP605	6			8 8-10 1-1-2	1 1/19 13/14	RS213 RN242 UR181	 B139 B137				78, 6A7, 37, 77, 42, 80	175	1
14 (123)	Vol.	64	TRP605	6			8-8 10 1-1-2	1 19 13/14	RS213 BN226 UR181	B66 B8 B137				78, 6A7, 37, 77, 42, 80	175	1
14 (126-226)	Vol.	64	TRP605	6			6-6 8-8	1 1	RS213 RS213	B66 B66				44, 36, 37, 42, 80	260	1
15 (Early 221)	Vol.	64	N				6 8	1 1	RS213 RS213					37, 44, 42, 80	175	1
15 (Early 223) 15 Late	Vol.	64	TRP605		See Note	A53	6-6	1	RS213	B66				37, 44, 42, 80	175	1
16	Vol. Supp.	64 12	TRP618 G12	6	See Note	A58	8-8 10	1 19	HD683 BN226	B66 B8				37, 77, 78, 42, 80	460	1
16 (Codes 121, 122, 123)	Vol. Supp.	64 12	TRP618 G12	6	See Note	A58	8 8-10	1 1/19	HD683 RN242	 B139				37, 77, 78, 42, 80	460	1
16 (Codes 125, 126, 127)	Vol.	64	TRP618	6	See Note	A58	8 8-10 1-1-1-2	1 1/19 13/14	HD683 RN242 UR181	 B139 B149				78, 77, 37, 76, 42, 80 or 5Z3	460	1
17	Vol. Vol. Supp.	64 64 ‡	TRP604 TRP618 Order from Mfr.	6	See Note See Note	A27 A4	8-8 10	1 19	HD683 BN226	B66 B8				6A7, 37, 77, 78, 42, 5Z3	175	1
17 (Code 121)	Vol. Vol. Supp.	64 64 ‡	TRP604 TRP618 Order from Mfr.	6 6	See Note See Note	A27 A4	8 8-10	1 1/19	HD683 RN242	 B139				78, 6A7, 37, 42, 5Z3	175	1
17, 17A (Codes 122 & 123)	Vol. Vol. Supp.	64 64 ‡	TRP604 TRP618 Order from Mfr.	6 6	See Note See Note	A27 A4	8 8-10	1 1/19	HD683 RN242	 B139				78, 6A7, 37, 42, 5Z3 or 80	175	1
18	Vol.	18	TRP605	6			8-8 10 1-1-2	1 19 13/14	RS213 BN226 UR181	B66 B8 B137				6A7, 78, 75, 42, 80	260	1

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
PHILCO—Continued																
18 (Codes 121 & 122)	Vol.	18	TRP605	6			8	1	RS213					6A7, 78, 75, 42, 80	260	1
							8-10	1/19	RN242	B139						
							1-1-2	13/14	UR181	B137						
18 (Code 124)	Vol.	18	TRP605				8	1	RS213					6A7, 75, 78, 42, 80	260	1
							8-10	1/19	RN242	B139						
							1-1-2	13/14	UR181	B137						
19	Vol.	18	N	6			6-6	1	RS213	B66				44, 36, 75, 42, 80	260	1
19 (Codes 122, 126, 126B)	Vol.	18	N				8-8	1	RS213	B66				44, 36, 75, 42, 80	260	1
19 (Code 128)	Vol.	18	TRP604				8	1	RS213					36, 44, 75, 42, 80	260	1
							2-8-10	1/13/19	RN245	B125						
20, 20A, 21	Vol.	2/8	DRP114		See Note	A56	‡	1/19	See Note	B1				24A, 27, 71A, 80		2
22L	Vol.	64	P				6-6	1	RS213	B66				44, 36, 37, 42, 80	260	1
23X	Vol.	64	P				6-6	1	RS213	B66				36, 37, 42, 80	260	1
28	Vol.	18	TRP605	6			12-6	49	RN235	B140				6A7, 39, 75, 43, 25Z5	460	
29, 29 (Code 123TX)	Vol.	18	TRP605	6			8-8-10	1/19	RN245	B141				6A7, 44, 75, 42, 80	460	1
							6	13	RS213							
30	Vol.	15	N											32, 30, 31		
32	Vol.	18	N		See Note	A27	8-8	25	RS213	B66	44	F502P		39, 36, 75, 42, 84	260	10
	Vol.	18	N	6	See Note	A4										
34, 34A	Vol.	45	N	13										30, 32, 24, 1C6, 19	460	
35, 35B, 36	Vol.	43	CE		See Note	A54								30, 32, 33	260	
37	Vol.	43	CE		See Note	A54								15, 30, 32, 19	175	
37-33	Vol.	18	N	14	See Note	A55	3	13	RS201					1D7G, 1D5G, 1H4G, 1E7G	470	
37-38	Vol.	45	UC512		See Note	A62	2-2-4	13	UR181	B142				1C7G, 1D5G, 1H4G, 1E5G, 1J6G	470	
37-60	Vol.	18	UC512		See Note	A62	12	25	RS215					6A8G, 6K7G, 6Q7G, 6F6G, 5Y4G	470	1
							8	25	RS213							
							16	14	RN242	B8						
37-61	Vol.	18	UC512		See Note	A62	12	25	RS215					6A8G, 6K7G, 6Q7G, 6F6G, 5Y4G	470	1
							8	25	RS213							
							16	14	RN242	B8						
37-84, Code 122	Vol.	2	Y	6			8-4	1	RN241					6J7G, 6F6G, 5Y4G	470	1
37-89	Vol.	18	UC512		See Note	A62	12	25	RS215					6K7G, 6A8G, 6Q7G, 6F6G, 5Y4G	470	1
							8	25	RS213							
37-116 (Codes 121, 122)	Vol.	17	TRP620		See Note	A58	8	1	RS213					6K7G, 6J5G, 6L7G, 6N7G, 6A8G, 6H6G, 6B4G, 6F6G, 5U4G	470	16
	Exp.	15	UC512		See Note	A62	8-10	1/19	RN242	B139						
	Hum.	37	Order from Mfr.				2-3-8	13/14	RN245	B125						
37-600	Vol.	6	‡	6	See Note	A63	8-4	1	CN151	B92				6A8G, 6J7G, 6K6G, 5Y4G	470	1
37-602	Vol.	18	UC512	6			16-16-10	1/15	RM259	B143				6A8G, 6K7G, 6Q7G, 25A6G, 25Z6G	470	
37-604	Vol.	18	TRP607	6	See Note	A64	16-16-10-8	41/15	See Note	B144				6A8G, 6K7G, 6Q7G, 25A6G, 25Z6G	470	
37-610 (Codes 121, 122)	Vol.	17	TRP620		See Note	A58	12	25	RS215					6A8G, 6K7G, 6Q7G, 6F6G, 5Y4G	470	1
							8	25	RS213							
37-620	Vol.	18	TRP620		See Note	A58	12	25	RS215					6K7G, 6A8G, 6Q7G, 6F6G, 5Y4G	470	1
							8	25	RS213							
							16	14	RN242	B8						
37-623	Vol.	18	TRP620		See Note	A58	2-2-8	12/13	RN235	B125				1D5G, 1C7G, 1F7G, 1H4G, 1J6G	470	
37-630	Vol.	18	TRP620		See Note	A58	12	25	RS215					6K7G, 6A8G, 6Q7G, 6F6G, 5Y4G	470	1
							8	25	RS213							
							16	14	RN242	B8						
37-640	Vol.	18	TRP620		See Note	A58	12	1	RS215					6K7G, 6A8G, 6Q7G, 6F6G, 5Y4G	470	1
							8-10	1/19	RN242	B139						
37-650	Vol.	45	TRP620		See Note	A58	20-10	1/19	RN245	B145				6K7G, 6A8G, 6J5G, 6K5G, 6F6G, 5Y4G	470	1
							8	1	RS213							
							16	14	RN242	B8						
37-660	Vol.	18	TRP620		See Note	A58	8-8	1	RS213	B66				6K7G, 6A8G, 6J5G, 6K5G, 6F6G, 5Y4G	470	1
							1-2-3	13/14	UR181	B146						
37-670	Vol.	45	TRP620		See Note	A58	8	1	RS213					6K7G, 6A8G, 6J5G, 6F6G, 5X4G	470	1
							8-10	1/19	RN242	B139						
							1-2-3	13/14	UR181	B146						
37-675 (Codes 121, 122)	Vol.	20	TRP620				8	1	RS213					6K7G, 6F6G, 6L7G, 6N7G, 6A8G, 6Q7G, 6H6G, 5X4G	470	1
	Tone	15	N				8-10	1/19	RN242	B139						
							4-4	13	RN241							
38, 38A (Codes 122, 123)	Vol.	2	Y											15, 30, 32, 19	460	
39, 39A	Vol.	45	N	13										1C6, 34, 30, 32, 19	460	
40 DC	Vol.	8	A2MP											24A, 27, 71A		
41 DC, 42 DC	Vol.	2/8	DRP114		See Note	A56	2-2-2-1	‡	See Note	B11				24A, 27, 71A		
43	Vol.	45	O	6			8-8	1	RS213	B66				37, 44, 42	450	1
							8	13	RS213							
43 (Code 121)	Vol.	45	O	6			8-8	1	RS213	B66				37, 44, 42	450	1
							8	13	RS213							
44	Vol.	18	N	6			8-8	1	RN242					6A7, 78, 75, 42, 80	460	1
							8	13	RS213							
45	Vol.	18	TRP605	6			8-8	1	RN242					6A7, 39/44, 75, 42, 80	460	1
							8	13	RS213							
46, 46E (DC)	Vol.	24	CE		See Note	A54								14, 17, 71A		
47 (DC) (Code 121-221)	Vol.	45	O											36, 44, 37, 43		
48 (DC)	Vol.	6	E12		(Early)	A27								36, 44, 43	175	
	Vol.	6	E12	6	(Late)	A4										
49 (DC)	Vol.	18	TRP605	6										6A7, 78, 85, 76, 43	260	
50, 50A	Vol.	2/8	CE				8-8	4	RS213	B66				24A, 47, 80		1
							10	4	RS215	B12						
51, 51A, 52	Vol.	6	E7				6-6	4	RS213	B66				24A, 35, 47, 80	175	1
							10	4	RS215	B12						
53 (AC-DC)	Vol.	2	Y	6			8-8	4	RS203	B66				77, 43, 12Z3	450	
							10	15	TS101							
54	Vol.	18	N	6	See Note	A57	12	50	RS205					6A7, 78, 75, 43, 25Z5	460	
							12-3	50	RN235							
57	Vol.	2	Y	6			8-4	1	CN151					77, 42, 80	460	1
							8-4	1	RN241	B20						
58, 59	Vol.	2	Y	6			8-4	1	RN241					77, 42, 80	460	1
60	Vol.	18	N	6			8-8	1	RS213	B66				6A7, 78, 75, 42, 80	460	1
65	Vol.	12	A2MP				2-2-1	3	See Note	B1				24A, 27, 45, 80		3
66	Vol.	18	N	6			8-8	1	RN242					6A7, 78, 75, 42, 80	460	1
							6	13	RS213							
70, 70A (Below No. B-22,000)	Vol.	2/8	DRP114				8-8	1	RS213	B66				24A, 27, 47, 80	260	3
							10	1	RS215	B12						

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
PHILCO—Continued																
70, 70A (Above No. B-22,000)	Vol.	45	O				8-8	4	RS213	B66				35, 24, 27, 47, 80	260	3
							14	4	RS215	B12						
							10	4	RS215	B12						
71 Series	Vol.	45	O				6-6	1	RS213	B66				36, 37, 44, 42, 80	260	1
							8-8	1	RS213	B12						
76	Vol.	8	X				2-2-2	‡	See Note	B1				24A, 27, 45, 80		3
							.15	‡	See Note	B9						
77, 77A	Vol.	2/8	DRP114		See Note	A56	2-2-2	30	See Note	B1				24, 27, 45, 80		3
							.15	‡	See Note	B9						
80	Vol.	2	Y	6			8	1	RS213					36, 42, 80	450	1
							4	1	RS211							
							10	19	TS101							
81	Vol.	2	Y		See Note	A27	8	1	RS213					77, 42, 80	460	1
	Vol.	2	Y	6	See Note	A4	4	1	RS211							
82	Vol.	2	G12				‡	3	See Note	B1				26, 27, 71A, 80		11
84	Vol.	2	Y	6			8-4	1	RN241					77, 42, 80	460	1
86	Vol.	2	G12				‡	3	See Note	B1				26, 27, 71A, 80		11
87	Vol.	2	G12				2-2-2-.1-.1	3/13	See Note	B1				26, 27, 45, 80		28
89	Vol.	18	N	6	See Note	A27	6-6	1	RS213	B66				44, 36, 75, 42, 80	260	1
	Vol.	18	N		See Note	A4										
89 (Code 123)	Vol.	18	N		See Note	A27	8-8	1	RS213	B66				44, 77, 75, 42, 80	260	1
	Vol.	18	N	6	See Note	A4										
89 (Codes 126 & 126B)	Vol.	18	N		See Note	A27	6-6	1	RS213	B66				44, 77, 75, 42, 80	260	1
	Vol.	18	N	6	See Note	A4										
90, 90A (with 2-45's)	Vol.	2/8	DRP114				8-8	1	RS213	B66				24A, 27, 45, 80	175	3
							10	1	RS215	B12						
90, 90A (with 1-47, Above 237,001)	Vol.	15	N				8-8	25	RS213	B66				24A, 27, 47, 80	175	3
							10	25	RS215	B12						
90, 90A (with 2-47's) Serial No. B-32001 to B-35000, and above B-53100)	Vol.	45	O				8-8	1	RS213	B66				24A, 35, 27, 47, 80	260	3
91 (Code 121-221)	Vol.	45	O				8-8	1	RS213	B66				44, 36, 37, 42, 80	260	1
							14	1	RS215	B12						
91 (126-226)	Vol.	45	TRP605				8-8	1	RS213	B66				44, 36, 37, 42, 80	260	1
95	Vol.	15	N				‡	‡	See Note	B1				24A, 27, 45, 80		3
							.15		See Note	B9						
96, 96A, 96E	Vol.	15	N				‡	‡	See Note	B1				24A, 27, 45, 80		3
97, 98	Vol.	18	N	6			12	1	RS215					78, 6A7, 85, 42, 80	460	1
							8	1	RS213							
							2-2-1	13/14	UR181	B147						
111, 111A	Vol.	15	N				‡	‡	See Note	B1				24A, 27, 45, 80	175	3
							.15		See Note	B9						
112, 112A (Below 174,001)	Vol.	15	N				‡	‡	See Note	B1				24A, 27, 45, 80	175	3
							.15		See Note	B9						
112, 112A, 112E (Above 174,001)	Vol.	15	N				6-6	1	RS213	B66				24A, 27, 47, 80	175	3
116B (Code 121)	Vol.	18	TRP618	6			8	1	RS213					76, 77, 78, 37, 42, 80	460	1
							8-10	1/19	RN242	B139						
							3-1-1-2	13/14	UR181	B148						
116X (Code 122)	Vol.	45	TRP613	6			8	1	HD683					76, 77, 37, 78, 42, 6A3, 5Z3	460	1
							8-10	1/19	RN242	B139						
							3-1-1-2	13/14	UR181	B148						
118, 118 (Code 123RX)	Vol.	18	TRP605	6			8	1	RS213					78, 6A7, 75, 42, 80	260	1
							8-10	1/19	RN242	B139						
							1-1-1-2	13/14	UR181	B149						
144	Vol.	18	TRP605	6			8-8-10	1/19	RN245	B141				6A7, 75, 78, 42, 80	460	1
							8	13	RS213							
200X	Vol.	18	TRP619	6	See Note	A58	8	1	HD683					6A7, 78, 75, 37, 42, 5Z3	175	1
	Band		Order from	Mfr.			8-10	1/19	RN242	B139						
							1-1-2	13/14	UR181	B150						
201 (Code 121)	Vol.	18	TRP619	6	See Note	A58	8	1	HD683					78, 6A7, 37, 75, 42, 5Z3	260	1
	Band		Order from	Mfr.			8-10	1/19	RN242	B139						
							1-2-1	13/14	UR181	B150						
							4-1	13	UR181	B151						
211, 211A	Vol.	15	N				‡	‡	See Note	B1				24A, 27, 45, 80	175	3
212, 212A (Radio-Phonograph)	Vol.	15	N				‡	‡	See Note	B1				24A, 27, 45, 80	175	3
220, 220A	Vol.	2/8	DRP114		See Note	A56	‡	1/19	See Note	B1				24A, 27, 71A, 80		2
270, 270A	Vol.	2/8	DRP114				8-8	1	RS213	B66				24A, 27, 47, 80	260	3
							10	1	RS215	B12						
296, 296A, 296E	Vol.	15	N				‡	‡	See Note	B1				24A, 27, 45, 80		3
470, 470A	Vol.	2/8	DRP114				8-8	1	RS213	B66				24A, 27, 47, 80	260	3
							10	1	RS215	B12						
490	Vol.	15	N				8-8	25	RS213	B66				24A, 27, 47, 80	BC175	3
							10	25	RS215	B12					SW1000	
							14	25	RS215	B12						
500, 501	Vol.	64	TRP618	6	See Note	A58	8-8	1	HD683	B66				76, 77, 78, 37, 42, 5Z3	460	1
	Supp.	12	G12				10	19	BN226	B8						
503	Vol.	18	TRP605	6			8-8	1	RS213	B66				6A7, 78, 75, 42, 80	260	1
							10	19	BN226	B8						
							1-1-2	13/14	UR181	B137						
504	Vol.	18	N	6			8-8	1	RN242					6A7, 78, 75, 42, 80	460	1
							8	13	RS213							
505	Vol.	18	N	6			8-8	1	RS213	B66				6A7, 78, 75, 42, 80	460	1
506 (Radio-Phonograph)	Vol.	18	TRP605	6			8-8-10	1/19	RN241	B141				6A7, 78, 75, 42, 80	460	1
							6	13	RS213							
507	Vol.	18	TRP605	6			8	1	RS213					78, 6A7, 75, 42, 80	260	1
							8-10	1/19	RN242	B139						
							1-1-1-2	13/14	UR181	B149						
509X	Vol.	18	TRP619	6			8	1	HD683					78, 6A7, 37, 75, 42, 80	260	1
	Band		Order from	Mfr.			8-10	1/19	RN242	B139						
							1-2-1	13/14	UR181	B150						
							4-1	13	UR181	B151						
511, 512, 513, 514, 515, 531, 551	Vol.	2	G12				‡	‡	See Note	B1				26, 27, 71A, 80		11
570 Grandfather's Clock (Below B-22,000)	Vol.	2/8	DRP114				8-8	1	RS213	B66				24A, 27, 47, 80	260	3
							10	1	RS215	B12						
570 Grandfather's Clock (Above B-22,000)	Vol.	45	O				8-8	4	RS213	B66				35, 24A, 47, 27, 80	260	3
							14	4	RS215	B12						
							10	4	RS215	B12						

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
PHILCO—Continued																
571	Vol.	2	G12				‡	‡	See Note	B1				26, 27, 71A, 80		11
600	Vol.	6	‡	6	See Note	A63	8-4	1	CN151	B92				6A7, 77, 41, 80	460	1
602	Vol.	18	UC512	6			16-16-10	1/15	RM259	B143				6A7, 78, 75, 43, 25Z5	470	
610, 610B, 610F	Vol.	18	N	6			8-8	1	RS213	B66				6A7, 78, 75, 42, 80	460	1
							16	13	RN242	B8						
611, 611 (121)	Vol.	18	N	6			16	51	RN232	B8				6A7, 78, 75, 43, 25Z5	460	
							10-10	51/15	RN232							
620, 620 (Code 121)	Vol.	18	TRP608	6			8-8	1	RN242					78, 6A7, 75, 42, 80	460	1
							16	14	RN242	B8						
623	Vol.	45	M	13			8-4-2	12/13	RN235	B152				1C6, 34, 30, 32, 19	460	
625	Vol.	18	TRP608	6			8-8	1	RN242					78, 6A7, 75, 42, 80	460	1
							16	14	RN242	B8						
630, 630 (121), 635,																
635 (Code 124)	Vol.	18	TRP608	6			8-8-10	1/19	RN245	B141				78, 6A7, 75, 42, 80	460	1
							16	14	RN242	B8						
640 (Code 121),																
640X (Code 122)	Vol.	17	TRP608	6			12	1	RS215					78, 6A7, 85, 42, 80	460	1
							8	1	RS213							
							2-2-1	13/14	UR181	B147						
643	Vol.	45	TRP614	13			2-4-8	12/13	RN235	B152				1C6, 1C1, 30, 32, 34,		
														19	460	
645	Vol.	18	TRP608	6			12	1	RS215					6A7, 78, 85, 42, 80	460	1
							8	1	RS213							
							1-1-2	13/14	UR181	B150						
650, 655	Vol.	18	TRP613	6			8	1	RS213					78, 6A7, 75, 42, 80	460	1
							8-10	1/19	RN242	B139						
							3-1-2	13/14	UR181	B146						
660, 665, 665 (Code																
122)	Vol.	18	TRP613	6			8	1	RS213					78, 77, 76, 75, 42, 80	460	1
							8-10	1/19	RN242	B139						
							3-1-2	13/14	UR181	B146						
680	Vol.	18	N				8-8	1	RN242					6B7, 76, 78, 85, 6F7,		
	Tone	15	O				8-4	14	RN241					42, 6A3, 5Z3, 80	460	15
	Sel.		Order from	Mfr.			2-1-1-2	13/14	UR181	B153						
							50		On order	B125						
700	Vol.	18	N	6	FS251	A51	4-8-10	1/15	CN151/TS101	B130	42	500P	C3	44, 77, 75, 42, 84	260	10
							.01		Buffer	B14						
800	Vol.	18	N	6	FS251	A51	4-8	1	CN151	B131	42	500P	C3	44, 6A7, 75, 37, 79, 84	260	10
							.25-8-10	14/15	See Note	B135						
							.01		Buffer	B14						
800 (Code 122), 802	Vol.	18	TRP605	6	FS251	A51	4-8	1	CN151	B131	42	500P	C3	44, 6A7, 75, 37, 79, 84	260	10
							.25-8-10	14/15	See Note	B135						
							.01		Buffer	B14						
805	Vol.	18	N		FS251	A51	4-4	4	CM170	B3	42	500P	C3	6A7, 78, 75, 41, 84	260	10
							.01		Buffer	B14						
806	Vol.	18	TRP605		FS251	A51	8-4	4	CM171	B3	42	500P	C3	78, 6A7, 75, 41, 84	260	10
	Tone	22	L				.01		Buffer	B14						
808	Vol.	18	TRP611		FS251	A51	4-8	1	CN151	B3	42	500P	C3	77, 6A7, 78, 75, 76,		
	Tone	44	L			A70	8	14	CS133					6A6, 84	260	10
							10-10	15	RN226	B3						
							.01		Buffer	B14						
809	Vol.	18	N		FS251	A51	8-4	4	CM171	B3	42	500P	C3	78, 6A7, 75, 41, 84	260	10
	Tone	22	L			A70	.01		Buffer	B14						
810PA, 810PB,																
810PV	Vol.	18	N		FS251	A51	8-4	4	CM171	B3	42	500P	C3	78, 6A7, 75, 41, 84	260	10
							.01		Buffer	B14						
816, 816B	Vol.	18	UC512				4-4	4	CM170		42	500P	C3	78, 6A7, 75, 41, 84	260	10
							.01		Buffer	B14						
817	Vol.	18	UC512				4-8	4	RM261	B86	43	501P	C3	78, 6A7, 75, 41, 84	260	10
							.0075		Buffer	B14						
818, 818K	Vol.	18	N				4-8	4	RM261	B86	43	501P	C3	78, 6A7, 75, 41, 84	260	10
	Tone	22	M				.0075		Buffer	B14						
819, 819H	Vol.	18	N				8-8	23	RM262	B50	43	501P	C3	78, 6A7, 75, 41, 84	260	10
	Tone	22	M				4	14	RS201							
							.0075		Buffer	B14						
1421P	Vol.	18	TRP614			A3	4-8	1	RN241		43	501P	C3	78, 6A7, 75, 37, 79, 84	260	10
	Sen.	7	UC500				.008		Buffer	B14						
PIERCE-ARROW—(Also see DeWald).																
506R	Vol.	6	SRP263		See Note	A14	2279	27/15	UR189	B94				6D6, 6C6, 43, 25Z5		
515	Vol.	6	SRP263		See Note	A14	10-10-4-4	6/15	UR189	B36				6D6, 6C6, 43, 25Z5		
517 Auto	Vol.	17	N	6	See Note	A1	2310	1	CN152		35	294	C3	6A7, 6D6, 75, 41, 84	456	10
	Tone	22	Z12		See Note	A1	2312	15	TS101							
							.01		Buffer	B14						
518	Vol.	6	SRP263	6	See Note	A14	10-10-4-4	6/15	UR189	B36				6D6, 6C6, 43, 25Z5		
520	Vol.	6	E12	6			2292	4	CM172					6A7, 6D6, 76, 42, 80	456	1
522	Vol.	18	N	6										1A6, 1A4, 1B5, 30, 33	456	
523	Vol.	18	N	6			5-5	23	See Note	B3				6A7, 6D6, 75, 41, 84	456	1
525	Vol.	6	C12				2354	27/15	UR182	B95				6A7, 6D6, 76, 43,		
														25Z5	456	
609	Vol.	6	‡	6	See Note	A5	2294	27/15	UR182	B95				6A7, 6K7, 6J7, 43,		
														25Z5	456	
610, 610LW	Vol.	17	N	6	See Note	A5	2292	4	CM172					6A8, 6K7, 6H6, 6F5,		
														6F6, 80	456	1
611, 611LW	Vol.	6	‡	6	See Note	A5	2296	27/15	UR182	B95				6A8, 6K7, 6F5, 43,		
	Tone	21	‡		See Note	A5								25Z5	456	
612, 612LW	Vol.	6	‡		See Note	A5	2201	27/15	UR182	B95				6A8, 6K7, 75, 43,		
														25Z5	456	
615, 615LW	Vol.	6	‡	6	See Note	A5	2201	27/15	UR182	B95				6A8, 6K7, 75, 43,		
														25Z5	456	
617	Vol.	17	500 M No. 1	6	See Note	A1	2269	1	CN152		35	294	C3	6D6, 6A7, 75, 41, 84	175	10
	Tone	22	75M No. 1		See Note	A3	2270	15	TN110							
							.025-.025		Buffer	B14						
618	Vol.	18	N	6	See Note	A5	16-16	27	UR190	B3				6A7, 6D6, 75, 43,		
	Tone	21	‡		See Note	A5								25Z5	456	
619	Vol.	6	C12	6			20-12-5	27/15	UR182	B95				6A7, 6D6, 76, 43,		
														25Z5	456	
620, 620LW	Vol.	18	N	6	See Note	A5	8-8	4	CM172	B3				6A7, 6D6, 75, 42, 80,		
	Tone	76	‡		See Note	A5								6G5	456	1
621, 621LW	Vol.	18	‡	6	See Note	A5	20-12	27	UR182	B155				6A7, 6D6, 75, 43,		
	Tone	76	‡		See Note	A5								25Z5	456	
622	Vol.	6	C12	6			20-12-5	27/15	UR182	B95				6A7, 6D6, 76, 43,		
														25Z5	456	
804, 805	Vol.	76	N	6			2282	26	CS133					58, 2A7, 2A6, 45,		
	Tone	76	N				2286	26	RM262					2A5, 80	456	1
							2259	15	TN111							
901, 902	Vol.	18	P	6			8	4	CS133					6K7, 6F6, 6H6, 6F5,		
	Tone	76	P				16	4	RN242	B8				6A8G, 80, 6G5	456	1
1100	Vol.	15	N	6			20-12-5	27/15	UR182	B95				6A8, 6K7, 6H6, 6C5,		
	Tone	21	O				8	12	CS133					43, 25Z5	456	
1102, 1103	Vol.	18	N	6			8	12	RS203					6K7, 6A8G, 75, 25B6,		
	Tone	‡	‡				25-40	4	See Note	B125				25Z5, 6G5	456	

‡ Data not substantiated.

*** IMPORTANT: Read Notes in Note Section if specified in Note Column.**

MANUFACTURER AND MODEL	CONTROLS Use	Circuit	Correct Replacement	Switch	Bias	*Note	CONDENSERS Original Part	Circuit	Correct Replacement	*Note	VIBRATORS Vibr. Conn.	Replacement	*Note	Types of Tubes Used	I. F. Peak	Trans. Circuit
PILOT																
Dual Wave TRF Midget	Vol.	7	E				12-8	4	See Note	B3				51, 24A, 47, 80		1
	Tone	34	L													
Pilotone (Electric)	Vol.	5	D12											26, 27		
B2 Standard	Vol.	6	Y	6			4-8-12	6	CN145	B3				77, 78, 43, 25Z5	456	
							5-5	15	TN110							
C151	Vol.	7	D				12-8	4	See Note	B3				51, 27, 24A, 47, 80	175	1
	Tone	34	L													
C153, C154, (with 2-45's)	Vol.	23	MM				8-8-4	1/14	See Note	B3				51, 27, 45, 80	175	1
	Tone	41	L													
C153, C154 (with 47's)	Vol.	23	MM				8-8-8-4	3/14	See Note	B3				51, 27, 47, 80	175	3
	Tone	41	L													
A.C. Midget, C-157, C157A, C157B, C157F	Vol.	12	K12				2-3-4-1	3	See Note	B1				24A, 27, 45, 80		3
C162, C165	Vol.	7	D				12-8	4	See Note	B3				24A, 27, 51, 47, 80	175	1
	Tone	34	L													
D3	Vol.	6	G12	6			70871	8/15	UR139	B134				77, 78, 43, 25Z5	456	
F14 (DC)	Vol.	18	UC503				4-4	13	CN140	B3				77, 78, 85, 37, 48	456	
	Tone	22	G12													
	Sen.	5	G12													
K106	Vol.	12	M				‡	‡	See Note	B1				27, 24A, 71A, 80		‡
K108	Vol.	4	E12				‡	‡	See Note	B1				26, 27, 71A, 80		‡
K117 "Twin Screen Grid 8"	Vol.	2	D12				2-3-3	3	See Note	B1				24A, 27, 45, 80		3
K121, K121X (Bat.) Country Special	Vol.	12	K12											24A, 01A, 12A		2
K122, K123, K124	Vol.	12	K12				3-3-3	3	See Note	B1				24A, 27, 71A, 80		2
K126, K128	Vol.	12	K12				3-3-3	3	See Note	B1				24A, 27, 45, 80		2
K136 (AC) "Universal Wasp"	Vol.	12	K12				4-2-2-1-1	‡	See Note	B1				24A, 27, 45, 80		3
L8 (8 Tube Dragon)	Vol.	18	UC503				8-8	23	See Note	B3				56, 57, 58, 2A5, 5Z3	115	1
	Tone	34	L	6			2	13	See Note	B3						
	Sen.	6	H7		5		5-5	15	TN110							
PE6SG	Vol.	12	K12				3-3-3	3	See Note	B1				24A, 27, 71A, 80		2
SG105	Vol.	12	M				‡	‡	See Note	B1				24A, 27, 71A, 80		‡
S-141 "Universal"	Vol.	12	K12				2-2-4	3	See Note	B1				24A, 27, 45, 80		2
S148	Vol.	7	D				12-8	4	See Note	B3				27, 24A, 51, 47, 80	175	1
	Tone	34	L													
AC Midget S155, S155A, S155B S-155F (Two Types)	Vol.	6	E12			See Note A4	2-3-4-1	3	See Note	B1				24A, 27, 45, 80		3
	Vol.	12	K12			See Note A27										
	Tone	21	N			See Note A4										
S156, S158 (DC) Midget	Vol.	11	K12				6	‡	See Note	B11				01A, 71A		
S164	Vol.	7	D				12-8	4	See Note	B3				27, 24, 51, 47, 80	175	1
	Tone	34	L													
V191 S. W. Converter							4-4	1	See Note	B3				24A, 27, 80		1
W145 "Public Address System"	Vol.	15	N				‡	3	See Note	B4				27, 50, 81		25
X63, X65	Vol.	17	UC503				71916	1/15	RN245					6D6, 6A7, 75, 42, 80	456	1
	Tone	34	L	6			71915	13/15	CN150/TS101	B3						
X68, X69 (DC)	Vol.	17	UC503				71600	26	On order	B125				6D6, 6A7, 75, 43	456	
	Tone	22	G12	6			22481	15	TS101							
X73	Vol.	15	UC503				71203	12	RS203					34, 1C6, 1B5, 30, 19	456	
	Tone	44	L	7												
X75	Vol.	15	UC503				71203	12	RS203					1C6, 34, 1B5, 30, 19	456	
	Tone	44	L	7												
2	Vol.	6	Y	6			4-12-8	8	CN145	B3				77, 78, 43, 25Z5	‡	
							6	15	TS101							
							5	15	TS101							
4 Tube (DC) Super	Vol.	5	G7		1		2	4	See Note	B11				36, 37, 48	‡	
							4	‡	TN111							
7, 8 (Dragon AW)	Vol.	17	UC503				8-8	4	See Note	B3				56, 57, 58, 2A6, 2A5, 5Z3	115	1
	Tone	34	L	6			2-2	13/15	See Note	B3						
	Supp.	12	Y				5-5	15	TN110							
10 (AC) Dragon Super	Vol.	25	GG				8-8	4	See Note	B3				56, 57, 58, 47, 80	115	1
11 Dragon (DC)	Vol.	6	G7											36, 37, 38, 39	115	
12	Vol.	18	N				8-8	23	See Note	B3				55, 56, 57, 58, 59, 82	115	1
	Tone	34	Y				P22483	13	CS130							
	Sen.	5	G12				5	15	TS105							
20	Vol.	17	UC503				8-8	4	CM172	B3				55, 57, 58, 2A5, 25Z5	115	‡
	Tone	21	UC503				5	15	TS105							
	Sen.	7	H													
28 (DC)	Vol.	18	UC503				2	1	CN140	B11				39, 36, 85, 37, 48	115	
	Tone	22	G12	6												
	Sen.	7	H7		5	A27										
31 Rainbow Super	Vol.	2	G		1		8-8	4	CM172	B3				57, 2A5, 82	115	
							5	15	TS101							
35	Vol.	3	G12											35, 24A, 27, 47, 80	456	
39 Series	Vol.	25	GG				8-8	4	See Note	B3				24A, 27, 35, 47, 80	115	1
	Tone	34	K12													
41 (AC)	Vol.	7	E	6	2		71647	1	RN241					6A7, 6F7, 42, 80	456	1
41 (DC) Dragon	Vol.	6	G12											36, 37, 38, 39	115	
	Tone	34	K12													
43 (with 47 output)	Vol.	6	D12				P22455	4	CS133					58, 57, 47, 80		1
	Tone	34	L				4	4	CS131							
43, 45 (with 42 output)	Vol.	7	E	6	2		8-4	1	See Note	B3				6A7, 6F7, 42, 80	456	1
53	Vol.	17	UC503				8-8	1	CN152	B3				6A7, 6D6, 75, 42, 80	115	1
	Tone	34	L	6			5-5	15	TN110							
55 Captain Kidd Chest	Vol.	6	D12				8-8	4	See Note	B3				58, 57, 47, 80		1
	Tone	34	L													
55 (with 42 output)	Vol.	17	UC503				8-8	1	CN152	B3				6A7, 6D6, 75, 42, 80	115	1
	Tone	34	L	6			5-5	15	TN110							
63	Vol.	17	UC503				71106	1/13	CN152/CN140	B3				6D6, 6A7, 75, 42, 80	456	1
	Tone	34	L	6			70791	15	TN110							
68 (DC)	Vol.	17	UC503				4-4-4	26	On order					6D6, 6A7, 75, 43	456	
	Tone	34	G12				5	15	TS101							
73, 75	Vol.	15	NN				71203	12	RS203					34, 1C6, 1A6, 30, 19	456	
	Tone	34	L	7												
81 (Dragon A-W)	Vol.	17	UC503				8-8	4	See Note	B3				56, 57, 58, 2A6, 2A5, 5Z3	115	1
	Tone	34	L	6			2-2	13	See Note	B3						
	Supp.	12	Y				5-5	15	TN110							

‡ Data not substantiated.

*** IMPORTANT: Read Notes in Note Section if specified in Note Column.**

MANUFACTURER AND MODEL	CONTROLS Use	Cir-cuit	Correct Replacement	Switch	Bias	*Note	CONDENSERS Original Part	Cir-cuit	Correct Replacement	*Note	VIBRATORS Vibr. Conn.	Replace-ment	*Note	Types of Tubes Used	I. F. Peak	Trans. Cir-cuit
PILOT—Continued																
81 Rainbow	Vol.	2	G12				8-8	4	See Note	B3				57, 2A5, 82 (2nd type)		
84 (Dragon A-W)	Vol.	17	UC503				5	15	TS101					57, 47, 80 (1st type)	482	1
	Tone	34	L	6			8-8	4	See Note	B3				56, 57, 58, 2A5, 2A6,		
	Supp.	12	Y				2-2	13	See Note	B3				5Z3	115	1
93 (AC-DC)	Vol.	17	UC503				5-5	15	TN110							
							70871	8/15	UR189	B134				6A7, 6D6, 75, 43,		
103, 105	Vol.	17	UC503	6			71045B	1	RN242					25Z5	456	
							71215	13	CS131					6A7, 6D6, 75, 42, 80	456	1
108, 109 (DC)	Vol.	17	UC503	6			71600	26	On order							
	Tone	34	G12				22481	15	TS101					6A7, 6D6, 75, 43	456	
114, 115	Vol.	15	UC503	6			71589	41/13	RN245/TS101							
	Sen.	7	E				71588	41/14	RN245					76, 6D6, 6A7, 85,		
							71590	15	BN226					6C6, 42, 5Z3	456	1
123	Vol.	17	UC503	6			71676	1/24	UR182							
	Tone	34	L				71675	15	TN110					6D6, 6A7, 75, 43,		
140 Auto Set	Vol.	12	K12											25Z5	456	
171 Amplifier and Power Supply	Mic.		A400P											24A, 27, 45		
183, 185	Vol.	15	UC5 3	6			2-2-2	3	See Note	B1				27, 71A, 80		25
	Tone	34	L				71045	28	RN242					6A8, 6J7, 6K7, 6H6,		
							72168	28	CS133					6F6, 5Z4	456	1
213, 215	Vol.	15	UC503				22481	15	TS101							
	Tone	22	L	6			71045	1	RN242					6K7, 6A8, 6H6, 6J7,		
							72252	24	See Note	B3				6F6, 5Z4	456	1
253, 255	Vol.	17	UC503	6			70971	15	TN111							
	Tone	34	L				78623	1/13	RN245		31	285XS	C17	6D6, 6A7, 75, 41	456	10
							22481	15	TS101		13	245	C18			
1010 All Wave							.01		Buffer	B14	13	215A	C19			
Dragon	Vol.	6	G12				8-8	4	See Note	B3				24A, 27, 35, 47, 80	115	1
PLAZA MUSIC CO.																
6 Tube Long Wave	Vol.	6	‡		See Note A5		8-8	4	See Note	B3				58, 57, 47, 80	175	1
	Tone	34	‡		See Note A5											
6 Tube T. R. F.	Vol.	6	‡		See Note A5		8-8	4	See Note	B3				35, 24A, 47, 80		1
	Tone	22	‡		See Note A5											
7 Tube Super	Vol.	6	‡		See Note A5		8-8	4	See Note	B3				56, 57, 58, 47, 80	175	1
	Tone	22	L													
24 Standard	Vol.	6	H12				8-8	4	See Note	B3				‡		1
	Tone	22	Z12													
49A	Vol.	7	Y100MP		EX400		8-4	6	CN141							
							442A	15	TN113					39, 36, 37, 43, 25Z5		
549 (5 tube Super)	Vol.	3	K12				380	6	CN142							
							442A	15	TN113					78, 77, 43, 25Z5	456	
711 (5 Tube Super)	Vol.	6	H7		2		8-8	4	See Note	B3				57, 58, 47, 80	175	1
711 Junior	Vol.	6	‡	6	See Note A5		8-8	4	See Note	B3				58, 57, 47, 80		1
PRECISION																
6 Tube A-W Super	Vol.	18	N	6			8-8	23	See Note	B3				6A7, 6D6, 75, 42, 80	465	1
	Tone	22	Y													
8 Tube A-W	Vol.	83	N				8-8	1	See Note	B3				57, 58, 55, 2A5, 5Z3	465	1
	Tone	44	Y													
511	Vol.	18	N	6			4-4	23	CM170	B3				6A7, 6D6, 75, 42, 80	465	1
RADIETTE (Also see Keller-Fuller).																
54, 61	Vol.	18	500M No. 1	‡	See Note A3		6-10	4	CM172	B3	35	294	C3	6A7, 6D6, 75, 42, 84	456	10
							.02		Buffer	B14						
RADIOBAR																
106 (6 tube)	Vol.	15	N	6			8-8	4	See Note	B3				2A7, 58, 55, 2A5, 80	262.5	1
	Tone	22	K12													
210 (10 tube with 46's)	Vol.	15	N	6			4-8-4	3	See Note	B3				55, 56, 57, 58, 46, 82	262	1
210B (8 tube with 59's)	Vol.	83	N	6			8-8	1	See Note	B3				55, 56, 57, 58, 59, 5Z3	262	1
	Tone	22	UC502													
	Sen.	8	UC500													
210B (10 tube with 59's)	Vol.	15	N	6			8-8	35	See Note	B3				57, 56, 58, 55, 59, 82	262	1
	Tone	22	UC502				4	19	CS121	B3						
	Sil.	‡	‡		See Note A5											
210C (10 tube with 59's)	Vol.	15	N	6			8-8	35	See Note	B3				55, 56, 57, 58, 59, 82	262	1
	Tone	22	UC502				4	19	CS121							
	Sil.	‡	‡		See Note A5											
505 (5 tube)	Vol.	56	N	6			4-8	23	See Note	B3				57, 58, 55, 2A5, 80	175	1
	Tone	22	G12													
506 (6 tube)	Vol.	15	N	6			8-8	4	See Note	B3				2A7, 58, 55, 2A5, 80	262	1
	Tone	22	K12													
508 (8 tube with 59's)	Vol.	83	N	6			8-8	1	See Note	B3				55, 56, 57, 58, 59, 5Z3	262	1
	Tone	22	UC502													
	Sen.	8	UC500													
510 (10 tube with 46's)	Vol.	15	N	6			4-8-4	3	See Note	B3				58, 57, 55, 56, 46, 82	262	1
510 (10 tube with 59's)	Vol.	15	N	6			8-8	35	See Note	B3				55, 56, 57, 58, 59, 82	262	1
	Tone	22	UC502				4	19	CS121							
	Sil.	‡	‡		See Note A5											
526 (6 tube)	Vol.	83	N	6			8-8	4	See Note	B3				2A7, 58, 55, 2A5, 80	262.5	1
	Tone	22	UC502													
528 (8 tube with 59's)	Vol.	15	N	6			8-8	1	See Note	B3				55, 56, 57, 58, 59, 5Z3	262	1
	Tone	22	K12													
	Sen.	‡	UC500													
RADIO CHASSIS, INC. (Marquette).																
Auto Receiver	Vol.	18	500M No. 1		See Note A3		5	15	TS101					78, 6A7, 75, 41	175	
A5D	Vol.	6	G7		3		16-8	6	CN145	B124				78, 77, 43, 25Z5	175	
							5-5	15	TN110							
A6D	Vol.	18	N				16-8	6	CN145	B124				78, 6A7, 75, 43, 25Z5	175	
							5-5	15	TN110							
AC25	Vol.	6	G7		3		8-8	4	See Note	B3				58, 57, 56, 47, 80		1
AC35	Vol.	8	G		3		8-8	4	See Note	B3				58, 57, 56, 47, 80	175	1
AC36	Vol.	8	G		3		8-8	4	See Note	B3				58, 57, 47, 80	175	1
HOAR48	Vol.	8	G		3		8-8	4	See Note	B3				58, 35, 24, 27, 47, 80		1
L5D	Vol.	6	D		3		16-8	6	CN145	B124				6A7, 78, 77, 43, 25Z5	456	
	Tone	22	L				5-5	15	TN110							
L6D	Vol.	17	N				16-8	6	CN145	B124				78, 6A7, 75, 43, 25Z5	115	
							5-5	15	TN110							
L6W	Vol.	17	N				8-8	4	See Note	B3				58, 2A7, 2A6, 47, 80	125	1
							5	15	TS101							

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
RADIO CHASSIS, INC.—Continued																
LSA36	Vol.	8	G		3		8-8	4	See Note	B3				58, 57, 47, 80	175	1
LSA37	Vol.	8	G		3		8-8	4	See Note	B3				58, 56, 47, 80	175	1
QAC35	Vol.	8	G		3		8-8	4	See Note	B3				58, 57, 56, 47, 80	175	1
QAC36	Vol.	8	G		3		8-8	4	See Note	B3				58, 57, 56, 47, 80		1
SDC36	Vol.	8	G		2									39, 36, 37, 18		
SMA24	Vol.	6	G7		3		8-8	4	See Note	B3				58, 57, 47, 80		1
SMA25	Vol.	6	D7		3		8-8	4	See Note	B3				58, 57, 56, 47, 80		1
RADIO CIRCULAR 5 Tube A. W. (AC)	Vol. Tone	17 22	N L				8-8-4 5	4/13 15	RM265 TS105	B58				6A7, 6D6, 75, 42, 80	456	1
ACE 5 Tone Dual (Battery)	Vol. Tone	15 22	N L	‡			2	12	CS121					1C6, 34, 30, 33	456	
ACE 5 Tube AC-DC Dual All-Wave	Vol.	17	N	‡			5-20-8-4 5	11/13 15	See Note TS105	B154				6A7, 6D6, 75, 43, 25Z5	456	
ACE 817	Vol. Tone	17 22	N L				4-8-8-8-8 5	‡ 15	See Note TS105	B3				6D6, 6A7, 75, 42, 80	456	1
RADIOCHRON—See Clago.																
R. C. A. 9 Tube General Purpose A.W. (AVR-5A)	Vol. Tone Sen.	19 21 6	TRP603 UC505 J		6		6889 6609 6626	6 6 14/15	RS216 RS216 CS121/TN111					58, 2A7, 2B7, 56, 53, 80	445	1
RCA Short Wave Adapter	Vol.	26	J				3538 3536	1 15	CN140 TN110					24A, 27	1000	
Premax PI AC/DC	Vol.	7	UC509		6		6571	1	RS215					36, 37, 38, 39		
AVR-1	Vol. Tone	19 21	TRP603 O		6		6609 6626	1 14/15	RS216 CS121/TN111					58, 2A7, 2B7, 56, 53, 80	445	1
R-3-B (Battery)	Vol.	9	Y100MP				4-4	13/15	See Note	B156				34, 32, 30, 33	456	
R-3-C (200/230 V. D. C.)	Vol.	7	E		6	3 A59	11240 5212	25 25	RS215 RS216					39, 37, 89	460	
4T	Vol.	6	F7		6	3	12844 8839	50 4/14	RM257 CM175	B157 B158				6A7, 6B7, 41, 1V	460	25
4X, 4X3, 4X4	Vol.	7	G											6A7, 6F7, 43, 25Z5	460	
R-4	Vol. Tone Vol.	7 21 98	SRP134 K12 E		6 6									24A, 35, 47, 80	175	1
T4-8	Vol.	6	F7		6	3	6661 6832 11240 11497	1/15 13 25 25	UR189 CS121 RS215 RS213	B84				6A7, 6F7, 41, 1V	460	29
T4-8A	Vol.	98	E		6									6A7, 6B7, 41, 1V	460	25
T4-9	Vol.	6	F7		6	3	6661 6832 11240 11497	1/15 13 25 25	UR189 CS121 RS215 RS213	B84				6A7, 6F7, 41, 1V	460	29
T4-9A	Vol.	7	UC509		6		11268 7956 12234	1 15 1	CN140 TN110 RS213					6A7, 6B7, 41, 1V	460	25
T4-10														6D6, 6C6, 38, 76		
5M Automobile	Vol. Tone	56 22	TRP603 L		6	RS 245 See Note A60	12238 .01-.01 11240 5212 12398	1/15 1 1 6/15	CS133/TN111 Buffer RS215 RS216 RM259	B14 B159	19	249	C3	6D6, 6A8, 6K7, 6B7, 42	260	10
5T	Vol.	17	TRP613											6A7, 6D6, 75, 42, 80	460	1
5X, 5X3, 5X4	Vol.	18	M		6									6A7, 78, 75, 43, 25Z5	460	
AVR-5A 9 Tube Gen. Purpose AW.	Vol. Tone Sen.	19 21 6	TRP603 UC505 J		6		6889 6609 6626 2957	6 6 14/15 4	RS216 RS216 CS121/TN111 RS215					58, 2A7, 2B7, 56, 53, 80	445	1
R-5-AC Radiolette	Vol.	2	Y				2957	4	RS215					24A, 47, 80		1
R-5 DC	Vol.	2	Y											36, 38		1
R-5-X AC Radiolette	Vol. Reg.	2 7	J J											24A, 47, 80		
T-5 End Table Electrola	Vol.	63	SRP152		6		7790 4428	1 1	RS215 RS213					No tubes used		
T-5-2	Vol.	19	TRP603				7589 3796	13/14 15	CN150 TS105					6A7, 6D6, 6B7, 41, 80	460	1
6BK	Vol.	18	M				12804 12804 11387 .02-.02	12/13 12/13 12	CN152 CN152 RS215 Buffer	B14	30	W285	C3	1C6, 1A4, 1F6, 30, 49	460	10
6BK6	Vol.	18	M											1C6, 1A4, 1F6, 30, 49	460	
6BT	Vol.	18	M				12804 12804 11387 .02-.02	12/13 12/13 12	CN152 CN152 RS215 Buffer	B14	30	W285	C3	1C6, 1A4, 1F6, 30, 49	460	10
6BT6	Vol.	18	M											1C6, 1A4, 1F6, 30, 49	460	
6K	Vol. Tone	15 22	TRP613 L		6	See Note A59	11240 5212	1 1	RS215 RS216					6A8, 6K7, 6H6, 6F5, 6F6, 5Z4	460	1
6K2	Vol. Tone	15 22	TRP613 L		6	See Note A59	11240 5212 11387	1 1 14	RS215 RS216 RS215					6A8, 6K7, 6H6, 6F5, 6F6, 5Z4	460	1
6M and 6M2	Vol. Tone	17 22	TRP608 L			RS 245 See Note A60	12234 12238 .01-.01	1 1/15	RS213 CS133/TN111 Buffer	B14	19	249	C3	6D6, 6A8, 6K7, 85, 6C5, 6A6	260	10
6T	Vol. Tone	15 22	TRP613 L		6	See Note A59	11240 5212	1 1	RS215 RS216					6A8, 6K7, 6H6, 6F5, 6F6, 5Z4	460	1
6T2	Vol. Tone	15 22	TRP613 L		6	See Note A59	11240 5212 11387	1 1 14	RS215 RS216 RS215					6A8, 6K7, 6H6, 6F5, 6F6, 5Z4	460	1
BC6-4	Vol.	18	M				11595 11387 6832 11645 .01-.01	12 1 13 15	CS123 RS215 CS121 TS101 Buffer	B14	30	285	C3	1C6, 34, 1B5, 30, 49	460	10
BC6-6	Vol.	18	M											1C6, 34, 75, 30, 49	460	
BT6-3	Vol.	18	M				11595 11387 6832 11645 .01-.01	12 1 13 15	CS123 RS215 CS121 TS101 Buffer	B14	30	285	C3	1C6, 34, 1B5, 30, 49	460	10
BT6-5	Vol.	18	M											1C6, 34, 75, 30, 49	460	
BT6-10	Vol.	18	M				11595 11240 5212	12 1 1	CS123 RS215 RS216					1C6, 34, 1B5, 30, 49	460	
C6-2	Vol.	20	TRP613				11387 11821	14 27/19	RS215 RM259/TS101	B170				6A8, 6K7, 6H6, 6F5, 6F6, 80	460	1
C6-8	Vol.	20	TRP613				5212 11240	13 25	RS216 RS215					6A8, 6K7, 6H6, 6J7, 25A6, 25Z6	460	
C6-12	Vol.	18	M		6	See Note A59	5212	25	RS216					6A8, 6K7, 6H6, 6F5, 6F6, 5Z4	460	1

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

‡ Data not substantiated.

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RE1
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D22-1
R22..
RO23..
25 (DC
RAE26.
R27....
R28, R2:
R28B\
CE29...

‡ Data not

...as specified in Note Column.

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MANUFACTURER AND MODEL	CONTROLS: Use	Circuit	Correct Replacement	Switch	Bias	*Note	CONDENSERS: Original Part	Circuit	Correct Replacement	*Note	VIBRATORS: Vibr. Conn.	Replacement	*Note	Types of Tubes Used	I. F. Peak	Trans. Circuit
R.C.A.—Continued																
M30 Auto Radio	Vol.	8	Y50MP											36, 37, 12	175	
P31 Portable	Vol.	15	O				4	12	See Note	B1				34, 32, 30		
M32 Auto Radio	Vol.	16	P											37, 39, 85, 89		
Victor R32	Vol.	102	DRP115				3-2.5-3	3	See Note	B1				26, 27, 45, 80		9
	Phono.	63	A													
PT33 Portable Turn-Table	Phono.	63	SRP152													
Radiola 33 (AC)	Vol.	1	SRP144				1-1	2	See Note	B166				26, 27, 71A, 80		11
Radiola 33 (DC)	Vol.	1	SRP133											12A, 71A		
M34	Vol.	‡	SRP252	6			7600	‡	See Note	B167	24	273	C15	78, 6A7, 6B7, 89	175	10
							6492	13	See Note	B125						
							6513	15	TN113							
Victor R35	Vol.	2/8	DRP250				2-2-2	3	See Note	B1				24, 27, 45, 80		3
	Tone	22	P													
	Phono.	63	SRP152													
R37, R37P, R38, R38P	Vol.	19	TRP607				7590	1	RS215					58, 2A7, 2B7, 2A5, 80	175	1
	Tone	103	N	6			6487	1/14/15	CN155/TS101	B168						
R39	Vol.	2/8	DRP250				2-2-2	3	See Note	B1				24A, 27, 45, 80		3
	Tone	22	P													
	Phono.	63	SRP152													
RE40, RE40P	Vol.	7	D	6	1		7590	1	RS215					58, 2A7, 57, 2A5, 80	175	1
	Phono.	87	E12	8	See Note A66		7589	1/14	CN150							
Radiola 41 (AC)	Vol.	1	SRP145				2-2	1	See Note	B1				26, 27, 10		8
Radiola 41 (DC)	Vol.	1	SRP145											12A, 71A		
Radiola 42	Vol.	2/12	DRP116				2-1	26	See Note	B1				24A, 45, 80		1
	Tone	44	Y													
R43	Vol.	54	K12				2957	12	RS215					32, 30	175	
	Tone	41	K12													
Radiola 44 (AC)	Vol.	12	SRP142		See Note A67		2-2-2	3	See Note	B1				24, 45, 80		3
Victor RE45	Vol.	102	DRP115				3-2.5-3	3	See Note	B1				26, 27, 45, 80		9
	Phono.	63	A													
Radiola 46 (AC)	Vol.	12	SRP142		See Note A67		2-2-2	3	See Note	B1				24A, 45, 80		3
Radiola 46 (DC)	Vol.	12	SRP150											22, 12A, 71A		
Radiola 47	Vol.	12	SRP142				2-2-2	3	See Note	B1				24A, 45, 80		3
	Phono.	63	SRP152													
48 Radiola	Vol.	2/12	DRP116				1-2	4	See Note	B1				24A, 45, 80		1
R50	Vol.	13	K12				4-4	4	See Note	B1				35, 24A, 27, 47, 80	175	3
	Tone	101	N													
Radiola 50	Vol.	1	SRP145				3.5-3.5	‡	See Note	B4				26, 27, 71, 80		11
Radiola 51 (AC)	Vol.	1	SRP144				1-1-.5	3	See Note	B1				26, 27, 71, 80		11
Radiola 51 (DC)	Vol.	1	SRP144											12, 71		
R51B	Vol.	20	Order from	Mfr.			6548	12	CS123					34, 30	175	
	Tone	41	UC505													
Victor R52	Vol.	102	DRP115				3-2.5-3	3	See Note	B1				26, 27, 45, 80		9
	Phono.	63	A													
R53B	Vol.	20	Order from	Mfr.			6548	12	CS123					30, 34	175	
	Tone	41	UC505													
R55	Vol.	13	K12				4-4	4	See Note	B1				35, 24A, 27, 47, 80	175	3
	Tone	101	N													
RE57	Vol.	2/8	DRP250				2-2-2	3	See Note	B1				24A, 27, 45, 80		3
	Tone	22	P													
	Phono.	63	SRP152													
RAE59	Vol.	13	K12				2-3	4	See Note	B1				35, 24A, 27, 47, 80	175	3
	Tone	101	N													
	Phono.	63	SRP152	6												
Radiola 60	Vol.	8	SRP138				2-2	2	See Note	B1				27, 71A, 80	180	3
Radiola 62	Vol.	8	SRP138				3.5-3.5	2	See Note	B1				27, 71A, 80	180	3
Radiola 64	Vol.	54	SRP141				4-4-4	26	See Note	B2				27, 50, 81	180	30
	Sen.	1	D12													
Radiola 66	Vol.	8	SRP139				2-2-1	3	See Note	B1				27, 45, 80	175	1
Radiola 67	Vol.	8	SRP141				2-4-4	26	See Note	B1				27, 50, 81	175	30
	Tone	21	N													
	Phono.	63	SRP152													
RAE68	Vol.	8	Y5MP				3-3-3	26	See Note	B1				24, 27, 45, 80	175	1
	Tone	34	K12													
	Phono.	63	SRP152													
R70	Vol.	8	F				10-8-4	4	See Note	B158				58, 56, 47, 80	175	1
	Tone	21	N	6												
R71	Vol.	8	Y50MP				10-8-4	4	See Note	B158				58, 56, 47, 80	175	3
	Tone	21	K12	6												
R71B	Vol.	20	TRP611				8	12	CS123	B169				34, 32, 30	175	
	Tone	41	UC502													
R72	Vol.	8	Y50MP				10-8-4	4	See Note	B158				58, 56, 47, 80	175	3
	Tone	21	K12	6												
R73 (with 47's)	Vol.	8	A10MP				10-10-8-8	4	See Note	B169				58, 56, 55, 47, 80	175	3
	Tone	41	P	6												
Victor RE73	Vol.	2/8	DRP250				2-2-2	3	See Note	B1				24A, 27, 45, 80		3
	Tone	22	P													
	Phono.	63	SRP152													
R73A (2A5 Output)	Vol.	18	P				10-10-8-8	4	See Note	B169				58, 56, 55, 2A5, 80	175	1
	Tone	41	P	6												
	Supp.	7	F		5											
R74	Vol.	105	K				10-10-7	2/14	CM175	B169				58, 56, 46, 82	175	7
	Tone	21	L	6			10-10	15/19	CM162	B169						
R75 (47 Output)	Vol.	104	G				10-8-10	4/15	CM175	B169				58, 55, 56, 47, 80	175	3
	Sen.	104	G													
	Tone	41	P	6												
R75 (2A5 Output)	Vol.	17	P				10-8-10	4/15	CM175	B169				58, 56, 55, 2A5, 80	175	1
	Tone	21	P	6												
	Sen.	7	F		5											
Victor RE75	Vol.	102	DRP115				3-2.5-3	3	See Note	B1				26, 27, 45, 80		9
	Phono.	63	A													
R76, R77	Vol.	105	K				10-10-7	2/14	CM175	B169				58, 56, 46, 82	175	7
	Tone	21	L	6			10-10	15/19	CM162	B169						
R78 (Less Noise Suppressor)	Vol.	7/20	Order from	Mfr.			8910	4	CM172	B169				58, 56, 46, 82	175	3
	Tone	‡	N													
R78 (With Noise Suppressor)	Vol.	20	TRP601				8910	4	CM172	B169				55, 58, 56, 46, 82	175	3
	Supp.	7	Order from	Mfr.												
	Tone	‡	N													
RAE79	Vol.	13	K12		See Note A61		4-4	4	CM170	B169				35, 24A, 27, 47, 80	175	3
	Tone	101	N													
	Phono.	87	‡		See Note A5											
Radiola 80	Vol.	7	A5MP		See Note A76		2-3-3	26	CM173	B169				24, 27, 45, 80	175	1
							3	26	CS131	B12						
RE80	Vol.	8	A10MP				10-8-10	4	See Note	B158				58, 56, 55, 47, 80	175	3
	Tone	41	P	6												
	Sil.	9	G													
	Phono.		Order from	Mfr.												

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
R.C.A.—Continued																
RE81	Vol.	8	K				10-10-10	2/14	CM175	B169				58, 56, 46, 82	175	7
	Tone	21	N	6			10-10	15/19	CM162	B169						
	Phono.	16	TRP603													
Radiola 82, 82 (with Remote Control)	Vol.	8	Y5MP				2-3-3	26	See Note	B1				24A, 27, 45, 80	175	1
	Tone	101	K12													
RAE84	Vol.	100	TRP601				10-10	4	See Note	B2				58, 56, 46, 82	175	3
	Tone	21	N													
	Supp.	7	E	6												
Radiola 86	Vol.	8	Y5MP				2-3-3	26	See Note	B1				24A, 27, 45, 80	175	1
	Tone	101	K12													
	Phono.	63	SRP152													
R90, R90P	Vol.	100	TRP622				6443	4	RS215					58, 56, 2A5, 80	175	1
	B. Tone	‡	Y200MP				6430	4/13	CM170	B169						
	T. Tone	41	UC505													
	Supp.	7	E													
91B	Vol.	7	Y200MP		EX350		6832	12	CS121					78, 77, 38		
							6844	15	TN113							
R92 Recorder	Vol.	16	N				7590	1	RS215					56, 53, 80		1
							4498	1	CS133							
							3536	15	TN113							
R93 Phonograph	Vol.	63	Y													
R95 Electrola	Vol.	63	Y				11867	9/15	UR190/CM161	B171				77, 43, 25Z5		
R99 High Fidelity Electrola	Vol.	16	Order from	Mfr.			12467	28	WE3540					6L7, 6C5, 6H6, 2A3,		
	Tone	41	UC505	6			11240	28	RS215					5Z3		14
	Exp.	15	P				11496	28	RS216							
	Exp. Bias	7	A2MP				5212	13	RS216							
							12470	15	TS102							
							12472	15	TS101							
100, 101	Vol.	7	E	6	2		6661	1/15	UR189	B84				6A7, 6F7, 38, 1V	460	29
M101	Vol.	17	M	6			4961	1	RS213		32	287M	C3	6D6, 6A7, 6B7, 41	175	10
							4958	24/15	CN150/TS101		32	G287M	C16			
							.02-.02		Buffer	B14						
102 Victor	Vol.	7	UC509	6			6823	1	CN140					37, 77, 78, 38		
							6824	15	TN113							
103	Vol.	7	E	6	2		6661	1/15	UR189	B84				6A7, 6F7, 41, 1V	460	29
M104	Vol.	17	M	6			4961	1	RS213		32	287M	C3	6D6, 6A7, 6B7, 41	175	10
							4958	24/15	CN150/TS101		32	G287M	C16			
							.02-.02		Buffer	B14						
M105	Vol.	17	SRP251	6			4-4	1	CN150	B169	24	273		78, 6A7, 6B7, 41	175	10
							6492	13	See Note	B125						
							3536	15	TN113							
M107	Vol.	19	TRP603	6	See Note A68		7776	1	RN241		20	253	C3	6D6, 6A7, 75, 41, 84	175	10
							6963	15	TN111		20	G253	C16			
							.02-.02		Buffer	B14						
M108	Vol.	17	M	6			4961	1	RS213		32	287M	C3	6D6, 6A7, 6B7, 41	175	10
							4958	24/15	CN150/TS101		32	G287M	C16			
M109	Vol.	17	M	6			5069	1	CN152		35	294	C3	6D6, 6A7, 6B7, 76,		
							5054	15	TS101					6A6, 84	175	10
110, 111	Vol.	8	D	6	1		7590	1	RS215					58, 2A7, 57, 2A5, 80	175	1
	Tone	34	L				7589	1/14	CN150							
112, 112A (DC-220V)	Vol.	8	A5MP				6728	25/15	UR189	B172				78, 6A7, 77, 43, 12Z3	175	
114	Vol.	8	E	6	2		6783	9/15	UR190/CM161	B171				78, 6A7, 77, 43, 25Z5	175	
115	Vol.	7	D	6	1		7590	1	RS215					58, 2A7, 57, 2A5, 80	175	1
	Tone	34	L				7589	1/14	CN150							
M116	Vol.	‡	M				6738	1	RS213		24	273	C15	78, 6A7, 6B7, 41, 1V	175	10/25
	Tone	34	O				6782	1	CS131							
							6781	13	See Note	B125						
							3536	15	TN113							
117, 118, 119	Vol.	19	TRP603	6			7790	1	RS215					6A7, 6D6, 6B7, 41, 80	460	1
							4428	1	RS213							
							7589	13	CN150							
							3796	15	TS105							
120	Vol.	19	TRP607				7590	1	RS215					2A7, 2B7, 58, 2A5, 80	175	1
	Tone	34	L	6			6487	13/14	CN155/TS101	B168						
121, 122	Vol.	19	TRP603				6571	1	RS215					58, 2A7, 2B7, 2A5, 80	370	1
	Tone	34	L	6			6703	1/13	CN155							
							3796	15	TS105							
M123	Vol.	18	M	6	See Note A68		7758	1	See Note	B173	7	224		6D6, 6A7, 75, 41, 79	175	10
	Tone	41	K12				6963	15	TN111							
	Supp.	7	A2MP													
124	Vol.	19	TRP607				7590	1	RS215					58, 2A7, 2B7, 2A5, 80	175	1
	Tone	34	L	6			6487	1/13	CN155/TS101	B168						
125	Vol.	19	TRP603	6			7790	1	RS215					6A7, 6D6, 6B7, 41, 80	460	1
							5101	1/14	RN245							
126B	Vol.	9	Y50MP				4349	12	See Note	B174				1A6, 34, 32, 30	460	
127	Vol.	19	TRP603				6986	12	RM257	B11				6D6, 6A7, 75, 41	370	
	Tone	44	L	6			6985	13	RN231							
							3796	15	TS105							
128, 128E	Vol.	19	TRP603				7790	1	RS215					6D6, 6A7, 6B7, 41, 80	460	1
	Tone	34	L				4428	1	RS213							
							7589	13	CN150							
							4525	15	TS101							
135B	Vol.	45	M				4498	12	CS123					1C6, 34, 30, 32, 19	460	
	Tone	41	N													
ACR136	Vol.	18	TRP603				7790	1	RS215					6D6, 6A7, 6B7, 41, 80	460	1
	Tone	34	L				4498	1	RS213							
	Sen.	7	SRP134				7589	14	CN150							
							4525	15	TS101							
140, 141, 141E	Vol.	19	TRP603				6571	1	RS215					58, 2A7, 2B7, 56, 53,		
	Tone	21	O	6			6609	1	RS216					80	445	1
							6626	14/15	CS121/TN111							
140, 141, 141E (Revised)	Vol.	19	TRP603				6889/6609	1	RS216					58, 2A7, 2B7, 56, 53,		
	Tone	21	UC505	6			6626	13/15	CS121/TN111					80	445	1
142B	Vol.	9	Y50MP				6548	12	CS123					34, 30	175	
143	Vol.	19	TRP603				7790	1	RS215					6D6, 6A7, 75, 76, 42,		
	Tone	41	O	6			4626	13/15	RN245	B177				5Z3	460	1
	Sen.	7	UC500				4619	15	TS101/TP441							
ACR175	Vol.	17	P				10	1	RS215					6J7, 6K7, 6L7, 6H6,		
	Sen.	7	G				18	1	RS216					6F5, 6F6, 5Z4, 6E5	460	1
							4	14	RS211							
210	Vol.	8	D	6	1		7590	1	RS215					58, 2A7, 57, 2A5, 80	175	1
	Tone	34	L				7589	1/14	CN150							
211, 214	Vol.	19	TRP603	6			7790	1	RS215					6A7, 6D6, 6B7, 41, 80	460	1
							4428	1	RS213							
							7589	13	CN150							
							3796	15	TS105							
220	Vol.	19	TRP603				6571	1	RS215					58, 2A7, 2B7, 2A5, 80	175	1
	Tone	34	L	6			6691	13/15	CN151/CN140	B175						

‡ Data not substantiated.

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MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
R. C. A.—Continued																
221	Vol.	19	TRP603				6571	1	RS215					58, 2A7, 2B7, 2A5, 80.	370	1
	Tone	34	L.	6			6703	1/13	CN155							
							3796	15	TS105							
222	Vol.	19	TRP603				6571	1	RS215					58, 2A7, 2B7, 2A5, 80.	175	1
	Tone	34	L.	6			6691	13/15	CN151/CN140	B175						
223	Vol.	19	TRP607				6859	13/15	CN150/CN141	B176	24	F273	C21	6D6, 6A7, 6B7, 38, 84	175	10
	Tone	34	L.													
224, 224E	Vol.	19	TRP603				7790	1	RS215					6D6, 6A7, 6B7, 41, 80	460	1
	Tone	34	L.				4428	1	RS213							
							7589	13	CN150							
							4525	15	TS101							
225	Vol.	19	TRP603	6			7790	1	RS215					6A7, 6D6, 6B7, 41, 80	460	1
							5101	1/14	RN245							
226	Vol.	19	TRP603				7790	1	RS215					6D6, 6A7, 6B7, 42, 80	460	1
	Tone	44	L.				4428	1	RS213							
							7589	13/14	CN150							
							4525	15	TS101							
235B	Vol.	45	M.				4498	12	CS133					1C6, 34, 30, 32, 19	460	
	Tone	41	N.													
236B	Vol.	45	M.				4498	12	CS133					1C6, 34, 30, 32, 19	460	
240	Vol.	19	TRP603				6571	1	RS215					58, 2A7, 2B7, 56, 53,		
	Tone	21	O.	6			6609	1	RS216					80.	445	1
							6626	14/15	CS12/TN1111							
240 (Revised)	Vol.	19	TRP603				6889/6609	1	RS216					58, 2A7, 2B7, 56, 53,		
	Tone	21	UC505	6			6626	14/15	CS121/TN111					80.	445	1
241B	Vol.	9	Y50MP				6548	12	CS123					34, 30.	175	
242, 243	Vol.	19	TRP603				7790	1	RS215					6D6, 6A7, 75, 76, 42,		
	Tone	41	O.	6			4626	13/15	RN245	B177				5Z3	460	1
	Sen.	7	UC500				4619	15/13	TS101/TP441							
260, 261	Vol.	100	TRP622				6443	4	RS215					58, 56, 2A5, 80	175	1
	B. Tone	‡	Y200MP				6430	4/13	CN150	B169						
	T. Tone	41	UC505													
	Supp.	7	E.													
262 (Two Types)	Vol.	45	TRP603		RS243		7790	1	RS215					6D6, 6A7, 76, 42, 5Z3.	460	1
	B. Tone	‡	Y200MP				7788	1	RS216							
	T. Tone	34	O.				7833	15/14/								
								19	RN231/TS101	B178						
	Sen.	7	UC500													
262, 263 (1935 Production)	Vol.	19	TRP603				7790	1	RS215					6D6, 6A7, 85, 76, 42,		
	B. Tone	‡	Y200MP				7788	1	RS216					80.	460	1
	T. Tone	34	O.				4831	14/19	CM171							
	Sen.	7	UC500													
280	Vol.	100	TRP622				6571	2	RS215					58, 56, 55, 59, 5Z3	175	1
	B. Tone	‡	Y200MP				[6574	13/14	CN152							
	T. Tone	41	UC505													
	Supp.	7	E.													
281	Vol.	100	TRP622				7790	1	RS215					6D6, 6A7, 85, 76, 42,		
	B. Tone	‡	Y200MP				7788	1	RS216					5Z3	460	1
	T. Tone	41	UC505				7789	13/14/	RN241/							
								19	TS106	B179						
	Supp.	7	UC500													
300	Vol.	7	K.	6	EX150		6587	9/15	See Note	B180				78, 77, 38, 25Z5		
	Phono.	64	E12													
301	Vol.	7	E.	6			6661	1/15	UR189	B84				6A7, 6F7, 41, 1V	460	‡
	Phono.	16	O.				6832	13	CS121							
310	Vol.	7	D.	6	1		7590	1	RS215					58, 2A7, 57, 2A5, 80	175	1
	Tone	34	L.				7589	1/14	CN150							
	Phono.	63	E12	8	See Note A66											
Duo 320, Duo 321	Vol.	19	TRP603				6571	1	RS215					58, 2A7, 2B7, 2A5, 80.	370	1
	Tone	34	L.	6			6703	1/13	CN155							
	Phono.	‡	Order from	Mfr.			3796	15	TS105							
322, Duo 322, 322E, Duo 322E	Vol.	19	TRP603				7790	1	RS215					6D6, 6A7, 6B7, 41, 80	460	1
	Tone	34	L.				4428	1	RS213							
	Phono.	‡	Order from	Mfr.			7589	13	CN150							
							4525	15	TS101							
327	Vol.	19	TRP603				6986	24	RM257	B11				6D6, 6A7, 75, 41	370	
	Tone	44	L.	6			6985	13	RN231							
	Phono.	‡	Order from	Mfr.			3796	15	TS105							
330, 331	Vol.	19	TRP607				7590	25	RS215					58, 2A7, 55, 56, 80, 53.	175	1
	Tone	21	N.	6			6555	25/13	CN151							
	Phono.	63	TRP609	6			3536	15	TN113							
340, 340E	Vol.	19	TRP603				6571	1	RS215					58, 2A7, 2B7, 56, 53,		
	Tone	21	O.				6609	1	RS216					80.	445	1
	Phono.	‡	Order from	Mfr.			6626	13/15	CS121/TN111							
340, 340E "All Wave Duo"	Vol.	19	TRP603				6609/6889	1	RS216					58, 2A7, 2B7, 56, 53,		
	Tone	21	UC505				6626	13/15	CS121/TN111					80.	445	1
	Phono.	‡	Order from	Mfr.												
341, 342	Vol.	19	TRP603				7790	1	RS215					6D6, 6A7, 75, 76, 42,		
	Tone	41	O.	6			4626	13/15	RN245	B177				5Z3	460	1
	Sen.	7	UC500				4619	15	TS101/TP441							
	Phono.	‡	Order from	Mfr.												
Duo 380, Duo380 HR	Vol.	100	TRP622	6			6571	2	RS215					58, 56, 55, 59, 5Z3	175	1
	T. Tone	41	UC505				6574	13/14	CN152							
	B. Tone	‡	Y200MP				6797	15	TS101							
	Supp.	7	E.													
	Phono.	‡	Order from	Mfr.												
Duo 381	Vol.	100	TRP622				7790	1	RS215					6D6, 6A7, 76, 85, 42,		
	T. Tone	41	UC505		See Note A69		7788	1	RS216					5Z3	460	1
	B. Tone	‡	Y200MP				7789	13/19	RN241/TS106	B179						
	Supp.	7	UC500													
ER-1240-A2	Vol.	7	SRP134				10	4	RS215					35, 27, 24A, 45, 80,		
	Tone	41	N.				4	4	RS211					81, 50	175	1
	Mike	‡	V.													
AR-4229	Vol.	18	SRP251	6			4-4	1	CN150	B169	24	273		78, 6A7, 6B7, 41	175	10
							6492	13	See Note	B125						
							3536	15	TN113							
23590-2	Vol.	9	A5MP	6			6728	25/15	UR189	B172				78, 6A7, 77, 43, 12Z3.	175	
RADIO ELECTRIC SERVICE	(Resco)															
Resco 3	Vol.	12	K12											34, 30		
Resco SW5 (AC)	Vol.	16	N.				8-8	2	See Note	B3				58, 56, 80		1
	Regen.	12	K12													
R. P. C. (Radio Products Corp.)																
L5	Vol.	18	N.	6			P474	32	RS211					6F5, 6F6, 6H6, 6K7,		
	Tone	34	L.				P160	32	CN151	B81				6L7, 5Z4	456	1
							P304	15	TS101							
L6	Vol.	18	N.	6			P474	32	RS211					6C5, 6F6, 6K7, 6L7,		
	Tone	44	L.				P160	32	CN151	B81				6Q7, 5Z4	456	1
							P304	15	TS101							

‡ Data not substantiated.

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MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
R. P. C.—Continued																
L7	Vol.	45	N	7			P391	1	RN232	B90	14	245C	C3	1C6, 19, 30, 34	456	10
	Tone		L				.01-.01		Buffer	B14						
U6	Vol.	17	UC514	6			8-6	4	CM172	B3	35	294	C3	6D6, 6A7, 75, 6F6, 84	175	10
	Tone	22	Order from	Mfr.			5	15	TS105							
							.0075		Buffer	B14						
Z4	Vol.	45	SRP275	7			P391	1	RN232	B90	14	245C	C3	1C6, 19, 30, 32, 34	456	10
	Tone	44	L				.01-.01		Buffer	B14						
Z5	Vol.	45	SRP275	7			P958	1	RN232	B90	14	245C	C3	1C6, 19, 30, 32, 34	456	10
	Tone	44	L				.01-.01		Buffer	B14						
RADIO RECEPTOR CO.																
AR3	Vol.	7	SRP134											24A, 27	175	
"C" Announcer	Vol.	16	N				8-8	4	RS213	B3				27, 47, 80		1
Ser. 70 Power Amp.	Vol.	16	L				8-8-8-8	3	See Note	B3				56, 2A5, 80		1
Ser. 150 Power Amp.	Vol.	16	L				8-8-3-8	3	See Note	B3				56, 2A3, 82		12
RADIO TRADING CO.																
S307 Doerle Band-Spread	Vol.	12	K12											57, 2A5		
308 "19" Twinplex	Reg.	11	K12											19		
	Fil.	29	T													
2115 "53" Twinplex	Vol.	16	M											53		
	Regen.	11	Y25MP													
2177 Doerle 3 Tube (AC)	Vol.	7	J											78 or 58, 77 or 57, 37 or 57		
RADIOTROPE (Also see U. S. Radio and Television)																
G Console	Vol.	6	F7	6			8-8-8	28	RS213	B66				24A, 27, 45, 80		1
	Tone	41	N													
R Console	Vol.	7	UC501				8-8-8	28	RS213	B66				24A, 27, 45, 80		1
	Tone	41	N													
S2 (Two Types)	Vol.	8	A400P				1-3-1	3	See Note	B1				24A, 27, 45, 80		3
	Tone	41	N													
27R (Early & Late)	Vol.	8	UC500		See Note	A27	8-8	1	RS213	B66				24A, 27, 45, 80		1
	Vol.	6	F7		See Note	A4										
62, 64	Vol.	6	F7				8-8-8	28	RS213	B66				24A, 27, 45, 80		1
	Tone	41	N													
70R	Vol.	15	O				2803	1	CS133					35, 27, 47, 80	262	3
	Tone	44	UC502				2719	13	CS123							
							2852	14	CS123							
71R, 72R, 73R	Vol.	15	O				2803	1	CS133					35, 27, 47, 80	262	3
	Tone	34	UC502				2852	17	CS123							
74R (First Type)	Vol.	6	F7				8-8	1	RS213	B66				24A, 45, 80		1
74R (Second Type)	Vol.	6	F7				8-8	1	RS213	B66				24A, 47, 80		1
RADOLEK																
Marvelo & Monroe "6-7-8-9"	Vol.	10	D12				2-1-1-2-1	3	See Note	B1				26, 27, 71A, 80		11
Marvelo 30, SR222, Monroe	Vol.	8	A5MP				4-4-2	3	See Note	B1				35, 56, 47, 80		3
SR223 Marvelo & Monroe (Trio Tone Dynamic)	Vol.	12	A5MP				2-3-2-2	3	See Note	B1				35, 56, 47, 80		3
SR224 Little Leader	Vol.	6	E7		4		4-4	1	CN150	B3				24A, 47, 80		1
SR225 Marvelo "6" Midget	Vol.	12	A5MP				4-4-4	3	CM173	B3				35, 56, 47, 80		3
	Tone	22	G12													
SR227 Batt. Super	Vol.	62	N											34, 30	456	
	Tone	22	UC502													
SR228 Marvelo	Vol.	8	F				8-8	1	See Note	B3				35, 24A, 47, 80	175	1
	Tone	22	K12													
SR229 10 Tube Super	Vol.	6	G12				10-10	1	See Note	B3				56, 57, 58, 47, 80	175	1
	Tone	22	K12													
SR230 (1933—12 Tube Super)	Vol.	45	Z12				8-8-4	3	See Note	B3				58, 56, 57, 46, 82	175	3
	Tone	41	UC502				8	19	TS106							
	Supp.	12	E12													
SR231 "1933" Compact 5 Tube	Vol.	6	G7		2		8-4	25	CM171					57, 58, 55, 47, 80	‡	1
SR232 "Little Master"	Vol.	7	G		2		8-4	4	CM171	B3				58, 57, 47, 80		1
SR233 (1933—12 Tube Super)	Vol.	16	N				8-8-8	3	CN155	B3				56, 57, 58, 47, 80	‡	3
	Tone	22	K12				4	15	TS105							
SR234 (1933—10 Tube Super)	Vol.	15	N				8-8-8	3	CN155	B3				56, 58, 55, 47, 80	‡	3
	Tone	44	K12													
	Supp.	12	G12													
SR235 (1933—5 Tube Super)	Vol.	17	N				8-8	1	CN152	B3				57, 58, 55, 47, 80	‡	1
SR236 Marvelo (1932 9 Tube)	Vol.	62	N				12-8	34	See Note	B3				35, 24A, 27, 47, 80	‡	1
	Tone	22	K12													
SR237 DeLuxe 5 Tube	Vol.	6	G7		2		8-4	4	CM171	B3				57, 58, 47, 80	‡	1
	Tone	22	K12													
SR243 "1933" 7 Tube Super	Vol.	56	N				8-8	1	CN152	B3				56, 57, 58, 55, 47, 80	‡	1
	Tone	22	K12													
SR248 Monroe	Vol.	10	D12				1-2-1-1-2	3	See Note	B1				26, 27, 71A, 80		11
SR249 Marvelo	Vol.	1	D12				‡	‡	See Note	B4				26, 27, 50, 80		1/11
	Tone	22	G12													
SR270 (1934) 15 Watt Amp. (AC)	Vol.	16	M				8-8-8	30	RS213	B66				57, 56, 2A3, 5Z3		1
	Tone	41	M				10	15	TS101							
SR271 (1934—30 Watt Amp.)	Vol.	16	M				8-8-8	30	See Note	B3				57, 56, 2A3, 5Z3		1
	Tone	41	M				10	15	TS101							
SR274 (1934) 15 Watt Amp. (DC)	Vol.	16	M				8-8	24	RS213	B66				39, 37, 2A3		
							10	15	TS101							
SR280 (3 Watt Amp.)	Vol.	16	M				8-8	1	RS213	B66				57, 2A5, 80		1
	Phono.	16	K12				10	15	TS101							
SR287 Octomatic	Vol.	17	M				8-8	1	See Note	B3				58, 2A7, 2A6, 2A5, 80	‡	1
	Tone	22	K12				10	20	TS101							
							25	15	TS103							
951	Vol.	6	H7	6	2		9412	11	UR182	B31				6A7, 78, 75, 43, 25Z5	265	
956, 958	Vol.	17	M	6			9659	1	CN152	B3				57, 58, 2A6, 2A5, 80	465	1
	Tone	22	K12				3876	15	TS101							

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS Use	Circuit	Correct Replacement	Switch	Bias	*Note	CONDENSERS Original Part	Circuit	Correct Replacement	*Note	VIBRATORS Vibr. Conn.	Replacement	*Note	Types of Tubes Used	I. F. Peak	Trans. Circuit
RADIOLEK—Continued																
10951	Vol.	6	H7	6	2		9442	11	UR182	B31				6A7, 78, 75, 43, 25Z5	262	
10953	Vol.	7	K		EX150		7-4	1	CN151					58, 57, 2A5, 80		1
							5	15	TS101							
10956	Vol.	17	M	6			9659	1	CN152	B3				57, 58, 2A6, 2A5, 80	465	1
	Tone	22	K12				8876	15	TS101							
10962	Vol.	6	G7		2		4-4	4	See Note	B3				78, 77, 42, 80		1
	Tone	22	L													
10963, 10964	Vol.	15	M				4-4	4	See Note	B3				6A7, 78, 75, 42, 80	465	1
	Tone	22	L				5	19	TS105							
							5	15	TS101							
10966	Vol.	6	G7		2		4-4	4	See Note	B3				6D6, 6C6, 42, 80		1
							5	19	TS105							
							5	15	TS101							
10967	Vol.	6	L		EX400		20-4-5-5	6/15	UR189	B98				78, 44, 43, 25Z5	456	
10968 (32 Volt)	Vol.	15	M				6-10	1	CN152	B3	34	F292	C3	6A7, 78, 75, 42, 84	456	10
	Tone	22	L				5-5	15	TN110							
							.05-.05		Buffer	B14						
10969	Vol.	54	M				5	19	TS105					1A6, 34, 32, 30, 19	456	
	Tone	22	L													
10970	Vol.	17	N				4-8-4	26	CM175	B3				78, 37, 85, 42, 80	456	1
	Tone	41	L													
K16700	Vol.	6	H12	6			20-12	27	UR182	B115				6D6, 6C6, 25A7		
K16701	Vol.	18	N	6			20-12	27	UR182	B115				6A7, 6D6, 75, 25A7	456	
K16702	Vol.	18	N	7			8-8	1	See Note	B3	48	See Note	C8	1C6, 1A4, 75, 30, 19	456	10
							.005		Buffer	B14						
K16703	Vol.	18	N	7			8-8	1	See Note	B3	48	See Note	C8	1C6, 34, 30, 19	456	10
							.005		Buffer	B14						
K16705	Vol.	17	N	6			311	27	CN145	B8				6A7, 6D6, 75, 43,		
							312	27	CS125					25Z5	456	
K16706	Vol.	18	N	‡			10-10-4	1/15	CN151/TS101	B3				6A7, 6D6, 76, 42, 80	456	1
	Tone	22	L													
K16722	Vol.	17	N				8-8	4	CM172	B3				6A7, 6K7, 76, 6F5,		
	Tone	34	L				5	15	TS105					42, 80	456	1
K16725	Vol.	45	N				4-8	1	CN151	B3				6K7, 6A8, 6D6, 76,		
	Tone	22	N				5	15	TS105					6B5, 80	456	1
K16728	Vol.	17	N				20-4-5-5	6/15	UR189	B98				6A7, 6K7, 75, 43,		
	Tone	22	L											25Z5	456	
K16740	Vol.	17	N	6			P337	6	CN145	B124				6A7, 6D6, 75, 43,		
							P304	15	TS105					25Z5	456	
K16743	Vol.	45	SRP275	7			P958	1	RN232	B90	14	245C	C3	1C6, 34, 30, 32, 19	456	10
	Tone	44	L				.01-.01		Buffer	B14						
K16746	Vol.	18	N	7			P958	1	RN232	B90	14	245C	C3	1C6, 34, 30, 19	456	10
	Tone	22	O				.01-.01		Buffer	B14						
K16747	Vol.	18	N	6			P950	1	CN151	B3				6A8, 6K7, 6Q7, 6F6,		
	Tone	34	L											5W4	456	1
K16748	Vol.	18	N	6			P160	1	CN151					6A7, 6D6, 75, 42, 80	456	1
K16749	Vol.	18	N	7			P958	1	RN232	B90	48	See Note	C8	1C6, 34, 1B5, 1F4	456	10
K16751	Vol.	17	N	6			8	3	WE847					6K7, 6A8, 6Q7, 6L6,		
	Tone	22	O				4-8	3	CN151	B181				6G5, 5W4G	456	1
							4	13	CS131							
							5	15	TS101							
K16753	Vol.	15	O	6			Tuner Section							6K7, 6A8, 6H6, 6C5,		
	Tone	22	L				P1156	3	WE3540					6G5, 5W4, 85, 6D6,		
							P1158	14	WE3540					42, 45, 80, 83V	456	1/‡
							P1155	3	CS135							
							P1043	13	CS131							
							P304	15	TS101							
							Amplifier Section									
							P1156	2	WE3540							
							P950	13	CN151							
							P1208	‡	See Note	B125						
							P304	15	TS101							
K16756	Vol.	18	N	6			P950	1	CN151	B81						
	Tone	34	‡		See Note	A5								6A8, 6K7, 6H6, 6F5,		
K16759	Vol.	17	N	6			8	3	WE847					6F6, 5W4	456	1
	Tone	22	O				4-8	3	CN151	B181				6K7, 6A8, 6Q7, 6L6,		
							5	15	TS105					5W4, 6G5	456	1
K16772	Vol.	18	N				1477	25	RS215	B3						
	Tone	44	K12	6			1476	25	RS216					6A7, 6K7, 75, 6C5,		
K16773	Vol.	18	N											6F6, 80, 6G5	465	1
	Tone	22	L	6										6A7, 6D6, 75, 76, 48	465	1
K16777	Vol.	20	500M No. 1		See Note	A19	3167	25	RN245	B8				6K7, 6L7, 6J7, 6H6,		
	Tone	22	K12	6			1476	25	RS216					6C5, 6F6, 5Z3, 6E5	465	1
							3170	19	TS106							
							1110	13	CS131							
							8876	15	TS105							
K16780	Vol.	45	750M No. 1		See Note	A19	3060	1	CN152		48	See Note	C8	15, 6A7, 76, 19, 6E5	465	10
	Tone	44	K12	6			3159	13	CS121							
							8876	15	TS105							
K16790	Vol.	18	N	6			8-8	23	RM262	B50				6C6, 6D6, 75, 42, 80	465	1
K16825	Vol.	17	UC514	6			P795	4	CM172		25	294	C3	6D6, 6A7, 6K7, 75,		
	Tone	22	Order from	Mfr.			G864	15	TS101					6F6, 84	175	10
							.0075		Buffer	B14						
RELIANCE																
L5	Vol.	18	N	6			P474	32	RS211							
	Tone	34	L				P160	32	CN151	B81				6F5, 6F6, 6H6, 6K7,		
							P304	15	TS101					6L7, 5Z4	456	1
L6	Vol.	18	N	6			P474	32	RS211							
	Tone	44	L				P160	32	CN151	B81				6C5, 6F6, 6K7, 6L7,		
							P304	15	TS101					6Q7, 5Z4	456	1
L7	Vol.	45	N	7			P391	1	RN232	B90	14	245C	C3	1C6, 19, 30, 34	456	10
	Tone		L				.01-.01		Buffer	B14						
Z4	Vol.	45	SRP275				P391	1	RN232	B90	14	245C	C3	1C6, 19, 30, 32, 34	456	10
	Tone	44	L				.01-.01		Buffer	B14						
Z5	Vol.	45	SRP275	7			P958	1	RN232	B90	14	245C	C3	1C6, 30, 19, 32, 34	456	10
	Tone	44	L				.01-.01		Buffer	B14						
REMLER																
10	Vol.	58	H				8-8	4	See Note	B3				35, 24A, 27, 47, 80	180	1
10-3 "Cameo"	Vol.	6	H12	6	EX300		8-8	4	See Note	B3				27, 58, 57, 47, 80	250	1
	Tone	22	H12													
10-3 "Cameo" (With 2A5 Output)	Vol.	6	H12	6			8-8	4	See Note	B3				27, 58, 57, 2A5, 80	250	1
	Tone	22	Y													
10-4	Vol.	76	N	6			8-8	4	See Note	B3				6A7, 78, 6B7, 42, 80	450	1
	Tone	76	N													
11	Vol.	6	Y		EX400		8-4-2	3	MN275					24A, 47, 80		3
	Tone	34	H12													
14	Vol.	6	Y		EX400		8-4-2	3	MN275					24A, 27, 45, 80		3
	Tone	34	H12													

‡ Data not substantiated.

*** IMPORTANT: Read Notes in Note Section if specified in Note Column.**

MANUFACTURER AND MODEL	CONTROLS: Use	Circuit	Correct Replacement	Switch	Bias	*Note	CONDENSERS: Original Part	Circuit	Correct Replacement	*Note	VIBRATORS: Vibr. Conn.	Replacement	*Note	Types of Tubes Used	I. F. Peak	Trans. Circuit
REMLER—Continued																
15	Vol.	58	H		3		8-8	4	See Note	B3				51, 24A, 27, 47, 80	180	1
15-3	Vol.	13	N				8-8	4	RS213	B66				56, 58, 57, 47, 82	180	3
	Tone	22	H12	6			4	13	CS131							
	Supp.	12	N													
17	Vol.	6	Y				8-42	1/17	MN275					24A, 27, 45, 80	180	3
	Tone	34	H12													
19	Vol.	15	N				8-6-8	3	MN275					35, 24A, 27, 47, 80	180	‡
	Tone	44	Y													
	Sen.	7	H													
21 Minuette	Vol.	6	H7	6	3		8-8	4	See Note	B3				35, 24A, 47, 80		1
21-3	Vol.	14	N				8-4	4	CM171	B3				57, 47, 82	250	1
	Tone	22	Y													
21-4	Vol.	18	N	6			8-8	4	CM172	B3				2A7, 58, 2B7, 2A5, 80	450	1
	Tone	76	‡		See Note A5											
26 (First Type) "Scotty"	Vol.	6	H12	6			8-8	1	CN142	B3				77, 78, 43, 25Z5	450	
							10	15	TS101							
26 (Above 54760) "Scotty"	Vol.	6	H12	6			8-8	6	CN142	B3				6A7, 78, 77, 43, 25Z5	450	
							10	15	TS101							
27 "Scotty"	Vol.	17	N	6			8-8	1	CN152	B3	34	292		6A7, 78, 6B7, 89, 1V,		
							10	15	TS101					84	465	10
29	Vol.	12	N											22, 01A, 12	‡	
	Bias	9	X													
	Fil.	29	R	6												
30	Vol.	6	H12	6			4-4	1	CN150	B3				6A7, 6F7, 41, 84	450	25
35 Auto	Vol.	18	500M No. 1		See Note A1		8-4	1	CN151	B3	34	292		6A7, 78, 75, 41, 84	450	10
	Tone	22	‡		See Note A5		10-10	15	TN111							
36 Auto Radio	Vol.	18	N	6			4-4	4	CM160					6D6, 6A7, 75, 76, 41	250	
							8	14	CS123							
40	Vol.	6	H1	6			4-4	1	CN150	B3				6A7, 6F7, 41, 84	450	25
42 (Above 53968)	Vol.	18	N	6			8-8	4	CM172	B3				6D6, 6A7, 75, 42, 80	450	1
53 (Above 54862)	Vol.	6	H12	6			8-4	1	CN151	B3				6A7, 6D6, 53, 42, 80	450	1
53C (Above 56208)	Vol.	6	H12	6			8-4	1	CN151	B3				6A7, 6D6, 76, 42, 80	450	1
REPUBLIC INDUSTRIES																
Sky Hawk Patrician	Vol.	6	G12	6			965	8	UR182	B3				78, 77, 43, 25Z5	175	
							928	15	TS102							
MS & Jr.	Vol.	6	G12				4-4	4	See Note	B3				57, 58, 47, 80	175	1
RC5, RC6 "Sky-hawk"	Vol.	18	N				4-4-4-8-8-4	‡	See Note	B3				78, 6A7, 75, 42, 25Z5	175	
	Tone	76	M													
SL5D "Skyhawk"	Vol.	76	N	6			496	4	See Note	B3				6A7, 78, 75, 42, 80	175	1
	Tone	76	M				928	19	TS102							
SL6 "Skyhawk"	Vol.	6	G12	6			1085	8	UR182	B3				77, 78, 43, 25Z5	115	
	Tone	22	M				928	15	TS102							
SL6D "Skyhawk"	Vol.	18	N	6			1085	8	UR182	B3				78, 6A7, 75, 43, 25Z5	175	
	Tone	21	M													
BP5E	Vol.	6	G12	6			4-10-4	8	UR182	B182				77, 78, 43, 25Z5	115	
							25	15	TS103							
CS6	Vol.	17	N	6			4-4	4	See Note	B3				77, 78, 75, 42, 80	115	1
	Tone	21	M				25	19	TS103							
TL6C	Vol.	17	N				4-4	4	See Note	B3				78, 6A7, 75, 42, 80	175	1
	Tone	21	M				25	19	TS103							
TR5B	Vol.	17	N	6			8-4	25	See Note	B3				6A7, 78, 75, 42, 80	175	1
							25	19	TS103							
RK RADIO LABORATORIES																
4 Tube B'cast & Long Wave	Vol.	6	SRP263	6	EX500		12-8-5	6/15	CN145/TS105					6D6, 6C6, 43, 25Z5		
RKP4 (AC-DC)	Vol.	6	SRP263		EX500		12-8-5	6/15	CN145/TS105					6D6, 6C6, 43, 25Z5		
RKS5 Radio Keg	Vol.	6	G7	6	3		12-8-5	6/15	CN145/TS105					6C6, 6D6, 85, 43,		
														25Z5	175	
RK60G	Vol.	15	N				8-8	1	CN152					2A7, 58, 55, 56, 2B6,		
														80	175	3
RK60L	Vol.	17	N	6			8-8	1	CN152					2A7, 58, 55, 56, 2B6,		
														80	115	3
421, 422, 423, 424	Vol.	6	SRP263				25-10	27	UR182	B115				6D6, 6C6, 43, 25Z5		
425, 426, 427, 428	Vol.	6	SRP263		EX500		4-4	1	CN150					6D6, 6C6, 42, 80		1
521, 522	Vol.	18	N				25-10-5	27/15	UR182	B95				6A7, 6D6, 75, 43,		
														25Z5	465	
534	Vol.	18	N				8-8	4	CM172	B3				6A7, 6D6, 75, 42, 80	465	1
	Tone	22	G12													
631, 633	Vol.	18	N				8-8	4	CM172	B3				6A7, 6D6, 75, 42, 80	465	1
	Tone	22	G12													
ROCKE INTERNATIONAL																
Arlab 51	Vol.	56	N				8-8	1	See Note	B3				56, 58, 55, 2A5, 80	‡	1
							25	15	TS103							
ROOTS AUTO RADIO																
55	Vol.	18	250M No. 1		See Note A1		10-10	15	TN111					78, 6A7, 85, 41, 79	‡	
ROYAL																
9A	Vol.	7	J				4-4	6	CN140	B3				78, 77, 43, 25Z5		
							5	15	TS101							
SARGENT																
20	Vol.	15	N	6			8-8-8	7	RS213	B66				6D6, 6C6, 76, 42, 80	525	1
	Sen.	12	K12													
SAVIL RADIO ENGINEERING																
557	Vol.	6	G7		2		4-4	4	See Note	B3				58, 57, 47, 80		1
	Tone	34	M													
589	Vol.	7	G7		2									39, 36, 89		
	Tone	34	M													
715	Vol.	6	G7		2		4-8	4	See Note	B3				57, 56, 58, 47, 80	‡	1
E. H. SCOTT RADIO LAB.																
"All Wave Super" 145 Pwr.	Vol.	12	L				8-8-8	3	RS213	B66				24A, 27, 45, 80	470	3
"Worlds Record" SG-AC 10	Vol.	7	Z											27, 22, 45, 80	‡	
1933 DeLuxe AVC Super	Vol.	20	500M No. 1		See Note A19		8-8-8	3	WE847	B3				58, 57, Wunderlich,		
	Tone	22	‡		See Note A5									56, 45, 80	‡	3
SEARS-ROEBUCK CO. "Silvertone" (Also see Colonial).																
FF	Vol.	4	G12				‡	‡	See Note	B1				26, 27, 12A		11
J	Vol.	4	G12				3-2	1	See Note	B1				26, 27, 71A		11
9 Tube Super AVC	Vol.	14	N				7051	34	RS213					35, 24, 27, 47, 80	175	1
	Tone	44	K12				7078	34	RS215							

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
SEARS-ROEBUCK—Continued																
36	Hum.	66	SRP266				8	1	RS213					24, 45, 80		3
36P	Hum.	66	SRP266				D4758P	1	RS213					35, 24A, 45, 80		3
37							5734A	4	RS216					35, 24A, 45, 80		3
37P							16	4	RS216					35, 24A, 45, 80		3
39-125							4758P	4	RS213					35, 24A, 45, 80		1
41, 41P, 42							5734A	4	RS216					24A, 45, 80		1
44	Vol.	6	H7		1		4758	4	RS213					35, 24A, 27, 47, 80	175	1
47, 48	Vol.	6	H7		2		4758	4	RS213					35, 24A, 47, 27, 80	175	3
49, 50	Vol.	‡	G12				1-2-1-1	3/13	See Note	B1				26, 27, 71A, 80		11
50 AVC	Vol.	7	H				4758P	4	RS213					35, 24A, 27, 47, 80	175	7
52	Vol.	6	G7				1-2-1-2	3/14	See Note	B1				27, 45, 80		3
53, 54 (Factory Model 94)	Vol.	6	G7				1-2-1-2	3/14	See Note	B1				27, 45, 80		3
56	Vol.	6	G12				1-2-1-2	3/14	See Note	B1				24A, 27, 45, 80		3
62	Vol.	6	H7	6			8	25	RS213					57, 58, 24A, 47, 80	175	3
	Tone	57	N				4	13	See Note	B3						
65, 69	Tone	34	N				8	12	See Note	B3				30, 32, 33, Ballast No. 31	175	
							20	19	TS102							
94, 95, 99	Vol.	6	G7				1-2-1-2	3/14	See Note	B1				27, 45, 80		3
100	Vol.	6	G12				1-2-1-2	3/14	See Note	B1				24A, 27, 45, 80		3
107HA62	Vol.	18	UC512				8-8	1	RN242	B3	19	249	C3	6D6, 6L7, 76, 75, 6B5.	465	10
	Tone	22	L				.005		Buffer	B14						
108	Vol.	6	G12				2-2-2-2-2	3/14	See Note	B1				27, 26, 71A, 80		11
109	Vol.	6	G12				8-8-8	46	MN275					24A, 27, 45, 80		3
110	Vol.	71	‡		See Note A5		8-8-8	46	MN275					27, 45, 80		3
111, 112	Vol.	6	H12				8-8-8	46	MN275					24A, 27, 45, 80		3
114	Hum.	66	SRP266				8	1	RS213					24A, 45, 80		3
218	Vol.	6	‡		See Note A5		8-8-8	46	MN275					24A, 27, 45, 80		3
566	Vol.	18	UC512	6			119-20	4	CM171	B93	35	294	C3	6A8, 6K7, 75, 41, 84-6Z4	465	10
							.01		Buffer	B14						
666	Vol.	18	UC512				119-21	1	CN151	B92	35	294	C3	6K7, 6A8, 6Q7, 6N6, 84-6X5	465	10
							.01		Buffer	B14						
1130	Vol.	6	G12				15-5	2	MN273					24A, 27, 45, 80		3
1150	Hum.	66	SRP266				D4758P	1	RS213					24A, 45, 80		3
1152							R5734A	4	RS216					24A, 45, 80		1
1170	Hum.	66	SRP266				D4758P	1	RS213					24A, 45, 80		3
1250							R4758P	4	RS213					24A, 45, 80		1
1252							4758A	4	RS213					24A, or 35, 47, 80		1
							4758P	4	RS213							
1260	Hum.	66	SRP266				D4758P	1	RS213					24A, 45, 80		3
1280, 1282	Vol.	6	L				8-16	31	See Note	B3				24A, 27, 45, 80	175	1
	Tone	22	K12													
1310, 1312							R5734A	4	RS216					35 or 24A, 45, 80		3
1320, 1322, 1324	Vol.	6	H7		1		4758A	4	RS213					35, 24A, 47, 27, 80	175	3
							4758P	4	RS213							
1370	Vol.	7	H				R6122	4	RS213					35, 24A, 47, 80		1
1370, 1371 /W/ Tap Field	Vol.	7	F				8-8	4	See Note	B3				24A, 35, 47, 80		1
1386	Vol.	6	H7		1		4758	4	RS213					35, 24A, 47, 27, 80	175	3
1390, 1400, 1402, 1404, 1406	Vol.	6	H7		1		4758	4	RS213					24A, 35, 47, 27, 80	175	3
1420							5734A	1	RS216					24A or 35, 45, 80		1
1430	Vol.	7	H				4758	4	RS213					24A, 27, 35, 47, 80	175	7
1450	Vol.	6	H7		1		4758	4	RS213					35, 24A, 47, 27, 80	175	3
1462	Tone	21	N				4758	25	RS213					35, 24A, 47, 27, 80	175	3
1480, 1482, 1484	Vol.	7	H				4758	23	RS213					35, 24A, 27, 47, 80	175	3
	Tone	57	N													
1506	Vol.	8	E		2		1-1-1	26	See Note	B1				51, 24A, 47, 80	175	1
1510	Vol.	7	H				4758	4	RS213					27, 35, 24A, 47, 80	175	7
1512X, 1520, 1522, 1522X	Vol.	109	N				7078	4	RS215					27, 35, 24A, 47, 80	175	1
	Tone	22	K12				7051	4	RS213							
1560, 1562, 1564	Vol.	15	N				8	12	CS123					30, 32, 33	175	
	Tone	57	N				5	17	TS101							
1570, 1572, 1574	Tone	22	N				8	12	See Note	B3				30, 32, 33	175	
							20	19	TS102							
1580, 1582, 1584, 1586	Vol.	6	H12				8-8	25	RS213	B66				57, 58, 24A, 47, 56, 80.	175	3
	Tone	57	N				4	13	See Note	B3						
1590, 1592	Vol.	6	H12				4758P	23	RS213					57, 58, 24A, 47, 80	175	1
	Tone	57	N													
1600							4-4	1	See Note	B3				24A, 27, 80	1000	1
1620, 1622	Vol.	29	U	6										30, 32 or 34, 33		
1626	Vol.	15	N				8876	15	TS105					39, 36, 85, 41	175	
1630	Vol.	6	H12				7236	23	RS215					57, 58, 46, 56, 80	175	3
	Tone	57	N				4958	23	RS213							
1640	Tone	22	UC506				8-8	34	WE847	B66				57, 58, 46, 83	175	7
	Phantom	7	W													
1650	Vol.	15	O				8-8	23	RS213	B66				58, 56, 27, 47, 80	175	3
	Tone	57	N													
1652, 1654	Vol.	15	O				14	‡	WE1647					58, 56, 27, 46, 80	175	3
	Tone	57	N				8	‡	WE847							
1660	Vol.	6	H12				8-8	23	RS213	B66				39, 36, 89, 80	175	1
1670 (Early)	Vol.	15	O				8-8	23	RS213	B66				58, 56, 27, 47, 80	175	3
	Tone	57	N													
1670 (Late) "B"	Vol.	15	O				8-8	23	RS213	B66				58, 56, 27, 47, 24A, 80.	175	3
	Tone	57	N													
1700	Vol.	68	D12	6			9150	29	CM165	B51				6A7, 6B7, 77, 43, 25Z5	175	
							5	15	TS101							
1703	Vol.	6	UC509	6	EX300		R8313	23	CM161					78, 77, 43, 1V		
1704	Vol.	56	N	6			R8431	4	CM162					6A7, 78, 6B7, 43, 1V.	480	
1705	Vol.	19	TRP609	6			R8624	23	RS213					6A7, 78, 41, 85, 84	175	1
	Tone	57	O													
	Sen.	7	A550P		‡											
1706, 1707	Vol.	18	N	6			R8488	23	RS213					41, 75, 78, 6A7, 84	480	1
1708, 1709	Vol.	18	N				R7236	23	RS215					78, 6A7, 75, 45, 37, 80.	175	3
	Tone	57	N				R8488	23	RS213							
	Sen.	7	UC500													
1708A	Vol.	62	N				R8488	23	RS213					6A7, 78, 37, 42, 83V.	175	1
	Tone	‡	N													
1710	Vol.	29	U				R8389	13/19	CS123/TS102					30, 940, 951, Ballast No. 52	175	
1711	Vol.	29	U				R8357	13/19	CS123/TS102					950, 951, 30, Ballast No. 52	175	
1711A	Vol.	29	U				R8357	13/19	CS123/TS102					951, 30, 950, Ballast No. 52	480	
1712, 1713	Tone	22	N				R8449	12/13/19	CN142/TS104	B183				951, 30, 33, Ballast No. 31	175	
1714	Vol.	15	O				R8707	12/13/19	CN142/TS101	B184				951, 30, 950, Ballast No. 31	175	
	Tone	34	N													

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
SEARS-ROEBUCK—Continued																
1715	Vol.	7/18	DRP317											78, 6A7, 75, 41	175	MG
	Tone	57	N	6												
1720	Vol.	7/18	DRP317				R7236	23	RS215					78, 6A7, 75, 45, 37, 83V	175	3
	Tone	57	N				D4758P	23	RS213							
							R1114	‡	CS131							
1721	Vol.	7/15	DRP317				R7236	4	RS215					78, 37, 2A3, 56, 83V	175	31
	Tone	34	N				R8780	13/14	CN151							
1722	Vol.	7/15	DRP317				R7236	4	RS215					78, 37, 2A3-H, 6B7, 56, 83V	175	31
	Tone	34	N				R8780	13	CN151							
	Hum.	‡	SRP266													
1722 (Revised)	Vol.	7/17	DRP317				R7236	4	RS215					78, 85, 56, 37, 2A3, 6B7, 5Z3	175	31
	Tone	34	N				R8780	13/14	CN151							
	Hum.	‡	SRP266													
1722X	Vol.	7/17	DRP317				R7236	4	RS215					78, 85, 56, 37, 2A3, 6B7, 83V		
	Tone	34	N				R8780	13/14	CN151							
	Hum.	‡	SRP266													
1724	Vol.	6	H12				R9150	29	CM165	B51				78, 77, 43, 25Z5		
	Tone	57	N	6												
1725	Vol.	7/18	DRP317				R7236	23	RS215					78, 75, 37, 45, 6A7, 83V	175	3
	Tone	57	N				D4758P	23	RS213							
							R1114	‡	CS131							
1726X	Vol.	7/17	DRP317				R7236	4	RS215					78, 56, 85, 37, 2A3, 5Z3	175	31
	Tone	34	N				R8780	13/14	CN151							
	Hum.	‡	SRP266			A67										
1728A	Vol.	58	UC509				5-12-5	8	UR182	B3				78, 77, 43, 25Z5		
							10	15	TS101	B6						
1729	Vol.	64	TRP609				D4758P	23	RS213					78, 6A7, 37, 41, 80	175	1
	Tone	22	N	6												
1730	Vol.	56	500M No. 1	6	See No	te A1	R10086	‡	CS131					78, 6A7, 85, 41	175	MG
	Tone	22	N													
1731	Vol.	18	N				8-4	1	CN151	B3				2A7, 58, 2A6, 2A5, 80	456	
1732	Vol.	7/15	DRP317				R7236	4	RS215					78, 37, 2A3-H, 6B7, 56, 83V	175	31
	Tone	34	N				R8780	13	CN151							
	Hum.	‡	SRP266													
1732 (Revised)	Vol.	7/17	DRP317				R7236	4	RS215					78, 56, 85, 37, 2A3, 6B7, 5Z3	175	31
	Tone	34	N				R8780	13	CN151							
	Hum.	‡	SRP266													
1732X	Vol.	7/17	DRP317				R7236	4	RS215					78, 56, 85, 37, 2A3, 6B7, 83V	175	31
	Tone	34	N				R8780	13	CN151							
	Hum.	‡	SRP266													
1733	Vol.	56	N	6			R8451	40	RS213		‡ Or	der from	Mfr.	6A7, 78, 6B7, 38, 1V	480	10
	Tone	107	N													
1743	Vol.	18	N	6			8-4	1	CN151	B3				2A7, 58, 2A6, 80, 2A5	456	1
							10	15	TS101							
1744, 1745	Vol.	29	U				R8357	13/19	CS123/TS102					951, 30, 950, Ballast No. 52	480	
1750	Vol.	56	N	6			R9070	29	RN235	B8				6A7, 78, 6B7, 37, 43, 25Z5	175	
	Tone	22	N				R9071	29	RS205							
							R9072	29	RS205							
1760	Vol.	62	N	6			R4758P	23	RS213					6A7, 78, 37, 42, 83V	480	1
1800	Vol.	6	SRP263	6	EX300		8-4	1	CN151	B3				58, 57, 2A5, 80		1
							10	15	TS101							
1801, 1801A	Vol.	18	N	6			5-16-5	11	RM257	B185				6A7, 78, 75, 43, 25Z5	456	
1802, 1802A, 1803, 1803A	Vol.	18	N	6			8-8	1	RN242					2A7, 58, 2A5, 2A6, 80	445	1
							2	13	CS130	B3						
1804, 1805	Vol.	106	N	6			D4758P	23	RS213					78, 75, 47, 41, 80	480	14
	Tone	106	N				R8488	23	RS213							
1805A	Vol.	106	N				R7236	23	RS215					58, 2A6, 47, 56, 80	175	1
	Tone	106	N				R8488	23	RS213							
1806	Vol.	18	N				R7236	23	RS215					78, 6A7, 75, 37, 47, 80	445	14
	Tone	107	O				R8488	23	RS213							
							R9237	13	CS131							
1807	Vol.	18	N	6			8-8	1	RN242					2A7, 58, 2A6, 2A5, 80	445	1
							2	13	CS130							
1808	Vol.	106	N	6			D4758P	23	RS213					78, 75, 47, 80	480	14
	Tone	106	N				R8488	23	RS213							
1808A	Vol.	106	N				R7236	23	RS215					58, 2A6, 47, 56, 80	175	1
	Tone	106	N				R8488	23	RS213							
1809, 1811	Vol.	106	N				R7236	23	RS215					58, 2A6, 47, 56, 80	175	1
	Tone	106	N	6			R8488	23	RS213							
1820	Vol.	106	N	6			D4758P	23	RS213					78, 75, 47, 41, 80	480	14
	Tone	106	N				R8488	23	RS213							
1821	Vol.	106	N	6			R7236	23	RS215					78, 85, 37, 47, 41, 80	480	14
	Tone	106	N				R8488	23	RS213							
1822	Vol.	106	O				4758P	28	RS213					78, 75, 45, 37, 41, 5Z3	445	32
	Tone	106	O				R9237	13	CS131							
1823	Vol.	18	N				R7236	23	RS215					6A7, 78, 75, 47, 37, 80	445	14
	Tone	107	O				R8488	23	RS213							
							R9237	13	CS131							
1824	Vol.	106	O				D4758P	28	RS213					78, 75, 45, 37, 41, 80	445	32
	Tone	106	O				R9237	13	CS131							
1825	Vol.	106	N	6			R7236	23	RS215					41, 78, 75, 45, 37, 5Z3	480	31
	Tone	106	N				R8488	23	RS213							
							R8217	17	CS130							
1825A	Vol.	106	N	6			R7236	23	RS215					78, 75, 45, 76, 5Z3	175	31
	Tone	106	N				R8488	23	RS213							
1826	Vol.	106	N	6			D4758P	23	RS213					78, 75, 41, 47, 80	480	14
	Tone	106	N				R8488	23	RS213							
1826A	Vol.	106	N				R7236	23	RS215					58, 2A6, 47, 56, 80	175	1
	Tone	106	N				R8488	23	RS213							
1827	Vol.	106	N	6			R7236	23	RS215					78, 85, 37, 47, 41, 80	480	14
	Tone	106	N				R8488	23	RS213							
1828	Vol.	106	N	6			R7236	23	RS215					78, 75, 45, 41, 5Z3	480	31
	Tone	106	N				R8488	23	RS213							
							R8217	13	CS130							
1829	Vol.	18	N				R7236	23	RS215					78, 75, 47, 37, 6A7, 80	445	14
	Tone	107	O				R8488	23	RS213							
							R9237	13	CS131							
1830	Vol.	106	O				D4758P	28	RS213					78, 75, 45, 37, 41, 80	445	32
	Tone	106	O				R9237	13	CS131							
1831	Vol.	106	O				4758P	28	RS213					78, 75, 45, 37, 41, 5Z3	445	32
	Tone	106	O				R9237	13	CS131							
1832	Vol.	106	N	6			R7236	23	RS215					78, 37, 47, 85, 41, 80	480	14
	Tone	106	N				R8488	23	RS213							
1832A	Vol.	106	N	6			R7236	23	RS215					78, 85, 37, 47, 41, 80	445	14
	Tone	106	N				R8488	23	RS213							
1833	Vol.	106	N				R7236	23	RS215					58, 2A6, 47, 56, 80	175	1
	Tone	106	N	6			R8488	23	RS213							
1840	Vol.	106	N	6			R7236	23	RS215					58, 56, 57, 2A5, 80	480	1
	Tone	106	N				R8488	23	RS213							

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS Use	Circuit	Correct Replacement	Switch	Bias	*Note	CONDENSERS Original Part	Circuit	Correct Replacement	*Note	VIBRATORS Vibr. Conn.	Replacement	*Note	Types of Tubes Used	I. F. Peak	Trans. Circuit
SEARS-ROEBUCK—Continued																
1841	Vol.	106	N				R7236	23	RS215					58, 2A6, 47, 56, 80	175	1
	Tone	106	N				R8188	23	RS213							
1845	Vol.	106	N				R7236	23	RS215					58, 56, 2A6, 47, 80	175	1
	Tone	106	N	6			R8488	23	RS213							
1850, 1851	Vol.	29	U				R10673	13/19	CN142/TS104	B183				951, 32, 33, 30, Ballast No. 30	480	
	Tone	34	N													
1852, 1853	Vol.	29	U				R8357	13/19	CS123/TS102					951, 30, 950, Ballast No. 52	480	
1854	Vol.	64	N				R10555	13/19	CN142/TS101	B184				951, 950, 30, Ballast No. 31	175	
	Tone	44	N													
1855	Vol.	56	N				R8488	40	RS213		17	See Note C6		6A7, 78, 6B7, 38, 84	480	10
	Tone	107	N	6												
1857	Tone	34	N	7			R10546	13/19	CN142/TS101	B184				951, 30, 33, Ballast No. 31	175	
1857A	Vol.	68	D12				R11178	13/19	CN142/TS102	B187				951, 32, 33, 30, Ballast No. 31	175	
1858	Vol.	56	500M No. 1		See Note A1		R10086	12	CS131	B3				78, 6A7, 85, 41	175	MG
	Tone	22	N													
1859A	Vol.	17	500M No. 1		See Note A1		1138	1	CN152	B3	24	271		6A7, 6D6, 6B7, 41	370	10
							9328	15	TN110							
1862	Vol.	29	U				R10673	13/19	CN142/TS104	B183				951, 32, 33, 30, Ballast No. 30	480	
	Tone	34	N													
1864	Vol.	17	1 Meg. No. 1		See Note A1		4-12	12/15	CS131/TS102					78, 6A7, 85, 41	175	MG
	Tone	22	N													
1868, 1870	Vol.	29	U				R10673	13/19	CN142/TS104	B183				951, 32, 30, 33, Ballast No. 30	480	
	Tone	34	N													
1904, 1904A, 1906, 1914							8-8	23	RS213	B66				6A7, 6K7G, 75, 6F6G, 6C5G, 84	175	25
1918A	Vol.	108	O				16	30	RS216					6K7MG, 6A8MG, 75, 45, 6C5MG, 5Z3	385	14
	Tone	108	O	6												
1920	Vol.	9	H12											1C6, 1A4, 32, 950, 1B1 Ballast	480	
1922A	Vol.	68	D12		See Note A68		6-6-25	13/19	CN142/TS103	B188				1C6, 1A4, 32, 950, 30, 1G1 Ballast	175	
	Tone	34	N													
1926	Vol.	9	H12											1C6, 1A4, 32, 950, 1B1 Ballast	480	
1932A	Vol.	68	D12		See Note A68		6-6-25	13/19	CN142/TS103	B188				1C6, 1A4, 32, 950, 30, 1G1 Ballast	175	
	Tone	34	N													
1954, 1964, 1964A							8-8	23	RS213	B66				6A7, 6K7G, 75, 6F6G, 6C5G, 84	175	25
1968A	Vol.	108	O				16	30	RS216					6K7MG, 6A8MG, 75, 6C5MG, 45, 5Z3	385	14
	Tone	108	O	6												
1980	Vol.	9	H12											1C6, 1A4, 32, 950, 1B1 Ballast	480	
1982A, 1992A	Vol.	68	D12				6-6-25	13/19	CN142/TS103	B188				1C6, 1A4, 32, 950, 30, 1G1 Ballast	175	
	Tone	34	N													
4400	Vol.	18	UC512				8-8	1	RN242	B3	19	249	C3	6D6, 6L7, 76, 75, 6B5	465	10
	Tone	22	L													
7000, 7001, 7002, 7012	Vol.	109	N				7078	4	RS215					27, 35, 24A, 47, 80	175	1
	Tone	22	K12				7051	4	RS213							
7042	Vol.	6	G7	6	2		9110-0	25	CM171	B3				55, 57, 58, 47, 80	175	1
7043, 7044, 7045, 7046, 7047	Vol.	15	UC503				1-2-8	26	See Note	B1				51 or 35, 57, 27, 56, 47 or PZ, 80	175	1
	Tone	34	L	6												
7048	Vol.	6	G12				8-4	23	CM171	B3				57, 58, 47, 80	175	1
7049	Vol.	8	E				‡	26	See Note	B1				51, 24A, 57, 47, 80	175	1
	Tone	22	L	6												
7057, 7058	Vol.	6	H7	6	2		9442	11	UR182	B31				6A7, 78, 75, 43, 25Z5	265 or 465	
7062	Vol.	68	D12	6			9150	29	CM165	B51				6A7, 6B7, 77, 43, 25Z5	175	
							5	15	TS101							
7064	Vol.	6	UC509	6	EX300		R8313	23	CM161					78, 77, 43, 1V		
7065	Vol.	7/18	LRP313				R7236	23	RS215					78, 75, 37, 45, 6A7, 83V	175	3
	Tone	57	N				D4758P	23	RS213							
							R1114	‡	CS131							
7066	Vol.	15	UC503				8-12	34	See Note	B3				58, 57, 56, 46, 80	175	3
	Tone	21	L													
7070, 7071, 7072, 7073, 7074	Vol.	56	N	6			R8431	4	CM162					6A7, 78, 6B7, 43, 1V	480	
7075, 7076, 7077, 7078	Vol.	56	N	6			R8952	29	CM165	B51				6A7, 78, 6B7, 43, 25Z5	480	
7090	Vol.	29	U				R8357	13/19	CS123/TS102					951, 30, 950, Ballast No. 52	175	
7090A	Vol.	29	U				R8357	13/19	CS123/TS102					951, 30, 950, Ballast No. 52	480	
7091, 7092, 7093, 7094	Vol.	56	N	6			R8952	29	CM165	B51				6B7, 43, 78, 6A7, 25Z5	480	
7106	Vol.	6	SRP263	6			106	11	UR182	B31				75, 6D6, 78, 6A7, 43, 25Z5	456	
7108	Vol.	6	H12				9925	12	CS133					78, 77, 38, 37	465	
							9328	15	TN110							
7110	Vol.	7	UC509	6			12-8-10	24/15	UR189	B189				78, 77, 38, 12Z3		
7111X, 7112, 7114	Vol.	6	SRP263	6			106	11	UR182	B31				6A7, 75, 6D6, 78, 43, 25Z5	456	
7117	Vol.	17	500M No. 1		See Note A1		1138	1	CN152	B3	24	271		6A7, 6D6, 6B7, 41	370	10
							9328	15	TN110							
7118	Vol.	62	N				R8488	23	RS213					78, 37, 42, 6A7, 83V	175	1
	Tone	‡	N													
7121	Vol.	6	SRP263	6	EX300		8-4	1	CN151	B3				58, 57, 2A5, 80		1
7124	Vol.	18	N				156	1	CN151	B3				58, 57, 2A6, 56, 2A5, 80	456	1
	Tone	22	K12	6			307	15	TS101							
7126	Vol.	7	UC509		EX300		12-8-10	24/15	UR189	B189				77, 78, 38, 12Z3		
7128	Vol.	56	500M No. 1		See Note A1		R10264	23	CM172		35	294	C20	78, 6A7, 85, 41, 84	175	10
							.01-.01		Buffer	B14	37	296	C20			
7130, 7132 AC-DC Midget	Vol.	7	UC509				70	24/15	UR189	B189				78, 77, 38, 12Z3		
7141, 7142	Vol.	18	N				5-12-5	8	CN145					43, 75, 6D6, 6A7, 25Z5	456	
SENTINEL RADIO CORP. (Also see Erla)																
8, 9	Vol.	6	H12				2-1-1	3	See Note	B1				24A, 27, 45, 80		3
11, 12, 15, 16	Vol.	6	G12				15-5	2	MN273					27, 45, 24A, 80		3
31, 33	Vol.	10	D12				.5-1-2	3	See Note	B1				26, 27, 45, 80		11
31B	Vol.	45	N				2272	1	CN155	B3	48	See Note C8		1C6, 34, 30, 19	465	10
	Tone	22	N	7			.02		Buffer	B14						
35B	Vol.	45	N				2289	12	RS201					1C6, 34, 30, 19	465	
	Tone	22	K12	14												

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
SENTINEL RADIO CORP.—Continued																
50B	Vol.	45	N				8-20	1	CN155	B3	48	See Note	C8	1C6, 34, 30, 19	465	10
	Tone	22	K12				.02		Buffer	B14						
104	Vol.	6	G12				15-5	2	MN273					27, 45, 24A, 80		3
106B	Vol.	6	G12				16-8	2	CN155	B3				24A, 27, 45, 80	175	1
	Tone	34	K12													
108	Vol.	6	L				8-16	31	See Note	B3				24A, 27, 45, 80	175	1
	Tone	22	K12													
108A	Vol.	7	F				8-8	34	See Note	B3				35, 27, 24A, 47, 80	175	1
	Tone	22	K12													
109	Vol.	7	F				16-8	34	See Note	B3				24A, 27, 35, 47, 51, 80	175	1
	Tone	22	K12													
110	Vol.	7	F				8-8	34	See Note	B3				27, 35, 24A, 47, 80	175	1
	Tone	22	K12													
111	Vol.	7	F				8-8	4	See Note	B3				47, 24A, 35, 80		1
114	Vol.	15	N	6			7078	34	RS215					47, 24A, 35, 27, 80	175	1
	Tone	44	K12				7051	34	RS213							
118	Vol.	109	N	6			7078	34	RS215					27, 35, 24A, 47, 80	175	1
	Tone	22	K12				7051	34	RS213							
125	Vol.	64	N				6-4-4	3	See Note	B3				24A, 35, 27, 47, 80	175	1
	Tone	22	K12				20	16	TS102							
261	Vol.	15	N				8876	15	TS105					39, 36, 85, 41	175	
264	Vol.	15	N	6			9110-0	1	CM171	B3				58, 57, 55, 47, 80	175	1
							8876-O	17	TS105							
440, 444	Vol.	6	G12				‡	‡	See Note	B1				24A, 27, 45, 80		3
501, 502	Vol.	70	H12											32, 34, 33	465	
	Fil.	29	R													
513	Vol.	6	G7	6	2		9110-0	25	CM171	B3				57, 58, 55, 47, 80	175	1
521	Vol.	15	N				8876	15	TS105					39, 36, 85, 41	175	
550, 560, 561	Vol.	6	H7	6	2		9355	8	CN145					36, 39, 38, 25Z5	265	
							9328	15	TN110							
570	Vol.	6	H7	6	2		9442	11	UR182	B31				6A7, 78, 75, 43, 25Z5	265 or 465	
590	Vol.	6	H7	6	2		9442	11	UR182	B31				6A7, 75, 78, 43, 25Z5	465	
599	Vol.	6	H7	6	2		9442	11	UR182	B31				6A7, 78, 75, 43, 25Z5	265	
600, 602	Vol.	17	500M No. 1	6	See Note	A1	9532	1	CN155	B3	34	292	C3	78, 6A7, 75, 41, 84	265	10
							9328	15	TN110							
							.02		Buffer	B14						
603	Vol.	17	500M No. 1	6	See Note	A1	1247	1	CN152	B3	34	292	C3	78, 6A7, 75, 41, 84	265	10
							9328	15	TN110							
							.02		Buffer	B14						
610	Vol.	7	F				8-8	34	RS213	B3				51, 27, 24A, 47, 80	175	1
	Tone	22	K12													
614	Vol.	15	N	6			9110-0	1	CM171	B3				58, 57, 55, 47, 80	175	1
							8876	17	TS105							
622, 623	Vol.	17	M	6			9659	1	CN152	B3				57, 58, 2A6, 2A5, 80	465	1
	Tone	22	K12				8876	15	TS105							
630	Vol.	17	M	6			9659	1	CN152	B3				57, 58, 2A5, 2A6, 80	456	1
	Tone	22	K12				8876	15	TS105							
634, 635	Vol.	17	M	6			9659	1	CN152	B3				57, 58, 2A6, 2A5, 80	465	1
	Tone	22	K12				8876	15	TS105							
660	Vol.	70	H12											32, 34, 33, 30, 5B1	465	
666C	Vol.	6	G7				‡	‡	See Note	B1				24A, 27, 45, 80		3
1020, 1030	Vol.	15	N	6			9193	3	CN155	B3				58, 57, 55, 59, 80	115	3
	Tone	22	K12				8876	15	TS105							
1020A, 1030A	Vol.	15	N	6			9739	3	RS215					58, 57, 56, 2A3, 80	115	3
	Tone	22	K12				9736	3/15	CN152/TN111							
	Supp.	7	C	8												
1040	Vol.	15	N	6			9739	3	RS215					58, 57, 2B7, 56, 2A3, 5Z3	465	3
	Tone	22	K12				9736	3/15	CN152/TN111							
	Supp.	7	G	8												
4100B	Vol.	6	G12	6			9982	11	UR182	B31				6D6, 6C6, 43, 25Z5		
							1693	15	TS101							
4300	Vol.	7	H	6			9982	11	UR182	B31				6A7, 6F7, 38, 25Z5	465	
4500	Vol.	6	SRP263	6	EX200		1258	25	CS133	B3				42, 6C6, 6D6, 80		1
							1260	25	CS131	B3						
4800	Vol.	110	H12	6			9982	11	UR182	B31				6D6, 6C6, 43, 25Z5		
							8876	15	TS101							
5000, 5100	Vol.	6	H12				9925	12	CS133					78, 77, 38, 37	465	
							9328	15	TN110							
5200	Vol.	18	N	6			9982	11	UR182	B31				6A7, 78, 75, 43, 25Z5	465	
5500	Vol.	17	500M No. 1	6	See Note	A1	1188	1	CN152		35	294	C3	6A7, 6D6, 6B7, 41, 84	370	10
							9328	15	TN110							
							.01-.01		Buffer	B14						
5600	Vol.	18	N				1258	1	CS133	B3	20	F253	C3	6A7, 6D6, 75, 38, 84	465	10
	Tone	22	Y	6			1260	1	CS131							
							9328	15	TN110							
							.01-.01		Buffer	B14						
5700	Vol.	18	N	6			9659	1	CN152	B3				58, 2A7, 2A6, 2A5, 80	465	1
							1100	13	CS130							
5700B	Vol.	18	N	6			9659	1	CN152	B3				2A5, 2A6, 2A7, 58, 80	465	1
	Tone	21	N				1108	13	CS130							
5721	Vol.	18	N	6			9659	1	CN152	B3				58, 2A7, 2A6, 2A5, 80	465	1
							1100	13	CS130							
6100, 6101, 6102	Vol.	6	H12				9925	12	CS133	B3	34	F292	C3	77, 78, 38, 37, 25Z5, 84	465	10
							9328	15	TN110							
							.02-.02		Buffer	B14						
6200, 6234, 6241	Vol.	45	N											1A6, 34, 30, 32, 5B1	465	
6300	Vol.	18	N	6			9659	1	CN152	B3				2A7, 2A6, 2A5, 58, 80	465	1
	Tone	22	K12				8876	15	TS105							
6315, 6317, 6321	Vol.	17	M	6			9659	1	CN152	B3				2A7, 58, 2A6, 2A5, 80	465	1
	Tone	22	K12				1110	13	CS131							
							8876	15	TS101							
7200B	Vol.	17	N	6			1477	1	RS215					6D6, 6A7, 75, 76, 80	465	1
	Tone	21	K12				1476	1	RS216							
							1110	13	CS131							
							8876	15	TS105							
7700, 7732, 7741	Vol.	45	N	7			1291	12	RS201					1C6, 34, 30, 32, 19	465	
8200B	Vol.	15	N	6			1477	3	RS215					6D6, 6A7, 76, 75, 41	465	1
	Tone	22	M				9659	3	CN152	B3						
							1110	14	CS131							
							8876	15	TS105							
5 Tube Superhet	Vol.	6	G7	6	2		9110-0	25	CM171	B3				57, 58, 55, 47, 80	262	1
7 Tube Super-Het. (with 45)	Vol.	6	G12				8	31	See Note	B3				27, 24A, 45, 80	175	1
	Tone	22	K12				16	31	See Note	B3						
7 Tube Superhet. (with 47)	Vol.	7	F				8-8	4	RS213	B3				51, 27, 24, 47, 80	175	1
	Tone	22	K12													
8 Tube Superhet	Vol.	7	F				16-8	34	CN155	B3				27, 47, 80	175	1
	Tone	22	K12													
SHAMROCK	Vol.	26	‡		See Note	A73	‡	1	See Note	B1				27, 71A, 80		2

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
SILVER KING (See Appel & Henderson)																
SILVER-MARSHALL																
A	Vol.	8	A5MP	6			13177	46	CS131					24A, 35, 47, 80	175	1
	Tone	22	N				13181	46	CS133							
B	Vol.	8	Y10MP				13181	46	CS133					24A, 27, 35, 47, 80	175	1
	Tone	57	N				13177	46	CS131							
							13203	17	TS101							
C	Vol.	8	A5MP				13181	3	CS133					24A, 27, 35, 47, 80	175	1
	Tone	‡	Y				13177	3	CS131							
C w/AVC	Vol.	‡	Y				13177	34	CS131					35, 24A, 27, 47, 80	175	1
	Tone	‡	N				13181	34	CS133							
D, E	Vol.	8	A5MP				4-4-4	3	CM173					24A, 27, 35, 47, 80	175	1
	Tone	34	N													
F	Vol.	8	A5MP				4-4-4	3	CM173					24A, 35, 47, 80	175	1
	Tone	22	N													
G	Vol.	8	A5MP	6			13120	3	CM173					24A, 27, 35, 47, 80	175	3
	Tone	‡	O				13177	13	CS131							
J, JT	Vol.	8	A5MP	6			13181	3	CS133					24A, 27, 35, 47, 80	175	1
	Tone	22	N				13177	3	CS131							
KB	Vol.	9	L											30, 32, 34	175	
	Tone	57	N													
Q with push-pull 47's	Vol.	100	L	6			13181	7	CS133					24A, 27, 35, 47, 80	465	1
	Tone	22	N				13177	7	CS131							
Q with parallel 47's	Vol.	15	M	6			3162	28	CS135					24A, 27, 35, 47, 80	465	1
	Tone	‡	L				13181	28	CS133							
							13177	28	CS131							
Q DeLuxe	Vol.	15	M	6			3162	34	CS135					56, 58, 45, 82	465	1
	Tone	95	L				13177	34	CS131							
	Sen.	7	D				13326	19	CS123							
R, RT	Vol.	15	M	6			3162	4	CS135					24A, 27, 35, 47, 80	465	1
	Tone	95	L				13181	4	CS133							
							13177	14	CS131							
V	Vol.	15	M	6			3162	34	CS135					56, 58, 45, 82	465	1
	Tone	95	L				13177	34	CS131							
	Sen.	7	D				13326	19	CS123							
X	Vol.	15	M	6			3162	34	CS135					58, 56, 45, 82	465	1
	Tone	95	L				13177	34	CS131							
							13326	19	CS123							
Y	Vol.	56	M	6			13181	4	CS133					51, 56, 55, 47, 80	465	1
	Tone	57	N				13177	4	CS131							
Z10	Vol.	15	N				8-8	2	RN242					2A7, 58, 2B7, 56, 2A5, 5Z3	465	1
	Tone	57	M	6			8	14	CS123							
							4	15	TS105							
Z13	Vol.	45	N	6			8	34	CS133					58, 56, 59, 5Z3	472.5	1
	Tone	85	E12				12	34	CS135							
Z DeLuxe	Vol.	45	N				12	34	CS135					56, 58, 2A5, 5Z3	472.5	1
	Tone	85	E12				8	34	CS133							
Bearcat Midget	Vol.	8	G				8-8	1	RS213	B66				24A, 27, 45, 80	175	1
	Tone	22	O													
30	Vol.	12	A10MP				2-2-4-1	3	See Note	B1				24A, 27, 45, 80		3
30B	Vol.	12	A10MP				2-1-2-4	3	See Note	B1				24A, 27, 45, 80		3
34A (with 33A Pwr. Unit)	Vol.	9	A3MP				4-4-4	34/40	CM173					24A, 45, 80		3
	Tone	34	G12				12-8-4	2/19	CN155	B12						
35A (with 33A Pwr. Supply)	Vol.	‡	‡		See Note A74		4-4-4	34/40	CM173					24A, 27, 45, 80		3
							12-8-4	2/19	CN155	B12						
36A	Vol.	58	D				4-4-4	3	CN151					24A, 27, 45, 80	175	1
37, 38, 39 Midget	Vol.	8	A10MP				8-8	1	RS213	B66				24A, 27, 45, 80	175	1
	Tone	22	O													
684 P.E. Amplifier	Vol.	15	O				13181	3	CS133					24A, 27, 47, 80		1
							13203	19	TS101							
685 P.A. Amplifier	Vol.	16	N				2-6-4	2/19	See Note	B1				27, 26, 50, 81		8
686 Portable P.A. Amplifier	Vol.	15	O				13181	3	CS133					24A, 27, 47, 80		1
							13203	19	TS101							
690 Amplifier	Vol.	16	L				‡	3	See Note	B1				27, 26, 50, 81		‡
692 Amplifier	Vol.	15	N				‡	‡	See Note	B1				24A, 45, 50, 81		8
710 Sargent-Rayment	Vol.	12	A3MP											22, 01A, 12A or 71A		
712 Tuner	Vol.	12	A10MP											24A, 27		
714 Tuner	Vol.	58	D											24A, 27	175	
716 Tuner with 683 Amplifier	Vol.	12	A5MP				13181	3	CS133					24A, 27, 35, 47, 80	175	3
	Tone	‡	G12				13177	3	CS131							
							13023	15	TS101							
720 AC	Vol.	12	A3MP											24A, 27, 45		
720 Battery	Vol.	12	A3MP											22, 01A, 12A		
722	Vol.	12	A10MP				‡	3	See Note	B1				24A, 27, 45, 80		3
722 DC (Battery)	Vol.	12	A10MP											22, 01A, 12A		
724 AC	Vol.	58	A3MP				4-4-4	3	CM173					24A, 27, 45, 80	175	3
724 DC	Vol.	9	Y50MP				2-2	12	See Note	B3				32, 30, 31	175	
726 (S.W. & Broadcast)	Vol.	8	A5MP	6			13120	3	CM173					24A, 35, 27, 47, 80	175	1
727 DC	Vol.	9	L											30, 32, 34	175	
	Tone	57	N													
727 SW	Vol.	15	M	6			3162	4	CS135					24A, 35, 27, 47, 80	465	1
	Tone	‡	L				13181	4	CS133							
728 SW	Vol.	15	N 6				3162	34	CS135					58, 56, 45, 82	465	1
	Tone	95	L				13177	34	CS131							
	Sen.	7	D				13326	19	CS123							
729 SW	Vol.	45	N	6			8	34	CS133					58, 56, 2A5, 5Z3	465	1
	Tone	22	E12				12	34	CS135							
738 Converter							8-8	1	CN152					24A, 27, 26	1000	1
739 Converter							4-4	1	CN150					24A, 27, 80	650	1
Sheridan 750, 750BS	Vol.	4	D12				2-2-.5	3	See Note	B1				26, 27, 45, 80		28
760	Vol.	4	D12				1-1-1-.5	‡	See Note	B1				26, 27, 45, 80		28
770 Auto Set	Vol.	7	J											24A, 12A, 71A		
773 B'cast/Long Wave	Vol.	8	A5MP	6			13120	3	CM173					24A, 35, 27, 45, 80	115	1
	Tone	22	N													
782 Midget	Vol.	8	A10MP				8-8	1	RS213	B66				24A, 27, 45, 80	175	1
	Tone	22	O													
1022 (724 AC)	Vol.	58	A3MP				4-4-4	3	CM173					24A, 27, 45, 80	175	3
4801, 4802	Vol.	15	UC503				12-8	34	CM175					58, 56, 59, 5Z3	Early	
	Tone	21	L	6			5-5	15	TN110						465	
	Sen.	12	Y												Late 175	3
McMURDO SILVER																
5D	Vol.	15	N				16	3	RS216					6B7, 6C6, 6D6, 76, 42, 5Z3	465	1
	Tone	21	O				18	3	RS216							
	Sen.	7	G				12	3	RS215							

‡ Data not substantiated.

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MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
McMURDO SILVER—Continued																
World Wide Nine	Vol.	18	O				8	2	See Note	B3				58, 55, 2A5, 5Z3	465	1
	Tone	57	Z12				12	2	See Note	B3						
							4	14	See Note	B3						
SILVERTONE (See Sears-Roebuck Co.)																
SIMPLEX RADIO CO.																
D	Vol.	4	‡		See Note	A5	‡	‡	See Note	B2				10, 27, 26, 80		8
	Sen.	‡	‡		See Note	A5										
DB	Vol.	‡	‡		See Note	A5	10-20	‡	RN245	B190	14	245C		‡	‡	10
G	Vol.	‡	Order from	Mfr.			‡	3	See Note	B3				45, 27, 24A, 80		1
	Tone	44	‡		See Note	A5										
H	Vol.	12	A20MP	6			8-8	1	See Note	B3				24A, 45, 80		3
	Tone	22	N													
H AC	Vol.	7	D	6			8-8	1	See Note	B3				24A, 45, 80		3
	Tone	‡	N													
J	Vol.	6	D12	6			8-8	1	See Note	B3				35, 24A, 47, 80		1
	Tone	22	L													
K	Vol.	6	G12				8-4	4	See Note	B3				24A, 35, 47, 80	175	1
L	Vol.	‡	Y50MP				4-4-4	26	See Note	B3				35, 24A, 47, 80	175	1
	Tone	22	L													
N	Vol.	6	G12				8-4	4	See Note	B3				24A, 35, 47, 80	175	1
	Tone	22	L													
N DC	Vol.	6	G12											39, 36, 38	175	
	Tone	22	L													
P AC	Vol.	15	N				4-4-10	4/19	See Note	B3				57, 58, 55, 47, 80	175	1
	Tone	22	L	‡												
P AC (Above serial No. 162500)	Vol.	15	N				4-4	4	CM170					57, 58, 55, 47, 80	175	1
	Tone	22	L	‡			10	19	TS101							
P AC (Above serial No. 330001)	Vol.	15	M				4-4	4	CM170					6A7, 78, 75, 42, 80	456	1
	Tone	22	L	7	See Note	A75	5	19	TS105							
P Battery	Vol.	9	Y10MP				8	12	See Note	B3				34, 32, 33	175	
	Tone	22	L				10	19	TS101							
PB, PF (Serial No. 352001 and up)	Vol.	‡	N				20-10-4	1/13	RM259	B191	14	245C	C3	‡	‡	10
	Tone	‡	L	6			.01		Buffer	B14						
P 32V (No. 350001 and up)	Vol.	15	M				6-10	1	See Note	B3	34	F292	C3	6A7, 78, 75, 42, 84	456	10
	Tone	22	L	7	See Note	A75	5	15	TS101							
							.05-.05		Buffer	B14						
P Dual Band (Above serial No. 600001)	Vol.	17	N				8-8-4	4/13	RM265	B192				6A7, 6D6, 75, 42, 80	456	1
	Tone	22	L	6			5	15	TS105							
P Battery (Above serial No. 173501)	Vol.	9	Y250MP				5	19	TS105					1A6, 34, 32, 19	456	
	Tone	22	L													
P1931	Vol.	6	G12				8-4	4	See Note	B3				24A, 35, 47, 80	175	1
	Tone	22	L	8												
Q 1931	Vol.	6	G12		EX350		8-4	4	See Note	B3				24A, 35, 47, 80	175	1
	Tone	22	L													
R	Vol.	6	G12		EX350		8-4	4	See Note	B3				58, 57, 47, 80		1
	Tone	22	L	7	See Note	A75										
R AC (Above No. 320001)	Vol.	6	G12				AB108	4	CM170					78, 77, 42, 80		1
	Tone	22	L	7	See Note	A75										
R DC	Vol.	6	G12		‡	A14								39, 36, 38		
	Tone	22	L	7	See Note	A75										
T	Vol.	17	500M No. 1		See Note	A1	6-10	1	SR601	B125	34	292	C3	78, 6A7, 75, 41, 84	‡	10
							5	15	TS101		14	245C	C14			
							.05-.05		Buffer	B14						
TA	Vol.	17	500M No. 1		See Note	A1	8-8	1	See Note	B3	48	See Note	C8	6A7, 78, 6B7, 41	456	10
							5	15	TS101							
							.0125-.0125		Buffer	B14						
U AC-DC Receiver	Vol.	6	UC510		‡	A14	20-4	6	See Note	B3				78, 44, 77, 43, 25Z5	456	
							5	15	TS101							
U AC-DC (Late)	Vol.	17	N				5-20-8	11	UR182	B3				75, 6A7, 6D6, 43, 25Z5	456	
							5	15	TS101							
V AC-DC Receiver	Vol.	7	UC510				20-4	6	See Note	B3				44, 77, 43, 25Z5		
							5	15	TS101							
V All-Wave	Vol.	12	N				40-8	6	See Note	B3				6F7, 77, 43, 25Z5		
							5	15	TS101							
W All-Wave	Vol.	17	N				4-8-4	26	See Note	B3				78, 85, 37, 42, 80	456	1
	Tone	41	L													
X	Vol.	6	G12		EX200		4-4	4	See Note	B3				6D6, 6C6, 42, 80		1
							5	15	TS105							
							5	19	TS105							
6A	Vol.	12	‡	6	See Note	A5	‡	3	See Note	B1				45, 27, 24A, 80		3
SKY ROVER	Vol.	6	G12				4-8	4	CM171					35, 24, 47, 80		1
SOLAR																
062	Vol.	45	N				4	15	TS105		1	206		39, 36, 37, 38	262	
062A	Vol.	45	N				4	15	TS105		1	206		39, 36, 37, 41	262	
	Tone	34	UC502													
SONORA																
A30, A32	Vol.	10	SRP283				2-1-1-3	3/13	See Note	B1				‡		‡
	Sen.	7	2M		See Note	A3										
A36	Vol.	10	SRP283				2-2-1-3	37	See Note	B1				‡		‡
	Sen.	7	2M		See Note	A3										
A40	Vol.	10	SRP283				2-4-1-3	3/13	See Note	B1				‡		‡
	Sen.	7	2M		See Note	A3										
	Phono.	63	‡		See Note	A5										
A46	Vol.	10	SRP283				2-3-1-3	37	See Note	B1				‡		‡
	Sen.	7	2M		See Note	A3										
B31 (25 cycle)	Vol.	12	A2MP				8-8	1	See Note	B3				24, 27, 45, 80		1
E AC	Vol.	14	N				2-2-7	3	See Note	B1				26, 27, 71A, 80		9
2RP (25 cycle)	Vol.	10	SRP283				2-1-1-3	3/13	See Note	B1				‡		‡
	Sen.	7	2M		See Note	A3										
	Phono.	*63	‡		See Note	A5										
3RP	Vol.	10	SRP283				3-2-1-3	37	See Note	B1				‡		‡
	Sen.	7	2M		See Note	A3										
	Phono.	63	‡		See Note	A5										
3R, 4R	Vol.	10	SRP283				2-1-1-3	3/13	See Note	B1				‡		‡
	Sen.	7	2M		See Note	A3										
5R (Arcturus Tubes)	Vol.	10	SRP283				2-3-1-3	37	See Note	B1				‡		‡
	Sen.	7	2M		See Note	A3										
7P Elec. Phonograph	Phono.	63	‡		See Note	A5	2-3-1-3	37	See Note	B1				‡		‡
DeLuxe 44	Vol.	10	SRP283				2-3-1-3	37	See Note	B1				RA1, DE1, SO2, RE2		‡
	Sen.	7	2M		See Note	A3										
	Phono.	63	‡		See Note	A5										

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
SONORA—Continued																
64	Vol.	6	F12		EX350		8-8-8	28	RM265					24A, 27, 45, 80		1
	Tone	41	N													
70	Vol.	15	O				8-8	1	CN152	B3				35, 27, 47, 80	262	3
	Tone	34	UC502													
71, 72, 73	Vol.	15	O				8-8	1	CN152	B3				27, 35, 47, 80	262	3
	Tone	44	UC502				8	15	CS123							
							8	13	CS123							
74	Vol.	6	F12		EX350		8-8	1	RS213	B66				24, 47, 80		1
84, 85	Vol.	6	F12		EX350		4-8	1	CN151					24A, 35, 47, 80	262	1
86, 87	Vol.	15	N				4-2-4	28	CM173					35, 24A, 27, 47, 80	262	2
	Loc'lzr.	‡	Y200MP													
	Tone	34	UC502													
SPARKS-WITHINGTON—See Sparton.																
SPARTON																
AC7	Vol.	7	SRP154				2-2-2	3	See Note	B1				C401, 71A or C181, BH		1
AR19	Vol.	11	Order from Mfr.											24A, 12A		
AR50, AR50A	Vol.	11	Order from Mfr.											24A, 27, 12A		
AC62, AC63	Vol.	7	SRP154				2-2-2	3	See Note	B1				C401 or C373, 71A or C181, BH		1
5, 9	Vol.	8	H	6			4-5	1	CN151					35, 27, 45, 80		1
9-30	Vol.	7	SRP154				‡	46	See Note	B1				‡		2
9A	Vol.	24	DRP246				B2327	1	MN273					24A, 27, 483, 80		2
9X	Vol.	109	M				A8123-1	4	HD680					58, 24A, 56, 47, 80	172.5	1
	Tone	34	K12	6			A9019A	4	CS133							
	Supp.	7	D													
10	Vol.	7	A2MP		RS244	A24	B2748A	1	MN275					35, 27, 47, 80	172.5	1
	Tone	22	K12													
12	Vol.	4	DRP162				1	4	CS131					24A, 35, 47, 80	172.5	1
	Tone	22	K12				7	4	CS133							
13, 14, 14A	Vol.	109	M				A8123-1	4	HD680					58, 24A, 56, 47, 80	172.5	1
	Tone	22	K12	6			A9019A	4	CS133							
	Supp.	7	D													
15	Vol.	7	UC500				B2748A	1	MN275					35, 27, 47, 80	172.5	1
	Tone	22	K12													
15X	Vol.	109	M				A8123-1	4	HD680					58, 24A, 56, 47, 80	172.5	1
	Tone	34	K12	6			A9019A	4	CS133							
	Supp.	7	D													
16, 16AW	Vol.	111	G				A8123-1	26	HD680					27, 35, 47, 80	172.5	1
	Tone	44	K12				A6611A	26	CS133							
17, 18	Vol.	111	G				A8123-1	26	HD680					58, 24A, 56, 47, 80	172.5	1
	Tone	22	L				A6611A	26	CS133							
	Supp.	‡	UC508													
25, 26, 26AW	Vol.	32	E	6			8-8-8	28	RM265					35, 27, 45, 80	172.5	3
27	Vol.	111	C				A8123-1	26	HD680					58, 24A, 56, 47, 80	172.5	3
	Tone	22	L				A6611A	26	CS133							
	Supp.	32	UC508													
27A	Vol.	111	G				A8123-1	26	HD680					58, 24A, 56, 47, 80	172.5	3
	Tone	22	L				A6611A	26	CS133							
	Supp.	32	UC508													
28	Vol.	111	G				A8123-1	26	HD680					58, 24A, 56, 47, 80	172.5	3
	Tone	22	L				A6611A	26	CS133							
	Supp.	32	UC508													
30, 30A, 30B	Vol.	111	A5MP				A6884	28	RM265					35, 27, 45, 80	172.5	3
	Tone	44	K12													
	Phono.	63	SRP259													
31, 32	Vol.	12	UC507											32, 30, 31		
33	Vol.	83	M				A8907	1	CS133		34	292	C3	39, 36, 85, 41, 84	172.5	10
							A9308	15	TS102							
							.02		Buffer	B14						
33A, 33B	Vol.	15	M	6			A10277	1	CN152		34	292	C3	78, 36, 75, 41, 84	172.5	10
							A9308	15	TS102							
							.02		Buffer	B14						
34	Vol.	15	M											39, 36, 70, 38	172.5	
35	Vol.	111	E				2-4-1	3	See Note	B2				35, 27, 50, 81	172.5	5
	Tone	44	K12													
	Phono.	63	K12													
36	Vol.	83	M	6			A10001	46	CN145		5	222		78, 36, 85, 37, 89, 79	172.5	10
							A10308	15	TN111							
40 Auto	Vol.	15	M											36, 37, 38		
41 Police Auto	Vol.	7	J											36, 37, 38		
41A	Vol.	7	J											39, 36, 12		
42	Vol.	15	M											39, 36, 38		
43 Police Auto	Vol.	15	M											39, 36, 37, 38		
43S, 43S-1600, 43S-2400	Vol.	15	M											37, 39, 36, 41 or 42		
45	Vol.	111	E				8-8-8	28	RM265					35, 27, 45, 80	172.5	3
	Tone	44	K12													
	Phono.	63	W													
49	Vol.	26	J											C686, 01A, 71A		
51, 52	Vol.	12	UC507											32, 30, 31		
	Tone	22	K12		See Note A4											
53 AC-DC	Vol.	17	N	6			A11093-1	11	UR182	B31				78, 75, 43, 25Z5	456	
54	Vol.	56	M				A8907	12	CS123					34, 25S, 30	172.5	
	Tone	44	K12	7												
55 Police Desk	Vol.	26	‡		See Note A5		16-8	1	MN275	B3				24A, 27, C183, 80		1
	Relay	‡	‡		See Note A5											
56	Vol.	7	C				B2748A	1	MN275					35, 27, 47, 80	172.5	1
	Tone	22	K12													
57 AC-DC	Vol.	17	N	6			A11093	11	UR182	B31				78, 75, 43, 25Z5	456	
58	Vol.	40	Y		RS244		A10318	12	CS130					1A6, 32, 30, 33	456	
60 S.W. Converter							5-5	1	CN150	B3				24A, 27, 80		1
61, 62	Vol.	15	M	6			A9550	11	UR182	B31				78, 75, 43, 25Z5	456	
65, 66, 65T, 66T	Vol.	17	M	6			A11093	11	UR182	B31				78, 75, 43, 25Z5	456	
67, 68	Vol.	17	M	6			A11223-1	1	RN242					78, 6A7, 75, 42, 80	345	1
							A11224-1	13	CS121							
							A10377	15	TS101							
69	Vol.	7	SRP154				‡	‡	See Note	B1				C484, 585, 80		5
70	Vol.	15	M	7	RS244		A11623	12	CS123					34, 1C6, 1A6, 30, 19	345	
							A10377	19	TS101							
71, 71B	Vol.	18	M	6			A9754	4	RM262	B73				6D6, 6C6, 75, 42, 80	456	1
72	Vol.	56	M	6			A9754	4	RM262	B73				6D6, 85, 42, 37, 80	172.5	1
	Supp.	58	E													
74	Vol.	109	M				A10018	35	CS133					58, 24A, 56, 2A5, 80	172.5	1
	Tone	22	K12	6			A10118	35	CN151							
	Supp.	7	E													
75A	Vol.	83	M				A8123	4	CS131					58, 56, 57, 55, 47, 80	456	1
	Tone	22	K12	6			A9019A	4	CS133							
	Supp.	7	UC510													

‡ Data not substantiated.

*** IMPORTANT: Read Notes in Note Section if specified in Note Column.**

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
SPARTON—Continued																
76	Vol.	15	M	6			A8123-1	26	CS131					58, 57, 56, 2A5, 5Z3	456	3
	Tone	22	L				A6611A	26	CM173							
	Supp.	7	UC510				A10609-1	13	CS130							
77	Vol.	15	M	7	RS244		A11623	12	CS123					34, 1C6, 1A6, 19	345	
							A10377	19	TS101							
78	Vol.	62	M	6			A9754	4	RM262	B73				6D6, 37, 42, 80	172.5	1
	Tone	7	E													
79, 79A	Vol.	7	SRP154				‡	‡	See Note	B1				C484, 585, 81		5
80	Vol.	56	M	6			11223	1	RN242					78, 6A7, 76, 85, 42, 80	456	1
	Tone	22	L				A10377	15	TS101							
	Voltage	26	A5MP													
	Supp.	58	UC510													
81	Vol.	40	Y				A10318	12	CS130					1A6, 32, 30, 33	456	
	Fil.	29	Q													
82	Vol.	40	Y				A10318	12	CS130					1A6, 32, 30, 19	456	
	Fil.	29	Q													
83, 84, 85X, 86X	Vol.	56	M	6			11223	1	RN242					78, 6A7, 76, 85, 42, 80	456	1
	Tone	22	L				A10377	15	TS101							
	Voltage	26	A5MP													
	Supp.	58	UC510													
89, 89A	Vol.	7	SRP154				‡	‡	See Note	B1				C484, 585, 80		5
99	Vol.	7	SRP154				‡	‡	See Note	B1				484, 26, 50, 81		5
101	Vol.	7	SRP154				1-4-1	26	See Note	B1				484, 585, 81		4
	Phono.	63	K12													
103	Vol.	98	SRP258				1-4-1	26	See Note	B1				484, 485, C586, 81		5
104	Vol.	56	M	6			A11223-1	1	RN242					78, 6A7, 76, 85, 42,		
	Tone	22	L				A10377	15	TS101					5Z3	456	1
	Voltage	26	A5MP													
	Supp.	98	Y200MP													
109 DeLuxe	Vol.	7	SRP154				‡	‡	See Note	B1				484, or 485, 585, 586,		
														81		5
110, 111 (DeLuxe)																
(Two Types)	Vol.	7	SRP154				1-4-1	3	See Note	B1				484, 26, 50, 81		8
111A	Vol.	7	SRP258				1-4-1	3	See Note	B1				484, 26, C586, 81		8
111X	Vol.	111	G				A8123-1	26	HD680					58, 24A, 56, 47, 80	172.5	1
	Tone	22	L				A6611A	26	CS133							
	Supp.	‡	UC508													
134, 136	Vol.	15	M	6	RS244		A8123-1	37	HD680					58, 2A7, 56, 2A5, 5Z3	456	3
	Tone	22	L		RS244		A6611A	37	CS133							
	Sen.	7	UC510		RS244		A10609-1	13	CS130							
	Voltage	26	E				A6316-1	19	CS125							
							A10377	15	TS101							
							A11582	15	TS101							
235	Vol.	58	SRP258				15-5	1	MN273					484, C183, 80		2
	Phono.	63	K12													
301 AC	Vol.	7	SRP154				2-2	1	See Note	B1				484, 50, 81		5
301 DC	Vol.	7	SRP154				3	‡	See Note	B11				484, 182		
333	Vol.	17	M	6	See Note	A1	A10277	1	CN142		34	292	C3	6F7, 78, 75, 41, 84	456	10
							A9308	15	TS102							
							.02		Buffer	B14						
400	Vol.	24	DRP246				15-5	1	MN273					24A, 27, C183, 80		2
410 AC (Junior)	Vol.	24	DRP246				B2327	1	MN273					24A, 27, C183, 80		2
410 DC (Junior)	Vol.	24	DRP246											24A, 27, C183		
420 AC (Jewell)	Vol.	24	DRP246				B2327	1	MN273					24A, 27, C183, 80		2
420 DC (Jewell)	Vol.	24	DRP246											24A, 27, C183		
475A	Vol.	83	M		See Note	A77	A8123	4	HD680					58, 57, 55, 56, 47, 80	456	1
	Tone	22	K12	6	See Note	A77	A9019A	4	CS 133							
	Sen.	58	UC510		See Note	A77										
478	Vol.	62	M	6	See Note	A77	A9754	4	RM262	B73				6D6, 37, 42, 80	172.5	1
	Supp.	58	E		See Note	A77										
478A	Vol.	83	M		See Note	A77	A8123	4	HD680					58, 57, 56, 55, 47, 80	456	1
	Tone	22	K12		See Note	A77	A9019A	4	CS133							
	Sen.	58	UC510													
506	Vol.	17	N	6			A11093-1	11	UR182	B31				78, 75, 43, 25Z5	456	
537	Vol.	17	O	6			A14102	1/15	CN152/TS101	B3				6A8G, 6K7G, 6Q7G,		
	Tone	22	O											6F6G, 5Y3G	456	1
564	Vol.	7	SRP258				2-2-2	3	See Note	B1				484, C586, 81		5
564 DC	Vol.	7	SRP258				3	‡	See Note	B11				484A, 182A		
570	Vol.	7	SRP258				2-2-2	3	See Note	B1				C484, C586, 81		5
570 DC	Vol.	7	SRP258				3	‡	See Note	B11				484A, 182A		
574	Vol.	7	SRP258				1-4-1	3	See Note	B1				484, 26, C586, 81		8
577	Vol.	17	O	6			A14102	1/15	CN152/TS101	B3				6A8G, 6K7G, 6Q7G,		
	Tone	22	O											6F6G, 5Y3G	456	1
578	Vol.	98	SRP258				1-4-1	26	See Note	B1				484, 485, C586, 81		5
589	Vol.	7	SRP154				15-5	1	MN273					484, 182, 80		2
591, 593	Vol.	7	SRP154				15-5	1	MN273					484, C182B, 80		2
594	Vol.	17	N	6			A11093-1	11	UR182	B31				78, 75, 43, 25Z5	456	
600	Vol.	7	SRP258				15-5	1	MN273					484, 182, 80		2
600 DC	Vol.	7	SRP258				3	‡	See Note	B11				484A, 182A		
610	Vol.	7	SRP258				15-5	1	MN273					484, 182, 80		2
610 DC	Vol.	7	SRP258				3	‡	See Note	B11				484A, 182A		
616, 616X	Vol.	17	O	6			A12048	1/15	RN245/TS101	B193				78, 6A7, 75, 42, 80	345	1
617, 617X	Vol.	77	N				A14073	25	RS216					6K7G, 6A8G, 6Q7G,		
	Tone	22	N	6			A14072	25	WE3540					6F6G, 5Y3	345	1
620	Vol.	7	SRP258				15-5	1	MN273					484, 182, 80		2
620 DC	Vol.	7	SRP258				3	‡	See Note	B11				484A, 182A		
620X	Vol.	109	M				A8123-1	4	HD680					58, 24A, 56, 47, 80	172.5	1
	Tone	34	K12	6			A9019A	4	CS133							
	Supp.	7	D													
655	Vol.	17	N	6			A11093	11	UR182	B31				78, 75, 43, 25Z5	456	
666, 666X	Vol.	17	O	6			A12048	1/15	RN245/TS101	B193				78, 6A7, 75, 42, 80	345	1
667, 667X	Vol.	77	N				A14073	25	RS216					6K7G, 6A8G, 6Q7G,		
	Tone	22	N	6			A14072	25	WE3540					6F6, 5Y3	345	1
691	Vol.	17	M	6			A11223-1	1	RN242					78, 6A7, 75, 42, 80	345	1
							A11224	13	CS121							
							A10377	15	TS101							
716, 716X	Vol.	17	M	6			A12048	1/15	RN245/TS101	B193				78, 6A7, 75, 42, 80	456	1
							A10377	15	TS101							
737	Vol.	7	SRP258				B2948	1	MN273					484, 182, 80		2
740	Vol.	7	SRP258				2-2-2	3	See Note	B1				484, C586, 81		5
740 DC	Vol.	7	SRP258				3	‡	See Note	B11				484A, 182A		
750 AC	Vol.	7	SRP258				2-2-2	3	See Note	B1				484, C586, 81		5
750 DC	Vol.	7	SRP258				3	‡	See Note	B1				484A, 182A		
750A, 750X	Vol.	111	G				A8123-1	26	HD680					58, 24A, 56, 47, 80	172.5	1
	Tone	22	L				A6611A	26	CS133							
	Supp.	‡	UC508													
766, 766X, 766XP,																
766XS	Vol.	17	M	6			A12048	1/15	RN245/TS101					78, 6A7, 75, 42, 80	456	1
							A10377	15	TS101							
835	Vol.	56	M	6			11223	1	RN242					78, 6A7, 76, 85, 42, 80	456	1
	Tone	22	L				A10377	15	TS101							
	Voltage	26	A5MP													
	Supp.	58	UC510													

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
SPARTON—Continued																
867	Vol.	77	M				A14073	25	RS216					6K7, 6A8, 6K7G,		
	Tone	107	N				A14072	25	WE3540					6Q7G, 6F6G, 5Y3,		
														6E5	456	1
870	Vol.	7	SRP258				1-4-1	3	See Note	B1				484, 26, C586, 81		8
870A, 870X	Vol.	111	G				A8123-1	26	HD680					58, 24, 56, 47, 80	172.5	1
	Tone	22	L				A6611A	26	CS133							
	Supp.	‡	UC508													
930 AC	Vol.	7	SRP154				‡	‡	See Note	B1				C484, 182, 80		2
931 AC	Vol.	7	SRP154				B2327	1	MN273					C484, C182B, 80		2
931 DC	Vol.	7	SRP154				3	‡	See Note	B11				C484A, C182A		
987	Vol.	77	500M No. 1		See Note	A19	A14122	25	RS216					6K7, 6A8, 6K7G,		
	Tone	22	K12	6			A14113	25	RN245	B8				6Q7G, 6J7G, 6N6G,		
														5Y3G, 6E5G	456	1
1116X	Vol.	15	N	6			A12330	1	RN245					6K7, 6L7, 6C5, 6H6,		
	Tone	22	L				A11223-1	24	RN242					6F6, 5Z3, 6E5	456	1
	Supp.	7	UC510				A10377	15	TS101							
1166	Vol.	15	N	6			A12330	1	RN245					6K7, 6L7, 6C5, 6H6,		
	Tone	22	L				A11223-1	24	RN242					6F6, 5Z3, 6E5	456	1
	Supp.	7	UC510				A10377	15	TS101							
1176, 1176XP, 1186, 1196	Vol.	15	N	6			A12330	1	RN245					6K7, 6L7, 6C5, 6H6,		
	Tone	22	L				A11223-1	24	RN242					6F6, 6E5, 5Z3	456	1
	Supp.	7	UC510				A10377	15	TS101							
SPENCER (See Truevalue)																
SPLITDORF (See Thomas A. Edison Inc.)																
STANDARD RADIO CORP.																
Standardyne 29 AC.	Vol.	14	H12				2-1-5	3	See Note	B1				26, 27, 71A, 80		11
STAR																
All Star Junior	Vol.	8	J	6			4-4-4	3	CM173	B3				6F7, 6A7, 77, 42, 80	‡	1
All Star Senior	Vol.	8	G				8-8-8	3	RS213	B66				2A7, 58, 56, 2A5, 80	‡	3
	Tone	21	L													
062, 062A	Vol.	45	N	6			4	15	TS101		1	206		39, 36, 37, 38	262	
6U	Vol.	18	M				10-10	1	CN152		20	253	C3	78, 77, 75, 41, 84	262.5	10
	Tone	22	UC502				12-12	15	TN111							
							.01		Buffer	B14						
STAR RAIDER (See Continental Radio Corp.)																
STEINITE RADIO CO.																
10	Vol.	7	Z		EX450		2-2-1-3	37	See Note	B1				24A, 27, 45, 80		3
10 Chassis No. 15	Vol.	7	Z		EX450		8-8	1	See Note	B3				24A, 27, 71, 80		11
20 (Chassis No. 22)	Vol.	6	G7		EX450		‡	3	See Note	B1				24A, 27, 45, 80	175	1
	Tone	22	‡		See Note	A5										
25 (8 tube Pentode)	Vol.	6	G7				8-2-4	3	See Note	B3				‡		1
26	Vol.	7	E				8-2-4	3	See Note	B3				51, 24A, 27, 47, 80	175	1
	Tone	44	D12													
28	Vol.	6	E7				8-8	4	See Note	B3				51, 24A, 47, 80		1
40, 40A	Vol.	7	Z				2-3-2	3	See Note	B1				27, 71A, 80		‡
40C	Vol.	7	Z				2-3-3	3	See Note	B1				45, 27, 80		7
50, 50A	Vol.	7	Z				1-2-4	3	See Note	B1				27, 45, 80		‡
	Phono.	63	K12													
60C	Vol.	7	Z				2-3-3	3	See Note	B1				45, 27, 80		7
70, 80, 95 (Chassis No. 10)	Vol.	7	Z				2-2-1-3	37	See Note	B1				24A, 27, 45, 80		3
102, 102A	Vol.	7	Z				1-2-4	3	See Note	B1				27, 50, 81		‡
	Phono.	63	K12													
102C	Vol.	7	Z				2-3-3	3	See Note	B1				27, 45, 80		7
203 (Chassis No. 22)	Vol.	6	G12				‡	3	See Note	B1				24A, 27, 45, 80	175	1
	Tone	22	‡		See Note	A5										
261, 262, 263, 264, 265	Vol.	10	‡		See Note	A5	1-1-1-1	3/13	See Note	B1				26, 27, 71A, 80		11
420 (Chassis No. 15)	Vol.	7	Z				8-8	1	See Note	B3				24A, 27, 71, 80		11
420 (Chassis No. 17)	Vol.	7	Z				2-2-3	3	See Note	B1				24A, 27, 45, 80		3
421, 425 (Chassis No. 21)	Vol.	6	Z	6			8-8-8	3	CN155	B3				24A, 45, 80		1
423 (Chassis No. 23)	Vol.	6	Z				8-8	1	CN152					24A, 45, 80		1
450 (Chassis No. 15)	Vol.	7	Z		EX450		8-8	1	See Note	B3				24, 27, 71, 80		11
450 (Chassis No. 17)	Vol.	7	Z				2-2-3	3	See Note	B1				24A, 45, 27, 80		3
600, 605, 630, 635, 642, 643, (Chassis No. 22)	Vol.	6	G12		EX450		‡	3	See Note	B1				27, 24A, 45, 80	175	1
	Tone	22	‡		See Note	A5										
642B, 700 (Chassis No. 26)	Vol.	7	E				8-2-4	3	See Note	B3				27, 51, 24, 47, 80	175	1
	Tone	39	D12													
700, 701 (Chassis No. 28)	Vol.	6	E7				8-8	4	See Note	B3				51, 24A, 47, 80		1
705, 706, 725, (Chassis No. 26)	Vol.	7	E				8-2-4	3	See Note	B3				51, 24A, 27, 47, 80	175	1
	Tone	44	D12													
STERLING MFG. CO.																
A (DC)	Vol.	25	DRP119	6			4	‡	See Note	B11				32, 30, 31		
3A	Vol.	12	G12				7350	3	RS213					51, 27, 45, 80		1
R3	Vol.	12	G12											24, 27, 45		
B	Vol.	12	G12											24, 27, 45		
4	Vol.	12	G12				8-8	1	See Note	B3				35, 27, 45, 80		25
B4	Vol.	12	G12											24, 27, 45		
C	Vol.	40/12	DRP119	6			1-2	1	See Note	B1				24, 45, 80		7
F	Vol.	24	DRP119	6			1-2	1	See Note	B1				24, 45, 80		3
Miniature	Vol.	25	DRP119	6			1-2	1	See Note	B1				24, 45, 80		7
M, N, P, Q	Vol.	24	DRP119	6			8237	1	RS211					24, 45, 80		3
							8238	1	RS213							
8 Tube Receiver	Vol.	25	DRP119	6			8-8-8	3	See Note	B3				24, 27, 45, 80		25
	Tone	41	O													
VA	Vol.	6	H12				8573	4	CS133					24, 51, 47, 80	175	1
STEWART RADIO CORP.																
50, 60	Vol.	17	500M No. 1		See Note	A1	6-10	1	CN152	B3	34	292	C3	6D6 or 78, 6A7, 75,		
							5-5	15	TN110					41, 6Z5	262	10
STEWART-WARNER CORP.																
R100A, B, E (AC)	Vol.	113	SRP245				66170	3	CN152					24, 27, 45, 80		3
	Tone	22	Z12													
R100C, R100CF (DC)	Vol.	‡	Order from	Mfr.										12A, 01A, 22, 71A		
	Tone	22	Z12													
R101A, R101B	Vol.	6	E12				67265	4	RS211					51 or 35, 24, 47, 80		1
							67264	4	RS211							

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
STEWART-WARNER CORP.—Continued																
R102A, B and E	Vol.	6	F12				67328	5	RS213					24A, 51 or 35, 47, 27, 80	177.5	1
	Tone	22	Z12				67588	26	RS213	B12						
R104A, B and E	Vol.	15	N				67328	5	RS213					57, 58, 47, 56, 80	177.5	1
	Tone	114	Z12				67588	26	RS213	B12						
105 Series (50 to 59)	Vol.	100	Z12				81347	26	RS213					57, 58, 56, 27, 47, 80	177.5	3
	Tone	22	L	6			81367	26	RS215	B12						
							67328	26	RS213							
R106	Vol.	56	N				67328	2	RS213					58, 55, 59, 56, 80	177.5	1
	Sen.	7	A10MP	6												
108, 108X, (10 to 20 incl.)	Vol.	6	UC509	6	EX10C		81678	1	CN140					39, 36, 38, 12Z3		
							81698	15	TN110							
109 (1090-1099)	Vol.	56	N	6			81347	1	RS213					58, 55, 56, 2A5, 80	177.5	1
R110, R110B, R110C	Vol.	56	N	6			81347	1	RS213					58, 55, 27, 2A5, 80	177.5	1
							81901	14	CS123							
R111	Vol.	17	N	6			81959	11	UR182	B31				78, 6B7, 43, 37, 25Z5	456	
							83394	11	CS125							
R112 (1121, 1122, 1123)	Vol.	18	500M No. 1	6	See Note A1		83111	1/15	CN152/TN110		34	292	C3	6A7, 78, 75, 41, 84	456	10
							83118	‡	See Note	B125						
R115	Vol.	17	N	6			81959	11	UR182	B31				78, 37, 6B7, 43, 25Z5	456	
							8339	11	CS125							
R116, R116X, R116XH, R116AL, R116XL	Vol.	17	N	6			83613	1	RS213					6A7, 78, 75, 42, 80	456	1
R117 (1171, 1172)	Vol.	17	UC512	6			83734	4	CM172		35	294	C3	78, 6A7, 75, 42, 84	177.5	10
	Tone	22	K12				83803	15	TS101							
							.015-.015		Buffer	B14						
R118 (1181, 1182, 1183)	Vol.	17	500M No. 1	6	See Note A1		83734	4	CM172		35	294	C3	78, 6A7, 41, 75, 84	177.5	10
	Tone	22	K12				83803	15	TS101							
							.015-.015		Buffer	B14						
R119, R119A, R119EF	Vol.	56	N	6			81347	1	RS213					78, 6A7, 85, 42, 80	177.5	1
							67328	1	RS213							
							80537	15	TS101							
R120 (1201-1209)	Vol.	56	N				81347	4	RS213					57, 58, 55, 2A5, 56, 80	177.5	3
	Tone	39	Y	6			67328	4	RS213							
R123 (1231-1239)	Vol.	6	F7	6	3		83960	1	RS213					6A7, 6F7, 41, 80	456	1
							83962	1/15	CS133/TS101							
R125, R125A and R125X (1251-1259)	Vol.	56	N	6			84193	25	RS216					6A7, 6D6, 75, 41, 80	456	1
R126, Series R126A, R126P, R126X (1261-1269)	Vol.	19	TRP606				84288	25	RS215					6C6, 6D6, 75, 42, 76, 80	456	1
	Tone	107	M	6			84286	25/13	RN241							
R127, R127X (1271-1279)	Vol.	18	N	6			84192	25	RS216					6A7, 6D6, 75, 41, 80	456	1
	Tone	107	M				84193	25	RS216							
R128D (Batt. 1281D-1289D)	Vol.	18	N	13										1C6, 34, 25S, 30, 33	456	
	Tone	57	M													
R130 (1301-1309)	Vol.	18	N	6			84193	25	RS216					6A7, 6D6, 75, 42, 80	456	1
	Tone	107	M		See Note A4		85112	25	RS216							
R131 (1311-1319)	Vol.	17	N	6			84829	4	CM171		35	294	C3	78, 77, 75, 41, 84	177.5	10
							83803	15	TS101							
							.03-.03		Buffer	B14						
R132 (Firestone R1322)	Vol.	1	UC511	6			85237	1	CN152	B3	33	289Y	C3	78, 77, 85, 41	177.5	10
	Tone	44	Z12				83803	15	TS101							
							85216	15	TS106							
							.005		Buffer	B14						
R133 (Firestone 1332)	Vol.	17	N	6			84961	4	CM171		35	294	C3	6A7, 6D6, 75, 41, 84	456	10
							83803	15	TS101							
							.03-.03		Buffer	B14						
R134 (1341-1349)	Vol.	18	M	6			85792	25	RS216					6D6, 6A7, 75, 42, 80	456	1
	Tone	107	N				85793	25	RS216							
R136 (1361-1369)	Vol.	46	M	6			85431	25	RS216					6K7, 6A8, 6H6, 6J7, 6F6, 5Z4	456	1
	Tone	107	N				85430	25	RS216							
R137 (1371-1379)	Vol.	15	M	6			85583	31	RS216					6K7, 6A8, 6H6, 6C5, 2A3, 83V	456	14
	Tone	57	N				85584	31	RS216							
							85588	31	RS216							
							85565	18	TS108							
							83803	15	TS101							
R138 (1381-1389)	Vol.	15	M	6			85583	31	RS216					6K7, 6A8, 6H6, 6C5, 2A3, 6J7, 83V	456	14
	B. Tone	‡	N				85584	31	RS216							
	T. Tone	57	O				85588	31	RS216							
							85565	18	TS108							
							85692	14	CS121							
							83803	15	TS101							
R139D	Vol.	18	N	7										1A6, 34, 1B5, 30, Ballast—1G1	456	
R142A, R142AS, (1421-1429)	Vol.	6	SRP263	6			88033	25	RS213					6K7, 6J7, 6F6, 6X5	456	25
							88007	25	RS213							
R143 (R1431)	Vol.	17	Order from Mfr.				88256	4	CM171		36	294SW	C3	6D6, 77, 75, 41, 84	456	10
							88170	15	TS101							
							.01		Buffer	B14						
R144AS	Vol.	6	Y	6			8-8	25	RS213	B66				6D6, 6C6, 41, 84	456	25
R145 (1451-1459)	Vol.	18	250M No. 1	6	See Note A19		88512	25	RS216					6A8, 6K7, 6H6, 6F5, 6F6, 5Z4	456	1
	Tone	57	N				88511	25	RS216							
R146 (1461-1469)	Vol.	18	250M No. 1	6	See Note A19		85431	25	RS216					6K7, 6A8, 6H6, 6F5, 6F6, 5Z4	456	1
	Tone	57	N				88033	25	RS213							
							88576	13	RS203							
R147 (1471-1479)	Vol.	18	250M No. 1	6	See Note A19		85431	25	RS216					6K7, 6A8, 6H6, 6F5, 6L6, 5Z4	456	1
	Note	57	N				88033	25	RS213							
							88576	13	RS203							
R149 (1491-1499)	Vol.	20	TRP608	6			85583	54	RS216					6K7, 6A8, 6H6, 6C5, 6J7, 6G5, 6L6, 5V4G	456	1
							88511	54	RS216							
							89186	54	RS201							
							88007	13	RS213							
							83803	15	TS101							
R160 (1601-1609)	Vol.	17	UC512	6			88256	4	CM171		36	294SW	C3	6D6, 77, 75, 41, 84	456	10
							88170	15	TS101							
							.01		Buffer	B14						
R161D (1611D-1619D)	Vol.	18	N	7										1C7G, 1D5G, 1H6G, 1H4G, 1R1G—Ballast	456	

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS Use	Circuit	Correct Replacement	Switch	Bias	*Note	CONDENSERS Original Part	Circuit	Correct Replacement	*Note	VIBRATORS Vibr. Conn.	Replacement	*Note	Types of Tubes Used	I. F. Peak	Trans. Circuit
STEWART-WARNER CORP.—Continued																
R162D (1621D-1629D)	Vol.	18	N	7										1C7G, 1D5G, 1H6G, 1H4G, 1R1G—Ballast	456	
	Tone	57	N													
R163D (1631D-1639D)	Vol.	18	N	6			89147	25	RS203	B3	Order	from Mfr.		1C7G, 1D5G, 1H6G, 1H4G	456	10
							89145	‡	See Note	B125						
							.005		Buffer	B14						
R164D (1641D-16490)	Vol.	18	N	6			89147	25	RS203	B3	Order	from Mfr.		1C7G, 1D5G, 1H6G, 1H4G	456	10
							89145	‡	See Note	B125						
							.005		Buffer	B14						
R167S, R168 (1671-1689)	Vol.	6	Y	6			88033	25	RS213					6K7G, 6J7G, 6K6G, 6X5G	456	25
							88007	25	RS203							
R173 (1731-1739)	Vol.	18	250M No. 1	6	See Note A19		88512	25	RS216					6A8, 6K7, 6H6, 6F5, 6F6, 6G5, 5Z4	456	1
	Tone	57	N				88511	25	RS216							
							89755	13	CS121	B3						
R189	Vol.	18	N	6			8-8	22/13	See Note	B3	31	285XS	C3	1C6, 34, 33	370	10
	Tone	57	N				.01		Buffer	B14						
202A, B and E	Vol.	6	F12				67328	5	RS213					24A, 35, 47, 27, 80	177.5	1
	Tone	22	Z12				67588	26	RS213	B12						
715, 720	Vol.	3	F12											26, 27, 71A		
750	Vol.	112	Y10MP				‡	3	See Note	B1				26, 27, 12A, 80		9
801, 802	Vol.	84	UC501				‡	3	See Note	B1				26, 27, 71A, 80		9
801, 801A, 811, 811A	Vol.	116	Y10MP				‡	3	See Note	B1				26, 27, 12A, 80		9
900, 901, 902, 903, 911, 912, 913	Vol.	7	Z		See Note A10		61303	3	CN152					27, 45, 80		3
950 Series (AC)	Vol.	113	SRP245		See Note A80		66170	3	CN152					24A, 27, 45, 80		3
950, 971, 972, 973 (DC)	Vol.	‡	Order from Mfr.				61303	‡	CN142	B11				12A, 01A, 22, 71A		
0200 (Companion Auto Set)	Vol.	56	500M No. 1		See Note A1		10	15	TS101					39, 36, 85, 41	‡	
0201	Vol.	15	500M No. 1		See Note A1		10	15	TS101					39, 36, 85, 79, 41	‡	
STORY & CLARK																
36	Vol.	6	G12				‡	3	See Note	B1				24, 45, 27, 80		3
43, 51	Vol.	6	G12				‡	3	See Note	B1				24, 45, 27, 80		7
	Supp.	‡	A5MP													
C108 Clock Model	Vol.	6	‡		See Note A5		8	53	RS213					24, 27, 45, 80		3
STRATFIELD—See Electrical Specialties Export Co.																
STROMBERG-CARLSON																
10, 11	Vol.	9	SRP260				2-2-2	3	See Note	B1				24, 45, 80		3
	Hum.	30	SRP253													
12, 14	Vol.	115	SRP213				2-2-2	3	See Note	B1				45, 27, 24A, 80		7
	Hum.	30	SRP253													
	Phono.	63	‡		See Note A5											
16, 17 (DC)	Vol.	9	SRP260				1-6	4	See Note	B11				45, 27, 24A		
19, 20 (AC)	Vol.	‡	Order from Mfr.				2-2-3-3	3	See Note	B1				27, 35, 45, 80	175	3
	Hum.	30	SRP253													
22, 22A	Vol.	15	SRP216				2-3-4	3	See Note	B1				45, 27, 35, 80	175	3
	Hum.	30	SRP253													
25, 26 (AC)	Vol.	9	SRP260				2-2-2	3	See Note	B1				24, 45, 80	175	3
	Hum.	30	SRP253													
27 (AC)	Vol.	‡	SRP213				2-2-2	3	See Note	B1				24, 27, 45, 80	175	7
	Hum.	30	SRP253													
29	Vol.	15	N	8			6-2-1	3	See Note	B1				45, 35, 27, 80	175	3
	Tone	44	N	6												
	Hum.	30	SRP253													
33	Vol.	15	UC514	6			P23538	1	CN155		12	236		78, 6A7, 6B7, 37, 41	175	26
	Tone	44	O													
33A	Vol.	15	UC514				P23538	1	CN155		12	236		78, 6A7, 6B7, 37, 41	175	26
37	Vol.	15/15	MM				22701	22	CN155					58, 45, 56, 80	175	3
	Tone	34	UC503													
	Hum.	30	SRP253													
38, 39, 40, 41 (1st type)	Vol.	15/15	MM	8			4-7-3	22	CN155	B3				58, 56, 45, 80	175	3
	Tone	34	UC503	6												
	Hum.	30	SRP253													
38, 39, 40, 41 (2nd type)	Vol.	15/15	MM	8			4-7-6	22	CN155	B3				58, 55, 45, 56, 57, 80	175	3
	Tone	34	UC503	6												
	Supp.	‡	SRP266													
	Hum.	30	SRP253													
48, 49, 50, 51	Vol.	‡	DRP245				4-5-6-4	‡	See Note	B1				58, 55, 56, 2A3, 57, 5Z3	175	3
	B. Tone	‡	Order from Mfr.													
	T. Tone	44	M	6												
	Hum.	30	SRP253													
52, 54	Vol.	‡	‡		See Note A5		4-5-6	3	CN155	B3				35, 2B7, 55, 56, 2A3, 57, 27, 5Z3	175	3
	B. Tone	‡	Order from Mfr.													
	T. Tone	44	M	6												
	Hum.	30	SRP253													
55, 56	Vol.	8	G				8-8-4	22	CN155	B3				58, 78, 2A5, 55, 2B7, 6A7, 5Z3	175	3
	Tone	34	M													
	Hum.	30	SRP265													
58L, 58LB, 58T, 58TB, 58W, 58WB	Vol.	17	O				P25479	1	RN242					6D6, 6A7, 75, 42, 80	465	1
	Tone	21	N	6			P25480	13	RS201							
							P25510	15	TN111							
60	Vol.	15	P				P24190	3	RN245					6D6, 6A7, 6B7, 37, 41, 80	370	1
	Tone	34	H12	6			P24207	15	TS106							
61 (AC-DC)	Vol.	18	O				P25907	1	RN235	B8				6K7, 6A8, 6Q7, 43, 25Z5	465	
	Tone	57	N	6			P25934	6	RN232							
							P25459	13	CS121							
							P25498	15	TN111							
62, 63, 62B, 63B	Vol.	15	P				P22757	3	RS213					6K7, 6A8, 6H6, 6F6, 5Z3	465	1
	Tone	22	P	6			P25757	3/13	RN245							
							P25458	3	RS216							
							P25788	13	CS130							
							P25459	13	CS121							
							P24207	15	TS101							
64	Vol.	15	P	6			16-8-8-4-4	3/13	See Note	B195				78, 6A7, 6B7, 37, 42, 5Z3	175	1
	Tone	34	M													
68	Vol.	8	G				16-8-8-4-4	3/13	See Note	B195				6D6, 6A7, 76, 6B7, 85, 42, 5Z3	370	3
	Tone	22	M	6												
69 All Wave Selector							24567	1	RN242					6D6, 6A7, 76, 84	545	25
70, 70B, 72, 72B, 72D, 74, 74B, 74D	Vol.	‡	Order from Mfr.				P24835	‡	See Note	B195				6D6, 76, 6A7, 6B7, 6C6, 42, 2A3, 5Z3	370	3
	Tone	22	P	6												

‡ Data not substantiated.

*** IMPORTANT: Read Notes in Note Section if specified in Note Column.**

MANUFACTURER AND MODEL	CONTROLS: Use	Circuit	Correct Replacement	Switch	Bias	*Note	CONDENSERS: Original Part	Circuit	Correct Replacement	*Note	VIBRATORS: Vibr. Conn.	Replacement	*Note	Types of Tubes Used	I. F. Peak	Trans. Circuit
STROMBERG-CARLSON—Continued																
80	Vol.	15	P.				8-8-16	3	See Note	B3				6K7, 6A8, 6J7, 6H6, 6F6, 5Z3	465	1
	Tone	22	P.				4	13	See Note	B3						
							10	15	TS101							
82, 82B	Vol.	20	1.5 Meg. No. 1		See Note	A19	P22757	3	RS213					6D6, 6A7, 76, 42, 5Z3	465	1
	Tone	22	P.	6			P22789	3	RS213							
							P22758	3	RS216							
							P22759	13	RN245							
							P22760	14	TS108							
							P24207	15	TS101							
83, 83B	Vol.	20	1.5 Meg. No. 1		See Note	A19	P22757	3	RS213					6K7, 6A8, 6C5, 6H6, 6F6, 5Z3	465	1
	Tone	22	P.	6			P22789	3	RS213							
							P22758	3	RS216							
							P22759	13	RN245							
							P22760	14	TS108							
							P24207	15	TS101							
84, 84B	Vol.	20	2 Meg. No. 1		See Note	A19	P22757	3	RS213					6K7, 6A8, 6C5, 6H6, 6J7, 6F6, 5Z3	465	1
	Tone	22	P.	6			P22789	3	RS213							
							P22758	3	RS216							
							P22759	13	RN245							
							P22760	14	TS108							
							P24207	15	TS101							
125 (AC-DC)	Vol.	18	N.				26162	6	RN235	B8				6A8, 6K7, 6Q7, 43, 25Z5	465	
							26163	6	RM257	B8						
							26164	13/15	RN235							
130 Series	Vol.	15	N.				26403	1	RN245	B8				6K7, 6A8, 6H6, 6F6, 80	465	1
	Sen.	‡	G12				25458	1	RS216							
							24207	15	TS101							
140 Series	Vol.	17	N.				22757	3	RS213					6K7, 6A8, 6Q7, 6E5, 6F6, 5Z3	465	1
	Sen.	‡	G12				22789	3	RS213							
							25458	3	RS216							
							26048	15	TN111							
							25788	13	CS130							
145 Series	Vol.	17	N.				22757	3	RS213					6K7, 6J7, 6A8, 6Q7, 6E5, 6L6, 5Z3	465	1
	Tone	39	‡		See Note	A5	22789	3	RS213							
							25458	3	RS216							
							26693	13	CS131							
							25788	13	CS130							
							24207	19	TS101							
							26048	15	TN111							
150	Vol.	20	TRP611				22757	3	WE847					6K7, 6J7, 6A8, 6H6, 6L6, 6E5, 5Z3	465	1
	Fid.	‡	Order from	Mfr.			26773	3	RS216							
							24580	13	CS131							
							26693	13	CS131							
							24207	15	TS101							
							25498	15	TN111							
635 (DC)	Vol.	3	SRP961		Front		4-1	1	See Note	B11				‡		
	Vol.	10	SRP901		Rear											
635, 636	Vol.	3	SRP961		Front		3-10	4	See Note	B1				71A, 27, 80		11
	Vol.	10	SRP901		Rear											
638 (AC)	Vol.	3	SRP961		Front		5-9	4	See Note	B1				71A, 27, 80		‡
	Vol.	10	SRP269		Rear											
638 (DC)	Vol.	3	SRP961		Front		4-1	1	See Note	B11				01A, 71A		
	Vol.	10	SRP269		Rear											
641	Vol.	8	SRP960		Front		2-1-2-1	3	See Note	B1				45, 24A, 27, 80		3
	Vol.	3	SRP900		Rear											
642	Vol.	8	SRP960		Front		2-2-2-2	3	See Note	B1				45, 24A, 27, 80		3
	Vol.	3	SRP900		Rear											
645 (DC)	Vol.	3	SRP900		Front		6	‡	See Note	B11				24A, 27, 45		
	Vol.	8	‡		Rear	A78										
652, 654	Vol.	8	SRP960		Front		2-1-2-1	3	See Note	B1				45, 24A, 27, 80		3
	Vol.	3	SRP900		Rear											
726X	Vol.	17	M.				16	1	RS216	B3				78, 6A7, 6K7, 75, 6F6, 6E5, 80	465	1
							8	1	RS213	B3						
734, 734B, 744	Vol.	12	Y50MP											01A, 10, 00A		
744B	Vol.	12	Y50MP											01A, 10, 00A		
	Phono.	63	H12													
776, 776X	Vol.	17	M.				16	1	RS216	B3				78, 6A7, 6K7, 75, 6E5, 6F6, 80	465	1
							8	1	RS213	B3						
846, 848	Vol.	115	SRP962		Front		‡	3	See Note	B1				45, 27, 24A, 80		7
	Vol.	3	SRP900		Rear											
STUDEBAKER LABORATORIES																
31	Vol.	6	D12				8-8	1	CN152	B3				51, 24A, 47, 80		1
42	Vol.	6	Y.				8-8	1	CN152	B3				51, 27, 24A, 47, 80		1
SUNGLOW																
Melody-Chest	Vol.	40/12	GE				‡	‡	See Note	B1				‡		‡
SUPERTONE PRODUCTS CO., INC.																
Superba	Vol.	17	N.				8-16	4	See Note	B3				57, 58, 2A5, 56, 80	465	1
L5	Vol.	18	N.	6			P474	32	RS211					5Z4, 6F5, 6F6, 6H6, 6K7, 6L7	456	1
	Tone	34	L.				P160	32	CN151	B81						
							P304	15	TS101							
L6	Vol.	18	N.	6			P474	32	RS211					5Z4, 6C5, 6F6, 6K7, 6L7, 6Q7	456	1
	Tone	44	L.				P160	32	CN151	B81						
							P304	15	TS101							
L7	Vol.	45	N.	7			P391	1	RN232	B90	14	245C	C3	1C6, 19, 30, 34	456	10
	Tone	‡	L.				.01-.01		Buffer	B14						
Z4	Vol.	45	SRP275	7			P391	1	RN232	B90	14	245C	C3	1C6, 19, 30, 32, 34	456	10
	Tone	44	L.				.01-.01		Buffer	B14						
Z5	Vol.	45	SRP275	7			P958	1	RN232	B90	14	254C	C3	1C6, 19, 30, 32, 34	456	10
	Tone	44	L.				.01-.01		Buffer	B14						
A31	Vol.	18	N.				8-4	4	See Note	B3				6A7, 6D6, 75, 42, 80	456	1
SYNCHROPHASE (See A. H. Grebe & Co.)																
L. TATRO PRODUCTS CORP.																
AK54 (Mayor)	Vol.	17	N.				10	15	TS101					6A7, 78, 75, 38	175	
AM54 (Senator)	Tone	44	N.													
A525, B525	Vol.	17	N.				4L-5	15	TS101					77, 78, 75, 38	456	
	Tone	22	N.	6			4L11	15	TS101							
C625, D625	Vol.	17	N.	6			4L3	1	RS213		20	F251	C3	78, 6A7, 75, 38, 84	177.5	10
	Tone	22	N.				4L5	15	TS101							
							4L11	15	TS101							
							.005		Buffer	B14						
E83	Vol.	117	E12								1	F204		44, 85, 41		
	Tone	41	N.													
F725	Vol.	17	N.	6			4L3	1	RS213		20	F251	C3	78, 6A7, 75, 41, 84	177.5	10
	Tone	34	N.				4L4	1	RS216							
							4L14	‡	2-TS108	B196						
							4L5	15	TS101							
							4L11	15	TS101							
							.005		Buffer	B14						

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
L. TATRO PRODUCTS CORP.—Continued																
F913	Vol.	117	E12								1	F204		44, 85, 41, 37		
	Tone	41	N													
H465, I465	Vol.	17	N	6			4L1	1	RS203		27	275		15, 75, 38	456	10
	Tone	22	N				4L5	15	TS101							
							4L11	15	TS101							
J665	Vol.	17	N	6			4L1	1	RS203		27	275		15, 6A7, 75, 30, 19	177.5	10
	Tone	22	N				4L5	15	TS101							
							4L6	19	TS102							
K54	Vol.	17	N				10	15	TS101					77, 78, 75, 38	‡	
K665	Vol.	17	N	6			4L1	1	RS203		27	275		15, 6A7, 30, 19	177.5	10
	Tone	22	N				4L5	15	TS101							
							4L6	19	TS102							
L54	Vol.	17	N				8	1	CS123		2	F211		78, 6A7, 75, 41	177	26
	Tone	41	N				16	1	CS126							
							20	‡	2-TS108	B196						
L74 (Lt. Governor)	Vol.	17	N				8	1	CS123		20	F251	C3	6A7, 78, 75, 41, 84	175	10
	Tone	41	N				16	1	CS126							
							20	‡	2-TS108	B196						
							10	‡	2-TS102	B196						
							‡		Buffer	B14						
L525	Vol.	15	O													
	Tone	22	L	6										6A7, 78, 12A7, 48	456	
M54	Vol.	17	N				10	15	TS101					77, 78, 75, 38	‡	
M4616	Vol.	18	N				4L1	1	RS203		31	285XS	C22	6A7, 15, 75, 33	456	10
	Tone	57	N	6			.01		Buffer	B14						
N54	Vol.	17	N				8	1	CS123		2	F211		6A7, 78, 75, 41	177	26
	Tone	41	N				16	1	CS126							
							20	‡	2-TS108	B196						
N74 (Governor)	Vol.	17	N				8	1	CS123		20	F251	C3	78, 6A7, 75, 41, 84	175	10
	Tone	41	N				16	1	CS126							
							20	‡	2-TS108	B196						
							10	‡	2-TS102	B196						
							‡		Buffer	B14						
N144	Vol.	17	N				10	15	TS101					77, 78, 75, 38	‡	
O84	Vol.	17	N				8	1	CS123		2	F211		78, 6A7, 75, 41	177	26
	Tone	41	N				16	1	CS126							
	Supp.	7	J		EX800		10	15	TS101							
							20	‡	2-TS108	B196						
O94 (President)	Vol.	17	N				8	1	CS123		20	F251	C3	78, 6A7, 75, 41, 84	175	10
	Tone	41	N				16	1	CS126							
	Supp.	7	J		EX800		10	15	TS101							
							20	‡	2-TS108	B196						
							‡		Buffer	B14						
O4626	Vol.	18	N				4L1	1/13	RS203		31	285XS	C22	6A7, 15, 75, 33	456	10
	Tone	57	N	6			.01		Buffer	B14						
P54	Vol.	17	N				8-8	1	See Note	B3	20	F251	C3	6A7, 75, 78, 38, 84	177.5	10
							10	15	TS101							
							10	‡	2-TS107	B196						
							‡		Buffer	B14						
P4626	Vol.	18	N				4L1	1/13	RS203		31	285XS	C22	6A7, 15, 75, 33	456	10
	Tone	57	N	6			.01		Buffer	B14						
Q5636, R5636, S5636	Vol.	17	O				4L1	1/13	RS203		31	285XS	C22	15, 6A7, 75, 33	456	10
	Tone	57	N	6			4L6	15	TS102							
							‡		Buffer	B14						
T6216	Vol.	17	N				4L3	1	RS213		20	F251	C3	78, 6A7, 75, 38, 84	177.5	10
	Tone	22	N	6			4L5	15	TS101							
							4L11	15	TS101							
							4L14	‡	2-TS108	B196						
							.005		Buffer	B14						
U5226, V5226	Vol.	18	N				4L3	56	RS213		20	F251	C3	6A7, 78, 75, 38, 84	456	10
	Tone	57	N	6			4L1	13	RS203							
							4L14	‡	2-TS108	B196						
							.005		Buffer	B14						
W6236, X6236, Y6236	Vol.	17	O				4L3	1	RS213		20	F251	C3	78, 6A7, 12A5, 25Y5, 75	456	10
	Tone	57	N	6			4L1	13	RS203							
							4L6	15	TS102							
							4L11	15	TS101							
							4L15	‡	2-TS108	B196						
							.005		Buffer	B14						
TELETONE																
5 Tube TRF	Vol.	6	E12	6			4-6	4	RM262	B3				‡		
	Tone	22	K12													
TEMPLE CORP.																
8-60, 8-80, 8-90	Vol.	4	E12				1-4-2	3	See Note	B1				27, 45, 80		3
	Hum.	37	HU20				.15		See Note	B9						
8-61, 8-81, 8-91	Vol.	6/16	DRP240				2-4-2	3	See Note	B1				45, 27, 24A, 80		3
	Hum.	37	HU20				.15		See Note	B9						
TIFFANY TONE—(See Herbert H. Horn)																
TOBE DEUTSCHMANN																
Browning 35	Vol.	45	N				8-8	1	RS213	B66				6K7, 6A8, 6F5, 6C5, 6H6, 6F6, 5Z4	456	1
	Sen.	7	G				.10	15	TS101							
TOM THUMB—See Automatic Radio																
TRANSFORMER CORP. of America (TCA) (Clarion)																
TC20, TC21	Vol.	56	N	6			9659	1	RN242					58, 2A7, 2A6, 2A5, 80	465	1
							1108	13	CS130							
TC30	Vol.	6	‡		See Note A5		12-16	4	UR190	B3				6D6, 6C6, 43, 12Z3		
40	Vol.	8	A5MP	6	1		1-4	25	See Note	B1				51, 24A, 47, 80		1
TC40	Vol.	6	G12				4-4	4	CM170					6D6, 6C6, 42, 80		1
							5	19	TS105							
							5	15	TS101							
TC50	Vol.	18	500M No. 1	6	See Note A1		6-6	1	CN152	B3	35	294	C20	78, 77, 75, 41, 84	175	10
							928	15	TS103		37	296	C20			
							.015		Buffer	B14						
AC51, 53, 55	Vol.	12	Y				1-1.5-1-1.5	37	See Note	B1				24A, 27, 45, 80		3
TC52	Vol.	6	G12	6			1295	8	CN145	B3				77, 78, 43, 25Z5	115	
							928	15	TS103							
AC60 (25-60)	Vol.	12	Y	6			1.5-1.5-.5	3	See Note	B1				24A, 45, 80		1
TC60	Vol.	7	G				TCG1018	6	UR182	B3				6A7, 6D6, 75, 43, 25Z5	456	
	Tone	22	L				TCG1019	13	CS121							
							TCG1020	15	TN111							
AC61 (25-61)	Vol.	6	H12				1.5-1.5-1	3	See Note	B1				24, 45, 80		1
AC70	Vol.	6	H12				1.5-1.5-1	3	See Note	B1				24, 27, 45, 80		1
AC80, 81	Vol.	8	G				8	25	BS213					51, 24A, 47, 27, 80	175	1
AC84, 85	Vol.	8	G				2-2-2.5	28	See Note	B1				51, 24, 27, 47, 80	175	1
	Tone	34	H12	6												

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
TRANSFORMER CORP.—Continued																
88	Vol.	8	G				2-2-2.5	28	See Note	B1				51, 24A, 47, 80	175	1
	Tone	34	H12	6												
AC90, 90A, 91, 91A, (25-90, 25-91)	Vol.	8	A400P				8-8	28	RS213	B66				35, 24A, 27, 47, 80	175	3
	Tone	34	H12	6												
92, AC94 (25-94)	Vol.	8	A400P				8-8	28	RS213	B66				27, 51, 24A, 47, 80	175	3
	Tone	34	H12	6												
AC100 Series	Vol.	8	A5MP	6			1-1-1	26	See Note	B1				35, 24A, 47, 80	175	1
100AR	Vol.	15	L				P4767	4	CM172		35	294		6A7, 78, 6B7, 89, 6Z4	465	10
120-139	Vol.	8	G				2-2-2.5	28	See Note	B1				51, 24A, 47, 27, 80	175	1
	Tone	34	L	6												
AC160 (25-160), 160AVC	Vol.	8	A1MP	6			8-8	28	RS213	B66				51, 27, 47, 80	175	3
	Tone	44	L	6												
AC220 (25-220)	Vol.	8	A5MP				1-1-1	26	See Note	B1				35, 57, 47, 24A, 80	175	1
	Tone	22	L	6												
AC240	Vol.	15	UC503				2-2-2.5	28	See Note	B1				24A, 51, 56, 58, 27, 80	490	1
	Tone	22	L	6												
241	Vol.	15	UC503				2-2-2.5	28	See Note	B1				51, 56, 27, 47, 80	175	1
	Tone	22	L	6												
AC260	Vol.	15	UC503				8	26	See Note	B3				51, 57, 27, 56, 47, 80	175	1
	Tone	22	L	6												
AC280 (25-280)	Vol.	15	UC503				8	26	See Note	B3				51, 27, 56, 46, 80	175	1
	Tone	22	L	6												
AC300	Vol.	6	500M No. 1		See Note	A19	6-8	34	See Note	B3				58, 56, 46, 82	175	3
	Tone	22	L	6												
	Supp.	20	G12													
AC320	Vol.	6	G12				8-4	23	CM171	B3				57, 58, 47, 80	175	1
AC340	Vol.	15	UC503				P4514	23	CM175					58, 57, 56, 47, 80	175	1
	Tone	22	L	6												
360	Vol.	15	UC503				P4514	23	CM175					58, 57, 56, 46, 80	175	3
	Tone	21	L	6												
400 AC-DC	Vol.	7	H				8-8	6	CN142					39, 36, 38, 25Z5		
							5-5	15	TN110							
AC420	Vol.	17	N				2-16-8	11	UR182	B31				6A7, 78, 75, 43, 25Z5	‡	
							10	15	TS101							
422, 423, 425	Vol.	98	J				P4633	11	CS121					6A7, 78, 77, 43, 25Z5	465	
							P4717	11	CS126							
							P4632	11	CS123							
440	Vol.	98	J				P4709	11	UR182	B31				6A7, 77, 43, 25Z5	465	
450	Vol.	56	N				P4737	29	UR190	B72				78, 6A7, 85, 43, 25Z5	465	
470, 472	Vol.	17	UC503				P4443	23	CM171					58, 2A6, 47, 56, 80	465	1
	Tone	22	L				P4724	15	TS101							
480	Vol.	15	UC503				P4514	34	CM175					58, 56, 59, 5Z3	465	3
	Tone	21	L	6			P4585	15	TN113							
	Sen.	12	Y													
490	Vol.	56	UC503				P4961	28	CM173	B3				58, 55, 53, 56, 80	175	3
	Tone	22	L													
500	Vol.	15	UC503											34, 1A6, 30, 19	175	
	Tone	22	L													
TRANSITONE—See Philco Radio & Television Corp.																
TRAV-LER RADIO & TELEVISION CORP.																
AC-SG-DX	Vol.	6	G12				2-1-1	30	See Note	B1				24A, 45, 80		3
	Screen	12	A5MP													
C	Vol.	12	A5MP				2-1-1	3	See Note	B1				24A, 45, 80		3
K	Vol.	6	E12				8-8	1	See Note	B3				24, 51, 47, 80		1
SG-AC-Super	Vol.	100	L				4-2	4	See Note	B1				35, 27, 47, 80	‡	1
	Tone	41	N													
SG-DC	Vol.	8	Y50MP				8-8	3	See Note	B11				‡		
SG-DX	Vol.	6	G12				2-1-1	3	See Note	B1				24A, 45, 80		3
Trav-Lette	Vol.	6	L				4-4	4	CM170					51, 24A, 47, 80		1
6 Tube TRF	Vol.	6	E12				2-1-1	30	See Note	B1				26, 24, 45, 80		28
	Tone	34	K12													
	Screen	12	A5MP													
8 Super	Vol.	6	G				8-8-2	30	See Note	B3				51, 24A, 27, 47, 80	‡	1
	Tone	41	K12													
S8	Vol.	8	G				8-8-2	30	See Note	B3				51, 24A, 27, 47, 80	175	1
	Tone	41	K12													
S9	Vol.	100	L				4-2	4	See Note	B1				35, 27, 47, 80	175	1
	Tone	41	N													
50A	Vol.	6	H12				16-12	27	RM257	B3				6D6, 6C6, 43, 25Z5		
51	Vol.	18	N				4-8	23	CM171	B3				6A7, 6D6, 75, 42, 89	‡	1
53	Vol.	18	N				6-10	23	CM172	B3				6A7, 6D6, 75, 42, 89	‡	1
54	Vol.	18	500M No. 1		See Note	A1	6-10	4	RM262	B3	35	294	C3	6A7, 6D6, 75, 42, 84	456	10
							.02		Buffer	B14						
56	Vol.	116	K12				4	12	CS121					34, 32, 33, 1E1		
60A	Vol.	18	N				8-16-12	11	UR182	B31				6A7, 6D6, 75, 43, 25Z5	‡	
63A	Vol.	18	N				8-8	23	RS213	B66				6A8, 6K7, 6H6, 6F5, 6F6, 5Z4, or 6A7, 6D6, 75, 42, 80		1
64	Vol.	18	500M No. 1		See Note	A1	6-10	4	See Note	B3	35	294	C3	6A7, 6D6, 75, 42, 84	456	10
							.02		Buffer	B14						
76	Vol.	18	N				8-8	1	CN142	B3	48	See Note	C8	34, 1B5, 1E1, 1C6, 30	‡	10
							.02		Buffer	B14						
TROPIC-AIRE																
06W	Vol.	56	N				8-16	1	CN155		2	210	C5	78, 77, 85, 41	262	26
	Tone	44	UC502				4	13	CS121		12	237	C5			
							4	15	TS101							
TROY RADIO MFG.																
4	Vol.	6	G12				4-4	23	CM170	B3				6D6, 6C6, 42, 80		1
4 Tube TRF	Vol.	6	H12		EX250		4-4	23	CM170	B3				58, 57, 2A5, 80		1
5L5, 5U5	Vol.	17	N	6			4-4	23	CM170	B3				6A7, 6D6, 85, 80, 42	465	1
14	Vol.	6	G12				4-4	23	CM170	B3				58, 57, 2A5, 80		1
15, 15-5	Vol.	17	N	6			4-4	23	CM170	B3				2A7, 58, 55, 2A5, 80	465	1
40	Vol.	6	G12				4-4	23	CM170	B3				58, 57, 2A5, 80		1
42	Vol.	6	G12		EX300		4-4	23	CM170	B3				6A7, 6F7, 42, 80	465	1
	Tone	22	L													
46	Vol.	17	500M No. 1		See Note	A1	4-4	4	CM170	B3				6A7, 6D6, 75, 42	465	MG
							5-5	15	TN110							
52	Vol.	17	N	6			4-4	23	CM170	B3				2A5, 2A6, 2A7, 58, 80	465	1
	Tone	22	K12				10	15	TS101							
53	Vol.	17	N	6			4-4	23	CM170					6A8, 6K7, 6Q7, 6F6, 5Y3	465	1
	Tone	22	K12				10	15	TS101							
54	Vol.	17	N				8-8	23	CM172	B3				2A5, 2A6, 2A7, 58, 80	465	1
	Tone	22	K12													
56	Vol.	17	500M No. 1		See Note	A1	4-4	1	CN150	B3				6D6, 6A7, 75, 42	175	MG
							5-5	15	TN110							

‡ Data not substantiated.

*** IMPORTANT: Read Notes in Note Section if specified in Note Column.**

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
TROY RADIO MFG.—Continued																
62BC, 62BU	Vol. Tone	17 22	N K12											34, 1C6, 25S, 30, 19	465	
62C, 62PC, 62L, 62U	Vol. Tone	17 21	N K12				8-8 10	23 15	CM172 TS101	B3				6D6, 6A7, 75, 42, 80	465	1
84	Vol. Tone	17 22	N L				8-8 10	1 15	CN152 TS101	B3				2A7, 58, 55, 53, 45, 80	465	3
84C, 84PC, 84U	Vol. Tone	118 22	N K12				16-16 4 10	4 13 15	See Note CS131 TS101	B3				6D6, 6A7, 85, 42, 76, 80	465	1
TR86	Vol. Tone	17 22	500M No. 1 K12		See Note	A1	8-8 10-10 .01	1 15	CN152 TN111 Buffer	B3 B14	37	296	C3	6D6, 6A7, 75, 41, 84	465	10
151-5	Vol. Tone	17 22	N K12				16-8-10-10	6/15	UR189	B98				6A7, 6D6, 75, 43, 25Z5	465	
162C, 162U	Vol. Tone	17 22	N K12				16-12 10-10	6 15	CN145 TN111	B3				6D6, 6A7, 75, 43, 25Z5	465	
TRUETONE—See Western Auto Supply Co.																
TRUEVALUE																
6U	Vol. Tone	18 22	UC511 UC502				P81028 P81021 .01	1 15	CN152 TN111 Buffer	 B14	20	253	C3	78, 77, 75, 41, 84	262.5	10
TURNER CO.																
M8	Vol. Tone	15 21	M M				8-8 8 25	1 13 15	See Note CS123 TS103	B3				57, 2A5, 5Z3		1
M16	Vol.	15	M				8-8 8 25	1 13 15	See Note CS123 TS103	B3				56, 2A5, 80		1
MC16	Vol.	15	M				8-8 8 25	1 13 15	See Note CS123 TS103	B3				57, 56, 2A5, 80		1
5780	Vol.	15	M				8-8 8 25	1 13 15	See Note CS123 TS103	B3				57, 80		1
TWINPLEX—See Radio Trading.																
TYRMAN ELECTRIC CORP.																
Imperial 80	Vol.	29	Z				‡	3	See Note	B3				27, 22, 30, 81		‡
UNITED AIR CLEANER—See Sentinel.																
UNITED AMERICAN BOSCH																
Model T	Vol.	6	G12				3-3	25	See Note	B1				36, 37, 33		
04	Vol.	7	J	6			CE9520	6/15	UR189	B98				6D6, 6C6, 43, 25Z5, 185R8—Ballast		
05	Vol.	17	N	6			CE9519	6/15	UR192/TN111	B197				6A7, 6D6, 75, 43, 25Z5	465	
4 (Essex)	Vol.	6			See Note	A5	4-8	25	CM171	B198				224, 47, 80		1
5A	Vol.	7	G	6			SA102553	25	CM171	B199				51, 24, 47, 80		1
5 (AC)	Vol.	6	G12				4-8	25	CM171	B198				24, 47, 80		1
7, 7C (DC)	Vol.	6	G12				3-3	25	See Note	B11				36, 37, 33		
10 (Essex)	Vol. Tone	15 22	N N				8-8-4	30	See Note	B3				51, 58, 27, 45, 80	175	1
20, 20J, 20K, 20L	Vol. Tone	6 22	G12 ‡	6	 See Note	 A5	2-3.5-2	26	See Note	B1				51, 27, 47, 80	175	1
28 (AC)	Vol.	13	SRP179				2-4	1	See Note	B1				26, 27, 71, 80		11
29 (AC)	Vol.	13	SRP179				2-4	1	See Note	B2				26, 27, 10, 81		34
31, 32 (AC)	Vol.	6	G12	6			3.5-3.5 .08	25	See Note See Note	B1 B9				51, 24, 47, 27, 80	175	1
36, 36A & B, 37	Vol.	6	G12				8-4 8	25 14	CM171 CS123	B199 B3				51, 24, 47, 80, 27	175	1
38	Vol.	13	SRP179				2-4	1	See Note	B1				26, 27, 71, 80		11
40, 41 (AC)	Vol. Tone	15 22	N N	6			8-8-4	56	CM175	B205				51, 27, 47, 80	175	1
45A, 45C	Vol.	18	N	6			SA-106878 SA105741	1 15	CN152 TS101		24	271		77, 78, 75, 41	175	10
46 (AC)	Vol.	14	N											71A, 26, 27		
48, 49 (AC)	Vol. Vol.	40/12 40/12	GK GE		Early Late	A79 A79	4-2-1	3	See Note	B1				45, 27, 24, 80		3
54 (DC)	Vol.	40/8	CE			A54	4-4	1	See Note	B11				27, 24, 71		
56 (Battery)	Vol.	40/12	GK											22, 201A, 112A		
58 (AC)	Vol. Tone	8 41	D N				2-2-4	3	See Note	B1				24, 27, 45, 80		3
60, 60D, 60E, 61	Vol. Tone	15 41	N N				2-2-4-2	3	See Note	B1				24, 27, 45, 80		7
62 (DC)	Vol. Tone	8 41	D N				4-4	1	See Note	B11				24, 27, 45		
63 (DC)	Vol. Tone	15 41	N N				4-4	1	See Note	B11				24, 27, 45		
66 (AC)	Vol.	14	N											26, 27, 71		
73, 74	Vol. Tone	6 ‡	G12 K12	6			2-2-4	26	See Note	B1				24, 27, 45, 80		1
79C	Vol. Tone	18 22	N N	6			SA106536 .008	4	CM172 Buffer	 B14	20	253	C3	77, 78, 75, 42, 84	175	10
80, 84	Vol.	7	A20MP											24, 12A		
91, 92	Vol. Tone	15 22	N N	6			16 4 SA103037	25 25 14	CS136 CS131 CS123	B39 B39				51, 24, 47, 27, 80	175	1
96 (AC)	Vol.	14	N											26, 27, 71		
96 (DC)	Vol.	14	N											26		
100 (Adv. 9-20 Auto)	Vol.	‡	‡		See Note	A5	4-6	24	CN151					36, 37, 38	175	MG
107 (AC)	Vol.	14	N											26, 27, 71		
113	Vol. Sen.	15 7	N J											39, 85, 89, 52		
113X	Vol.	18	N											39, 75, 89, 52		
114	Vol. Sen.	15 7	N J											39, 85, 89, 52		
116 (AC)	Vol.	14	N											26, 27, 71		
119 (Police Motorcycle Radio)	Vol.	18	500M No. 1		See Note	A1	4-4 5	1 15	See Note TS101	B3				78, 6A7, 75, 41	456	MG
123	Vol. Sen.	15 7	N J											39, 85, 89, 52		
123X	Vol.	18	N											39, 75, 89, 52		
126 (AC)	Vol.	14	N											71, 26, 27		
129 (Police Motorcycle Radio)	Vol.	18	500M No. 1		See Note	A1	4-4 5	1 15	See Note TS101	B3				78, 6A7, 75, 41	456	MG

‡ Data not substantiated.

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MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
UNITED AMERICAN BOSCH—Continued																
133	Vol.	6	G12	6			2-2-4	26	See Note	B1				24, 27, 45, 80		1
	Tone	‡	K12													
136 (AC)	Vol.	14	N											26, 27, 71		
139 (Types H, L, HT, LT, HC, LC, HTC, LTC)	Vol.	18	N	6	RS246		CE9510	1	See Note	B125				78, 6A7, 75, 41	456	MG
							SA105910	15	BN225							
139 (Types V, VC, VT, VTC)	Vol.	18	N	6	RS246		CE951	4	See Note	B125	20	253Y	C3	78, 6A7, 75, 41, 84	456	10
							SA-105910	15	BN225							
							.008		Buffer	B14						
140A	Vol.	18	‡		See Note A5		8-8	1	See Note	B3	24	271		78, 6A7, 75, 41	456	10
							10	15	TS101							
146	Vol.	14	N											71, 27, 26		
149 (Types H, L, HT, LT, HC, LC, HTC, LTC)	Vol.	18	N	6	RS246		CE9510	1	See Note	B125				78, 6A7, 75, 41	456	MG
							SA105910	15	BN225							
149 (Types V, VC, VT, VTC)	Vol.	18	N	6	RS246		CE951	4	See Note	B125	20	253Y	C3	78, 6A7, 75, 41, 84	456	10
							SA105910	15	BN225							
							.008		Buffer	B14						
150 (Type 1)	Vol.	18	N				SA105456	1	CN152		2	219		36, 39, 85, 41	175	26
							SA104614	1	CS123							
150 (Type 2)	Vol.	18	N				SA105456	1	CN152		24	271		77, 78, 85, 41	175	10
156 (DC)	Vol.	14	N											26		
160	Vol.	18	500M No. 1		See Note A1		8-8	1	CN152		24	271		77, 78, 85, 41	175	10
166, 176 (AC)	Vol.	14	N											71, 27, 26		
200, 201 (AC)	Vol.	7	G	6			SA101881	25	CM171	B199				51, 24, 47, 80		1
205, 205A, 206 (5A)	Vol.	7	G	6			SA102553	25	CM171	B199				51, 24, 47, 80		1
224	Vol.	6	G7	6			3-3	25	See Note	B11				39, 71A, 52, 37	175	
	Tone	21	N				.01		See Note	B9						
226	Vol.	16	N											32, 34, 30, 49	175	
	Tone	114	‡	14	See Note A5											
236, 237 (AC)	Vol.	6	G12				8-4	25	CM171	B199				51, 57, 47, 27, 80	175	1
							8	14	CS133							
239AA	Vol.	6	G12				8-4	25	CM171	B199				51, 24, 27, 47, 80	175	1
	Tone	22	N				8	14	CS123							
242, 243 (AC)	Vol.	15	N	6			SA103595	30/14	UR191	B200				56, 58, 47, 80	175	1
	Tone	22	N													
250, 251	Vol.	15	N	6			SA103950	3/13	UR191	B201				58, 56, 45, 80	175	3
	Tone	120	L				SA103740	1	CN152	B12						
260, 261	Vol.	20	500M No. 1	6	See Note A19		SA103950	3/13	UR191	B201				58, 56, 45, 80	517.5	3
	Tone	120	L													
305A	Vol.	6	G12	6			SA102768	25	CM171	B199				57, 58, 47, 80	456	1
503	Vol.	18	N	6			SA106487	25/19	CM172/TS102	B112				6F7, 78, 75, 43, 12Z3		
305 Ed. 2	Vol.	18	N	6			SA105237	25/19	CM171/TS102	B202				57, 58, 2A6, 47, 80	456	1
307	Vol.	56	N	6			SA105165	25/19	CM171/TS102	B202				57, 58, 55, 24, 80	175	3
	Tone	22	N													
310A	Vol.	15	N	6			SA104422	30	CM175	B206				58, 27, 45, 56, 80	175	1
	Tone	22	N				SA103037	15	CS123							
	Sil.	‡	A10MP													
312, 313 (AC)	Vol.	118	L	6			SA103740	57	CN155	B203				58, 57, 56, 46, 82	175	3
	Tone	122	L				SA103595	57	CS131/CN152	B204						
							SA103037	16	CS123							
350, 352	Vol.	18	N				SA106340	25/19	CM172/TS102	B202				2A7, 58, 2A6, 2A5, 80	175	1
	Tone	22	N	6												
355, 357	Vol.	18	N				SA105700	8/15	RM257/TS101	B207				6A7, 78, 75, 43, 25Z5	175	
	Tone	22	N	6												
360, 361, 364	Vol.	18	N				CE954	25/19	RM261/TS102	B213				2A5, 2A6, 58, 56, 80	456	1
	Tone	22	N	6												
370, 371	Vol.	18	N				SA105817	3	RN242					2A7, 58, 2B7, 53, 83	265	1
	Tone	22	L	6			SA105818	3/13/15	CM173/TS107	B208						
376, 376BT, 376F, 376S	Vol.	4/9	GG				SA107029	12/13	RN231	B209				1A6, 34, 33, 32	456	
	Tone	121	N													
385	Vol.	4/9	GG				CE959	12/13	RN231	B209				1A6, 34, 33, 32	463	
386	Vol.	45	N				CE959	12/13	RN231	B209				1C6, 34, 30, 32, 33	463	
402 Ed. 1, 2	Vol.	18	N	6			SA105722	8/15	UR182/TS101	B210				6F7, 78, 75, 43, 25Z5	456	
402 Ed. 3	Vol.	18	N	6			CE957	8	UR182	B210				6F7, 78, 75, 43, 25Z5	456	
							CE958	15	TS101	B210						
405	Vol.	18	N	6			SA105237	25/19	CM171/TS102	B202				57, 58, 2A6, 47, 80	456	1
420, 421	Vol.	18	N				SA107288	1/15	RN245	B211				6F7, 6D6, 75, 42, 80	456	1
	Tone	121	M	6												
430, 430J, 430T, 431, 431J, 431T, 434, 434J, 434T	Vol.	18	N	6			SA107239	1	RS213					6A7, 6D6, 75, 42, 80	450	1
							SA107288	1/13/15	RN245	B212						
440C, 440T, 441C, 441T, 444C, 444T	Vol.	18	N				SA106665	25/19	RM261/TS102	B213				6A7, 6D6, 75, 42, 80	456	1
	Tone	121	M	6			SA107239	13	RS213							
450L, 450H, 451L, 451H	Vol.	18	N	6			SA107239	1	RS213					6A7, 6D6, 75, 42, 80	450	1
							SA107288	1/13/15	RN245	B212						
454L, 454H	Vol.	18	N	6			SA107239	1	RS213					6A7, 6D6, 75, 42, 83V	450	1
							SA107288	1/13/15	RN245	B212						
460, 460A-B-R, 461A-B-R (Ed. 1 and 2), 464A-B-R	Vol.	18	N				SA106665	25/19	RM261/TS102	B213				58, 2A6, 2A5, 56, 80	456	1
	Tone	121	M	6												
470G-U, 471G-U, 474G-U	Vol.	18	N				CE954	25/19	RM261/TS102	B213				58, 2A6, 2A5, 56, 80, (83V)	456	1
	Tone	121	M	6												
480 (Early)	Vol.	18	N				SA107510	59	RN245					78, 77, 6B7, 42, 6A6, 76, 83V	456	1
	Tone	121	M	6			SA107516	15	BN226	B8						
480 (Ed. 1 and 2), 481, 484	Vol.	18	N				CE955	59	RN242					78, 77, 42, 6A6, 76, 83V	456	1
	Tone	121	M	6			SA107510	59/13	RN245							
	Supp.	7	G				SA107516	15	BN226	B8						
500	Vol.	18	N	6			SA105309	11/15	UR182/TS101	B214				78, 75, 43, 25Z5	456	
501, 502 (AC-DC)	Vol.	18	N	6			SA105722	8/15	UR182/TS101	B210				6F7, 78, 75, 43, 25Z5	456	
505, 510, 510E	Vol.	18	N	6			CE9512	25	RS215					6F7, 6D6, 75, 42, 80	465	1
							CE9511	25	RS213							
							CE958	19	TS101							
524A (Ed. 1, 2, 2D, 2G)	Vol.	18	N	6	RS246		CE951	4	See Note	B125	22	253Y	C3	6A7, 78, 75, 42, 84	456	10
							.008		Buffer	B14						
565W, 565K	Vol.	18	N	6			CE9512	1	RS215					6L7, 6K7, 75, 6F6, 6C5, 80	465	1
							CE9511	1	RS213							
							CE958	19	TS101							
575F, 575Q	Vol.	18	N				CE954	25/19	RM261/TS102	B213				6K7, 6H6, 6F5, 6F6, 6A8, 80	465	1
	Tone	121	N	6			CE9511	14	RS213							

‡ Data not substantiated.

*** IMPORTANT: Read Notes in Note Section if specified in Note Column.**

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
UNITED AMERICAN BOSCH—Continued																
585, 585Y, 585Z, 586	Vol.	18	N				CE954	25/19	RM261/TS102	B213				6K7, 6H6, 6F5, 6F6,		
	Tone	121	N	6			CE9518	14	RS213					6A8, 6C5, 80	465	1
							CE9515	15	TS101							
595M, 595P	Vol.	15	O				CE9516	59	RS213					6K7, 6A8, 6C5, 6H6,		
							CE9517	59	RS216					6F5, 6F6, 5Z3	465	1
							SA107913	15	BN226							
600	Vol.	18	N	6			CE9541	1/15	See Note	B125	13	245	C3	6A7, 6D6, 75, 41	465	10
							.008		Buffer	B14						
604	Vol.	7	‡	6	See Note A5		CE9533	6	RS215					6A7, 6C6, 43, K55C—		
							CE9534	6	RS216					Ballast, 25Z5	465	
							CE9515	15	TS101							
605, 605C	Vol.	18	N	6			CE9536	1	RS215					6A8, 6K7, 75, 6F6,		
							CE9535	1	RS216					5Y3	465	1
							CE9515	19	TS101							
620	Vol.	18	500M No. 1	6	See Note A19		CE9539	27	See Note	B125				6A8, 6K7, 6H6, 6F5,		
	Tone	22	‡		See Note A5		CE9538	27	RS216					25A6, 25Z6, K42C		
							CE9540	13	RS201					—Ballast	465	
625	Vol.	18	500M No. 1	6	See Note A19		CE9539	27	See Note	B125				6A8, 6K7, 6H6, 6F5,		
	Tone	22	‡		See Note A5		CE9538	27	RS216					25A6, 25Z6, K42E		
							CE9540	13	RS201					—Ballast	465	
634A, 634A (Ed. 2), 636, 637	Vol.	18	N	6	RS246		CE951	4	See Note	B125	22	253Y	C3	77, 78, 75, 42, 84	175	10
	Tone	121	N				.008		Buffer	B14						
640, 650	Vol.	18	500M No. 1	6	See Note A19		CE9536	25	RS215					6A8, 6K7, 6H6, 6F6,		
	Tone	125	20M No. 1		See Note A84		CE9535	25	RS216					6F5, 5Z4 or 5Y3	465	1
							CE9537	13/15	RN241	B217						
660T, 660C	Vol.	18	500M No. 1		See Note A19		CE9536	25	RS215					6K7, 6H6, 6F5, 6A8,		
	Tone	121	N	6			CE9535	25	RS216					6F6, 5Z4 or 5Y3	465	1
							CE9528	14	RS213							
							CE9526	15	TN111							
670S, 670C	Vol.	18	N				CE9536	25	RS215					6K7, 6H6, 6F5, 6A8,		
	Tone	22	L	6			CE9535	25	RS216					6F6, 5Z4	465	1
							CE9528	14	RS213							
							CE9526	15	TN111							
736, 737, 738	Vol.	18	M		RS246		CE951	4	See Note	B125	35	294	C3	6J7, 6A8, 6K7, 6H6,		
	Tone	121	M				CE9524	19	TS101					6F5, 6F6, 0Z4	175	10
							.005		Buffet	B14						
UNITED MOTORS SERVICE "DELCO" (Buick, Olds, Pontiac)																
A1, B1	Vol.	56	N				8-8	1	RS213	B66				58, 57, 56, 55, 47, 80	‡	1
	Tone	21	N													
	Sen.	7	F													
A3, B3	Vol.	45	N				2	‡	See Note	B11				39, 36, 37, 38	175	
	Tone	22	N													
A5A3 (Auburn)	Vol.	18	UC514	6			W32759	1	RS213		16	247	C3	78, 6F7, 6B7, 42	181.5	10
							W32802	1/15	SR605	B23						
							.005		Buffer	B14						
A255 (Cord)	Vol.	15	UC514				8-8	1	RN242		25	273C		6D6, 6A7, 6B7, 76,		
														6B5	450	10
A355 (Graham-Paige)	Vol.	15	UC514				8-8	1	RN242		25	273C		6D6, 6A7, 6B7, 76,		
														6B5	450	10
A455 (Cord)	Vol.	126	UC514				38478A	1	RN242		25	273C		6D6, 6A7, 6B7, 6B5	450	10
A555 (Graham-Paige)	Vol.	126	UC514				38473A	1	RN242		25	273C		6D6, 6A7, 6B7, 6B5	450	10
626 (Delco)	Vol.	18	UC512				1209285	22/15	RN245		25	273C		6D6, 6A7, 6B7, 42	262	10
	Tone	21	M				4	15	TS101							
627 (Delco)	Vol.	15	UC514				1209285	22/15	RN245		25	273C		6D6, 6A7, 6B7, 6E6	262	10
628 (Delco)	Vol.	62	UC514				1209283	1	RS215		25	273C		6D6, 6A7, 85, 6A6	262	10
	Tone	44	L				1209284	1/15	RS213/TN111	B5						
629 (Delco) (Below No. 40100)	Vol.	45	UC514				1209285	1/15	RN245		25	273C		6F7, 6B7, 6D6, 42	262	10
629 (Delco) (Above No. 40100)	Vol.	62	UC514				1209285	1/15	RN245		25	273C		6F7, 6A7, 6B7, 42	262	10
630 (500) (Delco)	Vol.	62	UC514				1209806	4	CM171		35	294	C3	6A7, 6B7, 6D6, 42, 84	262	10
							.01		Buffer	B14						
631 (Delco)	Vol.	18	UC514				1210556	1	CN152		35	294	C3	6A7, 6B7, 6D6, 6B5,		
							.05		Buffer	B14				84	262	10
631A (Delco)	Vol.	73	UC511				1211247	4	RM262	B73	35	294	C3	6D6, 6A7, 6B7, 42, 84	262	10
							.005		Buffer	B14						
632 (Delco)	Vol.	126	UC514				1210215	1	RN242		35	294	C3	6D6, 6A7, 6B7, 6B5,		
	Tone	21	O				.005		Buffer	B14				84	262	10
633 (Delco)	Vol.	126	UC514				1210220	1	RN242		35	294	C3	6D6, 6A7, 6B7, 6B5,		
	Tone	21	O				.005		Buffer	B14				84	262	10
634 (Delco)	Vol.	15	UC514				1210926	1/15	RN245/TS101	B193	25	273C		6D6, 6A7, 85, 41	262	10
	Tone	21	M													
635 (Delco)	Vol.	20	1 Meg. No. 1		RS245	A19	1210926	1/15	RN245/TS101	B193	25	273C		6D6, 6A7, 85, 6F6	262	10
1101 (Delco)	Vol.	56	N	6			1208786	11/15	See Note	B125				6F7, 78, 6B7, 43,		
														25Z5	181.5	
1102, 1103 (Delco)	Vol.	15	N				1208317	4	RS215					6D6, 6A7, 6B7, 76,		
	Tone	22	Z12	6			1208316	4/14	RN245					42, 80	456	1
1104 (Delco)	Vol.	‡	N				1208317	4	RS215					6D6, 6A7, 6B7, 6F7,		
	Tone	34	Z12	6			1208316	4/14	RN245					42, 80	456	1
2017, 2018 (Delco)	Vol.	25	GK				1202264	4	RS215					24A, 45, 80		1
	Tone	22	G12				1201400	4	RS213							
2035 (Revised)	Vol.	17	UC512	6			1207584	1	CN152		4	221	C3	36, 39, 85, 89	262	10
	Tone	44	K12				1207616	15	TS105							
							.015		Buffer	B14						
3201, 3202 (Below 800,000)	Vol.	17	N	6										6D6, 6A7, 85, 48	262.5	
3201, 3202 (Delco) (Above 800,000)	Vol.	17	N	6										6D6, 6A7, 85, 48	456	
3203, 3204 (Delco)	Vol.	15	N				1208892	1	RS205/TS106		17	F247	C3	6D6, 6A7, 6B7, 6F7,		
	Tone	44	Z12	6			1208891	1/14	RN245/TS101					43	456	10
							1208890	14	RS203							
							.01		Buffer	B14						
4036 (B. O. P.)	Vol.	17	UC512	6			1207830	1	CS133		4	221	C3	36, 39, 85, 89, 84	262	10
	Tone	44	K12				.015		Buffer	B14						
4037	Vol.	17	N		See Note A27		1207995	1/15	CN142/TN110		5	222		78, 6F7, 75, 41	262	10
	Vol.	17	UC512		See Note A4											
4038	Vol.	17	UC512				1208241	1	CN152		5	222		78, 6F7, 85, 41	262	10
	Tone	44	N													
4048	Vol.	6	Y				4-12-4	11	UR182	B31				6F7, 78, 75, 43, 25Z5	455	
4049, 4050	Vol.	15	UC504				W29978	1	CS125		17	F247	C3	78, 6B7, 37, 75, 43	181.5	10
	Tone	22	K12				8-8-8	24/15	CN155							
							12-2.5	‡	See Note	B125						
							.01		Buffer	B14						
4051 (32 volt)	Vol.	6	E7		1		12	1	CS135		17	F247	C3	78, 77, 43	181.5	10
							8	1	CS133							
							6	15	TS101							
							12-2.5	‡	See Note	B125						

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
UNITED MOTORS SERVICE—Continued																
4052 (AC-DC)	Vol.	17	UC504				8-25-16	11	UR182	B31				6A7, 78, 6B7, 43,		
							6	15	TS101					25Z5	456	
4053, 4053A	Vol.	15	UC504				W23705A	3	RS215					56, 58, 2A5, 80	181.5	1
	Tone	44	Z				W29097A	3/14	RN245	B57						
4054	Vol.	17	N	6										6A7, 6D6, 85, 48	262	
R6011 (Delco)	Vol.	18	N				8-8	1	RN242		48	See Note	C8	6A7, 15, 76, 19	465	10
	Tone	22	K12	6			10	15	TS101							
							.01		Buffer	B14						
364441 (Chevrolet)	Vol.	17	O	7	FS253		1207695	1	CN152		4	221	C3	36, 39, 85, 89, 84	262	10
	Tone	44	K12				1207901	15	TN110	B169						
							.015		Buffer	B14						
393884 (Oldsmobile)	Vol.	15	UC512				1209047	1/15	CN155		25	273C		6F7, 6A7, 6B7, 42	262	10
393885	Vol.	17	UC512		EB247		1209144	1/15	CN152/TN110	B220	25	273C		78, 6A7, 6F7, 85, 41	262	10
405045	Vol.	127	UC512		EB247		1209144	1/15	CN152/TN110	B220	25	273C		78, 6A7, 6F7, 85, 41	262	10
	Tone	44	K12													
405046	Vol.	15	UC512				1209047	1/15	CN155		25	273C		6F7, 6A7, 6B7, 42	262	10
405047, 405062	Vol.	15	UC512				1209588	1	CN152		25	273C		6F7, 6A7, 6B7, 41	172	10
	Tone	128	N													
405063 (Oldsmobile)	Vol.	15	UC512				1209531	1/15	CN155		25	273C		6F7, 6A7, 6B7, 42	‡	10
544245 (Buick-Pontiac)	Vol.	15	UC512				1209047	1/15	CN155		25	273C		6F7, 6A7, 6B7, 42	262	10
544246	Vol.	127	UC512		EB247		1209144	1/15	CN152/TN110	B220	25	273C		78, 6A7, 6F7, 85, 41	262	10
	Tone	44	K12													
544267	Vol.	15	UC512				1209047	1/15	CN155		25	273C		6F7, 6A7, 6B7, 42	262	10
544268	Vol.	127	UC512		EB247		1209144	1/15	CN152/TN110	B220	25	273C		78, 6A7, 6F7, 85, 41	262	10
	Tone	44	K12													
544289 (Pontiac) (Above 1,750,000)	Vol.	15	UC512				1209531	1/15	CN155		25	273C		6F7, 6A7, 6B7, 42	262	10
544290-1 (Pontiac)	Vol.	15	UC514				1209819	1	RN245		25	273C		6F7, 6A7, 6B7, 42	‡	10
	Tone	22	M													
600153 (Chevrolet)	Vol.	17	N		See Note	A27	1207995	1/15	CN142/TN110		5	222		‡	262	10
	Vol.	17	UC512		See Note	A4										
600249 (Chevrolet)	Vol.	17	UC512				1208241	1	CN152		5	222		78, 6F7, 85, 41	262	10
	Tone	44	K12													
600565 (Chevrolet)	Vol.	17	Order from	Mfr.			1208241	‡	CN152		5	222		78, 6F7, 85, 41	262	10
600566 (Chevrolet)	Vol.	17	Order from	Mfr.			1207995	1/15	CN142/TN110		5	222		78, 6F7, 75, 41	262	10
601038 (Chevrolet)	Vol.	18	N	6			1208584	1	CN152		25	273C		78, 6A7, 6F7, 85, 41	175	10
	Tone	44	N													
601176 (Chevrolet)	Vol.	17	UC512		EB247		1209144	1/15	CN152/TN110	B220	25	273C		78, 6A7, 6F7, 85, 41	262	10
601177 (Chevrolet)	Vol.	15	UC512				1209047	1/15	SR611		25	273C		6F7, 6A7, 6B7, 42	262	10
601525 (Chevrolet)	Vol.	17	500M No. 1		See Note	A1	1209144	1/15	CN152/TN110	B220	25	273C		78, 6A7, 6F7, 85, 41	262	10
601574 (Chevrolet)	Vol.	15	UC512				1209531	1/15	CN155		25	273C		6F7, 6A7, 6B7, 41	175	10
	Tone	‡	N													
601586	Vol.	15	UC512				1209047	1/15	CN155		25	273C		6F7, 6A7, 6B7, 42	262	10
601662 (Chevrolet)	Vol.	15	UC514				1209285	1/15	RN245		25	273C		6F7, 6A7, 6B7, 42	262	10
	Tone	21	N													
601814 (Chevrolet)	Vol.	20	UC514		EB247		1210065	1/15	CN152/TN110	B220	25	273C		6D6, 6A7, 6F6, 85, 41	‡	10
	Tone	44	K12													
980393	Vol.	17	UC512	6			1207830	1	CS133		4	221	C3	36, 39, 85, 89, 84	262	10
	Tone	44	K12				.015		Buffer	B14						
980455 (B. O. P.)	Vol.	17	UC512	6			1207995	1/15	CN142/TN110		5	222		78, 6F7, 75, 41	262	10
980459 (B. O. P.)	Vol.	18	UC512	6			1208241	1	CN152		5	222		78, 6F7, 85, 41	262	10
	Tone	44	K12													
980507-8 (Buick)	Vol.	17	Order from	Mfr.			1210537	1/15	CN152/TN110		26	273D		6D6, 6A7, 85, 76, 6A6	262	10
	Tone	22	O													
980509 (Buick)	Vol.	17	1 Meg. No. 1		RS245	A19	1210885	1/15	CN152/TN110		26	273D		6D6, 6A7, 75, 42	262	1
	Tone	22	O													
980525 (Buick)	Vol.	20	TRP608		RS245		1211167	1	CN152		26	273D		6D6, 6A7, 85, 76, 6A6	‡	10
							1211166	15	TN111							
980526 (Buick)	Vol.	20	TRP608		RS245		1211167	1	CN152		26	273D		6D6, 6A7, 75, 42	‡	10
							1211215	15	TS101							
980529 (Buick)	Vol.	20	TRP608		RS245		1211167	1	CN152		26	273D		6D6, 6A7, 75, 42	‡	10
							1211215	15	TS101							
980534-5 (Buick)	Vol.	20	TRP608	6	See Note	A1	1211570	1	RN242		50	514	C3	6K7, 6A7, 6D6, 85,		
							1211572	15	TN111					76, 6A6	‡	10
							.01-.01		Buffer	B14						
982006 (Oldsmobile)	Vol.	17	UC512				1210514	1/15	SR611		25	273C		6D6, 75, 76, 42	262	10
	Tone	22	N													
982007, 982008 (Oldsmobile)	Vol.	17	UC514				1210515	1/15	CN152/TN111		25	273C		6D6, 85, 76, 6E6	262	10
	Tone	22	N													
982043 (Oldsmobile)	Vol.	20	1 Meg. No. 1		RS245	A19	7230264	1	RN242		35	294	C3	6K7G, 6A8G, 6Q7G,		
							.005		Buffer	B14				6N6G, 6X5G	‡	10
983506 (Pontiac)	Vol.	17	UC514				1210528	1/15	CN152/TN111		25	273C		6D6, 6A7, 85, 76, 6E6	262	10
	Tone	22	N													
983507 (Pontiac)	Vol.	17	UC512				1210511	1/15	CN152/TS101		25	273C		6D6, 6A7, 75, 42	262	10
	Tone	22	N													
983526 (Pontiac)	Vol.	20	500M No. 1		RS245	A19	1210548	1	CN152		35	294	C3	6U7G, 6A8G, 6V7G,		
							1210549	15	TN110					6J5G, 6N7G,		
							.005		Buffer	B14				6X5G	‡	10
983527 (Pontiac)	Vol.	20	500M No. 1		RS245	A19	1211580	1/15	CN152/TS101		35	294	C3	6U7G, 6A8G, 6Q7G,		
							.005		Buffer	B14				6F6G, 6X5G	‡	10
982044 (Oldsmobile)	Vol.	20	500M No. 1		RS245	A19	1211580	1/15	CN152/TS101		35	294	C3	6U7G, 6A8G, 6Q7G,		
							.005		Buffer	B14				6F6G, 6X5G	‡	10
983534 (Pontiac)	Vol.	20	1 Meg. No. 1		RS245	A19	7230264	1	RN242		35	294	C3	6K7G, 6A8G, 6Q7G,		
							.005		Buffer	B14				6N6G, 6X5G	‡	10
985200 (Chevrolet)	Vol.	20	1 Meg. No. 1		See Note	A3	W38363	4	RM255	B64	35	294	C3	6D6, 6A7, 6B7, 76,		
							.01		Buffer	B14				42, 84	262	10
985300 (Chevrolet)	Vol.	17	1 Meg. No. 1		See Note	A19	1210857	1/15	CN152/TN110		26	273D		6D6, 6A7, 85, 76, 6A6	262	10
	Tone	119	K12													
985301 (Chevrolet)	Vol.	20	TRP608		RS245		1211167	1	CN152		26	273D		6D6, 6A7, 85, 76, 6A6	‡	10
							1211166	15	TN111							
985400 (Chevrolet)	Vol.	20	1 Meg. No. 1		RS245	A19	1209285	1/15	RN245		26	273C		6D6, 6A7, 85, 41	262	10
1291344 (Buick)	Vol.	127	UC512		EB247		1209144	1/15	CN152/TN110	B220	25	273C		78, 6A7, 6F7, 85, 41	262	10
	Tone	44	K12													
1291345 (Buick)	Vol.	15	UC512				1209047	1/15	CN155		25	273C		6F7, 6A7, 6B7, 42	262	10
UNITED REPRODUCERS CORP.			(Peerless)													
20 Series	Vol.	35	‡		See Note	A5	2-2-2	60	See Note	B1				24A, 27, 45, 80		‡
	Sen.	105	X													
45 (Arborphone)	Vol.	4	G12				‡	1/14	See Note	B1				26, 27, 71A, 80		11
65 (Electro Static Spkr.)	Vol.	7	UC500				2-1	1	See Note	B1				24A, 27, 45, 80, 99		24
70 Series (71, 72)	Vol.	6	E12		See Note	A3	2-2	1	See Note	B1				24A, 01A, 27, 45, 80		‡
	Sen.	98	X		See Note	A3										
UNITED SCIENTIFIC LABS.—See Dewald.																
UNIVERSAL BATTERY CO.																
613V (32 Volt DC)	Vol.	18	N											6A7, 6D6, 85, 6C6, 48	465	
7232, 7332	Vol.	15	N				12-6	1	See Note	B3	47	See Note	C6	76, 6D6, 6C6, 6A7, 42	465	10
							10	15	TS101							

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS Use	Cir-cuit	Correct Replacement	Switch	Bias	*Note	CONDENSERS Original Part	Cir-cuit	Correct Replacement	*Note	VIBRATORS Vibr. Conn.	Replace-ment	*Note	Types of Tubes Used	I. F. Peak	Trans. Cir-cuit
U. S. RADIO & TELEVISION (Apex. Radiotrope)																
3	Vol.	58	F				8-8	4	See Note	B3				24A, 47, 80		1
5A (AC) (Chassis 502)	Vol.	6	G12				8-8	1	See Note	B3				57, 58, 47, 80	455	1
7 (AC)	Vol.	15	N				3366	28	CS131					35, 24A, 27, 47, 80	262	3
	Lclzr.	‡	UC502				3529	28	CS131							
	Tone	22	UC509													
7D (Chassis 700)	Vol.	6	G12				8-8	1	See Note	B3				56, 57, 58, 47, 80	455	3
	Tone	34	M													
8 Series	Vol.	15	O				2803	1	CS133	B194				35, 27, 47, 80	262	3
	Tone	34	UC502				2852	17	CS123							
9 (Chassis 900, 902)	Vol.	15	M				8-8-8	28	See Note	B3				58, 57, 56, 46, 80	262	7
	Sen.	98	F													
	Tone	95	L													
10	Vol.	15	O				2803	1	CS133					35, 27, 47, 80	262	3
	Tone	44	UC502				2719	13	CS123							
							2852	15	TS106							
10C (Chassis 1000-1001)	Vol.	15	O				2803	1	CS133					35, 27, 47, 80	262	3
	Tone	41	M				2719	13	CS123							
							2852	15	CS123							
12 (Class "B") (Chassis 1200)	Vol.	15	M		See Note	A27	4-8-8	3	See Note	B3				58, 56, 46, 57, 82	262	33
	Vol.	20	TRP606		See Note	A4	8	18	See Note	B3						
	Tone	‡	L		See Note	A27	8	17	TS106	B3						
	Tone	21	N		See Note	A4										
	Sen.	7/12	DRP316													
19 (Chassis 900, 902)	Vol.	15	M				8-8-8	28	See Note	B3				58, 57, 56, 46, 80	262	7
	Tone	95	L				4	‡	See Note	B3						
	Sen.	98	F													
20	Vol.	6	G12				8-8	25	See Note	B3				24A, 71A, 80		1
24 (Chassis 400)	Vol.	40	Y				8-8	1	CN152	B3				47, 57, 80	455	1
							4	19	TS101							
25 (Chassis 500) (2 types)	Vol.	6	G12				8-8	1	See Note	B3				57, 58, 47, 80	455	1
26	Vol.	6	G12				1942	1	RS213					24A, 45, 80		1
26P	Vol.	6	G12				2678	1	RS213					24A, 45, 80		1
27 (Early)	Vol.	42	UC500				8-8	1	See Note	B3				24A, 27, 45, 80		1
27 (Late)	Vol.	6	G12	6			8-8	1	See Note	B3				24A, 27, 45, 80		1
27P	Vol.	6	G12				8-8	1	See Note	B3				24A, 27, 45, 80		1
	Phono.	87	‡		See Note	A5										
28 (Early) (Late)	Vol.	8	A400P				1-3-1	3	See Note	B1				24A, 27, 45, 80		3
	Tone	41	N													
29	Vol.	6	G12				8-8-8	1/14	See Note	B3				24A, 27, 45, 80		
	Tone	41	N													
30 Auto	Vol.	7	UC501											24A, 26, 71A, 01A		
31 Apex	Vol.	6	G12				8-8-8	28	RS213	B66				27, 24A, 45, 80		1
	Tone	41	N													
31R (Remote Control)	Vol.	7	G				8-8-8	28	RS213	B3				27, 24A, 45, 80		1
	Tone	41	N													
32 Series	Vol.	6	G12				8-8-8	28	RS213	B3				45, 27, 24A, 80		1
	Tone	41	N													
33 (DC)	Vol.	6	G12											64, 71A		
36, 37 Apex	Vol.	4	D12				1-1-1	3	See Note	B1				71A, 26, 27, 80		11
41 (60 Cycle)	Vol.	8	A400P				1-1.5-1	3	See Note	B1				27, 45, 80		3
42 (60 Cycle)	Vol.	8	A400P				1-1-1	3	See Note	B1				27, 45, 80		3
43 (25 Cycle)	Vol.	8	A400P				1-1.5-1	3	See Note	B1				27, 45, 80		3
44 (25 Cycle)	Vol.	8	A400P				1-1-1	3	See Note	B1				27, 45, 80		3
46, 46A, 47, 47A	Vol.	8	A400P				1-1.5-1	3	See Note	B1				27, 24A, 45, 80		3
48, 48A, 48W	Vol.	8	A400P				1-3-1	3	See Note	B1				27, 24A, 45, 80		3
	Tone	41	N													
49	Vol.	6	G12											24A, 26, 01A, 71A		
69 (Chassis 906)	Vol.	15	N				4-4	12/19	CN140	B3				32, 34, 30	262	
	Tone	44	UC502													
80 (Case)	Vol.	4	D12		See Note	A27	‡	‡	See Note	B1				26, 27, 71A, 80		11
	Vol.	40	G12		See Note	A4										
99 Series	Vol.	6	G12				3366	1	CS131					24A, 35, 47, 80	262	1
							2803	1	CS133							
120 Class "B" (Chassis 1200)	Vol.	15	M		See Note	A27	4-8-8	3	See Note	B3				58, 56, 46, 57, 82	262	33
	Vol.	20	TRP606		See Note	A4	8	18	See Note	B3						
	Tone	‡	L		See Note	A27	8	17	TS106	B3						
	Tone	21	N		See Note	A4										
	Sen.	7/12	DRP316													
160, 250 (Chassis 90)	Vol.	40	‡		See Note	A5	2-2-2	1/14	See Note	B1				27, 45, 80		25/34
482	Vol.	8	A400P				1-3-1	3	See Note	B1				24A, 27, 45, 80		3
	Tone	41	N													
1006, 1007 Class "B"	Vol.	15	M				8-8-8	28	See Note	B3				58, 56, 46, 80	262	7
	Tone	95	K12				8-8	‡	See Note	B3						
3040, 3056 (Chassis 507)	Vol.	6	Y				8-8	1	CN152	B3				47, 57, 58, 80	455	1
							4	17	TS101							
3070 (Chassis 1009)	Vol.	15	M				8-8	55	CN152	B3				58, 56, 46, 80	262	1
	Tone	41	K12				4	55	CS131							
3092 (Chassis 513)	Vol.	6	Y				4-12-4	11	UR182	B182				6F7, 78, 75, 43, 25Z5	455	
UTAH PRODUCTS CO.																
400A Series	Vol.	15	M				8-8-4-2	37	See Note	B3				58, 55, 56, 57, 47, 80	180	3
	Supp.	‡	Y250MP		See Note	A4	40	15	SR608	B3						
	Tone	41	O													
400B	Vol.	33	M				8-8-4-2-2	3	See Note	B3				55, 58, 56, 57, 2A5, 5Z3	180	7
	Tone	‡	M				40	15	SR608	B3						
	Supp.	44	UC501													
"B" Elim. (Non Sync.)							8	1	CS123		4	221	C3	84		10
							20	‡	TS102							
							.02		Buffer	B14						
VICTOR—See RCA.																
VIKING—See Ozarka.																
VOCO RADIO MFG. CO., INC.																
V41N	Vol.	6	SRP263				8-4	4	See Note	B3				35, 24A, 47, 80		1
V60	Vol.	15	N				6-6	1	CN152	B3				58, 57, 55, 47, 80	175	1
V80	Vol.	15	N				‡	1	See Note	B3				58, 56, Wunderlich, 47, 80	‡	1
V100	Vol.	15	N				‡	1	See Note	B3				58, Wunderlich, 56, 47, 80	‡	1
WALGREEN—See Aetna.																

‡ Data not substantiated.

* **IMPORTANT: Read Notes in Note Section if specified in Note Column.**

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
WALTHAM																
32	Vol.	6	H12				8-8	4	See Note	B3				24A, 45, 80		1
WALTON RADIO CORP.																
Wal-Tone "EX"	Vol.	7	H		2		A403	4	CS133	B3				56, 57, 58, 47, 80	457.5	3
							A404	4	CS131	B3						
WARE MFG. CORP.																
B1, B2, Bantam	Vol.	8	UC500				14-2	1	MN273	B3				24A, 27, 45, 80		‡
SBB	Vol.	42	G	6			8-8	4	RS213	B66				51, 24A, 27, 47, 80	175	1
	Tone	22	O													
SBA	Vol.	42	Y10MP				8-4-2	3	MN275					51, 24A, 27, 80	175	1
	Tone	22	O													
SBF, SBFa	Vol.	42	A10MP				8-8	25	See Note	B3				27, 24A, 35, 47, 80	175	1
	Tone	22	‡		See Note A5											
S1	Vol.	42	A400P				8-4-2	3/13	MN275					24A, 27, 45, 80	175	‡
	Tone	41	O													
SB7	Vol.	42	A10MP				8-8	23	RS213	B66				35, 27, 24A, 47, 80	175	1
	Tone	22	Y200MP													
SB8	Vol.	59	G12				8-8	23	RS213	B66				51, 24A, 47, 27, 80	175	1
	Tone	22	Y200MP													
SB45	Vol.	6	G12	6			8-4-2	3	MN275	B3				24A, 27, 45, 80	175	3
	Tone	22	O													
WEBSTER CO.																
B53	Vol.	‡	‡		See Note A5		8-8-8	3	See Note	B3				2A6, 53, 82		1
	Phono.	‡	‡		See Note A5		20-20	15	TS102	B66						
							20	14	TS102							
HG417	Vol.	15	O				8-8-8-8	3/13	See Note	B3				57, 53, 2A5, 5Z3		3
	Phono.	63	K12				12	15	TS102							
	Tone	41	L				8	15	TS106							
							8	14	CS123	B3						
K358A	Vol.	16	K12				8-8-8	3	See Note	B3				57, 56, 2A3, 83		3
	Phono.	63	S				4	15	TS101							
							8	15	TS101							
K359A	Vol.	16	K12				8-8-8	3	See Note	B3				‡, ‡, 2A3, 83		1
	Mic. Adj.		M100P				4	15	TS101							
PA17	Vol.	16	L				8-8-8-8	3	RS213	B3				58, 56, 2B6, 5Z3		3
	Phono.	‡	K12				20-20	15	TS102	B66						
PA42	Vol.	16	K12				8-8	1	See Note	B3				79, 42, 82		1
	Phono.	63	G12				20	‡	TS102							
	Tone	34	G12				4	15	TS101							
WR85	Vol.	15	O				8-8-8	3	See Note	B3				58, 56, 2A5, 80		1
	V.R.	‡	Order from	Mfr.			8	13	See Note	B3						
	P.E. Adj.	‡	M50MP													
	Tone	‡			See Note A5											
WELLS-GARDNER & CO.—"Gulbransen," "Truetone"—(See Trade Names)																
00A	Vol.	62	O				80891B	12	CS121					34, 30	175	
	Tone	44	UC502													
00B	Vol.	15	P	6			P80990	2	RS216					58, 56, 45, 80	175	3
	Tone	41	UC504				P81000	2/13	CN151							
0C Series (20C5)	Vol.	15	P	6			P81039	2	RS216					6D6, 76, 45, 80	456	3
	Tone	41	UC504				P81018	2/13	CM173							
0DM	Vol.	7/15	DRP315	6	See Note A59		44X10	4	RS216					6K7, 76, 45, 80	456	3
	Tone	41	UC504				44X11	4	RS216							
							44X18	13	RS201							
OEL	Vol.	62	2 Meg. No. 1	6	See Note A19		44X10	25	RS216					6K7, 6C5, 6G5, 6F6,		
	Tone	65	Order from	Mfr.			44X11	25	RS216					5Z4, MG	456	1
							44X213	13/15	CS121/TS101							
OF Series	Vol.	64	2 Meg. No. 1	13	See Note A19		P45X214	12	CM173	B3				30, 32, 34	456	
	Tone	44	UC502													
02A	Vol.	17	P	6			P80984	2/13	CN155/CN142	B120				58, 55, 56, 45, 82	175	21
	Tone	41	UC504													
02AA	Vol.	17	P	6			P80984	2/13	CN155/CN142	B120				58, 55, 45, 56, 82	175	21
	Tone	41	UC504													
022	Vol.	45	Z12				8	58	HD682					58, 56, 57, 46, 82	175	3
	Tone	41	UC502				8	58	RS213							
	Supp.	8	E				4	58	RS211							
							4	19	CS121							
05A	Vol.	6	G12	6	EX300		P80944	11	UR182	B31				77, 78, 43, 25Z5	262	
							80878C	19	CS121							
							80936C	15	TS101							
05AA	Vol.	6	H12	6			80944E	11	UR182	B31				6C6, 6D6, 43, 25Z5	262	
05BA	Vol.	6	H12	6			80944E	11	UR182	B31				6C6, 6D6, 43, 25Z5	262	
052 Series	Vol.	6	H12	6	EX300		8-8	4	CM172					57, 35, 47, 80	262	1
06A	Vol.	3	D12				P80968	12	CS121					32, 34, 19, 30	175	
06W	Vol.	18	N				P80939	2	CN155		1	210	C5	78, 77, 85, 41	262	26
	Tone	44	UC502				P80965	14	CS121	B3	12	237	C5			
							.01		Buffer	B14						
06Z	Vol.	18	N				P80956	25/19	RM262/TS102	B126	34	292	C12	78, 77, 75, 41, 84	262	10
							P80937	14/15	RN231	B127						
							.02		Buffer	B14						
062 (Auto Set)	Vol.	45	N				4	13	CS121		1	206		39, 36, 38	262	
							4	15	TS105							
062A	Vol.	45	N				4	13	CS121		1	206		39, 36, 37, 41	262	
							4	15	TS105							
07A	Vol.	15	O	6			P80990	25	RS216					6D6, 6C6, 37, 42, 80	175	1
	Tone	22	UC502				P80916	25	RS213							
072	Vol.	18	N				P80902	13/15	See Note	B145	2	211		39, 36, 37, 38	262	
	Tone	44	UC502													
073	Vol.	15	N				4	13	CS121					36, 39, 41	175	
	Tone	22	K12													
092 Series Battery	Vol.	45	N				P80878C	12	CS121					34, 30	175	
	Tone	22	UC502													
2B Series (22B5)	Vol.	15	P	6			P81058	2	RS216					6D6, 76, 42, 80	456	1
	Tone	21	UC502				P81039A	2	RS216							
							P81056	13	CN151							
							P82000	19	TS108							
2CM	Vol.	7/15	DRP315	6			P44X21	25	RN245	B8				6K7, 76, 6F6, 80	456	1
	Tone	22	UC504				P44X11	25	RS216							
							P44X20	19	See Note	B125						
2DL	Vol.	20	2 Meg. No. 1	6	See Note A19		44X21	30	WE3540					6K7, 6C5, 6H6, 6G5,		
	Tone	65	Order from	Mfr.			44X11	30	RS216					6F6, 5Z4, MG	456	1
							44X216	13	CS121							
							44X209	19	TS101							
5B	Vol.	6	G12	6	EX300		P80944	11	UR182	B31				77, 78, 43, 25Z5	262	
							P80878C	19	CS121							
							P80936C	15	TS105							
5D Series	Vol.	6	H12	6			P82004	23	RS215					6C6, 6D6, 42, 80	456	1
							P82003	23	RS213							

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
WELLS-GARDNER & CO.—Continued																
5E Series (25E1, 25E5)	Vol.	97	TRP602				P80968	12	CS121					32, 34, 30, 19	175	
5G Series (35G510, 35G560)	Vol.	97	TRP617	14			P45X28	12	CS121					32, 34, 30, 19	175	
5 Tube D. C. Model	Vol.	6	H12											24A, 01A, 71A		
	Tone	21	O													
5Y Series (25Y1)	Vol.	17	P	6			P82002	1/15	CM173		32	286S	C3	6D6, 6C6, 75, 41	175	10
											32	G286S	C16			
6B Series (26B1, 26B5)	Vol.	56	N				P81016	23	CM172		20	F253	C3	6F7, 6D6, 6B7, 12A5, 12Z3	175	10
	Tone	34	UC502				.015		Buffer	B14						
6C Series	Vol.	17	P				P81042	23	RS215					6D6, 6A7, 42, 6B7, 80	456	1
	Tone	34	UC502				P81043	23	RS216							
							P81003	15	TS101							
6G	Vol.	18	O	14			45X212	12	CS121					1C6, 34, 1B5, 30	456	
6K	Vol.	56	‡	6	See Note A81		E45X211B	1/15	SR601/TS101	B125	18	248	C3	6K7, 6J7, 6B7, 41, 6A6	175	10
	Tone	22	O				.005		Buffer	B14						
6L	Vol.	18	UC512	6			45X210	4	CM171		35	294	C3	6D6, 6C6, 75, 41, 84	175	10
	Tone	22	UC502				.0075		Buffer	B14						
6N, 6R	Vol.	17	Order from Mfr.				E45X206C	4/15	CM171/TS103		35	294	C3	6D6, 6C6, 75, 41, 84	175	10
	Tone	34	UC502				.0075		Buffer	B14						
6S (26S1)	Vol.	17	UC511	6			45X204	1	CN152		20	253	C3	6D6, 6C6, 75, 41, 84	175	10
	Tone	22	L				45X203	15	TN111							
							.01		Buffer	B14						
6 Tube 32 Volt	Vol.	56	N				P81016	23	CM172		20	F253	C3	6F7, 6D6, 6B7, 12A5, 12Z3	175	10
	Tone	34	UC502				.015		Buffer	B14						
6U Series (26U1)	Vol.	18	UC511	6			P81028	1	CN152		20	253	C3	78, 77, 75, 41, 84	262	10
	Tone	22	UC502				P81021	15	TN111							
							.01		Buffer	B14						
7C Series (27C1, 27C5)	Vol.	45	O				P81014	12	CM164					34, 30, 19	175	MG
7D Series (27D1, 27D5)	Vol.	56	N	6			P81043	4	RS216	B10				76, 6D6, 6B7, 42, 80	456	1
	Tone	34	UC502				P81042	4	RS216	B10						
							P80916	4	RS213							
							P81032	4	RS213							
7GM Series (37G508, 37G566)	Vol.	7/56	DRP314	6	See Note A59		44X10	23	RS216					6K7, 6B7, 6F6, 76, 80	456	1
	Tone	34	UC502				44X11	23	RS216							
7H Series (37H508, 37H566)	Vol.	45	O	14			20	12	CS126					34, 1C6, 30, 19	456	
	Tone	44	UC502													
7J	Vol.	56	N				44X11	23	RS216					6D6, 6B7, 42, 80	456	1
	Tone	34	UC502				44X10	23	RS216							
7K	Vol.	7/56	DRP314	6			44X10	23	RS216					6K7, 76, 6B7, 6F6, 80	456	1
	Tone	34	UC502				44X11	23	RS216							
7L	Vol.	20	2 Meg. No. 1	6	See Note A19		44X10	23	RS216					6K7, 6C5, 6Q7, 6F6, 6G5, 5Z4, MG	456	1
	Tone	34	Order from Mfr.				44X11	23	RS216							
							44X209	15	TS101							
7P	Vol.	18	N	6			45X217	12/15	TS107/TS101					6K7, 6A8, 6A6, 85, 43	456	
	Tone	44	Z12													
8T (AC)	Vol.	2/7	GG				‡	‡	See Note	B1				24A, 27, 45, 80		3
	Tone	41	O													
9 in Line	Vol.	1/15	DRP241				2-1-1-1.5	3	See Note	B1				26, 24A, 45, 80		9
9B Series (29B5)	Vol.	15	P				P82001	24	CN141					34, 30, 19	456	
	Tone	41	K12													
10-7 Tube Super	Vol.	7	F		2		8-8	23	RS213	B66				35, 24A, 47, 27, 80	175	3
	Tone	103	O													
20 Series	Vol.	78	N				8-8-8	30	RS213	B66				35, 27, 47, 80	175	1
	Tone	41	P	6												
40	Vol.	111	Y5MP				P80896	30	CM173					35, 24A, 47, 27, 80	175	3
	Tone	34	UC502				P80878	13	CS121							
40A	Vol.	14	N				P80896	30	CM173					35, 24A, 47, 27, 80	175	3
	Tone	34	UC502				P80878	13	CS121							
50	Vol.	‡	SRP271				P80196	4	RS213					35, 24A, 47, 80	175	7
	Tone	34	UC502				P80878C	13	CS121							
60, 63	Vol.	6	TRP600	7			P80849	25	RS213					24A, 45, 80		1
							P80848	25	RS213							
72	Vol.	6	H12				‡	‡	See Note	B1				24A, 27, 45, 80		1
	Tone	41	O													
80	Vol.	2/7	GG				‡	‡	See Note	B1				24A, 27, 45, 80		3
	Tone	41	O													
80A, 82	Vol.	‡	D	6			‡	‡	See Note	B1				24A, 27, 45, 80		3
	Tone	41	O													
90, 91, 92, 93	Vol.	4	DRP241				4	12	CS121					32, 33	175	
161, 162	Vol.	6	TRP600	7			P80849	25	RS213					24A, 45, 80		1
							P80848	25	RS213							
200, 291, 292, 295	Vol.	1/15	DRP241				2-1-1-1.5	3	See Note	B1				26, 24A, 45, 80		9
322	Vol.	45	Z12				8	30	HD682					58, 56, 57, 46, 82	175	3
	Tone	41	UC502				8	30	RS213							
	Supp.	8	E				4	30	RS211							
							4	19	CS121							
352 Series	Vol.	6	H7	6	3		8-8	4	CM172	B3				57, 35, 47, 80	175	1
502	Vol.	15	N	6			P80923A	30	CN155					58, 57, 56, 47, 80	175	1
	Tone	22	O				80873	30	CS131							
							80878C	13	CS121							
572 (AC)	Vol.	‡	SRP271				80894B	4	CM172					58, 57, 47, 80	175	7
	Tone	34	UC502				80891B	13	CS121							
872 Series	Vol.	‡	SRP271				80894B	4	CM172					58, 57, 47, 80	175	7
	Tone	34	UC502				80891B	13	CS121							
C-CG (1st and 2nd types)	Vol.	60/15	DRP243		See Note A4		2-1-1-1	59	See Note	B1				26, 24A, 45, 80		9
	Vol.	2	E12		See Note A27											
V6Z2, Z6Z1	Vol.	17	N				P80956	25/19	RM262/TS102	B126	34	292	C12	78, 77, 75, 41, 84	262	10
							P80937	14/15	RN231	B127						
							.02		Buffer	B14						
WESTERN AUTO SUPPLY CO. (Truetone, Wells-Gardner)																
062, 062A	Vol.	45	N				4	13	CS121		1	206		39, 36, 37, 41	262	
	Tone	34	UC502				4	15	TS105							
06W	Vol.	56	N				16-8	1	CN155		2	210	C3	78, 77, 85, 41	262	26
	Tone	41	UC502				4	15	TS105							
06Z	Vol.	18	N				P80956	25/19	RM262/TS102	B126	34	292	C12	78, 77, 41, 84, 75	262	10
							P80937	14/15	RN231	B127						
							.02		Buffer	B14						
6S	Vol.	17	UC511	6			45X204	1	CN152		20	253	C3	6D6, 6C6, 75, 41, 84	175	10
	Tone	22	L				45X203	15	TN111							
							.01		Buffer	B14						
6U	Vol.	18	UC511	6			P81028	1	CN152		20	253	C3	78, 77, 75, 41, 84	262	10
	Tone	22	UC502				P81021	15	TN111							
							.01		Buffer	B14						

‡ Data not substantiated.

*** IMPORTANT: Read Notes in Note Section if specified in Note Column.**

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
WESTERN AUTO SUPPLY CO.—Continued																
670	Vol.	17	N	6			P103-2	4	RM262		37	296	C3	6D6, 6C6, 78, 75, 42,		
							20	15	TS102					84	175	10
							.02		Buffer	B14						
1312 (R131)	Vol.	17	N	6			84829	4	CM171		35	294	C3	78, 77, 75, 41, 84	177.5	10
							83803	15	TS101							
							.03-.03		Buffer	B14						
L7	Vol.	45	N	7			P391	1	RN232	B90	14	245C	C3	1C6, 19, 30, 34	456	10
	Tone	‡	L				.01-.01		Buffer	B14						
S690, S691	Vol.	45	N				4	13	CS121		1	206		39, 36, 38	262	
							4	15	TS105							
S732, S733	Vol.	17	N				P80956	25/19	RM262/TS102	B126	34	292	C12	78, 77, 75, 41, 84	262	10
							P80937	14/15	RN231	B127						
							.02		Buffer	B14						
S735	Vol.	17	P	6			P82002	1/15	CM173		32	286S	C3	6D6, 6C6, 75, 41	175	10
S740	Vol.	18	UC511	6			P81028	1	CN152		20	253	C3	78, 77, 75, 41, 84	262	10
	Tone	22	UC502				P81021	15	TN111							
							.01		Buffer	B14						
S743	Vol.	17	N	6			84829	4	CM171		35	294	C3	78, 77, 75, 41, 84	177.5	10
							83803	15	TS101							
							.03-.03		Buffer	B14						
V6Z2	Vol.	17	N				P80956	25/19	RM262/TS102	B126	34	292	C12	78, 77, 75, 41, 84	262	10
							P80937	14/15	RN231	B127						
							.02		Buffer	B14						
Z4	Vol.	45	SRP275	7			P391	1	RN232	B90	14	245C	C3	1C6, 19, 30, 32, 34	456	10
	Tone	44	L				.01-.01		Buffer	B14						
Z5	Vol.	45	SRP275	7			P958	1	RN232	B90	14	245C	C3	1C6, 19, 30, 32, 34	456	10
	Tone	44	L				.01-.01		Buffer	B14						
Z6Z1	Vol.	17	N				P80956	25/19	RM262/TS102	B126	34	292	C12	78, 77, 75, 41, 84	262	10
							P80937	14/15	RN231	B127						
							.02		Buffer	B14						
WESTERN RADIO MFG. CO.																
SG80BM, SG80BMX	Vol.	12	Y50MP				8-8-8	3	See Note	B3				24A, 27, 45, 80		3
WESTINGHOUSE.																
WR4—See Radiola 48																
WR5—See Radiola 80																
WR6—See Radiola 82																
WR6R—See Radiola 82R																
WR7—See Radiola 86																
WR7R—See Radiola 86R																
WR8—See Radiola 82 (with clock)																
WR8R—See Radiola 82R (mod. for vertical operation.)																
WR9—See T5																
WR10—See R7 (Superette)																
WR10A—See R7A																
WR10 (DC)—See R7 (DC)																
WR12—See R9																
WR12 (DC)—See R9 (DC)																
WR13—See RE16																
WR13A—See RE16A																
WR14—See R5																
WR14 (DC)—See R5 (DC)																
WR14CR—See R5X																
WR15—See R11																
WR15A—See R10																
WR16—See RO23																
WR17—See R4																
WR18—See R8																
WR18 (DC)—See R8 (DC)																
WR19—See R71																
WR20	Vol.	6	Y	6			4-8	4	CM161					6D6, 6C6, 38, 1V		
WR21	Vol.	6	Y	6	EX300		4-16-8	11	UR182	B31				78, 77, 43, 25Z5	456	
WR22	Vol.	6	Y		EX500		8-8	4	CM172					58, 57, 47, 80	456	1
WR23, WR24	Vol.	18	N				WR06665	25	RM261/TS102	B213				58, 2A6, 2A5, 56	456	1
	Tone	26	M	6												
WR25	Vol.	17	1 Meg. No. 1		See Note A19		ZC123	1	See Note	B3	35	294	C20	78, 6A7, 75, 41, 84	172.5	10
							IC43	15	TS101		37	296	C20			
							.02		Buffer	B14						
WR26	Vol.	18	N	6			WR06558	4	CM172		35	294	C20	77, 78, 75, 42, 84	175	10
	Tone	22	N				.02		Buffer	B14	37	296	C20			
WR27	Vol.	6	Z12	6	EX250		8-8	4	CM172					6A7, 77, 42, 80	456	1
WR28, WR29	Vol.	18	N				4-8-20	25/19	RM261/TS102	B213				6A7, 6D6, 75, 42, 80	456	1
	Tone	121	M	6			8	13	RS213							
WR30	Vol.	18	N				WR07510	59	RN245					78, 77, 6B7, 6A6, 42,		
	Tone	121	M	6			WR07516	15	BN226	B8				76, 83V	456	1
WR100	Vol.	18	N	6			2DC203	27	CM165	B88				6A7, 6D6, 75, 43,		
														25Z5	456	
WR101	Vol.	55	N	6			ZZC192A	11/27	UR182	B99				6A8, 6K7, 75, 43,		
	Tone	121	M				YC98A	19	CS121	B99				25Z5	456	
WR201	Vol.	6	E12		EX150		8-6	1	See Note	B3				6D6, 76, 42, 80	456	1
							12	15	TS102							
WR203	Vol.	55	M				8-8	4	See Note	B3				6A8, 6K7, 75, 6F6, 80	456	1
	Tone	22	M	6												
WR204	Vol.	18	N				CE954	25/19	RM261/TS102	B213				6K7, 6A8, 6H6, 6F5,		
	Tone	121	N	6			CE9511	14	RS213					80	465	1
WR205	Vol.	18	N				CE954	25/19	RM261/TS102	B213				6K7, 6A8, 6C5, 6H6,		
	Tone	121	N	6			CE9518	14	RS213					6F5, 6F6, 80	465	1
							CE9515	15	TS101							
WR303	Vol.	55	M				8-8	4	See Note	B3				6A8, 6K7, 75, 6F6, 80	456	1
	Tone	22	M	6												
WR304	Vol.	18	N				CE954	25/19	RM261/TS102	B213				6K7, 6A8, 6H6, 6F5,		
	Tone	121	N	6			CE9511	14	RS213					80	465	1
WR305	Vol.	18	N				CE954	25/19	RM261/TS102	B213				6K7, 6A8, 6C5, 6H6,		
	Tone	121	N	6			CE9518	14	RS213					6F5, 6F6, 80	465	1
							CE9515	15	TS101							
WR500	Vol.	18	N	6	RS246		6-10	4	See Note	B125	22	253Y	C3	77, 78, 75, 42, 84	175	10
	Tone	121	N				.008		Buffer	B14						
WR501	Vol.	17	500M No. 1		See Note A3		8-8	1	See Note	B3	22	253Y	C3	78, 6A7, 85, 41, 84	172.5	10
							10-10	15	TN111							
							.008		Buffer	B14						
WR601	Vol.	17	N	7										33, 34, 25S, 1C6, 30,		
														LLL25—Ballast	456	
WESTONE RADIO CORP.																
20	Vol.	6	G12				4-4	4	See Note	B3				58, 56, 2A5, 80		1
34 (4 Tube)	Vol.	6	G12				4-4	23	See Note	B3				2A7, 57, 2A5, 80	456	1
34 (5 Tube)	Vol.	6	G12				4-4	23	See Note	B3				57, 58, 56, 2A5, 80	‡	1
40	Vol.	18	N				4-4	23	See Note	B3				2A7, 58, 2A6, 2A5, 80	456	1
WEXTARK RADIO CORP.	(See Allied Radio & Knight Radio)															

‡ Data not substantiated.

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MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
WHOLESALE RADIO SERVICE "Lafayette"—Also see Wells-Gardner																
L1 (AC)	Vol.	45	Z12				8	58	HD682					56, 57, 58, 46, 82	175	3
	Tone	41	UC502				8	58	RS213							
	Supp.	8	E				4	58	RS211							
							4	19	CS121							
10	Vol.	7	F		2		8-8	23	RS213	B66				35, 24A, 27, 47, 80	175	3
	Tone	103	O													
20	Vol.	78	N				8-8-8	30	RS213	B66				35, 27, 47, 80	175	1
	Tone	41	P	6												
L20 (05A Series)	Vol.	6	G12	6	EX30C		P80044	11	UR182	B31				77, 78, 43, 25Z5	262	
							P8087C	20	CS121							
							P80936C	15	TS105							
M31	Vol.	6	G12				271	4	CS131					57, 58, 47, 80	‡	1
M35, M37	Vol.	124	N				4-4	4	See Note	B3				58, 55, 56, 47, 80	175	1
	Tone	22	M													
40	Vol.	111	Y5MP				4-2-6	30	CM173					35, 24A, 27, 47, 80	175	3
	Tone	34	UC502				4	13	CS121							
40A	Vol.	14	N				4-2-6	30	CM173					35, 24A, 27, 47, 80	175	3
	Tone	34	UC502				4	13	CS121							
M53	Vol.	124	N				4-4	4	See Note	B3				58, 55, 47, 80	175	1
	Tone	22	M													
Mighty Atom	Vol.	6	G12	6			2-2	1	See Note	B2				51, 24, 47, 80		3
V.A.	Vol.	6	H12				5-5	4	See Note	B3				24A, 51, 47, 80	‡	1
Great Duo-Symphonic	Vol.	24	GG				1-1-1.5-1.5	61	See Note	B1				24, 27, 45, 80		3
	Tone	41	O													
Duo-Symphonic Jr. 1931	Vol.	6	H12				1-1-5	‡	See Note	A1				24A, 27, 45, 80		1
	Tone	41	O													
Duo-Symphonic 1930	Vol.	1	E12				1-1-1-2	59	See Note	B1				26, 24, 45, 80		9
Auto Radio Superheterodyne	Vol.	64	N											39, 36, 37, 38	262	
WILCOX-GAY																
2S5	Vol.	6	G12				4-4	4	See Note	B3				57, 58, 47, 80	175	1
2T5	Vol.	6	G12				4-4	4	See Note	B3				57, 58, 47, 80	175	1
2U7	Vol.	18	N				4-12	4	See Note	B3				2A5, 2A6, 56, 58, 80	175	1
	Tone	21	M													
2VA7	Vol.	124	N				4-4	4	See Note	B3				58, 56, 47, 80	175	1
	Tone	22	M													
2VB7	Vol.	18	N				4-12	4	See Note	B3				58, 2A6, 2A5, 56, 80	‡	1
	Tone	21	M													
3D5	Vol.	6	G12	6			4-4	4	See Note	B3				57, 58, 47, 80	175	1
	Tone	21	M													
3F7	Vol.	6	G12	6			4-12	4	See Note	B3				57, 58, 56, 47, 80	‡	1
	Tone	21	M													
3J5, 3K5	Vol.	6	G12				4-12-4	8	See Note	B3				78, 77, 43, 25Z5	175	
							928	15	TS103							
3JD5, 3JG5	Vol.	6	G12	6			1085	8	UR182					6A7, 78, 77, 43, 25Z5	115	
							267A	15	TS101							
							928	15	TS103							
3JF5	Vol.	6	G12				6-6	6	See Note	B3				6A7, 78, 77, 43, 25Z5	175	
3KD5	Vol.	6	G12	6			4-10-4	8	See Note	B3				77, 43, 78, 25Z5	115	
							25	15	TS103							
3KE5	Vol.	6	G12				1085	8	UR182					77, 78, 43, 25Z5	175	
							928	15	TS103							
3LB7	Vol.	18	N				8-8-4-1-4-4	62	See Note	B3				78, 6A7, 75, 42, 25Z5	‡	
	Tone	76	M													
3PA6-66, 3P6	Vol.	6	G12	6			1085	8	UR182					77, 78, 43, 25Z5	115	
	Tone	22	M				928	15	TS103							
3PB8	Vol.	6	G12	6			4-10-4	8	See Note	B3				43, 76, 77, 78, 25Z5	115	
	Tone	21	M													
3R6	Vol.	7	J	6	See Note A1		8-4	1	CN151	B3	47	See Note C6		77, 78, 75, 79, 84	175	10
	Tone	22	M				928	15	TS103							
							.02		Buffer	B14						
3SB5	Vol.	15	N				8-4	25	See Note	B3				6A7, 78, 75, 42, 80	175	1
	Tone	21	M				25	19	TS103							
3S5-66	Vol.	76	N	6			4-4	4	CM170	B3				6A7, 78, 75, 42, 80	175	1
	Tone	76	M				928	15	TS103							
3T6-66	Vol.	18	N	6			1085	8	UR182					6A7, 78, 75, 43, 25Z5	175	
	Tone	21	M				928	15	TS103							
3TB8	Vol.	18	N				4-19-4	8	UR182	B3				78, 6A7, 75, 43, 25Z5	175	
	Tone	22	M													
3V6 (BC & SW) 3VA6 (BC only)	Vol.	17	N				4-4	4	See Note	B3				78, 6A7, 75, 42, 80	175	1
	Tone	21	M				25	19	TS103							
3VB6	Vol.	17	N	6			4-4	4	See Note	B3				6A7, 78, 42, 75, 80	175	1
	Tone	21	M				25	19	TS103							
4B6 Road Mate	Vol.	18	N				1327	1	CN142		34	292	C23	78, 77, 75, 41, 84	175	10
							25	15	TS103							
							.015		Buffer	B14						
4C5, 4CA5 4CB5,..	Vol.	17	N				8-4	25	See Note	B3				6A7, 78, 75, 42, 80	175	1
							25	19	TS103							
4CD5	Vol.	17	N				8-4	25	See Note	B3				6A7, 78, 75, 42, 80	175	1
							25	19	TS103							
4D10, 4DB10	Vol.	106	N				8-8	1	CN152	B3				2B7, 45, 2A7, 58, 56,		
	Tone	106	M				25	15	TS103					80	175	1
4E6	Vol.	17	N	6			1-4	4	CM170	B3				42, 75, 76, 77, 78, 80	115	1
	Tone	21	M				25	15	TN113							
4G7	Vol.	17	N	6			1129	4	RM261					42, 75, 76, 78, 80	456	1
	Tone	76	M				928	20	TS103							
4H11	Vol.	76	N	6			18-721	1	RS213					45, 6B7, 76, 78, 80	456	3
	Tone	76	M				75-267A	13	CS121							
							18-928	15	TS103							
4J6, 4JC6	Vol.	76	N	6			1295	8	CN145					6A7, 78, 43, 75, 25Z5	456	
	Tone	76	M				1379	13	CS121							
							928	15	TS103							
4JA6, 4JB6	Vol.	76	N	6			1295	8	CN145					6A7, 78, 43, 75, 25Z5	456	
	Tone	76	M				1379	8	CS121							
							928	15	TS103							
5E7	Vol.	17	N	6			18-1247	4	CM170	B3				76, 78, 42, 75, 80	456	1
	Tone	21	M				18-928	15	TS103							
5EA7	Vol.	76	N	6			18-1247	4	CM170	B3				76, 78, 75, 42, 80	456	1
	Tone	76	M				18-928	20	TS103							
WINGS—See Goodyear Service.																
WORKRITE MFG. CO.—See U. S. Electric Corp.																
RUDOLPH WURLITZER—Also see All American Mohawk "Lyric"																
Model "B" 1930-31	Vol.	25	DRP169											32, 30, 31		
C4, M4	Vol.	‡	O	6			16	10	CS126					6A7, 6B7, 43, 25Z5	456	
							8-4-10	10/15	CN141/TS101							

‡ Data not substantiated.

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MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
RUDOLPH WURLITZER—Continued																
P5	Vol.	17	N	6			Y3764RA	6/15	UR189	B98				6A7, 78, 75, 43, 12Z3.	456	
SA5	Vol.	18	N				Y3715RA	1/15	RN245					2A7, 58, 2A6, 2A5, 80.	175	1
	Tone	22	G12	6			10	15	TS101							
SU5	Vol.	17	N	6			16-12-10	6/15	UR182	B110				6A7, 78, 75, 43, 12Z3.	456	
	Tone	22	H12													
SA6	Vol.	18	N				8-8	1	RN242					2A7, 58, 2A6, 2A5, 80.	175	1
	Tone	22	G12	6			10	15	TS101							
B6	Vol.	25	DRP244											1A6, 34, 32, 33, 10AB.	175	
	Tone	22	H12	6												
D.C. 7 110 volts	Vol.	24	‡		See Note A5		1.5-2	I	See Note	B7				33, 36, 37	175	
	Tone	34	K12													
S40	Vol.	2	Y				8-8	1	See Note	B3				47, 57, 80	175	1
							10	19	TS101							
S50	Vol.	6	F12	6			8-8	1	RS213	B66				47, 57, 58, 80	175	1
	Tone	22	G12				10	19	TS101							
U50	Vol.	6	Y	6			16-12-10	6/15	UR182	B110				44, 43, 25Z5	485	
A60	Vol.	‡	UC502				Y3773RA	1/15	CN141/TS101		34	292	C3	6B7, 78, 6A7, 84	485	10
	Tone	22	H12				.02		Buffer	B14						
S63	Vol.	42	H				6900	1	RS213					24, 27, 35, 47, 80	175	1
	Tone	22	G12				10	15	TS101							
DC65 110 volts	Vol.	8	G				3.5	‡	See Note	B11				33, 36, 37, 39	175	
	Tone	34	K12													
SA65	Vol.	15	N	6			8-8	1	RS213	B66				47, 55, 57, 58, 80	175	1
	Tone	22	G12				10	16	TS101							
B80	Vol.	43	DRP169				8	12	RS203					30, 34, 32	175	
	Tone	21	M													
SW80	Vol.	15	N				8-8	1	RS213	B66				47, 56, 57, 58, 80	485	1
	Tone	22	G12													
SW88	Vol.	15	N				8-8	1	RS213	B66				57, 58, 56, 2A5, 80	485	1
	Tone	22	G12	6			10	15	TS101							
SA90, SA91	Vol.	45	N	6			8-8	1	RS213	B66				24, 27, 35, 47, 55, 80.	175	1
	Tone	21	N				10	15	TS101							
	Sen.	‡	F		See Note A4											
SA91A	Vol.	45	N				8-8	1	RS213	B66				57, 58, 56, 55, 2A5, 80.	175	1
	Tone	21	N	6			10	15	TS101							
	Sen.	‡	F													
SA120	Vol.	45	N				8-8	1	RS213	B66				58, 56, 57, 46, 80	175	1
	Tone	21	N				5	15	TS105							
	Supp.	‡	F				5	17	TS105							
SA130	Vol.	15	N				8-8-8	7	RS213	B66				47, 56, 57, 58, 82	175	7
	Tone	39	N	6			5	15	TS105							
	Sen.	8	H12		See Note A4											
SA133	Vol.	15	O				8-8-8	7	RS213	B66				56, 57, 58, 2A5, 82	175	7
	Tone	21	N	6												
450	Vol.	6	F7	6	I		Y3715RA	1/15	RN245					58, 57, 2A5, 80	456	1
454	Vol.	18	N	6			Y3715RA	1/15	RN245					6A7, 6D6, 75, 41, 80.	456	1
							10	15	TS101							
460	Vol.	17	UC512				8-6-10	4/15	CM162/TS101	B3	34	292	C3	41, 6B7, 6D6, 84	175	10
	Tone	22	H12													
470, 471	Vol.	18	N				8-8	1	CN152	B3				6D6, 76, 6A7, 6B7,		
	Tone	22	G12				10	15	TS101					80 or 6D6, 6A7, 75,		
														41, 80	370	1
480	Vol.	18	N				8	1	CS133	B3				6D6, 6A7, 75, 41, 80.	456	1
	Tone	21	L				12	1	CS135	B3						
							10	15	TS101							
U500	Vol.	17	N	6			Y3764RA	6/15	UR182	B110				6A7, 78, 6B7, 43,		
														25Z5	456	
ZANEY GILL																
Vitatone Model 54	Vol.	4/7	DRP119	6	Dual		2-2	1	See Note	B1				24, 27, 45, 80		3
	Vol.	6	G12	6	Single											
	Tone	22	G12													
ZENITH																
A, B, C, D (2004)	Vol.	‡	Order from	Mfr.			22-87	1	RS213					24, 45, 80		3
	Tone	34	Order from	Mfr.												
AH	Vol.	8	A2MP				22-118	4	RS213					27, 51, 24, 47, 80		17
	Tone	22	‡		See Note A5		22-119	4	RS213							
BH (2021)	Vol.	7	G	6			22-132	26	CS131	B3				51, 24, 27, 47, 80	175	3
	Tone	22	K12				22-133	26	CS131	B3						
CH	Vol.	8	A10MP				22-118	4	RS213					27, 51, 24, 47, 80		17
	Tone	22	K12				22-119	4	RS213							
L (2009-C)	Vol.	6	G12				22-87	1	RS213					24, 45, 80		1
							22-102	1	RS213							
LH, MH (2022)	Vol.	8	F	6			22-131	4	CS133					51, 24, 27, 47, 80	175	1
	Tone	34	K12				22-140	4	CS133							
LP (2009CP)	Vol.	6	G12				22-119	1	RS213					51, 24, 47, 80		1
							22-118	1	RS213							
R.H.	Vol.	8	A10MP				22-118	4	RS213					27, 51, 24, 47, 80	17.	
	Tone	22	K12				22-119	4	RS213							
WH (2022)	Vol.	8	F	6			22-131	4	CS133					51, 24, 27, 47, 80	175	1
	Tone	34	K12				22-140	4	CS133							
4B106, 4B131, 4B132 (5406)	Vol.	18	N	6			22-419	1	RN241		15	246	C3	15, 75, 38	456	10
	Tone	34	L				22-225	15	TS101							
							.01-.01		Buffer	B14						
4P26, 4T26 (Chassis 5403)	Vol.	6	D7	6			22-407	4/13	RM265	B58				6A7, 6F7, 42, 80 or		
														6A8, 6P7; 6F6, 5Y3	456	1
4P51, 4T51 (Chassis 5401)	Vol.	6	D7	6			22-407	4/13	RM265	B58				6A7, 6F7, 42, 80 or		
														6A8, 6P7, 6F6, 5Y3	456	1
4V31, 4V59 (5405)	Vol.	18	M	6			22-419	1	RN241		15	246	C3	15, 75, 38	456	10
	Tone	34	K12				22-225	15	TS101							
							.006		Buffer	B14						
5M90 (Chassis 5510)	Vol.	18	500M No. 1	6	See Note A1		22-388	4	CM171		36	294SW	C3	6A7, 6D6, 75, 41, 6Z4.	456	10
							.01		Buffer	B14						
5S29, 5S56 (Chassis 5513, 5513A)	Vol.	18	M	6			22-125	23	RM262	B216				6A8, 6K7, 6B6, 6F6,		
	Tone	34	K12											5Y3	252.5	1
5S119, 5S126, 5S127, 5S150, 5S151, 5S161 (5516)	Vol.	18	N	6			22-505	4	RS215					6A8, 6K7, 6Q7, 6F6,		
	Tone	34	K12				22-506	4	RS216					5Y3	456	1
6B107, 6B129, 6B164 (5635)	Vol.	18	2 Meg. No. 1	6	See Note A19		22-459	1	RN241	B3	36	246	C3	15, 6A7, 76, 19	456	10
							.01-.01		Buffer	B14						
6D116, 6D117, 6D118 (5633)	Vol.	18	N	6			22-517	11	UR182	B31				6A8, 6K7, 6Q7, 25A6,		
														25Z6	456	

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS: Use	Circuit	Correct Replacement	Switch	Bias	*Note	CONDENSERS: Original Part	Circuit	Correct Replacement	*Note	VIBRATORS: Vibr. Conn.	Replacement	*Note	Types of Tubes Used	I. F. Peak	Trans. Circuit
ZENITH—Continued																
6M90S, 6M90D (Chassis 5630)	Vol.	18	N	6	RS246		22-464	4	CM172		35	294	C3	6K7, 6A8, 6Q7, 6F6,		
	Tone	22	L				.008		Buffer	B14				6X5	252.5	10
6M91S, 6M91D (Chassis 5631)	Vol.	18	N	6	RS246		22-464	4	CM172		35	294	C3	6K7, 6A8, 6X5, 6Q7,		
	Tone	22	L				.008		Buffer	B14				6F6	252.5	10
6M92 (Chassis 5632)	Vol.	18	N	6	RS246		22-474	4	CM172		35	294	C3	6K7, 6A8, 6Q7, 6F6,		
							.008		Buffer	B14				6X5	252.5	10
6S27, 6S52 (Chassis 5619)	Vol.	18	N	6			22-414	25	RM262					6A8, 6K7, 6F6, 6H6,		
	Tone	34	K12				22-420	15	TS101					5Y3	252.5	1
6S128, 6S137, 6S147, 6S152, 6S157 (5634)	Vol.	45	2 Meg. No. 1	6	See Note	A19	22-294	1	RS216					6A8, 6K7, 6F6, 6H6,		
							22-491	1/13	RN241					6F5, 5Y3	456	1
6V27, 6V62 (Chassis 5621)	Vol.	18	M	6			22-432	1	RN231		15	246	C3	15, 6A7, 75, 76, 19	456	10
	Tone	34	K12				.01		Buffer	B14						
7	Vol.	17	UC512				7119-4	4	SR605		37	296	C3	6D6, 75, 42, 6C6, 84	175	10
							.015		Buffer	B14						
7D119, 7D126, 7D127, 7D138, 7D148, 7D151, 7D162, 7D168 (5707)	Vol.	45	N	6			22-514	1/11	RN235	B218				6A8, 6K7, 6H6, 6F5,		
	Tone	34	K12				22-515	11/13	RN231	B218				25A6, 25Z6	456	
7M91S, 7M91D (Chassis 5706)	Vol.	18	2 Meg. No. 1	6	RS246	A19	22-469	1/15	SR611	B219	35	294	C3	6K7, 6A8, 6Q7, 6X5,		
	Tone	22	L											6C6, 6N7	252.5	10
7S28, 7S53 (Chassis 5704)	Vol.	45	N	6			22-416	25/12	RM265					6K7, 6A8, 6H6, 6F6,		
	Tone	34	K12											5Y3	456	1
8S129, 8S154 (Chassis 5801)	Vol.	45	2 Meg. No. 1	6	See Note	A19	22-294	25	RS216					6K7, 6A8, 6H6, 6F5,		
							22-491	25/13	RN241					6F6, 5Y3	456	1
9S30, 9S54, 9S55 (5903)	Vol.	45	1 Meg. No. 1	6	See Note	A19	22-412	46	See Note	E3				6K7, 6A8, 6H6, 6C5,		
	Tone	‡	O											6F6, 5Y3	456	1
10, 11, 12	Vol.	12	SRP261				22-72	3	RS213					24, 27, 45, 80		3
	Tone	41	N													
10S130, 10S147, 10S153, 10S155, 10S156, 10S157, 10S160 (1004)	Vol.	45	2 Meg. No. 1	6	See Note	A19	22-504	3	RS213					6K7, 6A8, 6H6, 6C5,		
							22-506	14	RS216					6L6, 5Y3	456	1
							22-493	3	RN242							
							22-405	19	TS106							
							22-507	15	TS101							
11, 12	Vol.	11	L											01A, 71A, 00A, 12A		
12 (2nd Type)	Vol.	11	L											12A, 01A, 71A		
12L57, 12L58 (Chassis 1202)	Vol.	45	1 Meg. No. 1	6	See Note	A19	22-294	3	RS216					6K7, 6A8, 6C5, 6H6,		
	Tone	‡	O				22-445	3	CN151					6F6, 5Y3	456	1
							22-405	19	TS106							
							22-420	15	TS101							
12U158, 12U159 (Chassis 1203)	Vol.	45	2 Meg. No. 1	6	See Note	A19	22-504	3	RS213					6K7, 6H6, 6F5, 6F6,		
							22-294	3	RS216					6L6, 5Y3, 6L7, 6C5	456	1
							22-425	3	RM262	E216						
							22-506	14	RN232	B8						
							22-405	15	TS106							
							22-509	19	TS106							
14	Vol.	11	L											01A, 12A, 71A, 00A		
17	Vol.	11	L											01A, 71A		
31, 32 Battery	Vol.	11	SRP261		See Note	A82								01A, 12A, 71A, 00A		
34P	Vol.	11	SRP261		See Note	A82								27, 10, 81		
33, 33X, 34, 35, 35A	Vol.	11	SRP261		See Note	A82								27, 71A		
35P, 35AP	Vol.	11	SRP261		See Note	A82								27, 10		
35APX, 35PX	Vol.	11	SRP261		See Note	A82								27, 26, 50		
37A, 39, 39A	Vol.	11	SRP261		See Note	A82								27, 10		
40A	Vol.	11	SRP261		See Note	A82								27, 26, 10		
41, 42	Vol.	11	SRP261		See Note	A82								24, 27, 71A		
	Sen.	1	K12													
52, 53, 54, 55 (50 Series)	Vol.	12	SRP261		Single	A82	22-61	3	MN277					24, 27, 45, 80		‡
	Vol.	123	DRP221		Dual	A83										
60, 61, 62, 64, 67 (60 Series)	Vol.	12	SRP261		Single	A82	22-61	3	MN277	B83				24, 27, 45, 80		‡
	Vol.	123	DRP221		Dual	A83										
71, 72, 73, 77 (70 Series)	Vol.	12	SRP261		Single	A82	22-72	3	RS213					24, 27, 45, 80		3
	Vol.	123	DRP221		Dual	A83	22-73	3	RS216							
	Tone	41	M		See Note	A4										
80 (Hypermetron)	Vol.	12	SRP261				22-72	3	RS213					24, 27, 45, 80		3
	Tone	41	N				22-73	3	RS216							
91, 92	Vol.	111	A5MP		See Note	A27	22-119	26	RS213					51, 27, 45, 24, 80	175	17
	Vol.	15	N		See Note	A4	22-125	26	RS213							
	Tone	41	M													
102	Vol.	12	SRP261		See Note	A82	22-72	3	RS213					24, 27, 45, 80		3
103 (2017) Serials 450,001 to 450,450	Vol.	111	Y5MP				22-119	26	RS213					51, 24, 27, 45, 80	175	17
	Tone	41	M				22-125	26	RS213							
103 (2017) Serials above 450,451	Vol.	23	NN				22-119	26	RS213					51, 24, 27, 45, 80	175	17
	Tone	41	M				22-125	26	RS213							
112, 122	Vol.	12	SRP261		See Note	A82	22-72	3	RS213					24, 27, 45, 80		3
210, 210-5, 211-5 (2022 A & B)	Vol.	8	G	6			22-156	4	CS133					58, 24, 27, 47, 80	175	1
	Tone	34	M				22-157	4	CS133							
215-216 (Chassis 2044)	Vol.	15	N				22-73	25	RS213					58, 56, 55, 59, 80	175	1
	Tone	34	N													
	Sen.	7	C													
220 (2022 A & B)	Vol.	8	G				22-157	4	CS133					58, 24, 27, 47, 80	175	1
	Tone	34	M				22-156	4	CS133							
225 (Chassis 2044)	Vol.	15	N				22-73	25	RS213					58, 56, 55, 59, 80	175	1
	Tone	34	N													
	Sen.	7	C													
230, 240, 244, 245 (Chassis 2036)	Vol.	15	N				22-172	23	RS213					58, 56, 57, 59, 80	175	3
	Tone	34	N				22-173	23	RS213							

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
ZENITH —Continued																
250, 260 (Chassis 2031)	Vol.	8	G	6			22-156	4	CS133					58, 24, 27, 47, 57, 80	175	1
	Tone	34	M				22-157	4	CS133							
270-5	Vol.	8	G				22-156	4	CS133					58, 24, 27, 47, 80	175	1
	Tone	34	M				22-157	4	CS133							
272 (Chassis 2031)	Vol.	8	G	6			22-156	4	CS133					58, 24, 27, 47, 57, 80	175	1
	Tone	34	M				22-157	4	CS133							
333	Vol.	11	SRP261		See Note	A82								01A, 71A		
342	Vol.	11	SRP261		See Note	A82								27, 71A		
342P	Vol.	11	SRP261		See Note	A82								27, 10, 81		
352, 352A	Vol.	11	SRP261		See Note	A82								27, 71A		
352P, 352AP	Vol.	11	SRP261		See Note	A82								27, 10		
352PX, 352APX	Vol.	11	SRP261		See Note	A82								27, 26, 50		
353A	Vol.	11	SRP261		See Note	A82								01A, 71A		
362, 362X	Vol.	11	SRP261		See Note	A82								27, 71A		
392, 392A	Vol.	11	SRP261		See Note	A82								27, 10		
410, 411	Vol.	20	TRP606				22-167	28	RS213					58, 56, 59, 57, 80	175	3
	Tone	41	N				22-169	15	TS106							
412	Vol.	11	SRP261		See Note	A82								24, 27, 71A		
420	Vol.	20	TRP606				22-167	28	RS213					56, 57, 58, 59, 80	175	3
	Tone	41	N				22-169	15	TS106							
422	Vol.	11	SRP261		See Note	A82								24, 27, 10		
	Sen.	1	K12													
430, 440	Vol.	20	TRP606				22-167	28	RS213					56, 57, 58, 59, 80	175	7
	Tone	41	N				22-169	15	TS106							
460 (2047) (Auto)	Vol.	‡	N				22-183	1	CN151		34	292	C3	6D6, 85, 89, 6Z4	485	10
	Tone	44	K12				22-195	15	TS101							
	Sen.	7	J				.02		Buffer	B14						
462 (Chassis 2057)	Vol.	17	500M No. 1	6	See Note	A1	22-236	4/15		B125	34	292	C3	6C6, 6F7, 6D6, 75, 42, 84	252.5	10
	Tone	34	K12				.02		Buffer	B14						
474 (Chassis 2053)	Vol.	17	N				22-168	1	CN152					58, 55, 59, 56, 80	175	1
	Tone	41	N													
	Sen.	7	C													
475 (Chassis 2054)	Vol.	17	N				22-168	1	CN152					56, 58, 59, 80	175	1
	Tone	41	N				22-169	15	TS105							
	Sen.	7	UC500													
476, 476A (Chassis 2032)	Vol.	20	TRP606				22-241	28	RN241					56, 57, 58, 59, 80	175	7
	Tone	41	N				22-240	28	RS213							
	Supp.	7	A400P													
476B (Chassis 2059)	Vol.	15	N				22-230	3	RN242					56, 58, 59, 80	175	1
	Tone	57	K12				22-247	3	RS213							
	Sen.	7	K				22-225	15	TS101							
500, 501, 503, 514, 515, 516 (Chassis 2037)	Vol.	15	N				22-173	23	RS213					56, 57, 58, 59, 80	175	3
	Tone	34	N				22-172	23	CS130							
520, 521, 530, 531, 533, 535 (Chassis 2035)	Vol.	20	TRP606				22-167	28	RS213					58, 56, 59, 57, 80	175	7
	Tone	41	M				22-169	15	TS106							
	Sen.	7	UC500													
563	Vol.	11	SRP261		See Note	A82	22-61	3	MN277	B83				‡		
600 (Chassis 2037)	Vol.	15	N				22-173	23	RS213					56, 57, 58, 59, 80	175	3
	Tone	34	N				22-172	23	CS130							
M601 (P51)	Vol.	6	G12				22-119	1	RS213					35, 24, 47, 80		1
							22-118	1	RS213							
602	Vol.	12	SRP261		See Note	A82	22-61	3	MN277	B83				24, 27, 45, 80		
604, 606, 610 (Chassis 2037)	Vol.	15	N				22-173	23	RS213					56, 57, 58, 59, 80	175	3
	Tone	34	N				22-172	23	CS130							
613	Vol.	12	SRP261		See Note	A82	22-61	3	MN277	B83				24, 27, 45		
616, 618 (Chassis 2037)	Vol.	15	N				22-173	23	RS213					56, 57, 58, 59, 80	175	3
	Tone	34	N				22-172	23	CS130							
622, 642	Vol.	12	SRP261		See Note	A82	22-61	3	MN277	B83				24, 27, 45, 80		
650HD, 651HE, 660TD, 661TE	Vol.	17	N				22-236	4/15		B125	34	292	C3	6D6, 6F7, 75, 42, 84	252.5	10
	Tone	34	K12													
663-4 (Chassis 5510)	Vol.	18	500M No. 1	6	See Note	A1	22-388	4	CM171		36	294SW	C3	6A7, 6D6, 75, 41, 6Z4	456	10
							.01		Buffer	B14						
666, 668 (Chassis 5616)	Vol.	18	N	6	RS245	A1	22-347	4	CM171		35	294	C3	6D6, 6C6, 75, 42, 84	252.5	10
							.01		Buffer	B14						
672	Vol.	12	SRP261		See Note	A82	22-61	3	MN277	B83				24, 45, 27, 80		
680 (Chassis 5617)	Vol.	18	N	6	RS245	A1	22-347	4	CM171		35	294	C3	6D6, 6C6, 75, 42, 84	252.5	10
							.01		Buffer	B14						
701	Vol.	15	N	6			C525	11	UR182	B31				6D6, 75, 43, 25Z5	456	
702	Vol.	17	N	6			C525	11	UR182	B31				6A7, 6D6, 75, 43, 25Z5	465	
705, 706, 707 (Chassis 2052)	Vol.	17	N	6			22-217	1	RN242					57, 58, 2A6, 59, 80	485	1
							22-225	15	TS101							
710	Vol.	17	N	6			C525	11	UR182	B31				6D6, 75, 43, 25Z5	465	
711, 712 (Chassis 2052)	Vol.	17	N	6			22-217	1	RN242					57, 58, 2A6, 59, 80	485	1
							22-225	15	TS101							
712 (Early)	Vol.	12	SRP261		Single	A82	22-72	3	RS213					24, 27, 45, 80		3
	Vol.	123	DRP221		Dual	A83	22-73	3	RS216							
	Tone	41	M		See Note	A4										
715 (Chassis 2053)	Vol.	17	N				22-168	1	CN152					58, 55, 59, 56, 80	175	1
	Tone	41	N													
	Sen.	7	C													
722	Vol.	12	SRP261		Single	A82	22-72	3	RS213					24, 27, 45, 80		3
	Vol.	123	DRP221		Dual	A83	22-73	3	RS216							
	Tone	41	M		See Note	A4										
730	Vol.	97	TRP602				P80968	12	CS121					19, 30, 32, 34	175	
732	Vol.	12	SRP261		Single	A82	22-72	3	RS213					24, 27, 45, 80		3
	Vol.	123	DRP221		Dual	A83	22-73	3	RS216							
	Tone	41	M		See Note	A4										
735	Vol.	97	TRP602				P80968	12	CS121					19, 30, 32, 34	175	
740	Vol.	15	O				P80968	12	CS121					34, 30, 10AB	175	
	Tone	44	UC502													
750 (Chassis 2052)	Vol.	17	N	6			22-217	1	RN242					57, 58, 2A6, 59, 80	485	1
							22-225	15	TS101							
755, 756 (Chassis 2053)	Vol.	17	N				22-168	1	CN152					58, 55, 59, 56, 80	175	1
	Tone	41	N													
	Sen.	7	C													

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS						CONDENSERS				VIBRATORS			Types of Tubes Used	I. F. Peak	Trans. Circuit
	Use	Circuit	Correct Replacement	Switch	Bias	*Note	Original Part	Circuit	Correct Replacement	*Note	Vibr. Conn.	Replacement	*Note			
ZENITH—Continued																
760, 765, 767 (Chassis 2054)	Vol.	17	N				22-168	1	CN152					56, 58, 59, 80	175	1
	Tone	41	N				22-169	15	TS105							
	Sen.	7	UC500													
770 (Chassis 2032)	Vol.	20	TRP606				22-241	28	RN241					58, 56, 57, 59, 80	175	7
	Tone	41	N				22-240	28	RS213							
	Supp.	7	A400P													
770B (Chassis 2059)	Vol.	15	N				22-230	3	RN242					58, 56, 59, 80	175	1
	Tone	57	K12				22-247	3	RS213							
	Sen.	7	K				22-225	15	TS101							
775 (Chassis 2032)	Vol.	20	TRP606				22-241	28	RN241					56, 57, 58, 59, 80	175	7
	Tone	41	N				22-240	28	RS213							
	Supp.	7	A400P													
775B (Chassis 2059)	Vol.	15	N				22-230	3	RN242					56, 58, 59, 80	175	1
	Tone	57	K12				22-247	3	RS213							
	Sen.	7	K				22-225	15	TS101							
777	Vol.	12	SRP261		Single	A82	22-72	3	RS213					24, 27, 45		3
	Vol.	123	DRP221		Dual	A83	22-73	3	RS216							
	Tone	41	M		See Note	A4										
780 (Chassis 2032)	Vol.	20	TRP606				22-241	28	RN241					56, 57, 58, 59, 80	175	7
	Tone	41	N				22-240	28	RS213							
	Supp.	7	A400P													
801	Vol.	17	N	6			C525	11	UR182	B31				6D6, 75, 43, 25Z5	456	
805 (Chassis 5502)	Vol.	18	N	6			22-125	23	RM262	B50				6F7, 6D6, 75, 42, 80	252.5	1
806, 807 (Chassis 5504, 5505)	Vol.	18	M	6			22-125	23	RM262	B50				6A7, 6D6, 75, 42, 80	252.5	1
808, 809 (Chassis 5605, 5607)	Vol.	18	M	6			22-125	25	RM262	B216				6D6, 6A7, 75, 42, 80	252.5	1
							22-318	25/14	RN241							
							22-306	13	CS130							
811 AC-DC (Chassis 5609)	Vol.	18	M	6			22-307	11	RM257	B215				6D6, 6A7, 75, 43, 25Z5	252.5	
							22-308	11	RN232	B8						
							22-195	15	TS101							
812 (Chassis 5608) AC-DC	Vol.	18	M	6			22-307	11	RM257	B215				6D6, 6A7, 75, 43, 25Z5	125	
							22-308	11	RN232	B8						
814, 815 (Chassis 5611, 5612)	Vol.	18	M	6			22-125	25	RM262	B216				6D6, 6A7, 75, 42, 80	125	1
							22-318	25/13	RN241							
825, 827, 829 (Chassis 5701-2-3)	Vol.	18	M	6			22-283	23	CM172					6D6, 75, 42, 37, 80	485	1
							22-266	23	CM175	B10						
S829 (Chassis 5701R, 5702R, 5703R)	Vol.	18	M	6			22-321	25	CS133					6D6, 75, 42, 76, 80	252.5	1
							22-322	25/13	CN152							
835 (Chassis 1001, 1001A)	Vol.	18	500M No. 1		See Note	A19	22-331	3	RS213					6D6, 75, 42, 76, 5Z3, 6A7	485	1
							22-125	3	RM262	B216						
							22-225	15	TS101							
845 (Chassis 5502)	Vol.	18	N	6			22-125	23	RM262	B50				6F6, 6D6, 75, 42, 80	252.5	1
S847, 850 (Chassis 5504, 5505)	Vol.	18	M	6			22-125	23	RM262	B50				6A7, 6D6, 75, 42, 80	252.5	1
860, 861 (Chassis 5605, 5607)	Vol.	18	M	6			22-125	25	RM262	B216				6D6, 6A7, 75, 42, 80	252.5	1
							22-318	25/14	RN241							
							22-306	13	CS130							
862 AC-DC (Chassis 5609)	Vol.	18	M	6			22-307	11	RM257	B215				6D6, 6A7, 75, 43, 25Z5	252.5	
							22-308	11	RN232	B8						
							22-195	15	TS101							
864 (Chassis 5611, 5612)	Vol.	18	M	6			22-125	25	RM262	B216				6D6, 6A7, 75, 42, 80	125	1
							22-318	25/13	RN241							
865, 866 AC-DC (Chassis 5609)	Vol.	18	M	6			22-307	11	RM257	B215				6D6, 6A7, 75, 43, 25Z5	252.5	
							22-308	11	RN232	B8						
							22-195	15	TS101							
870 (Chassis 5701-2-3)	Vol.	18	M	6			22-283	23	CM172					6D6, 75, 42, 37, 80	485	1
							22-266	23	CM175	B10						
S870, S871 (Chassis 5701R, 5702R, 5703R)	Vol.	18	M	6			22-321	25	CS133					6D6, 75, 42, 76, 80	252.5	1
							22-322	25/13	CN152							
880, 881 (Chassis 1001, 1001A)	Vol.	18	500M No. 1		See Note	A19	22-331	3	RS213					6D6, 75, 42, 76, 5Z3, 6A7	485	1
							22-125	3	RM262	B216						
							22-225	15	TS101							
908, 909 (Chassis 5614)	Vol.	18	M	6			22-385	25/13	RM265					6D6, 6A7, 75, 42, 80	252.5	1
	Tone	22	Y50MP													
S908, S909 (Chassis 5618)	Vol.	18	M	6			22-385	25/13	RM265					6D6, 6A7, 75, 42, 80	252.5	1
	Tone	34	K12													
945, 950 (Chassis 5508, 5509)	Vol.	18	M	6			22-125	25	RM262	B216				6A7, 6D6, 75, 42, 80	252.5	1
	Tone	22	Y50MP													
960, 961 (Chassis 5614)	Vol.	18	M	6			22-385	25/13	RM265					6D6, 6A7, 75, 42, 80	252.5	1
	Tone	22	Y50MP													
S961 (Chassis 5618)	Vol.	18	M	6			22-385	25/13	RM265					6D6, 6A7, 75, 42, 80	252.5	1
	Tone	34	K12													
970, 975 (Chassis 5902)	Vol.	114	N	6			22-125	3	RM262	B216				58, 2A7, 2A5, 56, 80	175	1
	Tone	114	N				22-230	3	RN242							
980, 985, 990 (Chassis 1201, 1201A)	Vol.	20	TRP606				22-331	3	RS213					6D6, 76, 6A7, 42, 5Z3	485	1
							22-125	3	RM262	B216						
Stratosphere 1000Z (Chassis 2501C, 2501P)	Vol.	‡	Order from Mfr.				22-361	3	RS216					6D6, 6A7, 76, 42, 85, 79, 45, 5Z3	485	‡
	Tone	‡	Order from Mfr.				22-360	3	HS691							
	Supp.	‡	500M No. 1		See Note	A19	22-362	14	RS213							
							22-189	15	TS102							
							22-225	15	TS101							
1117 (Chassis 5614)	Vol.	18	M	6			22-385	25/13	RM265					6D6, 6A7, 75, 42, 80	252.5	1
	Tone	22	Y50MP													

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

MANUFACTURER AND MODEL	CONTROLS Use	Circuit	Correct Replacement	Switch	Bias	*Note	CONDENSERS Original Part	Circuit	Correct Replacement	*Note	VIBRATORS Vibr. Conn.	Replacement	*Note	Types of Tubes Used	I. F. Peak	Trans. Circuit
ZENITH—Continued																
1161 (Chassis 5611, 5612)	Vol.	18	M	6			22-125	25	RM262	B216				6D6, 6A7, 75, 42, 80.	125	1
							22-318	25/13	RN241							
1162 (Chassis 5609) AC-DC	Vol.	18	M	6			22-307	11	RM257	B215				6D6, 6A7, 75, 43, 25Z5	252.5	
							22-308	11	RN232	B8						
							22-195	15	TS101							
1167 (Chassis 5618)	Vol.	18	M	6			22-385	25/13	RM265					6D6, 6A7, 75, 42, 80.	252.5	1
	Tone	34	K12													
1170 (Chassis 5701R, 5702R, 5703R)	Vol.	18	M	6			22-321	25	CS133					6D6, 75, 42, 76, 80	252.5	1
							22-322	25/13	CN152							
2009C	Vol.	6	G12				22-87	1	RS213					24, 45, 80		1
							22-102	1	RS213							
2051 (Chassis)	Vol.	15	N	6			22-204	1	RN242					58, 55, 59, 56, 80	485	1
	Tone	34	K12				22-203	15	TS101							
	Sen.	7	J													
2056, 2056I (Chassis)	Vol.	18	N				22-204	1	RN242					58, 2A6, 59, 56, 80	485	1
	Tone	34	K12				22-203	15	TS101							
	Sen.	7	E													
2062 (Chassis)	Vol.	17	N	6			22-230	1	RN242					58, 57, 56, 2A6, 2A5, 80	125	1
	Tone	34	K12													
	Sen.	7	K													
ZEPHYR																
AA (650,001 & up)	Vol.	‡	N				5	19	TS101					1A6, 1B4, 1F4	456	
C (AC-DC 750,001 & up)	Vol.	6	G12		EX600		8-4	6	See Note	B3				78, 77, 43, 25Z5		
							5	15	TS101							
DA	Vol.	17	N				5	19	TS101					1C6, 1A4, 1B5, 30, 19.	456	
	Tone	22	L													
DB, DF	Vol.	17	N				10-20	1	See Note	B3	48	See Note	C8	1C6, 34, 1B5, 38	456	10
							.01		Buffer	B14						
G	Vol.	15	N				8-8	4	See Note	B3				6A7, 6K7, 76, 6F5, 42, 6G5, 80	456	1
	Tone	34	L				5	15	TS101							
GB, GBE	Vol.	17	N				8-8	1	See Note	B3	48	See Note	C8	1C6, 1A4, 1B5, 30, 19.	456	10
	Tone	34	N				.01		Buffer	B14						
GE	Vol.	15	N				8-8	4	See Note	B3				6A7, 6K7, 76, 6F5, 42, 6G5, 80	456	1
	Tone	34	L													
NT, NTE	Vol.	15	N				4-8-8	3	CN155	B3				6K7, 6A8, 6D6, 76, 6B5, 75, 80, 6G5	456	1
	Tone	22	N				5	15	TS101							
P (645,001 & up)	Vol.	17	N				8-8	4	CN152	B3				6A7, 6D6, 75, 42, 80.	456	1
	Tone	22	L				5	15	TS101							
RKD, RKE, RKSD	Vol.	6	UC510		EX300		15-8	6	See Note	B3				6D6, 6C6, 43, 25Z5		
							5-5	15	TN110							
V (AC-DC, 285,001 & up)	Vol.	6	UC510		EX500		8-4	6	See Note	B3				77, 78, 43, 25Z5		
							5-5	15	TN110							
Y (AC-DC, 405,001 & up)	Vol.	6	G12		EX500		20-4	6	See Note	B3				6D6, 6C6, 43, 25Z5		
	Tone	22	L				5-5	15	TN110							
4Z (290,001 & up)	Vol.	6	UC510		EX300		15-8	24	See Note	B3				78, 6C6, 38, 76		
							5-5	15	TN110							
5DA	Vol.	17	N				5	19	TS101					1C6, 34, 1B5, 30, 19.	456	
5DK (780,001 & up)	Vol.	17	N				4-20	6	See Note	B3				6A7, 6D6, 75, 43, 25Z5	456	
	Tone	22	L				5-5	15	TN110							
6G (700,001 & up)	Vol.	17	N				8-8	4	See Note	B3				6A7, 6D6, 75, 76, 42, 80	456	1
	Tone	22	L				5	15	TS101							
6GM (650,001 & up)	Vol.	17	N				8-8	4	See Note	B3				6A8, 6K7, 6H6, 6F5, 6F6, 5Z4	456	1
	Tone	22	L				5	15	TS101							
8J (765,001 & up)	Vol.	17	N				4-8-8-8	‡	See Note	B3				6D6, 6A7, 75, 42, 80.	456	1
	Tone	22	L				5	19	TS105							
							5	15	TS101							
8J (765,361 & up)	Vol.	17	N				4-8-8	3	RN245	B3				6D6, 6A7, 75, 76, 6B5, 80	456	1
	Tone	22	L				4	12	CS121							
							5	15	TS101							
8JM (720,001 & up)	Vol.	118	L				8-8	1	CN152	B3				6K7, 6A8, 6F6, 5Z4	456	1
	Tone	22	L				8	19	CS123							
							4	19	CS121							
							5	15	TS101							

‡ Data not substantiated.

* IMPORTANT: Read Notes in Note Section if specified in Note Column.

CURRENT CAPACITY TABLE—Yaxley Controls

● In many instances it is necessary to have reference to a table which will give the approximate current value which can be applied to a control.

In presenting these tables we wish to call your attention to the fact that the current capacity of a control is limited by certain considerations, such as ventilation, temperature of surrounding air, and voltage applied to the control.

We advise the full consideration of these factors when using either of the two tables given.

CURRENT TABLE FOR No. 4 TAPER (LINEAR) CONTROLS

Overall Resistance Value	Catalog Number	Safe Current (at any point on the control)
5,000	Y5MP	20 Milliamperes
10,000	Y10MP	15 Milliamperes
20,000	Y20MP	10 Milliamperes
25,000	Y25MP	7 Milliamperes
50,000	Y50MP	6 Milliamperes
100,000	Y100MP	4 Milliamperes
200,000	Y200MP	2 Milliamperes
250,000	Y250MP	1 Milliamperes
500,000	Y500MP	1 Milliamperes
1,000,000	Y1000MP	.5 Milliamperes

CURRENT CAPACITY OF YAXLEY No. 2 RIGHT HAND TAPER CONTROLS (in Milliamperes)

Rotation from Right to Left, starting point at full Clockwise rotation.

Resistance in Ohms	Catalog Number	10%	25%	50%	75%	100%
10,000	UC501	70	45	22.5	11	10
25,000	J	55	34	14	7	6
50,000	K	40	24	10	5	4
75,000	Z	33	19	8	4	3½
100,000	UC510	20	12	5	2½	2
250,000	UC509	13	7	3	1½	1
500,000	UC513	9	5	2	1½	½

Yaxley Universal Single Controls

Ohms Resistance	Taper	General Use	Type Element	Catalog Number
2	IV	Filament	W.W.	Q
6	IV	Filament	W.W.	R
10	IV	Filament	W.W.	S
20	IV	Filament	W.W.	T
30	IV	Filament	W.W.	U
60	IV	Filament	W.W.	V
100	IV	Misc	W.W.	W
200	IV	Misc	W.W.	X
400	IV	Misc	W.W.	A400P
500	I	Ant.-Shunt	W.W.	A
550	IV	Bias	W.W.	A550P
1M	IV	Voltage Divider (Bias)	W.W.	A1MP
1M	I	Ant. or Pri. Shunt	W.W.	B
1M	II	Bias	W.W.	UC500
2M	IV	Voltage Divider (Bias)	W.W.	*A2MP
2M	I	Ant. or Pri. Shunt	W.W.	*C12
2M	II	Bias	W.W.	*C
3M	IV	Voltage Divider	W.W.	*A3MP
3M	I	Ant. or Pri. Shunt	W.W.	*D12
3M	II	Bias	W.W.	*D
3M	VII	Ant.-Bias	W.W.	*D7
5M	IV	Voltage Divider	W.W.	*A5MP
5M	IV	Voltage Divider (Bias, Screen)	Carbon	Y5MP
5M	I	Ant.-Shunt or Ant.-Bias	Carbon	E12
5M	II	Bias	W.W.	*E
5M	VII	Ant.-Bias	W.W.	*E7
7500	I	Ant.-Shunt or Ant.-Bias	Carbon	F12
7500	II	Bias	W.W.	*F
7500	VII	Ant.-Bias	W.W.	*F7
10M	IV	Voltage Divider (Bias, Screen)	W.W.	*A10MP
10M	IV	Voltage Divider (Bias, Screen)	Carbon	Y10MP
10M	I	Ant.-Shunt or Ant.-Bias, Tone	Carbon	G12
10M	II	Bias	W.W.	*G
10M	II	Bias	Carbon	UC501
10M	VII	Ant.-Bias	W.W.	*G7
15M	I	Ant.-Shunt or Ant.-Bias, Tone	Carbon	H12
15M	II	Bias	W.W.	*H
15M	VII	Ant.-Bias	W.W.	*H7
20M	IV	Voltage Divider (Bias)	W.W.	*A20MP
20M	I	Ant.-Shunt, Ant.-Bias, Screen	Carbon	Y
25M	IV	Voltage Divider (Screen)	Carbon	Y25MP
25M	II	Bias	Carbon	J
50M	IV	Batt. Bias, Screen	Carbon	Y50MP
50M	I	Screen Voltage, Tone	Carbon	K12
50M	II	Bias	Carbon	K
75M	I	Screen Voltage, Tone	Carbon	Z12
75M	II	Bias	Carbon	Z
100M	IV	Voltage Divider (Bias, Screen)	Carbon	Y100MP
100M	I	RF or AF Shunt, Screen, Tone	Carbon	L
100M	II	Bias or Ant.-Bias (AC-DC)	Carbon	UC510
150M	I	Tone, RF or AF Shunt	Carbon	UC502
200M	IV	Voltage Divider, Misc	Carbon	Y200MP
250M	IV	Voltage Divider, Misc	Carbon	Y250MP
250M	I	Audio Tone, RF or AF Shunt	Carbon	M
250M	I	Audio (Automobile)	Carbon	†UC511
250M	II	Bias, Ant.-Bias (AC-DC)	Carbon	UC509
500M	IV	Voltage Divider, Misc	Carbon	Y500MP
500M	I	Audio, RF or AF Shunt	Carbon	N
500M	I	Audio (Automobile)	Carbon	†UC512
500M	I	Audio (Automobile)	Carbon	††UC515
500M	II	Bias, Ant.-Bias, Bias-Audio	Carbon	UC513
750M	I	Tone, Audio, Audio Shunt	Carbon	UC503
1 Meg.	IV	Misc	Carbon	Y1000MP
1 Meg.	I	Audio, Audio Shunt, Tone	Carbon	O
1 Meg.	I	Audio (Automobile)	Carbon	†UC514
2 Meg.	I	Audio, Audio Shunt, Tone	Carbon	P
3 Meg.	I	Audio Shunt, Tone	Carbon	UC504
4 Meg.	I	Tone	Carbon	UC505
5 Meg.	I	Audio Shunt	Carbon	UC506
5 Meg.	II	Series Screen Control	Carbon	UC507
9 Meg.	I	Audio Shunt	Carbon	UC508

*Has exclusive Yaxley Adjustable Bias Feature. W.W.—Wire Wound Element.
†Has Slotted Shaft for Automobile Receivers.
††Has long, adjustable Slotted Shaft for Automobile Receivers and Special Shaft Coupling.

Yaxley Universal Dual Controls

Ohms Resistance		Taper		Type Element		General Use	Cat. No.
Front	Rear	Front	Rear	Front	Rear		
2M	5M	I	I	W.W.	W.W.	Ant. Shunt and Bias	CE
10M	5M	VII	IV	W.W.	W.W.	Ant.-Shunt Bias or Screen	*GE
10M	10M	VII	IV	W.W.	W.W.	Ant.-Shunt Bias or Screen	GG
10M	50M	I	IV	Carbon	Carbon	Ant.-Shunt Bias or Screen	GK
50M	50M	IV	IV	Carbon	Carbon	Grid Shunt and Cathode Control	†KK
100M	100M	I	I	Carbon	Carbon	Audio Shunt in Push-Pull	LL
100M	250M	I	I	Carbon	Carbon	Audio Shunt, Tone, Screen or RF Shunt	LM
250M	250M	I	I	Carbon	Carbon	Audio Shunt in Push-Pull	MM
250M	500M	I	I	Carbon	Carbon	Audio Shunt and Tone Compensation	MN
500M	500M	I	I	Carbon	Carbon	Audio Shunt in Push-Pull	NN

*Formerly DRP192 †See DRP 308.

Yaxley Universal Tapped (TRP) Controls

Catalog Number	Total Ohms Resistance	Tapped at Ohms	Used As	Catalog Number	Total Ohms Resistance	Tapped at Ohms	Used As
TRP600	6M	2500	Vol.	TRP612	2 Meg.	25000	Vol.
TRP601	30M	6000	Vol.	TRP613	2 Meg.	400000	Vol.
TRP602	63M	3000	Vol.	TRP614	350M	75000	Vol.
TRP603	250M	125000	Vol., Phono.	TRP615	3 Meg.	1 Meg.	Vol.
TRP604	350M	25000	Vol.	TRP616	500M	50000	Vol.
TRP605	350M	75000	Vol., Phono.	TRP617	60M	10000	Vol.
TRP606	500M	100000	Vol.	TRP618	2 Meg.	200M	Vol.
TRP607	500M	250000	Vol.	TRP619	500M	100M 300M	Vol.
TRP608	1 Meg.	200000	Vol.	TRP620	2 Meg.	1 Meg.	Vol.
TRP609	1 Meg.	500000	Vol., Phono.	TRP621	2½ Meg.	250M 500M	Vol., Phono.
TRP610	1 Meg.	20000	Vol.	TRP622	44M	7000 14000	Vol.
TRP611	1 Meg.	170000	Vol.				

Yaxley Universal Hum Controls

Ohms Resistance	General Use	Type Element	Cat. Number
6	Hum	W.W.	HU6
10	Hum	W.W.	HU10
20	Hum	W.W.	HU20
30	Hum	W.W.	HU30
50	Hum	W.W.	HU50
75	Hum	W.W.	HU75
100	Hum	W.W.	HU100
200	Hum	W.W.	HU200

Yaxley Special Single (SRP) Controls

Catalog Number	Ohms Resist.	Type Element	Used As
SRP133	2M	W.W.	Vol.
SRP134	4500	W.W.	Vol. Sen.
SRP138	450	W.W.	Vol.
SRP139	550	W.W.	Vol.
SRP141	1200	W.W.	Vol.
SRP142	2400	W.W.	Vol.
SRP144	2M	W.W.	Vol.
SRP145	2M	W.W.	Vol.
SRP150	50M	Carbon	Vol.
SRP152	60	W.W.	Phono. Vol.
SRP153	13M	W.W.	Vol.
SRP154	50M	Carbon	Vol.
SRP160	2500	W.W.	Equal
SRP170	75M	Carbon	Vol.
SRP179	125M	Carbon	Vol.
SRP185	1500	Carbon	Vol.
SRP188	32M	Carbon	Vol.
SRP213	250M	Carbon	Vol.
SRP216	500M	Carbon	Vol.
SRP223	1M	W.W.	Vol.
SRP226	250M	Carbon	Vol., Tone
SRP239	450	W.W. Strip	Vol.
SRP241	6M	W.W. Strip	Vol.
SRP245	32M	Carbon	Vol.
SRP249	20M	W.W.	
SRP251	250M	Carbon	Vol.
SRP252	500M	Carbon	Vol.
SRP253	400	W.W.	Hum
SRP254	3500	W.W.	Vol.
SRP255	15M	W.W.	Vol.
SRP256	10M	Carbon	Vol.
SRP257	3M	WW..	Vol.
SRP258	15M	Carbon	Vol.
SRP259	50M	Carbon	Phono.
SRP260	1M	W.W.	Vol.
SRP261	100M	Carbon	Vol.
SRP262	1500	W.W.	Vol.
SRP263	32M	Carbon	Vol., Tone
SRP264	650	W.W.	Vol.
SRP265	200	W.W.	Hum
SRP266	600	W.W.	Hum
SRP267	8M	W.W.	Tone Beam
SRP268	15	W.W.	Vol.
SRP269	10M	Carbon	Vol.
SRP270	15M	W.W.	Vol.
SRP271	150	W.W.	Vol.
SRP272	300	W.W.	Vol.
SRP273	500M	Carbon	Vol.
SRP274	10M	W.W.	Vol.
SRP275	500M	Carbon	Vol.
SRP276	3M	Carbon	Regen.
SRP277	2M	Carbon	Vol.
SRP278	500M	Carbon	Vol.
SRP279	50M	Carbon	Vol.
SRP280	500M	Carbon	Vol.
SRP281	350M	Carbon	Vol.
SRP282	350M	Carbon	Vol.
SRP283	2500	W.W.	Vol.
SRP900	20M	Carbon	Vol.
SRP901	10M	Carbon	Vol.
SRP960	800	W.W.	Vol.
SRP961	10M	Carbon	Vol.
SRP962	250M	Carbon	Vol.

Yaxley Special Dual (DRP) Controls

Catalog Number	Ohms Resistance		Type Element		Used As
	Front	Rear	Front	Rear	
DRP114	250	5M	W.W.	W.W.	Vol.
DRP115	3800	3800	Carbon	Carbon	Vol.
DRP116	Spcl.	Spcl.	W.W.	W.W.	Vol.
DRP117	500	2500	W.W.	W.W.	Vol.
DRP119	3M	10M	W.W.	W.W.	Vol.
DRP122	645	10M	W.W.	W.W.	Vol.
DRP169	7500	10M	W.W.	W.W.	Vol.
DRP221	10M	100M	Carbon	Carbon	Vol.
DRP222	75M	32M	Carbon	Carbon	Vol.
DRP232	3 Meg.	3 Meg.	Carbon	Carbon	Vol.
DRP239	25M	25M	Carbon	Carbon	Vol.
DRP240	250M	10M	Carbon	Carbon	Vol.
DRP241	5M	150M	Carbon	Carbon	Vol.
DRP242	10M	500M	Carbon	Carbon	Vol.
DRP243	3M	750M	Carbon	Carbon	Vol.
DRP244	25M	6M	Carbon	Carbon	Vol.
DRP245	1 Meg.	3 Meg.	Carbon	Carbon	Vol.
DRP246	32M	50M	Carbon	Carbon	Vol.
DRP250	50M	1M	Carbon	Carbon	Vol.
DRP301	5M	2500	W.W.	Carbon	Vol.
DRP302	100M	250M	Carbon	Carbon	Vol.
DRP303	2500	100M	Carbon	Carbon	Vol.
DRP304	1 Meg.	3 Meg.	Carbon	Carbon	Vol.
DRP305	15M	25M	Carbon	Carbon	Vol.
DRP306	5M	10M	W.W.	Carbon	Vol.
DRP307	3M	12M	W.W.	Carbon	Vol.
DRP308	50M	50M	Carbon	Carbon	Vol.
DRP309	12M	65M	Carbon	Carbon	Vol.
DRP310	25M	27M	Carbon	Carbon	Vol.
DRP311	150M	250M tapped 90M	Carbon	Carbon	Vol.
DRP312	75M	500M	Carbon	Carbon	Vol.
DRP3 3	1000	500M	Carbon	Carbon	Vol.
DRP314	500M	2500	Carbon	Carbon	Vol.
DRP315	2 Meg.	2500	Carbon	Carbon	Vol.
DRP316	200M	1M	Carbon	Carbon	Supp.
DRP317	500M	1M	Carbon	Carbon	Vol.

SECTION "A" CONTROLS

RESISTANCE VALUE

What control value should I use for this circuit?

What type control of 10,000 ohms should I use?

Do I need a certain value control for a certain use?

Here follows a complete explanation.

The most common misunderstanding is that of resistance value of a control. This is due to the general **lack of information on the tolerance** of resistance value.

Many servicemen will be amazed to learn that this **tolerance is often very great.** In one instance, **a tolerance of plus 40%, minus 25% was allowed.** Think of it. **This means that if the nominal value is 10,000 ohms, the control will be acceptable and will give good performance if its resistance is anywhere between 7500 ohms and 14,000 ohms inclusive. Nominal tolerance of carbon controls is plus or minus 20% from stated value.** Yet many servicemen fear to use a 10,000 ohm control, (of proper taper) to replace one of 11,000 ohms. **This is ridiculous.**

Always Remember—**"RESISTANCE VALUE IS NOT CRITICAL BUT TAPER MUST NOT BE CHANGED." This rule will save time and worry because the resistance value need only be sufficient to give full control. Thus, it should be great enough that weak stations may be heard at their full strength, and yet it should not be so great that difficulty is encountered on local stations. Simple, isn't it?**

Consider an actual case, wherein the specified value is 12,500 ohms. This is readily replaceable with a 15,000 ohm control. **Warning! Of the same taper.** (Remember the rule.)

In many instances this control is replaceable with a 10,000 ohm control (of the same taper). To a certain extent, this is controlled by circuit action. (See "Circuit Action"—page 104.) To sum up, **"RESISTANCE VALUE" IS NOT CRITICAL BUT "TAPER" IS CRITICAL.**

TAPER

"Taper" is the most important consideration in replacing a control.

Do you know that Taper is a complex question involving the human ear, as well as tube action?

Can you select the correct taper without hesitating?

Why are some controls smooth and others jerky?

Make all your replacements function smoothly.

Make your work easier. Understand "TAPER"—the most important control consideration.

Taper is the key to successful control replacement. Taper is simple, yet there is more misinformation and lack of information on this subject than on all others. Let us glance at a common taper graph. Here we see a graph with lines running in every direction, with little if any explanation as to what they mean. But remember, taper is as simple as A B C, regardless of all claims.

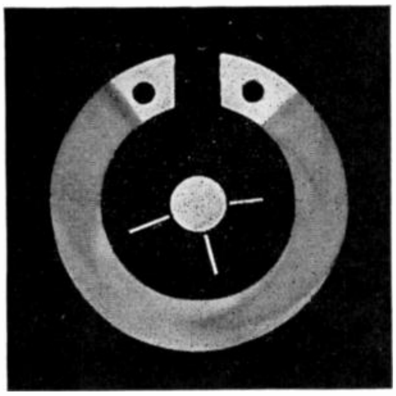


FIGURE 37

THERE ARE ONLY TWO TYPES OF TAPERS

"Left Hand" (Yaxley No. 1) and **"Right Hand"** (Yaxley No. 2). **Period!**

Popular usage has defined "Linear" as a "Taper," therefore it will be listed as such.

In addition to the two basic tapers, Yaxley lists the III (3), a combination of tapers I (1) and II (2), for "special" (SRP) controls. Also, the VII (7) taper (in wire wound controls only) for special use as a replacement for Ant.-Bias circuits, or to replace shunt controls for circuits designed before it was possible to make logarithmic types of taper. **It is not desirable to have a large and confusing array of slightly different tapers, because they are necessary only in special circuits (for which Yaxley supplies SRP [special] controls).**

Yaxley tapers are controlled by a new and exclusive design as shown in Figure 37.

This views a tapered element (Yaxley No. 2 right hand taper, with switch) and shows the method of tapering a control by **"Geometric Design," mathematically calculated and field checked. The only real solution to the problem of taper.** Notice that the tails of each section fade into the next section (marked by the ball and arrows) and that the **"Roller" which does not roll, contacts a gradually increasing or decreasing area of each section. This prevents and eliminates any "step" or "jump" in resistance value and assures a smoothness unknown to any other method of tapering a control.**

WHAT IS TAPER?

Taper means that the resistance of the control does not change "linearly," with the rotation of the control. Linearly means that the resistance value varies directly with the degree of rotation of the control. That is—at ¼ rotation there is ¼ of the total resistance, similarly—at ½ of the rotation of the control there is ½ of the total resistance.

WHY TAPER?

It is necessary to taper the resistance of a control in order to give an apparent linear control of the signal, thus when the control is turned to the "half-way on" position, one expects to hear a volume of signal which will be one-half that obtained at the full "on" position of the control. Why Taper the resistance to obtain this action? Why not use a linear control, won't it give ½ volume at ½ rotation? To quote Amos and Andy, the answer is "Yes and No — Mostly No," **inasmuch as "Circuit Action" and the human ear are the determining factors.**

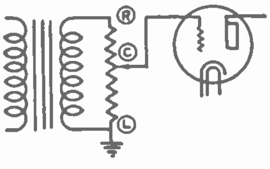


FIGURE 38

Let us suppose that the control in Circuit 16 (Figure 38) is in an amplifier and that we supply a certain measured value of signal, with the control at full "on" position, then we turn down the control until the signal sounds only half as loud, and then measure the signal at the grid of the tube.

Look! It's almost unbelievable. Our measurement shows that we have reduced the signal to approximately 1/10 its former value. Why is this? It doesn't seem sensible.

The reason for this peculiar action is that **the human ear has a peculiar characteristic in that to double a given volume of sound requires an increase of approximately ten times the original intensity.**

Or, more simply—if it requires a pressure of one pound per square inch, to produce a certain volume of sound, it will require a pressure of ten pounds per square inch to double this volume. Sound pressures are not measured in the large quantities given. However, the explanation is plain.

5

LEFT-HAND TAPER
(Yaxley No. 1)

The taper action shown in Circuit 16 (Figure 38) is that of the common or "Left-Hand" taper (Yaxley No. 1). **Let us see why this is called a "Left-Hand" taper.**

It is common practice to have volume controls wired so that when the knob is rotated all the way in a clockwise direction, or as we often say, "to the right," we will have our full volume position. Minimum volume or "off" position will be at the full counter-clockwise, or "left hand" position of the knob.

In the explanation of taper action, we pointed out that at half volume or half rotation position of the control knob, we need only 1/10 of the full volume voltage. Therefore, we need only 1/10 of our total resistance between full "left" position and the "half-way" position of our knob. This is made clear in Figure 39.

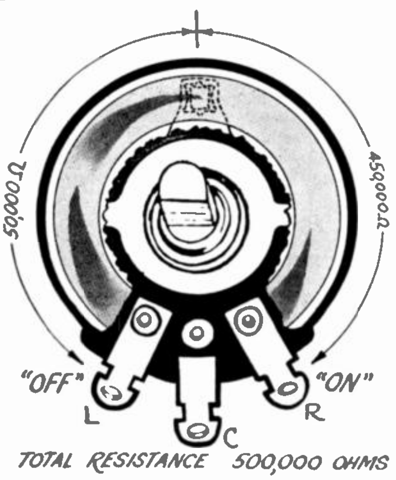


FIGURE 39

Note the position of the arm of the control and the resistance values of the two halves of the control.

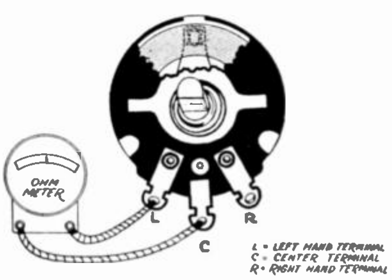


FIGURE 40

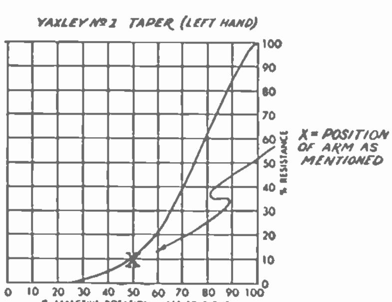


FIGURE 41

Figure 40 shows the connections of the ohmmeter, and Figure 41 illustrates the plotting of the complete taper curve.

Note that the left hand half of the control has its resistance tapered out. This is the reason for calling this a "Left Hand" taper. (Remember, it is Yaxley No. 1 taper.)

Always use a left hand taper (Yaxley No. 1) **for all "Shunt" or "Short Out" circuits.** (See the exceptions given in the chapter on "Circuit Action," page 104.) Refer to pages 117 to 121 and look at circuits numbered 1 to 6, 10 to 16 to 20, (21), (22), 23, 33 to (36), 39 to 41, 44 to 46, 50, 55 to 57, 60 to (67), (69), 72, 73, 76, 77, 79, 80, 81, 83, 85, 87, 93, 94, 96, (100). All these circuits require a left hand taper **fundamentally.** Those marked with parenthesis and a few others use a modified or combination taper. The reasons for this departure are given in the chapter on "Circuit Action." **Note! Tone Controls are generally left hand taper.** They usually have the "Bass" position at the left of the knob. When "Bass" position is at the right of the knob, a right hand taper is required. See the chapter on "Tone Controls," page 110.

A good general rule is, **"When only the center and left hand terminals are used, use a left hand taper** (Yaxley No. 1).

When replacing a control, always examine the circuit and check the taper of the original control. It is wise to question your customer in regard to the action of the control to learn if it was smooth or jerky in its action. Study the circuit and refer to the chapter on "Circuit Action" before replacing it. Often a slight change will give better volume control and a satisfied customer.

HOW TO FIND THE TAPER OF A CONTROL

To find the taper of a control, set the moving arm at the middle point or center of its arc of travel and then (with the terminals "down" or toward you) (Figure 42) measure the resistance between the center terminal and the left hand terminal and compare this resistance value with the resistance between the center and right hand terminals.

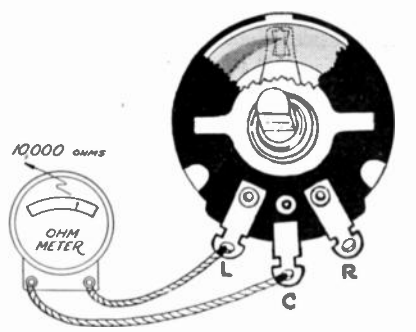


FIGURE 42

If the left-hand half of the control (Figure 42) has a lower resistance than that of the right-hand half of the control (Figure 43), the taper is "Left-Hand" (Yaxley No. 1). If the resistance of the two halves are the same (or very nearly so), the control is a "linear" taper. If the right-hand half has the lowest resistance value, the control has a "right-hand" taper. (Figures 42 and 43 show a 100,000 ohm left-hand (Yaxley No. 1) tapered control Type "L").

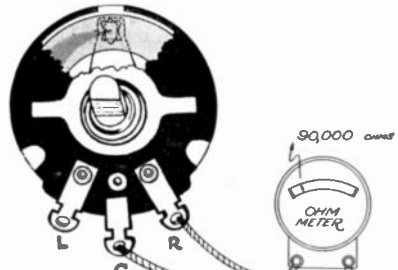


FIGURE 43

To determine the taper of a control wherein there is an "open" in the resistance element proceed as follows:

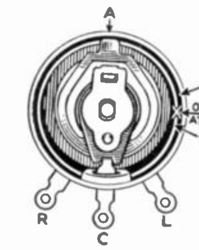


FIGURE 44-5

Refer to Figure 44-5 wherein there is a rear view of a wire wound control with an "open" at the point marked "X."

Although a wire wound control is shown, these instructions also apply to carbon type controls.

In Figure 44-5, **note that the terminals bear the designations R, C and L. By turning the control around and facing the shaft end, these would read properly; i. e., L, left hand; C, center, and R, right hand.**

To determine the taper first place the moving arm in the center of its rotation as shown in Figure 44-5.

Second, measure the resistance between terminal "R" and terminal "C" and make a note of this value.

Third, measure the resistance between "C" and the edge of the "open" marked "B" and make a note of this value.

Fourth, measure the resistance between terminal "L" and the edge of the "open" marked "D."

Fifth, add the values obtained in steps three and four to obtain the resistance of right hand half of the control.

With the values of the two halves of the control known a comparison will quickly show the taper as explained earlier in this article.

If there is more than one "open" proceed as above with the exception that the value of resistance between the different "open" places will have to be obtained and added together so that it is possible to compare the resistance of the two halves of the control.

The foregoing method of determining taper by comparing the right and left halves of the resistance element is a "rough and ready" method applicable in most cases. However, for those who wish to obtain the exact shape of taper curve employed in any control they may do so very readily by employing the 360 deg. scale.

This scale should be made on paper, cut out and pasted on a thin Bakelite or Wood panel with a 7/16" or 1/2" hole at the center for the volume control bushing.

To use this device mount the control on the rear of the panel and fasten with the usual mounting nut or one of the Yaxley shoulder nuts No. 11260-12 or 11260-2. Adjust the control so that when the knob is turned all the way to the left the dial reading is zero. Then turn the knob all the way to the right and read the total rotation in degrees and divide by ten to get the number of degrees for each 10% rotation. Attach an ohmmeter to the left hand terminal and to the center terminal of the control and with the control rotated all the way to the left take the first reading which in most instances will be zero.

Take a reading of the resistance every 10 percent of the rotation from left to right and plot the readings on graph paper.

RIGHT HAND TAPER
(Yaxley No. 2)

Right Hand Taper (Yaxley No. 2) **is the designation applied to a control wherein the Right Hand half of the resistance is tapered out. Right Hand taper is used in series circuits.**

We have explained the necessity of taper, because of the characteristics of the human ear. **Right Hand taper is necessary because of the peculiar combination of circuit action and the action of the ear.** Figures 46, 47, 48 and 49 give a clear picture of the arrangement and measurement of Right Hand Taper.

Study these illustrations. They will help you understand taper. Let's take a common application of Right-Hand Taper (Yaxley No. 2) to see why it is necessary and how it works. The "graph" (Figure 50) plots the "resistance against rotation" versus the Mutual Conductance (Gm) of a tube of the remote "cut-off" type such as a 6D6. The control—Yaxley UC510—100,000 ohms No. 2 right-hand taper.

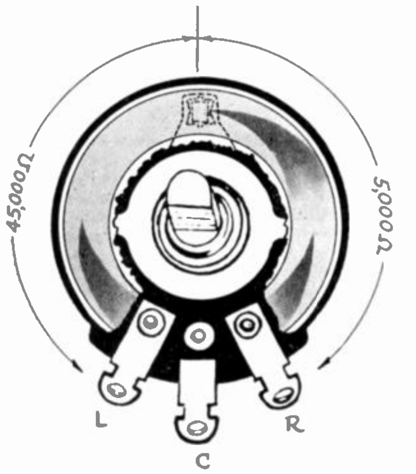


FIGURE 46

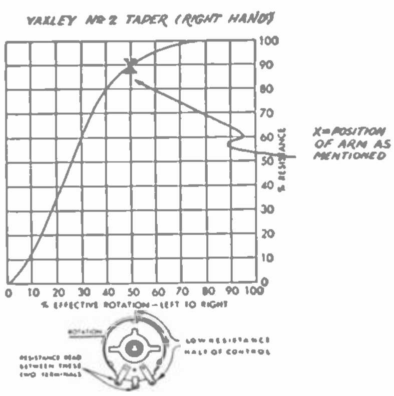


FIGURE 47

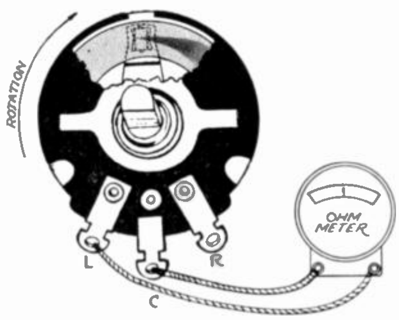


FIGURE 48

Reducing the Mutual Conductance (Gm) of a tube lowers the amplification, however, there is a limit to this reduction because if the plate current of the tube is reduced to the "cut-off" point, distortion will occur. Be sure to read the full particulars of this in "Circuit Action" page 104. Study the curve in Figure 50. Note that the "gain" is reduced to approximately 10% when this control is at the "middle" point of its rotation. This is necessary if we wish to have an apparent linear reduction of volume with rotation of the control. Right hand taper (Yaxley No. 2) is used in most "Series" circuits, such as plate voltage, screen voltage, cathode or "Bias" control and "series losser" types of circuits. Note the list of Right Hand tapered controls (Yaxley No. 2) and look at the circuits that are specified for each one.

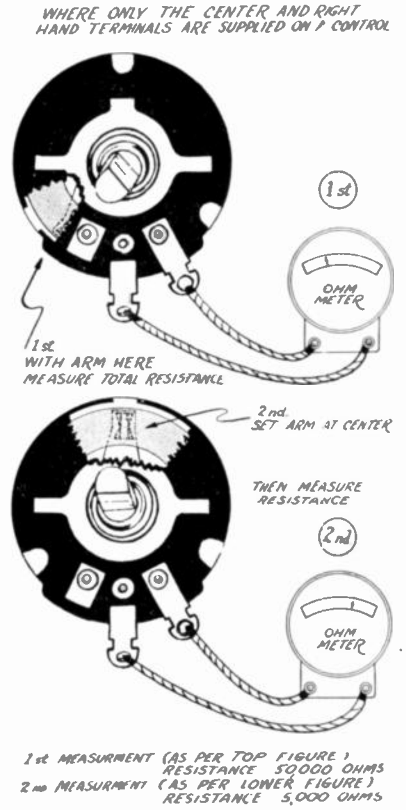


FIGURE 49

QUICK REFERENCE
(Yaxley No. 2)
RIGHT HAND
TAPERED CONTROLS

Ohms Resistance	Catalog Number	Type	General Use
1,000	UC500	W. W.	Bias
2,000	C*	W. W.	Bias
3,000	D*	W. W.	Bias
5,000	E*	W. W.	Bias
7,500	F*	W. W.	Bias
10,000	UC501*	Carbon	Bias, Losser
10,000	G*	W. W.	Bias, Losser
15,000	H*	W. W.	Bias, Losser
25,000	J*	Carbon	Bias
50,000	K*	Carbon	Bias, Plate, Screen
75,000	Z*	Carbon	Bias, Plate, Screen
100,000	UC510*	Carbon	Bias, Ant.-Bias, Plate
250,000	UC509*	Carbon	Bias, Ant.-Bias, Bias-Audio
500,000	UC513	Carbon	Bias, Ant.-Bias, Bias-Audio
5 Meg.	UC507	Carbon	Screen

*Have exclusive Yaxley "adjustable fixed bias" feature.

Note: **Nearly all low resistance "Bias" controls carry heavy current and are therefore wire wound type. Don't take a chance. Use Yaxley.**

In the "general use" column are abbreviations of the use of the control; Circuits follow:

Bias—Circuits 7, 8, 42, 47, 49, 58, 98.

Losser—Circuit 84.

Plate—Circuit 26.

Screen—Circuit 27.

*Ant.-Bias—Circuits 6, 69, 70 (See note).

Bias-Audio—Circuit 88.

WARNING! **Right Hand taper** (Yaxley No. 2) **is to be used for Ant.-Bias only with Variable Mu or Remote Cut-Off tubes.** It is usually found in popular AC-DC receivers. Be sure to read "Circuit Action" page 104. Look at the taper curves for Yaxley No. 2 **Right Hand taper** and see the small curve at the left hand end. This curve gives smooth action in Ant.-Bias and Bias-Audio Circuits.

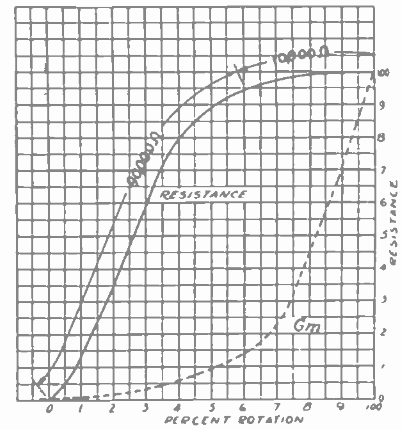


FIGURE 50

QUICK REFERENCE
(Yaxley No. 1)
LEFT HAND
TAPERED CONTROLS

Ohms Resistance	Catalog Number	Type	General Use
500	A	W. W.	Ant. Shunt
1000	B	W. W.	Ant. or Pri. Shunt
2000	C12	W. W.	Ant. or Pri. Shunt
3000	D12	W. W.	Ant. or Pri. Shunt
5000	E12	Carbon	Ant. or Pri. Shunt
7500	F12	Carbon	Ant. or Pri. Shunt
10,000	G12	Carbon	Ant. Shunt or Ant.-Bias Tone
15,000	H12	Carbon	Ant. Shunt or Ant.-Bias Tone
20,000	Y	Carbon	Ant. Shunt or Ant.-Bias Tone
50,000	K12	Carbon	Screen Voltage, Tone
75,000	Z12	Carbon	Screen Voltage, Tone
100,000	L	Carbon	AF or RF Shunt, Audio, Tone
150,000	UC502	Carbon	AF or RF Shunt, Audio, Tone
250,000	M	Carbon	AF or RF Shunt, Audio, Tone
250,000	UC511*	Carbon	Audio Control (Auto)
500,000	N	Carbon	Audio Control
500,000	UC512*	Carbon	Audio Control (Auto)
500,000	UC515	Carbon	Audio Control (Auto)
750,000	UC503	Carbon	AF Shunt, Audio, Tone
1 Meg.	O	Carbon	Audio, Tone
1 Meg.	UC514*	Carbon	Audio, Auto
2 Meg.	P	Carbon	Audio, Tone
3 Meg.	UC504	Carbon	Audio, Tone
4 Meg.	UC505	Carbon	Audio, Tone
5 Meg.	UC506	Carbon	Audio, Tone
9 Meg.	UC508	Carbon	Audio, Tone

*Slotted shaft for auto receivers.

In the "General Use" column are abbreviations of the use of the control; circuits follow:

Ant. Shunt—Circuits 1 to 5, 40, 60.

Pri. Shunt—Circuits 10, 81 (Plate control).

Ant.-Bias**—Circuits 6, 69.

Screen Voltage—Circuit 12.

Tone—Circuits 21, 22, 34, 39, 41, 44, 57, 65, 67, 72, 85, 101, 103.

AF Shunt—Circuits 15 to 18, 33, 76, 96.

RF Shunt—Circuits 13, 14, 81 (Grid).

Audio—Circuits 15 to 18, 33, 45, 46, 55, 56, 61, 73, 76, 77, 78, 83, 93, 96.

**Ant.-Bias circuits 6 and 69 often use a left hand tapered control where tubes of sharp cut off characteristics (such as type 24) are used: Yaxley No. 7 taper is excellent for this use.

WARNING! Be careful that the control for circuits 6 and 69 is not too large a resistance value that plate current "cut-off" occurs at or near minimum volume position. If **cut-off** is approached too closely distortion will occur. Read "Circuit Action" page 104.

COMBINATION TAPER (Yaxley No. 3)

Yaxley No. 3 taper is a combination of left and right-hand tapers. It is necessary in only a few designs. Supplied in SRP (special) controls only.

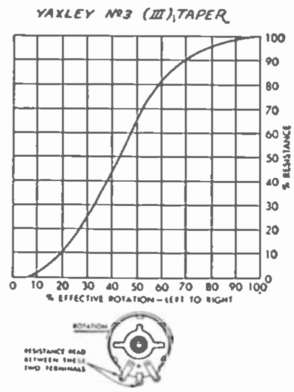


FIGURE 51

LINEAR TAPER (Yaxley No. 4)

A Linear control is not tapered, that is the resistance is equal in percentage to the percentage of rotation. At the center of rotation the resistance is equal in both halves of the control.

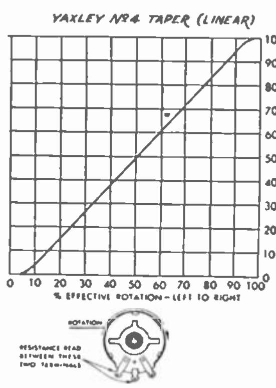


FIGURE 52

Note the ends of the "curve" are tapered off so that there will be no "hop off" on a weak signal.

"LINEAR" CONTROLS

Ohms Res't.	Catalog No.	Type
400	A400P	WW
550	A550P	WW
1,000	A1MP	WW
2,000	A2MP*	WW
3,000	A3MP*	WW
5,000	A5MP*	WW
5,000	Y5MP	Carbon
10,000	A10MP*	WW
10,000	Y10MP	Carbon
20,000	A20MP*	WW
25,000	Y25MP	Carbon
50,000	Y50MP	Carbon
100,000	Y100MP	Carbon
200,000	Y200MP	Carbon
250,000	Y250MP	Carbon
500,000	Y500MP	Carbon
1 Meg	Y1000MP	Carbon

*Has exclusive Yaxley adjustable bias feature.
WW—Wire Wound.

YAXLEY No. 7 TAPER

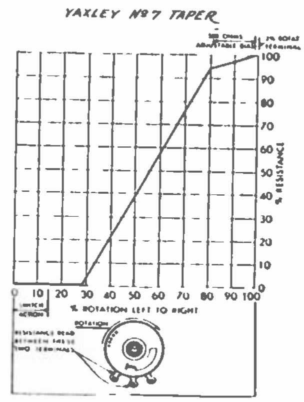


FIGURE 53

Yaxley No. 7 taper is almost a linear. Note that at the left hand terminal there is a small amount of resistance in the first few degrees of rotation. Yaxley No. 7 taper is for use in replacing older types of Wire Wound controls in Ant.-Bias circuits. The **"spread-out" portion** of resistance, at the left hand end of the control, **gives a smooth control of the most powerful signals.** Controls with this taper have the **Adjustable Bias feature**, explained on page 123.

CIRCUIT ACTION

Many servicemen are deathly afraid to change a single wire in a receiver, even though they know that the receiver is old and entirely unfit for present day use, and that possibly a change of the control circuit will, for example, allow them to "turn down" the locals, yet they fear this change. They forget that the receiver was made when 5,000 watts was "Hipower" and that modern receivers use modern circuits.

Try to help your customers. Here is a complete analysis of circuits that tells why and what takes place in the various circuits. Why does one receiver require 10,000 ohms and another, having the same circuit, require 20,000 ohms? Increase your knowledge! Get those "hard jobs"—they pay. Read this chapter on "Circuit Action." It will pay you well.

ANTENNA CONTROL CIRCUITS

The most simple type of control circuit is that generally called the **"Antenna Control."** This type of control came into popular use with the introduction of the AC Tube, the filament rheostat having been widely used as a volume control previous to that time.

The reason for using this type of circuit was not so much to gain "volume control" but was to allow **single dial tuning** because at this early date, antenna coil design had not been developed sufficiently to allow a tuned antenna circuit to "track" with the other tuned circuits. In addition the "AC" tube filament current could not be successfully varied so as to give control of volume.

This type of **"Antenna" control functions as a regulator, controlling the amount of signal fed to the grid of the first RF amplifier.** Circuits 1 to 5, 40 and 60 on pages 117 to 121, are variations of this type of control circuit. Circuit 1 (Figure 54), illustrates the simplest circuit of this type.

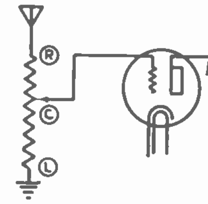


FIGURE 54

The antenna is directly connected to the right hand terminal of the control, the left hand terminal being connected to the ground, and the moving arm (center terminal) is connected directly to the grid of the first RF amplifier tube. This connection gives maximum volume when the control is turned to the right (clockwise).

Thus, we see that the full antenna voltage of all signals, affecting the antenna, is applied directly across the control and that any portion of this voltage may be applied to the grid of the first tube, depending upon the setting of the moving arm of the control. The resistance value of this type control varies from a minimum of 450 ohms (see the older Atwater Kent receivers) to a value of about 10,000 ohms maximum, inasmuch as a resistance value greater than this tends to isolate the grid of the tube, and causes hum.

TAPER! Refer now to the previous article on "Left Hand" taper and note that, here, we have the same conditions; i. e., a control shunted across the source of signal, therefore the same rules will apply to this or to any other circuit so connected, as apply to the circuit given as an illustration in that article.

The taper for the Antenna type control is, in general, of the left-hand, or Yaxley No. 1 type. Many of the earlier receivers used wire wound controls, which are difficult to make with logarithmic taper, and inasmuch as the antenna voltages developed by the earlier low-power transmitters were not of any great magnitude, it was not necessary to pay much attention to taper, although a slight amount of taper in the form of a low resistance winding, generally 10 to 25 ohms and spread over about 20% (1/5) of the rotation, at the left hand side of the control, was often used.

It is found **that this type circuit,** using the earlier type wire control, **does not give good attenuation, because of the high antenna signal voltages developed by modern transmitters.** This condition may be overcome by **using a left-hand taper carbon control** (Yaxley No. 1). This will allow smooth attenuation of powerful local signals. TROUBLES usually encountered with this type of circuit are: **Poor attenuation** or "hop off," that is, a sharp "cutting off" of the signal (usually on local stations), and generally poor control of all signals, as previously mentioned, a simple change from the original wire type control to the Yaxley No. 1 left-hand tapered carbon control will often cure the trouble. **It has been** reliably reported that a sure cure of this trouble will be had if a Yaxley DRP241 or DRP243 control is installed with the low resistance section connected as the original antenna control and the high resistance section connected as per Circuit 16 (Figure 38), so as to give a dual control of both the input signal and of the output. This overcomes chassis pick-up due to lack of, or poor shielding.

Circuit 2 (Figure 55), illustrates the second type of "Antenna" control circuit.

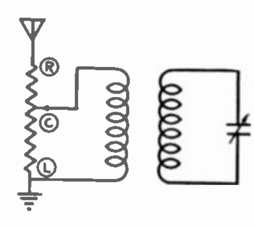


FIGURE 55

The connections of the Antenna to the control are the same as those in Circuit 1 (Figure 54) but that the primary of an RF transformer is connected to "ground" and to the moving contact (center terminal), of the control. **When the control is at maximum volume position** (R-right-hand terminal) **the total resistance of the control is in shunt with both the Antenna** (Source) **and the primary coil** (Load). Varying the position of the control arm causes the resistance value of the shunt across the **primary** to vary over the full range of the resistance value of the control.

In view of this, **the total resistance of the control must be of such a value so that, at "full volume" position, there will be but little loss of signal through the control.** In other words, **the total resistance of the control must be much greater than the impedance of the primary.** In practice the resistance value of the control is usually not more than 4 or 5 times the value of the primary impedance, as higher ratios are not practical because of the shunting action of the antenna impedance, which varies greatly because of the wide variety of Antennas.

Resistance value of the control for this type circuit may range from 2,000 to 20,000 ohms, depending upon the receiver design which is, of course, dependent to a large degree upon the impedance value of the primary coil of the RF transformer.

TAPER for this circuit is Left Hand, or Yaxley No. 1. Some receivers were built with very little taper in the control. The replacement control for the latter, may well be a Yaxley control of No. 4 (Linear) taper although a Yaxley No. 1 tapered (carbon type) control will sometimes be better, than the original linear control, depending on local conditions.

Troubles with this type circuit are best overcome by the methods outlined for Circuit 1 (Figure 54), however, due to increased transmitter power, a lower resistance control will often work wonders without loss of signal strength even on the weaker stations. It is best to "cut and try" to ascertain the correct value.

Circuit 3 (Figure 56) illustrates the third type of "Antenna" control.

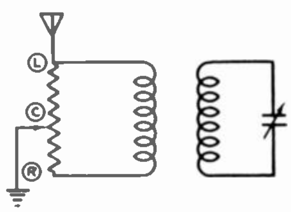


FIGURE 56

In this circuit the Antenna is connected to the left-hand terminal of the control. The primary coil floats across the total resistance of the control.

This change of connections causes the effective resistance in shunt with the antenna to vary with the setting of the moving contact of the control. The shunt resistance across the primary coil does not vary, to any great extent, with the position of the contact arm of the control. If anything, the shunt impedance rises slightly, with reduction of volume. This type of circuit does not give as good results as that of Circuit 2 (Figure 55) or Circuit 4 (Figure 57).

TAPER and Resistance values for this circuit are the same as for the previously mentioned types except that the range of resistance is limited to a certain extent by the impedance of the primary coil.

Trouble—In case of attenuation trouble it might be advisable to change the connections to either that of Circuit 2 (Figure 55) or Circuit 4 (Figure 57) in addition to the information given previously.

Circuit 4 (Figure 57) is an illustration of a fourth type of "Antenna" control.

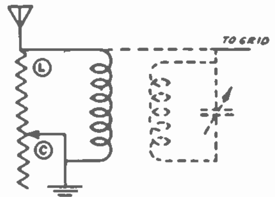


FIGURE 57

The antenna is connected to the left-hand terminal and ground to the moving arm terminal. The right-hand terminal is not used.

This type of circuit is often called a "Shunt" circuit, however, it is better to refer to it as a Short Out type of circuit, inasmuch as the control "Shorts Out" the primary and simultaneously grounds the antenna.

Taper and Resistance Value of the controls for this type circuit is the same as for the circuits previously given.

Trouble is usually encountered with this type of circuit unless the chassis is thoroughly grounded. This is not so when the ground wire is connected to the antenna post, because this leaves the chassis at RF potential to ground.

If a good Antenna cannot be erected and it is necessary to use such an improvision for an Antenna, it may be advisable to change this circuit to that of Circuit 2 (Figure 55) or if possible use Circuit 6 (Figure 68).

Circuit 5 (Figure 58) is the fifth type of "Antenna" circuit.

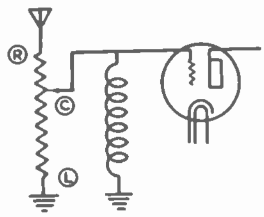


FIGURE 58

This circuit is similar to that of Circuit 1 (Figure 54) except that an RF choke is connected from Grid to Ground.

The purpose of this choke may be to either give a "rising response" at the lower frequency end of the broadcast band or to allow the use of a higher resistance value of control without hum trouble. In addition these chokes are often broadly peaked in the center of the broadcast band so as to get a slightly increased signal voltage from the Antenna. For all practical purposes there is little to gain from such design.

Taper and Resistance values for this circuit are much the same as for previous circuits except that the resistance of the control may be as high as 50,000 ohms.

This ends the discussion of "Antenna" type circuits and we will now consider the next most popular type of the older circuits, **one that is widely used today** for "Sensitivity," "Quiet" or "Silent Tuning" control.

"BIAS" CONTROL CIRCUITS

This type of volume control circuit makes use of a variation of the bias voltage, applied to the tubes as a means of controlling the volume of a receiver. Increasing the bias of a tube lowers the Mutual Conductance (GM) of a tube and reduces the "Gain" of the stage.

Remember, there are two general types of tubes, those with "Sharp" cut-off and the Variable Mu or Remote cut-off types. This introduces a disturbing factor in that complete control cannot be had with Sharp cut-off types of tubes.

"Cut-off" means the cutting off of plate current by means of a high bias voltage. The Sharp Cut-Off type requires a rather **small** increase in bias voltage to completely cut off the plate current whereas the Remote Cut-Off type requires an enormous increase in bias voltage to bring the plate current down to "cut-off" and in some types of tubes the plate current cannot be completely cut off by the bias voltage.

As an illustration, the type 24A tube has a (GM) of 1050 at 3 volts bias, yet it requires only 9 volts to bring the plate current down to cut-off. This is an example of the sharp cut-off type of tube. The type 35 tube also has a (GM) of 1050 at the same plate, screen and bias voltages. It requires 40 volts to bring the plate current down to approximate cut-off. This is an example of the Remote Cut-Off type of tube. Incidentally, **the useful range of control is 5 to 1 for the 24 and 70 to 1 for the 35 tubes respectively.**

Circuit 31 (Figure 59) is an illustration of the earliest Bias Type control.

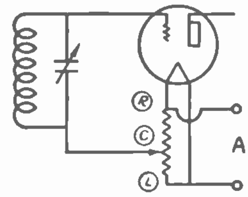


FIGURE 59

This control was used on the early battery sets. It consists of a fairly high resistance potentiometer generally of 200 or 400 ohms total resistance shunted across the filament supply which was, of course, 6 volts. This control served to vary the bias on the R.F. amplifier tubes, and thereby gave control of the volume. On the whole, this circuit was not very satisfactory, as the range of control was not great and it was used mostly as a control to prevent oscillation.

Figure 60 (Circuit 7) illustrates the common Bias control circuit.

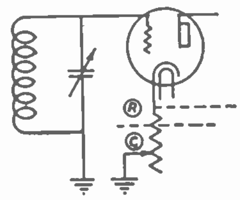


FIGURE 60

In this illustration **dotted lines indicate that a portion of the control resistance may be retained to supply the minimum bias which is required by the tube at full volume.** Also, the dotted lines show that one or more cathodes may be connected to the control and that there may, or may not be a bleed current through the control. For the present, we will consider that the circuit controls only one tube and does not have a bleed current. Although a triode tube is shown, this circuit is also used with tetrodes and pentodes. For the purpose of explanation, we give Figure 61, which shows the use of a 100,000 ohm Yaxley No. 2 right-hand taper control, Yaxley type UC500, with the resistance plotted against the (GM) Mutual Conductance of the tube and both curves against the rotation of the control.

Note that **at 50% rotation, we have introduced approximately 10% of the total resistance of the control** (considering for the present the rotation from right to left) and that **with this amount of resistance the Mutual Conductance has dropped to approximately 10% of its "full volume" value.** Thus—by this curve we see that the Yaxley No. 2 right-hand taper is adhering to the laws laid down in the explanation of "taper." A study of this graph with its two curves will reveal that at the full resistance of the control, i. e., at full counter-clockwise position, the "Mutual Conductance" has not been reduced to absolute zero. However, it is down to such a value that no signals other than from powerful stations will be heard.

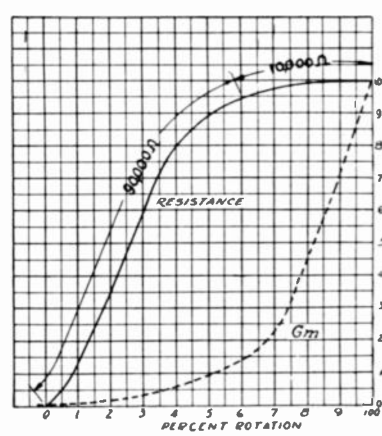


FIGURE 61

The graph in Figure 61 (page 105) illustrates the use of a bias type control on a remote cut-off type of tube. In fact, a 6D6 was used in this calculation. In practice, a straight Bias type control would hardly ever be used with this tube, but rather the combination Ant.-Bias circuit in order that locals may be fully attenuated.

The cathode bias type control was widely used with the type 27 tube which has a fairly remote cut-off. However, the increased power of modern broadcasting stations has resulted in poor control from this type of circuit. Therefore, **it is sometimes necessary to change this circuit to the "Ant.-Bias" type circuit by connecting the right-hand terminal, of the control, to the Antenna.** Additional types of circuits similar to circuit 7 are circuits numbers 47, 58 and 98, see pages 117 to 121. The difference in these circuits is merely in the connections to the control and associate circuit, the control action remaining entirely the same.

A study of these circuits will reveal that **the main difference is in the connection of the bias resistor** which supplies the minimum bias necessary for correct operation of the tube or tubes at full volume position.

The Second Class of "Bias" control circuits, represented by Circuit 8 (Figure 62) and Circuit 42 (Figure 63) differs but little from the class just mentioned, the difference being that the resistance value is lower and that a current is bled, from either the screen or plate supply, into the control so as to give a rapidly rising bias voltage, with rotation of the control.

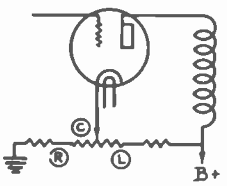


FIGURE 62

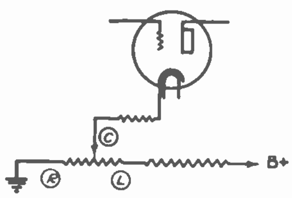


FIGURE 63

In receivers using the lower values of control resistance, such as from 15,000 ohms down, the control used for these types of circuits will usually be found to be of linear taper.

Taper used for bias control is nearly always of the right-hand type (Yaxley No. 2), except in the instances mentioned, or in the third class of bias control circuit which we will now discuss.

The Third Class of "bias" control circuit is that in which the grid return connects to the arm of a variable resistance, which is connected across the source of bias voltage. This type of circuit is generally used in battery receivers and therefore the bias source is usually a "C" battery or "voltage dropping" network of resistors in the "B" circuit. In this type of control circuit, **the range of bias voltage applied to the tube, is dependent** almost exclusively **upon the voltage applied to the control**, inasmuch as the grid does not draw any current from the control circuit. The resistance value of the control **may be quite high in order to prevent unnecessary "drain"** on the batteries.

Circuit 9 (Figure 64) is an illustration of one of the most common circuits of this type.

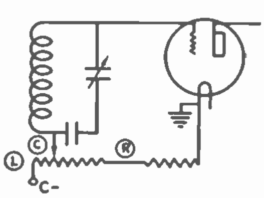


FIGURE 64

Note, that **the left hand terminal** of the control **connects to the highest negative polarity of the "C" battery**, as shown by the notation C—. The Right-Hand terminal of the control connects to a fixed resistor which is of such a value that **the current flowing through the control will cause a voltage drop across it, equal to the required "minimum" bias of the tube.** The rotating arm or "Center Terminal" of the control connects directly to the grid return. Thus, it will be seen that the bias may be varied over quite a range, depending upon the voltage of the "C" battery.

Circuit 54 (Figure 65), although a resistance coupled amplifier, is basically, identical to Circuit 9 (Figure 64) and clearly shows the full connections for this type of circuit.

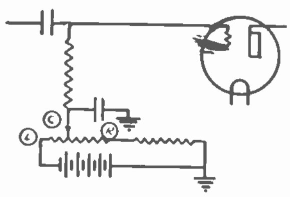


FIGURE 65

Circuit 59 (Figure 66), is of the same type as that of Circuit 9 (Figure 64) and Circuit 54 (Figure 65). However, it is applied in this case to an "A.C." receiver.

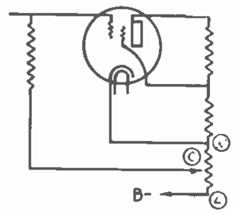


FIGURE 66

This type of circuit is often used on the AVC tube for control of its action.

There is one remaining type of bias control in which **the grid of the tube is biased by signal voltage developed across a diode rectifier Load**, which in this case is the resistance of the control. Circuit 62 (Figure 67) illustrates a circuit of this type

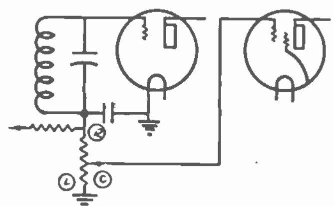


FIGURE 67

Usually, there is provision made for minimum bias of the controlled tube, which is not shown in this schematic. Study of this circuit will reveal that the bias on the controlled tube **varies with the strength of the signal input**, in addition to the position of the "arm" of the control, this type of circuit being used in "Quiet" AVC circuits.

Resistance for use in the third class of Bias type control circuits is usually of a range from about 20,000 to 100,000 ohms, with the following exceptions:

The control for use in Circuit 59 (Figure 66) is usually of a fairly low value ranging from 150 ohms to 10,000 ohms, whereas the resistance range for Circuit 62 (Figure 67) will be from 100,000 to 500,000 ohms inclusive. **The main consideration of resistance for this type of circuit is that the current flowing through the control should not be of such a large value that it will quickly exhaust the battery.** In addition, where the voltage of the battery is much higher than that required to bring the tube or tubes down to cut-off, it is usually necessary to insert resistors in series with the control so as to limit the voltage drop across the control to the required value.

Taper of controls for the third class of Bias type of control circuit varies considerably. It depends upon the class of tube, that is, Sharp or Remote cut-off. In general, the taper is linear, although in some cases a slight left-hand taper is required, particularly where sharp cut-off types of tubes are employed.

Trouble encountered in "bias" type control circuits is usually "noisy" controls, best overcome by replacing with a new control. In case the "range" of control is too great (i. e., cut-off is obtained, even on the most powerful stations, at less than full rotation), it may be advisable to insert a resistor in series with the control to reduce the voltage drop across the control, and give a smoother action.

In laying out a battery receiver using this type of control, or in rebuilding an old receiver to a modern circuit, involving the use of this type circuit, **it is advisable to carefully calculate the voltage drop which will be obtained across the control. It is imperative that the control circuit include means for obtaining the minimum bias.**

"ANT.-BIAS" CONTROL CIRCUITS

The "Ant.-Bias" type of control circuit is probably the most widely used to date. However, it is indeed surprising that so many servicemen fail to have any knowledge concerning the action of this type circuit.

In this circuit, there are two distinct actions combined. The first is the control of volume by means of increasing the bias on the controlled tubes. The second action is the shorting out of the input signal at the Antenna.

Important—There are two basic types or classes of this circuit; i. e., that type employed with sharp cut-off tubes and that employed with remote cut-off tubes. **In the first class, the control serves to increase the bias to reduce the (Gm) Mutual Conductance of the tube or tubes, to a slight extent, and simultaneously short out the input signal.**

Note: **The main function of the control in this case is really to short out the signal input and at the same time reduce the (Gm) Mutual Conductance of the tubes** to a point where chassis pick-up will not be bothersome. Chassis pick-up means the absorption of signal voltage from powerful stations by poorly shielded conductors within the receiver. **This type of circuit is used where the straight antenna shunt or short-out type of circuit would fail to give full attenuation of powerful signals** such as from local broadcasting stations, and was widely used in the days when the type 24 and sharp cut-off tubes were used as radio frequency amplifiers.

The second class of Ant.-Bias circuit operates in exactly the reverse manner, in that the main attenuation of signal is accomplished by increasing the bias to a high value, which reduces the (Gm) Mutual Conductance. This action will attenuate all but the most powerful local signals. These powerful signals are taken care of by the antenna short-out action. The resistance value of controls for the second type circuit is much greater than that for use in the first class.

Circuit 6 (Figure 68) is an illustration of the "Antenna-Bias" type of circuit.

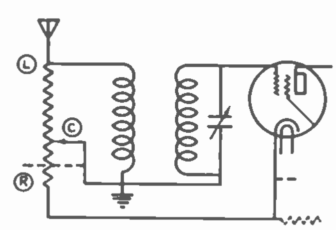


FIGURE 68

Your attention is called to the dotted lines on this schematic. **The dotted line across the control indicates that a portion of the resistance may be retained for use as the minimum bias resistor** to supply correct bias to the tube or tubes at full volume position.

The straight dotted line immediately below the tube indicates that other cathodes may be connected at this point. The dotted line resistor immediately below the last mentioned dotted line indicates that there may be a bleed current flowing through the control.

The exclusive design of Yaxley controls provides **an adjustable resistor** for use **when replacing controls** wherein a portion of the resistance was set aside for use **as the minimum bias resistor.** In **wire type** controls, this is a built-in variable resistor. **In carbon type controls, it is a variable resistor** supplied with the control for exterior application.

The bleed current mentioned is merely a current which is bled from either the screen or plate supply circuits. The purpose of this current is to stabilize the circuit and to provide a greater increase of bias per degree of rotation of the control, where it is necessary or desirable to use a fairly low resistance control.

Remember: That this is a very convenient way of controlling or improving the action of a volume control when used in this type circuit. There are many cases, especially in old receivers, where the control will not "cut out" the local **signals, in which case the addition of a slight amount of bleed current through the control will provide for sufficient increase in bias, and thereby give complete cut-off.**

WARNING—Be very careful that the bleed current is not high enough to give complete cut-off, as this will introduce distortion. The correct value of bleed current is best ascertained by the old reliable cut and try method.

Circuit 69 (Figure 69) is the same as Circuit 6 (Figure 68) except for the untuned antenna circuit.

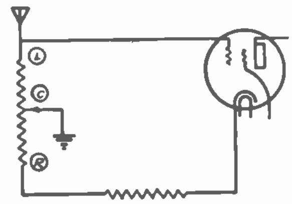


FIGURE 69

Another type of "Antenna-Bias" circuit is generally used in battery receivers. Circuit 70 (Figure 70) given below, is an example of this type circuit.

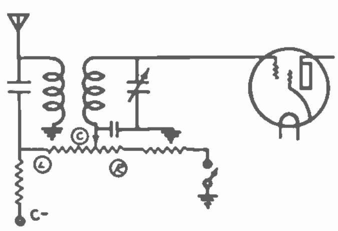


FIGURE 70

Study this circuit. Note that **the control varies the bias** applied to the tube, and in the left-hand position **shorts out the antenna.** This latter action is accomplished by reason of the condenser connected from the antenna to the control. Signal current leakage, or by-pass in the full volume of the control, is prevented by the resistance of the control, and by the resistor connected between "C" and the junction of the condenser and left-hand terminal of the control.

Your attention is called to the resistor connected between the right-hand terminal of the control and the switch. This is the minimum bias resistor.

Taper for use in this circuit is generally left-hand (Yaxley No. 1), although Yaxley No. 4 may be used, depending upon the type of tubes, as previously explained under "Bias Control Circuits."

Trouble encountered in this type of circuit may be due to leakage of the antenna condenser, or in the by-pass condenser which is connected between moving arm of the control and ground. This condenser serves as an R.F. by-pass for the grid circuit. In addition, we wish to point out that a shorted tube would quickly exhaust the "C" battery, if the volume control should be in minimum volume position.

Oscillation and **poor tuning may** often be traceable to a **poor by-pass condenser,** inasmuch as the R.F. impedance of these condensers usually increases with age. It might be well to check this whenever servicing a receiver using this type of circuit.

General design of this type circuit calls for selecting the proper value of resistance for the control, for the minimum bias resistor, and in addition for the R.F. blocking resistor. The latter also serves to limit the value of bias voltage which may be applied to the tube, which, as has been previously mentioned, if too high, particularly with sharp cut-off tubes, will cause distortion.

The capacity value for the Antenna condenser should be rather large, inasmuch as it should offer but very little Capacitive Reactance to the lowest frequency signal voltage to be handled, and it will thus act so as to allow a complete short-out of the signal. The capacity value of the by-pass condenser from the moving arm of the control to ground, is generally of a value of .05 mfd., or .1 mfd.

Circuit 97 (Figure 70A) is an illustration of another type Ant.-Bias circuit.

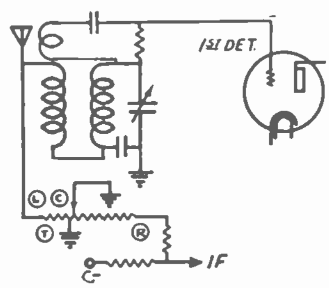


FIGURE 70A

Observe that in this circuit the control is tapped. The purpose of this tap is to divide the action of the control into two separate and distinct parts. Thus—when the moving arm is to the right of the tap, the control is acting purely as a bias type control. When it is to the left of the tap, the control acts only as an Antenna short-out type of control. This circuit is ingenious in this respect, as the two actions of the control are entirely separate. They do not conflict.

Resistance Value for this control is usually about 6,000 ohms with the tap located at approximately 2,500 ohms from the left-hand terminal.

Taper for this control is special. This need not be explained as Yaxley TRP600 replacement control is especially designed for this circuit.

Trouble in this circuit is rare. A shorted antenna or tube will have little effect upon batteries.

SUMMARY "ANT.-BIAS" CONTROL CIRCUITS

The Resistance Value of controls for the first type Ant.-Bias control circuit ranges from 1,500 to approximately 15,000 ohms, as the resistance value for use with sharp cut-off type tubes (type 24), can not very well be higher than these values, without introducing distortion due to cut-off. For the Remote cut-off type of tubes, the resistance will range from a minimum of 10,000 ohms to 250,000 ohms.

AC-DC receivers quite often use the Ant.-Bias type of circuit. Because they usually contain but one RF amplifier tube, the resistance value for the control must be very high. The types of tubes suitable for use in these receivers are usually of the Variable Mu or Remote cut-off type, such as 6D6.

For use in this type of circuit, and especially in these receivers, Yaxley controls—UC509 of 250,000 ohms resistance, and UC510 of 100,000 ohms resistance will be found to be ideal.

Receivers using the lower resistance values of control, such as 1,500 ohms, usually employ a rather heavy "bleed" current, in order to obtain sufficient bias, and in addition to stabilize the current distribution of the receiver.

For the intermediate values of resistance approximating 25,000 ohms, we advise the use of the Yaxley special control SRP263 (which is equipped with universal shaft), because this control is of the Yaxley No. 3 taper, which, incidentally, is the reason for it being listed as an SRP or special control.

Taper for use in Ant.-Bias type circuits has been explained to a certain extent. However, we would like to call your attention to the use of the Yaxley controls having No. 7 taper, wire wound and of special design for use in Ant.-Bias circuits wherein the original control was wire wound, especially where a heavy bleed current is used. Yaxley No. 1 left-hand taper will be found to be excellent in most all cases where the resistance value is 20,000 ohms or less. As explained, intermediate resistance values above 20,000 ohms, can be serviced by Yaxley SRP263. In replacing controls having a resistance value above 50,000 ohms, we advise the use of Yaxley No. 2 right-hand taper, unless recommended otherwise.

Troubles in this type of circuit, are usually limited to failure to cut-off the signal. The most frequent cause of this trouble is that the receiver was originally designed for much lower signal strengths than are found today (because of the terrific increase in power of broadcasting stations). **Increasing the bias voltage developed across the control will often effect a cure. However, we would again like to give you warning that this voltage should not be increased so far as to drive the Tube to plate current cut-off, due to the possibility of distortion.**

SCREEN VOLTAGE CONTROL CIRCUITS

Circuit 12 (Figure 71) is an illustration of the usual screen voltage control.

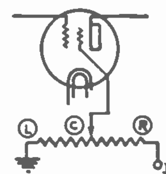


FIGURE 71

The action of this control is similar, in most respects, to the action obtained by controlling the bias of the tube. The (Gm) "Mutual Conductance" of the tube varies with the screen voltage.

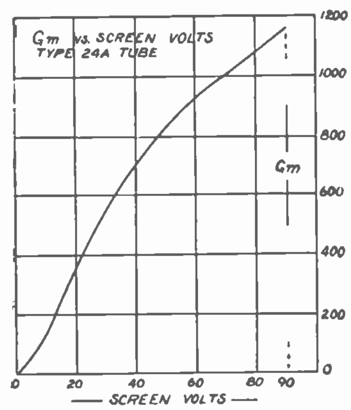


FIGURE 72

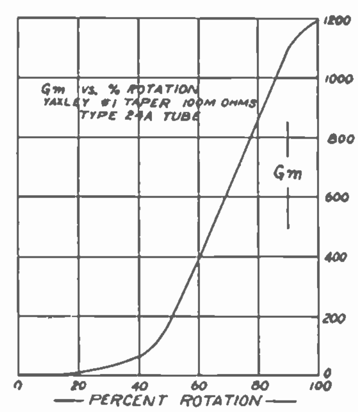


FIGURE 73

The first graph (Figure 72) (page 107) shows the relation of Mutual Conductance to screen voltage. The second graph (Figure 73) shows the curve of "Mutual Conductance" versus the rotation of the Yaxley control and illustrates the use of left-hand taper in this circuit.

At this time, we would like to point out that circuit 27, as given on page 118, is a rare type of screen voltage control, in which the control is in series with the screen. Taper for this control is Yaxley No. 2 right-hand, and the resistance is 5 megohms total. Circuit 79 (Figure 74), is an illustration of a combined screen voltage and antenna short-out control circuit.

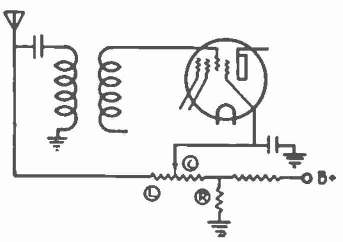


FIGURE 74

This control is used to a limited extent in battery receivers. **A study of this circuit will reveal that the control simultaneously controls the screen voltage, and by that the (Gm) of the tube, and at the same time acts as an Antenna short-out.**

This type control circuit is not recommended. Yaxley Silent Controls **will give faultless service** in this, or any other critical circuit.

General Design considerations for the screen-voltage type control circuit are that the voltage range should be such that the plate current of the tube is not reduced to too low a value, inasmuch as this will introduce serious distortion. On the whole, the screen-voltage type of control circuit is not to be recommended wherever another type circuit could be used.

The screen-voltage type of control circuit is not recommended for Variable Mu tubes, as it is much better to employ the Bias type of control circuit for these tubes.

TAPER AND RESISTANCE

For very low resistance values, 10,000 ohms or less, the taper of the volume control, for use in this circuit is generally linear. For values above 10,000 ohms, it is the general rule to use Yaxley No. 1 left-hand taper.

The most common value of resistance for this type control, with the exceptions noted above, is 100,000 ohms. This value is replaceable with Yaxley type L control.

PLATE VOLTAGE CONTROL CIRCUITS

Circuit 11 (Figure 75), is an illustration of the most common "Shunt Plate Voltage" volume control circuit.

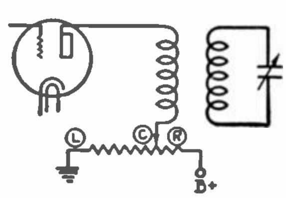


FIGURE 76

The action in this circuit is similar to that of the "Screen Voltage" control circuit except that here the plate voltage is varied.

The Taper for use in this type circuit is nearly always left-hand. The resistance value is usually of the order of 50,000 to as much as 500,000 ohms.

The Trouble usually encountered in this type circuit is noise, due to the rather heavy current and the possibility of the control developing minute "burned" spots, which cause a rapid variation in resistance with rotation. Of course, this would cause terrific noise in the receiver.

This type of control circuit is no longer used. If encountered in service work, we advise that the control circuits be rewired to a more modern type.

Before closing this chapter on "Plate Voltage Control Circuits," we would like to call your attention to Circuit 26 (Figure 76).

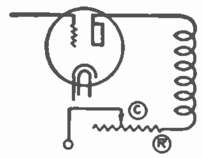


FIGURE 76

This circuit uses a series control which should be of right-hand taper Yaxley No. 2. **We strongly advise that wherever this circuit is encountered, the receiver should be rewired to use a different type control circuit.**

RF (PRIMARY SHUNT) CONTROL CIRCUITS

Circuit 10 (Figure 77), illustrates the connections of this type control circuit.

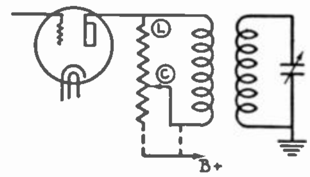


FIGURE 77

The dotted lines show connections that differ but little from each other, and may be encountered in the wiring of a control in a circuit of this type.

The action of this circuit is similar to that of the Ant.-Shunt type of circuit, in that the control is so arranged as to Short Out the primary of the RF transformer, and thereby prevent the transfer of RF current to the succeeding tubes in the receiver. This circuit was popular with the later battery and early AC receivers. **It is totally unsuited for modern conditions.**

An additional type of this circuit is shown in Circuit 81, on page 120, in which the plate connects to the moving arm of the control. The action in this circuit is similar to that of the ant.-shunt Circuit 3 (Figure 56), on page 105, or Circuit 40 on page 118.

Resistance range of controls used in the RF Primary-Shunt type of control circuits is usually only a few thousand ohms, ranging from 1,000 to perhaps an upper limit of 10,000 ohms.

Many of the original controls in this type of circuit are wire wound. When encountered in your service work, we advise replacing the wire type controls with Yaxley wire wound controls, or in some cases, with the Yaxley carbon controls.

Taper used in this type of circuit where the original control was wire wound, is usually of the Yaxley No. 7 type. **Where the original control was of the carbon** type, it may be either Linear Yaxley No. 4, or Left-Hand Yaxley No. 1.

RF SECONDARY (SHUNT) CONTROL CIRCUITS

Circuit 13 (Figure 78), illustrates the usual connections for this type circuit.

Although the connections shown in circuit 14 on page 117 may sometimes be encountered, the latter circuit does not give quite as good control as that of Circuit 13 (Figure 78). The action of Circuit 13 (Figure 78) is similar to the action of Circuit 16 (Figure 38), page 101, illustrated and thoroughly explained in the chapter entitled Taper.

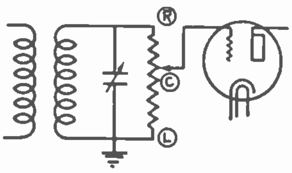


FIGURE 78

In Figure 78, we see the control shunted across a tuned RF transformer, with the left-hand terminal connected to the ground, and the right-hand terminal to what would ordinarily be the grid side of the tuned circuit. The grid of the tube is connected to the moving arm of the control. Hence—Variation in the position of the moving arm of the control varies the amount of RF voltage impressed on the grid of the tube.

In common with all shunt type circuits, the resistance of the control should be of such a value that it will not present too great a load or by-pass of the RF voltage developed in the secondary circuit. Inasmuch as one might broadly state **that the average impedance of a tuned circuit of this type is rarely more than 100,000 ohms,** the lowest value possible to use would be 100,000 ohms, with usual values of 250,000 ohms and in some cases 500,000 ohms. An outstanding example of this circuit is that of the Bosch model 28, which, incidentally, uses Yaxley Control SRP179 of 125,000 ohms resistance.

Taper of the control for use in this type circuit is of the left-hand Yaxley No. 1 type, thoroughly explained in the chapter entitled Taper. This also applies to controls for use in Circuit 14, page 117.

This type control circuit was not very widely used, and has long since passed out of favor. The introduction of the control into an RF circuit causes broad tuning and other troubles which make it impractical.

AF "SHUNT" CONTROL CIRCUITS

Circuit 15 (Figure 79), is one of the two basic types of this circuit.

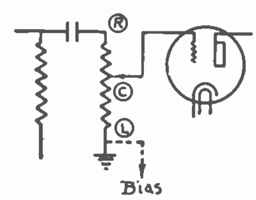


FIGURE 79

The AF "Shunt" control circuit is one in which the control is shunted across the Source of Audio frequency voltage, either as indicated in Circuit 15 (Figure 79), or as in the Short Out type of circuit as is shown in Circuit 33 (Figure 80).

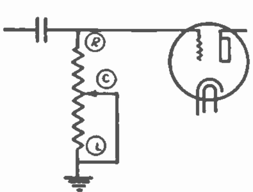


FIGURE 80

Circuit 33 (Figure 80), is not recommended because of distortion caused by the variation of the "plate load" of the preceding tube. Returning to Circuit 15 (Figure 79), note that the left-hand terminal of the control is the low volume or ground connection of the control and that the signal is applied to the right-hand terminal through the coupling condenser, which also serves to block out the DC plate voltage of the preceding tube.

In this type of circuit the control is actually part of the plate load of the preceding tube. This load is made up of the coupling condenser (capacitive reactance), the resistance of the control and the resistance of the plate coupling resistor. The input admittance of the tube must be considered. This is best determined by consulting tube manufacturers' data wherein you will often find a note: "When using resistance coupling, the grid resistor for this tube should not exceed 'blank' ohms." This is one way of saying that the admittance of the tube is rather low and that a high value of resistance (of the control) cannot be used.

Volumes have been published on the subject of "Impedance Matching" i. e., the relation of the load impedance to the impedance of the source or generator. We regret that space limitations do not allow more than a mention of this subject as applied to the above control circuits. The important point is that the resistance of the control is determined by the required plate load of the preceding tube, and by the admittance of the grid circuit of the tube. It is also influenced by the coupling condenser and the plate resistor of the preceding tube. Thus we have a series parallel circuit made up of these three elements and also the consideration of admittance of the tube. Truly a complicated subject. Entirely too broad to be presented here as gain, distortion and other factors must be considered. Finally it is necessary to make a compromise of all these factors.

Circuit 16 (Figure 81) is an illustration of the second type of Audio Shunt control circuit.

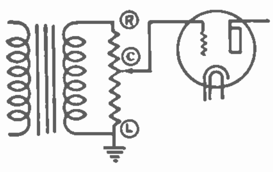


FIGURE 81

In this circuit we have approximately the same connections as for Circuit 15 (Figure 79). Note that the control is connected across the secondary of an Audio transformer. This gives a different picture, in that the control resistance is determined to a certain extent by the Impedance Ratio of the transformer in addition to the other factors, such as plate load and admittance, previously mentioned.

Circuit 96, page 120, is a peculiar reversed type of the Audio Shunt circuits. The same considerations, such as taper and resistance, also apply to this circuit.

Resistance Value of controls for this type of circuit usually range from 100,000 ohms to 2 megohms. In replacing controls the original resistance value should be approximated, thus for 200,000 ohms use 250,000; 350,000 ohms may be replaced with either 250,000 or 500,000 ohm values.

Taper of controls for use in these circuits is always Yaxley No. 1 Left-Hand. These circuits give but little trouble.

AUDIO CONTROL CIRCUITS

This designation is applied to any control which varies the Audio frequency voltage or current as a means of controlling the volume of a receiver. With one exception, they are mostly variations of the Shunt type of Audio circuits. The exception is Circuit 18 (Figure 82).

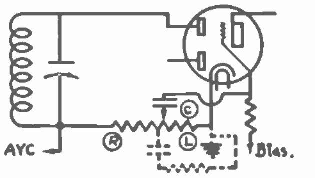


FIGURE 82

In this type of circuit the control acts as a Load Resistor, commonly referred to as the Load of a diode rectifier.

Study of this circuit will reveal the following actions. The signal current generated in the transformer secondary is applied to the diode plate or plates and to the resistance of the control.

The signal current is an alternating current, the same as our usual power and light supply. The frequency is determined by the resonant point of the transformer, usually several hundred kilocycles, i. e., 465, 175, or other frequencies. When the plate of the diode goes positive, in relation to the control, a current, the value of which depends on the voltage and load resistance, flows from the cathode to the plate, through the coil and resistance of the control and arrives back at the cathode, thus completing the circuit. The end of the control which is connected to the secondary is at a potential above the cathode, because: "There is a voltage drop across a resistor when a current is flowing through it." Incidentally the polarity of the voltage drop is negative at the secondary end of the control, in respect to the cathode of the tube.

The voltage developed across the diode load (the control) is usually thought of as having two components, first the DC voltage developed by the rectifying action of the diode and second, the Audio Frequency voltage This is fully explained in the graph shown in Figure 83.

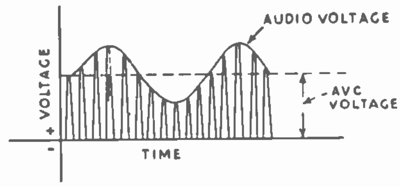


FIGURE 83

This graph shows the voltage appearing across the diode load; i. e., the control.

This is the Audio Frequency voltage applied to the grid of the tube (through the control) and in addition, it is also applied to a "filter" from which it emerges as DC. The value of which (in voltage) is directly proportional to the signal voltage induced in the secondary coil. As the signal voltage rises in value, so does the DC. The DC can be used as a "bias" voltage. (Remember it is negative to the chassis) to give Automatic Volume Control.

The Audio frequency component is taken off the control resistance and applied to the grid of the tube through the blocking condenser. In this circuit, the DC component of the signal does not affect the grid circuit of the tube.

In a certain type of this circuit, similar to Circuit 62 (Figure 67), there is no blocking condenser. The DC potential across the control is applied to the grid so that the bias on the grid varies with the signal intensity, therefore the tube is said to be "signal biased." This type of circuit is used in certain "Quiet" AVC circuits wherein the first audio stage is biased to "cut off" (with no signal). When a signal is applied to the diode, the DC component, appearing across the control, counteracts the bias applied to the tube. When the signal is strong enough to overcome the "over-bias" on the tube, the signal will be amplified and appear at the speaker.

Resistance value of controls for use in these types of circuits is from 250,000 to 500,000 ohms inclusive.

Tapers for controls for these circuits are Yaxley No. 1 Left-Hand for the first type and in most cases Yaxley No. 4 Linear for the second type, because of the common use of "Sharp Cut-Off" type tubes in this position.

TAPPED CONTROL CIRCUITS

With rare exceptions, there are only three principal types of control circuits using a tapped control. By "tapped" control we mean a control having a tap brought out from some point on the resistance element. This type of control construction is so common that it is hardly necessary to go into any detailed description.

The three basic types of circuits using the tapped control are: first—where the control is tapped in order to provide different values of voltage, such as in an AVC circuit; and second—where the tap is brought out so that automatic tone compensation may be accomplished; third—where it is desired to use one control to act upon two circuits; for example, to give either radio or phonograph control.

We will consider the explanation of the action in these three types of circuits in the order in which they have been given—

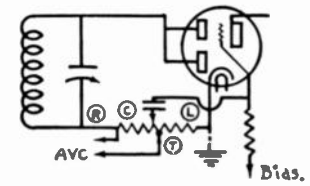


FIGURE 84

Circuit 19 (Figure 84), is a circuit (of the first type) employing what might be termed the voltage type of tapped control, in that the tap is brought out so that two different values of Automatic Volume Control Voltage may be had.

Note that this control is used as a "diode load" type of control, the functions of which were explained in the chapter "Audio Controls."

A study of the connections of the control reveals that the maximum DC voltage, as developed across the control, is used for Automatic Volume Control in a portion of the preceding circuit. The design of the receiver is such that only a fraction of this voltage is required in certain parts of the circuit. The easiest and the best method of obtaining this fractional voltage, is to tap it off the control. This assures the correct relation between the two values of AVC voltage which might not be obtained by the use of a separate resistor net-work in parallel with the control, when one considers that the control resistance changes, with wear and age and in addition, the resistor net-work would add to the cost. Note that circuits using the net-work actually use a control circuit as shown in Circuit 15 (Figure 79).

This type of circuit and/or connections is perfectly satisfactory, except in a circuit such as Circuit 62, (Figure 67), wherein the control is used as the diode load resistor, and furnishes signal bias to the succeeding tube.

The second type of tapped volume control circuit is that wherein the tap is used to obtain automatic tone compensation with rotation of the control; i. e., an increase in apparent Bass response at the lower volume levels to compensate for a deficiency of the ear.

Circuit 20 (Figure 85) illustrates most clearly the usual connections for the tone compensated type of tapped control circuit.

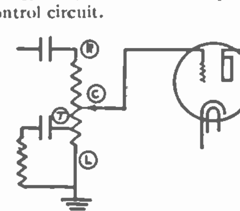


FIGURE 85

The action which takes place in this circuit follows:. With the control arm at the Right-Hand (R) terminal, the signal is fed directly to the grid of the tube without being affected by the circuit. As the control arm is rotated toward the "Left-Hand" (L) terminal, the effect of the tap, with its associated circuit, consisting of the condenser and resistor connected from the tap to ground, becomes pronounced. The condenser, with or without a series resistor, as shown in the illustration, acts as a by-pass for the higher frequencies of the signal. When the arm is at the tapped position, or is at any position between the tap and the "Left-Hand" terminal, the higher frequencies of the signal are by-passed to ground. It appears to the ear as though the bass portion of the signal had been increased.

The position of the tap, that is, the relation of the amount of resistance between the left-hand terminal and the tap, and the resistance between the tap and the right-hand terminal determines the signal level at which the tone compensation becomes effective.

Previous to the designing of the Yaxley tapped replacement control (TRP) the method of locating and attaching the tap to the resistor element of the control was inaccurate, in that usually a rivet was driven through the resistor element at some pre-determined point based on the rotation of the control, or else an ear was made on the element to which the tap was attached. Both of these two methods of tapping a control are, in our opinion, inaccurate, because the tap is mechanically fixed, and cannot be shifted from its position. This would not be quite so bad, were it not for the fact that the total resistance of a carbon type control element varies considerably in manufacturing, it being usual to allow a "tolerance" of plus or minus 20% of the value of the control. This means that there can be a variation in the resistance of the control of plus or minus 20% of the stated value.

When Yaxley engineers started the development of the Yaxley "TRP" type controls, they determined to overcome these difficulties, and to so design the Yaxley TRP control that the tap could always be located in the correct ratio of resistance, regardless of the variation in total resistance.

Figure 86 shows the method used in "tapping" the Yaxley control.

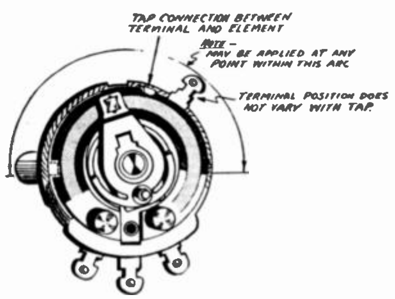


FIGURE 86

Note that underneath the resistor element is a silver-plated "ring," and that the actual tap connection is NOT at the terminal, but that the tap connection to the resistor element is made by means of the little clip which is indicated by the arrow. Observe that this clip may be attached at any point over the greater arc of the control element.

In building Yaxley TRP controls the elements are first made and then the tap location is determined on the basis of the resistance ratio. This method of tapping a control is exclusively Yaxley. It assures you that the action of the tap will be correct at all times. This assurance cannot be had with any other method of tapping a control.

To return to the action of the tapped control circuit, the percentage of attenuation, of the higher frequencies of the signal, is determined by the capacity of the condenser, and where used, the value of the resistor. The resistor is employed to broaden the action of the condenser and to prevent a rather sharp attenuation of the higher frequencies.

We regret that space does not permit a full discussion of the various factors entering into the design of the tone compensated tapped control circuit. We have covered the basic action, and although a great many varieties of circuits are used, the basic law rules all of them.

One of the latest developments in the use of (tone compensated) control circuits, is illustrated in Circuit 100 (Figure 87).

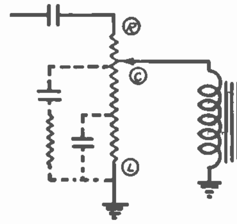


FIGURE 87

This shows a control circuit wherein there are two taps on the control, both used for tone compensation. The action in this circuit is basically the same as the action in any tone compensated control circuit using a single tap, except that here we have the compensating action in two phases. The first is not nearly so noticeable as the second. In simple words, when the control arm is in the full volume position, there is practically no compensation in the circuit, but as the signal value is reduced, there is a slight amount of compensation at the first tap, and a much greater amount at the second tap. The reason for this arrangement is to give a very gradual and smooth tone compensation, which is much more gradual than that to be obtained by the use of a single tap, particularly where it is desirable to have a rather large attenuation of the higher frequencies or where two different bands are to be successfully attenuated.

The third type of tapped control circuit is illustrated in Circuit 82 (Figure 88).

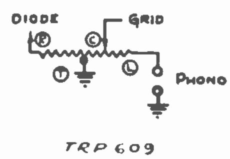


FIGURE 88

In this circuit the control is center tapped and is made with two separate tapers which meet at the tap, so that in effect there are two separate controls. When the arm of the control is to the left of the tap the control acts as the radio signal. When the arm is to the right of the tap it controls the phonograph signal. Circuit 28, page 118, illustrates a slightly different circuit often used in amplifiers. The action is the same as described with the exception that, here, the sources of signal may be microphone and phonograph. Yaxley control number TRP609 is especially designed for these types of circuits.

Resistance Value of controls for use in tapped control circuits is roughly the same as for the audio control circuits.

Note: When replacing a tapped control, select a Yaxley TRP control having the same overall resistance as that of the original AND BE SURE that the resistance between the left-hand terminal and the tap (with terminals down and facing the shaft side of the control) is duplicated within reasonable limits by the Yaxley control which you select.

NOTICE—Do not be confused by the fact that the Yaxley tap terminal may be in a different position from the other terminals than that of the original control. As we pointed out, the tap value of Yaxley controls is determined upon a scientific basis and not by the mechanical replacement of the tap.

Taper of controls for use in tapped volume control circuits is roughly the same as for audio control circuits. It is sometimes necessary to distort what would otherwise be a logarithmic taper, in order that the tone compensation will not occur at such a fast rate as to cause an apparent hop-off in the signal attenuation. Yaxley TRP controls are properly designed with this feature in mind. You need not consider this when using Yaxley TRP controls.

TONE CONTROL CIRCUITS

Tone controls are supplied with radio receivers so that the user may adjust the tone characteristics to suit a personal preference, for some people like a deep Bass Boomy response and others like a shrill and tinny sound.

The usual tone control consists of a condenser in series with a variable resistance so connected that when the resistance of the control is zero, the higher frequencies of the signal will be attenuated; i. e., by-passed, and will not appear at the loud speaker.

There are many types of tone control circuits. Fundamentally, all of them act upon this principle. There are a few tone control circuits arranged to really boost the bass response of a receiver. There are certain circuits so arranged that when the control is turned in one direction, the higher frequencies are attenuated. When turned in the other direction, the lower frequencies are attenuated. This type circuit can only be successfully employed in a receiver having a flat response over the whole audio frequency spectrum.

Circuit 21 (Figure 89) illustrates what is popularly known as a "Grid circuit" tone control.

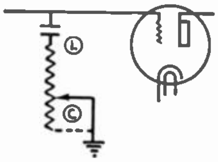


FIGURE 89

This circuit is seen to consist of the condenser and the variable resistor. The action of the circuit follows: When the control arm is at the "Left-Hand" (L) terminal, the condenser is seen to be shorted directly from grid to ground. Inasmuch as the Capacitive Reactance of a Condenser decreases with an increase in frequency, it is easy to see that the resistance; i. e., "Capacative Reactance" of the condenser is much lower at the higher frequencies and that they are effectually short circuited and cannot influence the grid of the tube to any great extent. As the arm of the control is rotated toward the right hand terminal, resistance is gradually introduced into the circuit, in series with the condenser. This increasing resistance gradually adds to the resistance; i. e., Capacitive Reactance of the condenser. It will be seen that the variable resistance is a convenient means of reducing the Capacative Reactance of the condenser. Of course, the same action could be obtained by using a variable condenser. However, the space required by a variable condenser of a size suitable to obtain the desired action would be entirely prohibitive. Therefore, a fixed condenser and a variable resistance is used to obtain the same action. In the design of a tone control circuit of this type, a control having a resistance value many times that of the "resistance"; i. e., "Capacitive Reactance" of the condenser (at the lowest frequency to be considered) is chosen, in order that when the moving arm of the control is at the right-hand terminal there will be very little, if any, attenuation of the higher frequencies of the signal.

Circuit 22 (Figure 90), illustrates the so-called "plate circuit" type of tone control circuit.

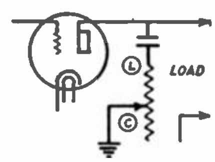


FIGURE 90

The connections and action of this control circuit are practically the same as that of the previously discussed grid circuit type, with of course the exception that the condenser is connected to the plate of the tube.

There is one outstanding difference between the grid circuit and plate circuit types of tone control. That is the difference in impedance of these two circuits.

The impedance of the ordinary grid circuit is in the order of 100,000 ohms or more, whereas the impedance of the plate circuit, particularly of the output or power tubes, ranges from approximately 2,000 to 20,000 ohms. As tone controls are in "shunt" with the respective grid or plate circuits, it is easy to see that in a grid circuit, a small condenser and a large value of resistance must be used. In the plate circuit, a larger condenser and a lower value of resistance is required to give the same amount of tone control.

Another consideration in the action of these two types of tone control circuits is the fact that **there is little voltage, other than that of the signal, impressed upon the grid circuit type of control. In the plate circuit type of tone control the condenser is subject to the full plate voltage of the tube. When used in the plate circuit of a high-powered amplifier, the control must be able to dissipate considerable power.**

Failure to take this factor into consideration has caused a good bit of grief to service men who have installed tone controls in power amplifiers, in that they forgot that the control might have to handle 4 or 5 watts of power when used in this position, with the result that they "Burned Out" the control, and were "mystified" because the condenser failed to show leakage of the DC plate current. The "Grid Circuit" type of tone control may use an ordinary carbon control with safety.

Resistance Value of controls for use in tone control circuits ranges for the "Grid" type from 50,000 to 500,000 ohms inclusive. The resistance value of controls for the plate type ranges from 5,000 to 50,000 ohms. In some cases, to a maximum of 150,000 ohms. **The exact value of the control is dependent upon the amount of high frequency attenuation desired. This is determined by the "Capacitive Reactance" of the condenser. We would again like to point out that the value of control resistance and capacity of the condenser is regulated by the impedance of the circuit in which it is used; i. e., high impedance for grid circuits, and a low impedance for plate circuit use.**

Taper used in tone controls is generally of the Yaxley No. 1 Left-Hand type.

A simple rule, regarding taper, to be observed when replacing tone controls is: "WHEN THE BASS POSITION IS TO THE LEFT OF THE KNOB, USE A YAXLEY NO. 1 LEFT-HAND TAPER, or, WHEN THE BASS POSITION IS AT THE RIGHT-HAND SIDE OF THE KNOB, USE A YAXLEY NO. 2 RIGHT-HAND TAPER."

Another convenient rule to be applied when replacing tone controls is: "WHEN ONLY THE CENTER AND LEFT-HAND TERMINALS OF THE CONTROL ARE USED, USE YAXLEY NO. 1 LEFT-HAND TAPER, or, WHEN ONLY THE CENTER AND RIGHT-HAND TERMINALS OF THE CONTROL ARE USED, USE YAXLEY NO. 2 RIGHT-HAND TAPER."

For the combination Bass and Treble control circuit where the control gives Bass attenuation when turned in one direction, and Treble in the other direction, use Yaxley No. 4 Linear taper.

Trouble encountered in tone control circuits is usually in burning out of the control because of the break-down of the condenser. This occurs only in the plate circuit type of control. The cure for this, of course, is to install a new condenser of the same value of the original before replacing or attempting to replace the control.

Additional tone control circuits of the grid type are illustrated by Circuits 39, 41, 57, 65, and 72, appearing on pages 117 to 121. Additional tone controls of the plate type are illustrated in Circuits 34, 44, 80, 85, 95, and 103, on pages 117 to 121.

"LOSSER" TYPE CONTROL CIRCUITS

Losser type volume controls were at one time in fairly common use. The general development and improvement of circuits obsoleted this type of control circuit.

Circuit 84 (Figure 91), illustrates one common type of "Losser" control.

This control was employed in a receiver designed only a few years ago; in fact, one of the early receivers using AVC.

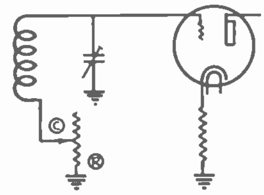


FIGURE 91

This circuit is an outstanding example of all "losser" type control circuits. **The reason for the peculiar name applied to this type of circuit is that the control introduces a "loss" into a circuit. The word "losser" indicates that the control destroys the efficiency of the circuit. In other words, consumes energy, thus causing a "loss."**

To explain the action of this circuit it is necessary to briefly review the action of a tuned circuit.

The voltage developed across the tuned circuit; i. e., from grid to ground, is maximum when the impedance of the circuit is maximum; i. e., at resonance; as is shown by the formula L/RC. Where L is the inductance, R is the resistance and C is the capacity.

This formula shows that an increase of R will decrease the impedance of the circuit and lower the voltage applied to the grid of the tube.

When the control arm is at the Right-Hand terminal, the lower end of the coil is grounded. In this position the control has no effect on the tuned circuit. When the arm is rotated, resistance is introduced into the circuit. This is, of course, an increase of "R" in the formula.

It will be seen from this formula and explanation, that as resistance is introduced into the circuit, the voltage applied to the grid of the tube is reduced, and from the explanation, it is clearly seen that **any control which destroys the efficiency of a circuit, can very aptly be termed a "losser" type control.**

A characteristic of this type of control is that it tends to broaden the resonant peak, resulting in reduced selectivity.

Resistance Value of controls for "losser" type circuits is dependent upon the circuit with which they are used. In the example given, the resistance, for a circuit tuned to 175 kilocycles, is 10,000 ohms. This might be taken as an average value for this type of circuit.

Taper for controls used in a circuit as shown in Figure 91, is of the Yaxley No. 2 Right-Hand type, because the control is a Series Control, and as we have previously explained in the chapter on Taper, a series circuit requires the use of a Right-Hand taper.

Trouble in Circuit 64 (Figure 91), outside the general objections listed is noisy operation. This can best be cured by replacing the original control with a Yaxley No. 2 Right Hand taper control of approximately the same value as the original. It might be wise when servicing a receiver equipped with a control circuit of this type, to change the wiring of the receiver to use a more efficient and more modern control circuit wherever the control action is not satisfactory.

"DUAL" CONTROL CIRCUITS

The expression "Dual Control Circuits" is applied to all circuits using two controls driven by the same shaft.

The reason for using a dual control circuit is that it is often necessary to do this in order to obtain smooth, even and complete attenuation of all signals.

In the following paragraphs, we will discuss a few of the outstanding, or more common types of dual control circuits.

The first of these types to be discussed is one of the most common, illustrated by Circuit 23 (Figure 92).

This shows the use of a dual "Audio" control. This control is applied, in the circuit, to the grids of a push-pull amplifier. This is necessary as it would be quite impossible to control the volume on only one side of the circuit.

Study of the control connections in the illustration reveals that as the control is rotated, the arm moves from the center of the diagram, where the letter "L" indicates the Left-Hand terminals of both sections of the control, outward toward the Right-Hand terminals of the control, which are indicated by the letter "R."

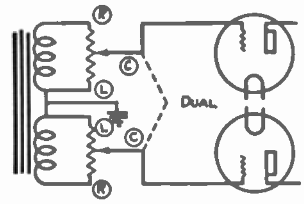


FIGURE 92

A control for use in this circuit would consist of two sections, each of the same resistance and taper.

In our previous study of the action in volume control circuits, we learn that an "Audio" control requires a Yaxley No. 1 Left-Hand taper, and that, in general, the resistance for such a circuit may range from 100,000 ohms to an approximate upper limit of 1 megohm.

Yaxley furnishes "Universal Dual" replacement controls, suitable for use in this circuit. These are "LL," "MM," and "NN." A dual megohm is not supplied because there is little or no demand for such a high resistance value, particularly in a circuit such as is given.

Before taking up other types of "dual" control circuits, we wish to point out that Circuit 36, on page 118 is, for all practical purposes, identical to the one explained above.

The second most common type of dual control circuit is Circuit 24 (Figure 93).

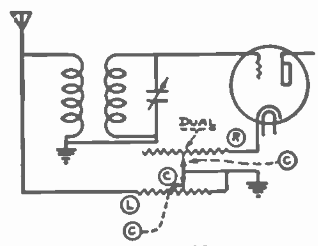


FIGURE 93

In this circuit we meet a combination of **two entirely different circuits, which are controlled by means of a dual control.**

A study of this circuit reveals that **it is a combination of two rather common circuits.** One section of the control acts as an antenna control of the Short-Out type, similar to that previously shown and discussed. (See Circuit 4, Figure 57). The other section of the control is of the Bias type. This section of this control circuit is identical to that described and illustrated in Circuit 7, Figure 60.

The action in the dual control circuit No. 24 (Figure 93) is a combination of the action of the two circuits controlled, in that as the control is rotated from right to left, the bias on the tube is increased and the signal is shorted out at the antenna.

The reason for using a dual control in this circuit, which is, as far as its action is concerned, the same as that of Circuit 6 (Figure 68), is that the conditions in this particular design are such that neither one of the two sections of the circuit could be used for satisfactory control of the volume. Also Circuit 6 (Figure 68) was not applicable at the time of design, because the sensitivity of the receiver was probably rather low, and every possible means had to be taken to get the most out of the receiver. The use of the single control Ant.-Bias circuit would probably reduce the input from the Antenna, whereas a special taper on the Antenna section of the dual control, assures the full possible input.

Circuit 24 (Figure 93), has not been used for several years, because the terrific increase in power by the broadcasting stations has made it possible for designers to use Circuit 6 (Figure 68) even in the lowest gain receivers. It is often practical to replace the original dual control with a Yaxley single control with, in many instances, an improvement in the control action.

Resistance Values for controls for use in Circuit 24 (Figure 93) usually range from a minimum value of 2,000 and 5,000 ohms to 10,000 and 50,000 ohms. Yaxley DRP119, of 3,000 and 10,000 ohm value, is widely used in this type of circuit, as is the DRP169, 7,500 and 10,000 ohms. "Universal Dual" controls "CE," "GE," "GG" and "GK" are widely used for this type dual control circuit.

Circuit 43 (Figure 94) illustrates another type of "Dual Control Circuit." This is one of the combination antenna Short-Out and Bias Control circuits.

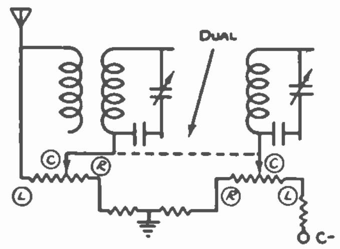


FIGURE 94

Circuit 43 (Figure 94), is used in battery type receivers. A study of the circuit reveals that the action is identical to that of Circuit 24 (Figure 93).

In some cases it might be possible to replace this dual control with a single tapped control, by using Circuit 97, see page 120.

"ANTENNA-LOSSER" TYPE CONTROL CIRCUITS

This type is illustrated in Circuit 38 (Figure 95), and is seen to consist of two sections, one of which is an antenna "Short-Out" type control. The other section serves to short out the RF signal at the plate of the first RF tube.

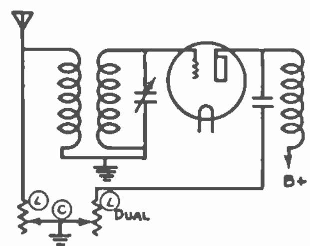


FIGURE 95

This circuit is rather unique in its action, in that when the control is rotated to its full counter-clockwise position, the two arms of the control, as shown in Figure 95, would be at the top of the resistance. In this position the antenna would be connected to ground. Inasmuch as the "Capacitive Reactance" of the condenser (usually of rather large capacity value) is practically zero at the frequencies involved, the plate is effectively shorted to ground, thereby preventing the flow of RF current through the primary coil and thereby transferring to the succeeding tubes.

This circuit was used to a limited extent in some of the earlier battery receivers, and it is rarely encountered in service work.

Resistance Values for the control for this circuit, for replacement purposes, should approximate the values of the original control.

A second type of "Antenna-Losser" circuit is illustrated in Circuit 102 (Figure 96).

The action in this circuit is standard for the antenna section. However, the losser section is unusual, in that **the control forms a series circuit with a tertiary, or third coil, which is inductively coupled to the RF transformer between the second and third RF tubes.**

The action of this losser control circuit is rather unique in that **when the control is at maximum volume position, the full resistance value of the control is in series with the tertiary coil, and thus prevents this coil from absorbing energy from the RF transformer.**

The antenna control arm, at full volume position, is at the right-hand terminal of the control. In this position it contacts the antenna. The signal is applied directly to the grid of the first RF tube.

When the control is turned so as to reduce the volume, the arm of the antenna section moves down the control, away from the antenna, reducing the RF input. At the same time the arm of the losser section of the control moves up on the resistance, reducing the amount of resistance in series with the tertiary coil. This reduction of resistance causes the tertiary coil to absorb energy from the transformer and reduces the amount of signal which reaches the grid of the third RF tube.

When the control is at the minimum volume position, the grid of the first RF tube is grounded. The resistance in series with the tertiary coil is at zero. Under this condition this coil will absorb practically all the RF energy present in the RF transformer. Thus—it is seen that there will be no voltage at the grid of the third RF tube.

The reason for using this circuit was that the straight single antenna control would be impractical in the high gain receiver in which the circuit was used. Due to the fact that filament heater Type 26 tubes, were used as the RF amplifier, it was impossible to use a bias type or combination "Ant.-Bias" circuit, because increasing the bias on a "filament type" tube introduces a serious amount of hum.

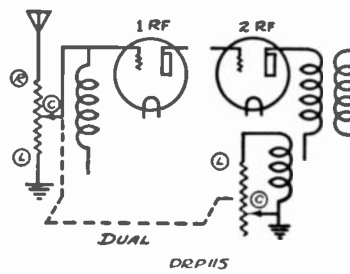


FIGURE 96

"ANT.-RF RHEO" DUAL CONTROL CIRCUITS

In some respects, an unusual type of dual control circuit to be discussed. One of the most unique ever designed. The schematic, Circuit 123, is shown in Figure 97.

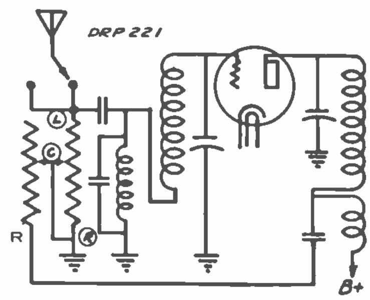


FIGURE 97

Circuit 123 consists of two sections, each controlled by its own section of the dual control. One section is a more or less standard antenna control, discussed in the chapter headed Ant.-Controls. The other section acts as an RF Rheostat which controls the amount of RF current flowing into the primary circuit of the RF transformer. This couples the plate of the first RF tube to the grid of the second RF tube.

A study of the connections of the above circuit will reveal that the primary of the RF transformer is tuned to resonance with the signal. The primary is coupled to the secondary by means of a small coupling coil, immediately below. Immediately below this coil is an RF choke which prevents the RF current from getting into the plate voltage supply of the receiver.

In order to complete the RF circuit, that is, in order that there may be a connection between the tuning condenser and the primary, there is a large condenser connected on one side to the junction of the coupling coil and the choke, and on the other to the right-hand terminal of the control.

Now, when the control is at the full volume position, the path of the RF current is from the plate through the primary and coupling coil; then through the large condenser, inasmuch as the right-hand terminal of the control is grounded at full volume position to the chassis. The tuning condenser being connected from the plate of the tube to chassis is (at full volume position of the control) effectively connected across the primary.

As the control is turned to reduce the volume, resistance is introduced in series with the tuned primary circuit. The Antenna-Section acts exactly as outlined in a previous chapter and illustrated by Circuit 4 (Figure 57).

In addition, due to the decreased current flowing in the primary circuit (because of the resistance introduced into its path) **there will be a reduction in signal transfer at the coupling coil. This signal transfer depends upon the amount of current flowing in the circuit.**

While this action is taking place, the antenna section of the control has reduced the signal input to the grid of the tube.

The reason for using this peculiar and rather complicated circuit was because an "Antenna Type Control Circuit" (using a single control) would not have given satisfactory control of the volume. Also, the then popular screen voltage control (which was used on the same chassis in place of this control circuit) **failed to give smooth** and complete attenuation of signals, especially when the receiver was used in areas of high signal strength.

This dual control circuit may be replaced with the "Antenna-Bias Circuit," described in the chapter under that heading and illustrated by Circuit 6 (Figure 68).

Resistance and Taper of the dual control for use in Circuit 123 (Figure 197), are both special. A correct dual replacement control for the receivers using this circuit, is listed in the forepart of the encyclopedia

"HUM" CONTROL CIRCUITS

As the title suggest, the type of circuit now explained is used to control hum in receivers.

Whenever "filament type" tubes are used, it is necessary that the grid return be connected (in effect) to the center tap of the filament. In other words the grid return must be connected to a neutral point in respect to the filament voltage. If the grid return is connected to either side of the filament, there will be an alternating voltage impressed upon the grid, which will cause an objectionable hum. An adjustable resistor is used to select the "neutral voltage" point in the filament circuit.

Although this effect may be had by center tapping the filament winding on the transformer, in practice it has been found that there are disturbing factors which in most cases make it preferable to use the adjustable resistor.

The adjustable resistor used for hum control is a potentiometer, usually connected directly across the filament supply. **In some designs hum control is effected by selecting a voltage equivalent to the disturbing or hum voltage, but "out of phase" with the hum voltage, and applying this "out of phase" voltage to the grid of the tube in such a manner as to counteract the effect of the voltage causing the hum.**

The most common circuit for hum control is illustrated by Circuit 37 (Figure 98), which shows the control connected across the filament supply.

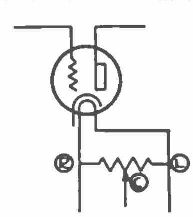


FIGURE 98

The action in this circuit is simple, but rather difficult to explain. The simplest explanation is to consider that the filament supply of voltage reverses the polarity twice for each cycle of the supply voltage. The frequency at which this reversal occurs, is of course determined by the frequency of the filament supply current, ordinarily 60 cycles per second, meaning 120 reversals of polarity per second.

In receivers using a direct current for filament supply, as in old battery receivers, **it is customary to connect the grid return to one side or the other of the filament, depending upon the polarity of bias desired, it being the usual practice to make the connection to the negative side of the filament. If this were attempted with an AC filament supply, the polarity applied to the grid would shift with the reversal of polarity in the filament circuit. This, of course, would give rise to a terrific hum.**

Suppose that we theoretically "stop" or arrest the AC filament supply at such a point in its cycle so that we would have full voltage across the filament. If this were possible, we could take a voltmeter and find a point on the resistance element of the control at which the polarity of the voltage would be neutral. That is, it would be neither positive or negative. This neutral point does not shift with the frequency or the alternations of the filament supply voltage. If we connect our grid return to this point, there will be no alternating voltage impressed upon the grid, and no hum.

In practice the control is wired with the resistor element across the filament. The moving arm of the control is connected to the grid return circuit. This is usually accomplished through the chassis. The control arm may be connected directly to the chassis. It is necessary to apply a bias voltage to the tube. As this control not only provides the return or completion of the grid circuit, but also for the plate circuit, **there is often a resistor connected between the moving arm of the control and the chassis. This resistor, because of the plate current, causes a "voltage drop" between the filament and the chassis** (which is the grid return). **This voltage developed across the resistor, is the bias voltage,** because, due to the polarity of the plate current, the chassis end of the resistor will be negative in polarity, in respect to the filament.

Resistance Values of controls for use in this circuit are usually of a very low value, because of the low voltage impressed across the control. In practice, the resistance usually ranges from 6 ohms for a 2 1/2-volt circuit, to a value of probably several hundred ohms where high filament volts are used.

Yaxley "HU" controls are especially designed for use in this type circuit.

Taper is not required in controls for these circuits, because of their use as a simple voltage divider.

Another type of hum control is illustrated in Circuit 30 (Figure 99).

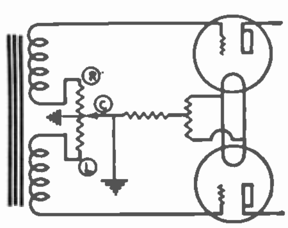


FIGURE 99

In this circuit we see a center tapped control which is connected between the two halves of the secondary of an audio transformer which supplies signal to the grids of a push-pull amplifier.

The action taking place in the above circuit is that when the two tubes are exactly alike, **the neutral point, obtained by the fixed center tapped resistor across the filament circuit, provides the correct adjustment for minimum hum.** In this case the arm of the hum control would be at the center position of the control, which point is grounded.

Because tubes for use in this circuit **are rarely exactly alike** in their characteristics, and because of a slight difference in plate current, hum might develop, were it not for the fact that **the control can be shifted to either side of the center tap to adjust the bias supplied to the tubes, and equalize the plate current** and other factors causing the hum.

Another circuit, having the same action as Circuit 30, is shown in Circuit 66 on page 119. These circuits are practically identical, with the exception that Circuit 66 is applied to a resistance coupled type of amplifier.

Resistance of the control for use in Circuit 30 is usually one of three values i. e., 200, 400 or 600 ohms. Yaxley supplies SRP controls Nos. 265, 253 and 266 for use in these circuits.

These hum-controlling circuits are usable to a certain extent to **overcome distortion which might arise due to a lack of balance in the plate currents drawn by the tubes.** These circuits perform a dual function, both controlled by one adjustment of the control. This could not be accomplished by the use of the first described type of hum control shown in Circuit 37 (Figure 98).

Circuit 51 (Figure 100), illustrates an unusual circuit which accomplishes the same results as that of the two circuits which have just been discussed.

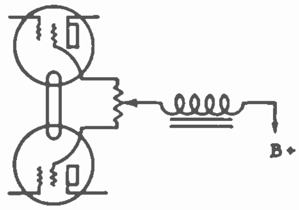


FIGURE 100

A study of this circuit reveals that **the control is connected from one screen to the other** of the two tubes in a push-pull amplifier, usually the output or power tubes.

The arm of the control is connected, in case of Circuit 51 to a choke. This has little bearing on the action of the control.

As explained, **the action of this circuit** is similar to that of Circuit 30 (Figure 99), and Circuit 66 (see page 119). In this case **the control of the hum is accomplished by balancing the plate current of the two tubes by means of varying the screen voltage. As explained, balancing the plate current tends to minimize hum and to prevent distortion.**

Resistance for this control should be rather low, determined to a certain extent by the range of control desired, which in most cases need only be a few volts. The resistance value can be calculated by means of the screen current.

MISCELLANEOUS CONTROL CIRCUITS

In addition to the control circuits discussed, there are others of relative unimportance. Gain, Sensitivity, Silent Tuning and Suppressor, are subsidiary controls in that they are used to control the sensitivity of a receiver, and not the volume. Although many of these controls affect the volume of the receiver, they are provided so that the sensitivity may be reduced to the required level and thereby reduce the amount of noise or interference which would otherwise be objectionable.

All these controls will be found to use one of the control circuits previously discussed. For example, the most usual circuit for use as Gain or Sensitivity control, is the "Bias" control circuit.

When you encounter a circuit not mentioned, we advise that you carefully study the connections. In practically all cases you will find that it will fall into one or another of the different types of control circuits which are illustrated on pages 117 to 121.

Occasionally a receiver will use a control, the circuit of which is peculiar and to be found only in that receiver.

A good example is the "Flash-O-Graph" control listed in the Encyclopedia with the abbreviation "F.O.G." This is a "trade name" for a tuning indicator used to indicate resonance of the receiver to incoming signals.

As signal intensity varies with each installation, it is necessary to provide a control so that the indication will be the same for all locations.

The proper control for use in this circuit is specified in the "Replacement Part" of the Encyclopedia. It is a simple voltage divider and should be replaced with a control of the same resistance value. Taper is not required.

Another control circuit of the same description is a simple voltage divider used to control the height of gas glow in a Neon tube used as a tuning indicator.

This circuit is listed in the "Replacement Part" of the Encyclopedia as "Tone Beam" with its proper replacement.

CARBON OR WIRE CONTROLS

This question is often asked.

Do you know all the advantages of carbon controls?

Do you know the weaknesses and disadvantages of carbon controls?

Do you know why it is often imperative to use a wire wound control and that failure to do so will mean loss of prestige, time and money?

Stop wondering. See the whole picture clearly.

Many servicemen are of the opinion that only carbon type controls should be used. This is a mistake. Carbon and wire wound controls have their distinct individual advantages—advantages which are not alike. The wire wound control is the oldest type. Let us analyze its advantages and disadvantages first.

ADVANTAGES OF WIRE WOUND CONTROLS

1. **Absolute accuracy of resistance value** maintained throughout the life of the control. Wire controls can be commercially made to within a tolerance of 2% plus or minus.

2. **High current carrying ability.** In the case of Yaxley wire wound replacement controls, dissipation of a full 5 watts is assured.

3. **Low resistance values** are obtainable with the wire wound type control. Yaxley wire wound controls start as low as one-half ohm. Think of it.

DISADVANTAGES OF WIRE WOUND CONTROLS

1. **Difficulty of obtaining taper.** Tapers in wire wound controls are rather abrupt.

2. **A slight amount of noise is generated** when the arm moves from one turn of wire to another. The cause of this noise is the "voltage drop" per turn of the resistance wire.

3. **Limited resistance value.** Because it is difficult to handle wire of less than .001" diameter, controls of more than 150,000 ohms would be not only extremely difficult to wind, but would require a large amount of space.

ADVANTAGES OF CARBON TYPE CONTROLS

1. **Ease of tapering**—A distinct advantage in that any taper "curve" may be easily obtained.

2. **Silent operation,** because the resistance change is progressive and not by means of minute steps as in the wire control.

3. **Resistance values** of carbon type controls **may range into many megohms** without bulkiness or undue difficulty of manufacture.

DISADVANTAGES OF CARBON TYPE CONTROLS

1. **Variation of resistance.** The resistance value of a carbon control is influenced by humidity, heat, age and wear, in addition to the tolerance which must be allowed in order to obtain commercial production. (See page 122 for further data).

2. **Low current handling capacity.** The usual limit of dissipation for carbon type controls is 1 watt. Yaxley carbon controls below 75,000 ohms will readily handle 2 watts, or even more for the lowest resistance values.

3. **Limited resistance value.** It is almost impossible, at this time, to successfully make carbon controls of less than approximately 500 ohms.

From this compilation, we see that **each type of control has advantages which offset the disadvantages of the other type. Each type of control is limited in its application to the circuits or conditions requiring the particular advantages of its type.**

In your service work, you are confronted with the **replacing of controls of either type.** It is our advice that **you replace a wire control with a wire control, and an original carbon type control with a carbon type control. By adhering to this rule, you will avoid customer dissatisfaction,** loss of time and labor, which are distinct possibilities if one type control is substituted for the other.

For your convenience "Yaxley" provides both type controls in all necessary resistance values; and tapers in the range of resistance wherein either type may be used.

There are certain conditions where it might be desirable to change the type of control; i. e., use a carbon control to replace an original wire wound control. This is a matter of discretion for the serviceman. The exchange should not be made unless the advantages to be gained are NOT offset by the disadvantages of the particular type control. Quite often this can only be correctly ascertained by trial and error.

For your advantage, we list below a table showing the Yaxley wire wound and carbon types which are interchangeable as to resistance value and taper.

Wire	Carbon
E7	E12
F7	F12
G7	G12
H7	H12
G	UC501

MIDGET CONTROLS

What to do? Do you fear these small controls? Read this article and see how easy it is to handle this "tough" situation!

1935 saw the introduction of Midget volume controls—to many service men a distinct headache. But it is a headache that has a cure—for **90% of these midget controls may be replaced with a standard sized control.** The general belief that a midget control must be replaced with another midget control is erroneous, especially so where there is plenty of space for the Yaxley universal replacement control, inasmuch as **the advantages of silent operation, higher current capacity and long life of the Yaxley control are not to be compared to the usual operation, low current carrying ability and short life of the average midget control now in use.**

We strongly advise that the Yaxley Universal replacement control be used to replace all midget controls wherever space is available. It will pay you to do this, because by so doing, your customer is assured of advantages which cannot be had in the present midget type.

Yaxley's development of a small-sized control for original equipment, as well as replacement use, has had, and will have, months of proving and of testing. When released, it promises a definite solution to midget control problems.

AUTOMOBILE CONTROLS

Mechanical monstrosities. Here in a few words with clear distinct pictures is something new which will lighten your work tremendously. See the many ways provided for the replacement of Auto Radio Controls.

The rapid development and wide spread use of auto radio receivers has brought about an annoying situation, in that it seems as though every designer strives to out-do all others in the mechanical design of the control shafts to be used in his receiver.

The serviceman is faced with shafts of every conceivable shape and size. There are round shafts; square shafts; shafts with holes, with slots, grooves and pins. This extremely wide variety of shapes of control shafts would be almost unbearable to the serviceman, were he without the universal features of the Yaxley line.

For your benefit, Yaxley pioneered the "Universal" plan and it is in the field of auto radio control replacements that this plan of Universality finds its full expression and assures you of being able to replace practically any control, regardless of its shaft.

A study of auto radio controls reveals that a 1/4" diameter shaft, with a longitudinal slot, the width of which is usually 3/32", is by far the most popular type. Therefore, we will first demonstrate the universal replacement features of the Yaxley line with this type shaft.

Figure 101 shows a type of slotted shaft which is often used with auto receivers. This type of shaft is usually required where the control is operated by means of a removable key, as this allows the locking of the receiver by removal of the key.

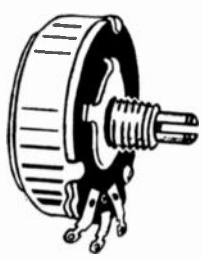


FIGURE 101

Yaxley supplies two controls equipped with this type shaft. These are:

SRP251—250,000 ohms—No. 1 Left-Hand taper.
SRP252—500,000 ohms—No. 1 Left-Hand taper.

These controls have the Yaxley attachable switch feature. In addition **THE SHAFT MAY BE CUT OFF FLUSH WITH THE BUSHING** wherever the application requires a control having a slotted shaft which is flush with the bushing. Such controls are used by certain models of Arvin, Ford and RCA Auto Receivers.

For the replacement of the slotted type shaft where the length of the shaft lies between 1/4" and 2" (as measured from the bushing), Yaxley presents in Figure 102 the type of shaft used in Yaxley controls—types:

UC511—250,000 ohms—No. 1 Left-Hand taper.
UC512—500,000 ohms—No. 1 Left-Hand taper.
UC514—1 Meg.—No. 1 Left-Hand taper.
TRP620—2 Meg.—Tapped at 1 meg. Special Tapped Taper.

These controls will supply a replacement for any automobile receiver requiring a slotted shaft less than 2" long.

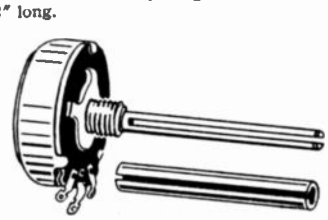


FIGURE 102

Figure 102 shows that this shaft is equipped with a sleeve. **When cutting the shaft it is advisable to cut through the sleeve, except in rare cases where it is necessary to have the sleeve project beyond the end of the shaft.**

For replacing controls having a slotted shaft over 2" in length, Yaxley presents the UC515 which is truly a Universal Control.

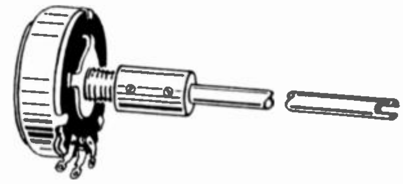


FIGURE 103

Figure 103 clearly reveals that Yaxley Control Type UC515 of 500,000 ohms No. 1 Left-Hand taper will readily replace any control wherein the shaft length is not more than 5 1/2".

By cutting off the shaft and using the coupler to connect it to the control, you may easily and quickly make a replacement.

Because controls of values other than 500,000 ohms rarely are equipped with a slotted shaft greater than 2" in length, Yaxley has not found it necessary to furnish the above described type of control in values other than 500,000 ohms.

For your convenience, and to assure that you may replace most any control which may have a slotted shaft, Yaxley supplies a Slotted Extension Shaft—RS245 as shown in Figure 104.

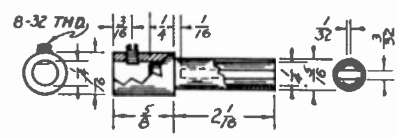


FIGURE 104

QUICK AND EASY REPLACEMENT OF CONTROLS

Replacement of controls in receivers will always be an easy and simple matter if the instructions outlined in this chapter are followed.

If the following tabulated procedure is followed, you will find a great saving in time and labor.

1. **Before removing the control,** or even unsoldering the leads **TRACE OUT THE CIRCUIT and be sure to note the connections of the leads to** the control. It is advisable to **make a sketch** so as to **prevent confusion** when attaching the leads to the new control.

2. Remove the control from the chassis.

3. **Measure the overall resistance.** If the control is burned out, it will be necessary to open it and measure the various remaining sections of the resistance, and from this total, calculate the amount of resistance which has been destroyed, so as to obtain the overall resistance value.

4. **Ascertain the taper. To measure the taper,** it is only necessary to **set the moving arm** of the control **at the center of its arc of movement.** It is not necessary to remove the cover to do this, inasmuch as the shaft of the control may be marked, its total travel ascertained from this mark by rotating the shaft, then set the mark at the center of the indicated travel. **With the arm of the control at the center of its rotation, measure the resistance of the two halves of the control.** When **facing the shaft end** of the control and **with the terminals down or toward the operator, if the resistance between the center terminal and left-hand terminal is lower than the resistance between the center and right hand terminal, replace with a Yaxley No. 1 Left-Hand tapered control. If the resistance between the center and left hand terminal is greater than that between the center and right hand terminal, the control should be replaced with a Yaxley No. 2 Right-Hand tapered control.**

In case the resistance of the two halves of the control is equal, a Yaxley control of No. 4 taper should be used.

5. If the control is tapped, measure and note the resistance between the left hand terminal and the tap.

6. At this point, you have the following information which is to be used in selecting the correct Yaxley replacement control:

(a) Circuit.
(b) The overall resistance.
(c) The taper.
(d) Tap value (if control is tapped).
(e) Shape of shaft.

Procedure:

If shaft is of standard 1/4" diameter (regardless of milling [flat] on the shaft), **proceed as follows:** For purposes of explanation we will assume that we have the following information: **50,000 ohms resistance, left hand taper** and no tap. Therefore, it is necessary to consult only a listing of Yaxley controls and select a control of 50,000 ohms No. 1 Left-Hand taper, which will be the Yaxley type K12.

However, if we are dealing with a tapped control, it is necessary to consult the table of Yaxley TRP controls, first looking for the TRP control having an overall resistance value nearest that of the original. Then choose the TRP control having the same overall resistance which is tapped at a value nearest that of the original. The above procedure is simple, isn't it? It will save you time and headaches. Try it and be convinced.

"A" NOTES

Explanation of "A" Control Notes

The following section of the MALLORY-YAXLEY ENCYCLOPEDIA is without doubt the finest and most helpful compilation ever presented to servicemen.

This section of the encyclopedia enables you to have detailed instruction on replacement of controls. It also allows us to be perfectly frank with you. It permits the listing of receivers and information which will enable you to make a quick replacement.

WE STRONGLY ADVISE FOR YOUR OWN BENEFIT THAT YOU READ "A" NOTES. IT WILL SAVE YOU TIME, WORRY, AND MONEY.

A1—Shape of shaft unknown; if slotted or tongue shaped see Yaxley UC511, UC512, SRP251 or adapter shafts RS245, RS246, etc. (See article "Auto Controls").

A2—This control used on some types of this chassis in place of the first mentioned control.

A3—Mechanics of control unknown; select proper Yaxley control having resistance and taper given, or if value is not given, see Note 5. If control is of two sections use a Yaxley dual. See Note 1.

A4—This control used on later type of this chassis.

A5—Resistance value unknown; measure the overall resistance; if control is burned out use the method given under heading "Determination of Taper," then select Yaxley control having an equivalent resistance of the taper suggested. If not suggested see the article, "Determination of Taper."

A6—Use Yaxley GG if there is sufficient space; if not change circuit to use G12. See Circuit No. 6.

A7—Circuit was changed during production so as to use a 500M control.

A8—This receiver was originally equipped with either a Yaxley wire control of 6M ohms, or a carbon control of 30M ohms. Yaxley Type Y control will replace either of the originals. However, if you wish a wire control use the Yaxley F7.

A9—Space available unknown; if not sufficient for the Yaxley DRP119, change the circuit to the ordinary "Ant.-Bias" circuit as shown in Circuit No. 6 and use the Yaxley G12 control; this will be both easy and satisfactory.

A10—Improved signal attenuation may be obtained by connecting the left-hand terminal of the control to the antenna. This gives the ordinary Bias and Antenna type of control circuit.

A11—Original control is in filament circuit. Change to Circuit No. 2 and use Yaxley type G12.

A12—AK receivers for which Yaxley SRP-239 is specified may be serviced with the Yaxley silent carbon control type E12 by installing it in the original bakelite control housing. This is easily accomplished and gives a smooth, silent control. See note 30.

A13—See instructions on page 123 for use of Yaxley No. 7 Switch.

A14—Check original control or circuit to ascertain if the minimum bias resistor is included in the original control. If so use the Yaxley minimum bias plate on the wire controls, or if a carbon is recommended, use the adjustable resistor.

A15—Requires use of Yaxley shoulder nut A11260-12 and also the regular nut. Arrange so that control is set back from the panel so as to clear the dial. Yaxley extension bushing EB247 might be used.

A16—May require use of Yaxley bracket RB248.

A17—Note: This replacement requires the expenditure of some mechanical ingenuity when installing the control; however, the control will be satisfactory in operation.

A18—Note: Some of these chassis use the Yaxley Type GG Dual Control.

A19—Note: Measure resistance between left-hand terminal and tap (when facing shaft, terminals at bottom), and select Yaxley TRP having same overall resistance and tapped at a value nearest that of the original.

A20—Originally a dual control, this circuit is easily adaptable to the Yaxley Type G12 Control by using Circuit No. 6 as given in the schematics. Refer to Note 14 when installing the control. If desired, Yaxley DRP119 is suitable for this circuit.

A21—This receiver may require a control with a portion of the shaft of smaller diameter to clear the dial; if so, use Yaxley SRP275.

A22—Note: Use Yaxley extension shafts RS242 and RS244. These shafts are attached to the Type T Control and cut to the proper length, preferably by cutting the shaft of the Type T Control and the RS242 Shaft.

A23—Note: When using the Yaxley SRP185 with metal shaft, be sure to ground the shaft near the front of the set by means of a pigtail, if there is any tendency toward oscillation.

A24—Extension shaft required; use RS244 for 3/16" diameter. For 1/4" diameter use RS242 or RS243.

A25—Note: If shaft of UC512 Control is not of sufficient length use the Yaxley Type N Control and extension shaft RS245.

A26—Note: Some of these chassis use a dual control; Yaxley GG is correct replacement.

A27—Used on first type of this chassis.

A28—Volume control for radio tuner section.

A29—Volume control for radio amplifier section.

A30—Note: This is a replacement strip to be installed in the original housing.

A31—Parallel the two sections of the Yaxley No. 7 Switch to prevent overload; see page 123 for instructions on the use and connections of the Yaxley No. 7 Switch.

A32—It is suggested that this receiver be changed to use type '36 tubes in place of the 24 and 26 types, and the 37 in place of the 01A.

A33—Requires Nos. 203 and 212 washers.

A34—"Kennedy" made by Detrola; see Detrola Model 1000.

A35—Note: Controls SRP276 and SRP277 are to be used together and neither is to be used with any other make of control.

A36—Note: Mechanical features unknown; we suggest Control SRP276.

A37—The original values were 500M and 100M. The change to Dual Control Type LM (that is, 100M and 250M) will not be noticeable. Connect the front section of the control in the grid circuit of the 33 with the grid to center terminal, coupling condenser to right-hand terminal, left-hand terminal to bias supply. Connect rear section center terminal to grid (cap) of 1A6, right-hand terminal to coupling condenser and left-hand terminal to bias supply. Note: Terminal order as viewed from shaft end with terminals down or toward operator. If switch is required use Yaxley No. 7.

A38—Note: The Antenna section of this control is wired as per schematic No. 4. The other section is wired as follows: the center terminal to type '30 plate, the right-hand terminal to "P" of the audio transformer, and the left-hand terminal to "B" positive. Yaxley GK should make a satisfactory replacement. However, the Yaxley DRP243 wired with the rear section in the grid circuit of the 1st A.F. ('30) as per schematic No. 15, and the front section wired as per schematic No. 2, will give better attenuation in areas of high signal intensity.

A39—Note: Switch used on later types and model KDC only.

A40—Note: Switch used on volume control only on the chassis having a tone control.

A41—Connect left-hand terminal to chassis, center terminal to screen circuit, and right-hand terminal to positive 67.5 volts. (View control from shaft end, terminals down or toward operator).

A42—Note: Cut off the shaft of the SRP251 Control flush with bushing.

A43—Note: Original control was of the inductive type. Replacement with a variable resistance control is highly satisfactory. Connect the left-hand terminal to the antenna and grid, and the center terminal to ground. (Control viewed from shaft end, terminals at bottom).

A44—Original control is a dual; however, only one section is to be used at any one time. The Yaxley G7 is a perfect replacement for the Antenna Shunt section which is most commonly used.

A45—Note: When replacing the tone control, use Yaxley Bracket RB249, or file out the hole in the original mounting bracket. Be sure to use only the left-hand and center terminals of the control.

A46—Original dual control is replaced with single Yaxley Y100MP, which is connected as follows: Center terminal to first audio plate, left terminal to tone condenser, and right terminal through 5,000 ohm resistor to B positive.

A47—If original control is wire and carbon, use Yaxley DRP307. If original is carbon in both sections, use DRP244, with the front section (nearest the shaft) for the screen circuit and the rear section for the Antenna circuit.

A48—Refer to schematic 14. The original control was in the filament circuit. We recommend a change as per Circuit No. 14 using a Yaxley Type "M" Control as a shunt across the detector grid coil.

A49—The DRP222 Control was originally made with a short shaft for use in the chassis 180 (model 181), and requires the use of two RS242 extension shafts when used in the chassis 100 (model 101).

The DRP222 is now being made with a 7 5/32" shaft to fit the chassis 100. When used in the chassis 180 this shaft should be cut off at a point 1 3/8" from the body of the control.

Note: The chassis 100 requires the use of three terminals on the rear (phono.) section and only the center and right-hand terminals of the front section.

In some cases better ratio of signal attenuation is obtained by connecting the left-hand terminal of the front section to the Antenna so as to obtain a signal attenuation in addition to the bias increase.

A50—The DRP117 Control is an exact replacement for the Yaxley original. The DRP242 Control is an exact replacement for the control in the bakelite housing.

A51—Requires Yaxley FS251 flexible shaft.

A52—Requires Yaxley FS252 flexible shaft.

A53—This control does not require the fixed resistor shunt.

A54—When installing the "CE" control, connect the front section to the Antenna circuit and the rear section to the bias circuit. This is the reverse of the original but has been field checked and found to give satisfactory results.

A55—The Yaxley No. 14 Switch has four terminals which must be connected as follows: one terminal to chassis, one terminal to white lead and one to black lead with white tracer. Disconnect the 1,500 ohm resistor from the chassis and connect it between the remaining switch terminal and the remaining lead, which goes to C-9 volts and to the grid returns of the 1H4G and 1E7G.

A56—The Yaxley DRP114 has a 250 ohm front section for the bias control (Circuit 8) and a 5000 ohm rear section for the antenna control (Circuit 2). Original control may have had sections in reverse order.

A57—The original control is two megohms.

A58—Left-hand terminal (control viewed from shaft end, terminals down) must be grounded to chassis.

A59—Note: The original switch has three terminals, only two are actually used, the other is a "tie" point. When using the Yaxley switch, solder together and tape—the wires formerly connected to this "tie" terminal.

A60—May require use of Yaxley EB247 extension bushing.

A61—Can be replaced with Standard Yaxley Control. May require use of RB248.

A62—Although the Yaxley control is of greater diameter than the original, it will satisfactorily replace it. Cut off the slotted shaft to the correct length, by sawing through the sleeve. File the slot in the shaft until it will fit over the driving shaft, then slightly crimp one end of the longer piece of Yaxley sleeve until it fits the driving shaft snugly. Push the sleeve, crimped end first, up on the driving shaft, then install the control (being sure to ground the left-hand terminal) and pull the sleeve down over the junction of the driving shaft and the slot over the control shaft; the result is a good permanent replacement with an easily obtained silent Yaxley control.

A63—This control may be replaced with a Standard H12 Control if the knob is replaced with either a push on or set screw type.

A64—This control is easily replaced by using a Yaxley TRP607, No. 6 Switch, EB247 Bushing, and FS250 Flexible Shaft. Use either the solid portion of the old shaft or any 1/4" shaft such as the 1/4" portion of a Yaxley RS242. This replacement is easily accomplished.

A65—For emergency replacement use SRP-265 Control

A66—Wire the switch so that it is shorted when control is turned to extreme counter-clockwise position. (See chapter on "Attachable Switches.")

A67—Disregard the tap in this replacement.

A68—File shaft to duplicate original.

A69—This control requires two Yaxley RS-242 Extension Shafts or the EC240 Coupler and a suitable length of 1/4" shaft.

A70—This replacement (L) requires a slot to be filed or sawed in the shaft of the "L" control, or change of the knob to the standard Philco push-on type.

A71—Note: Requires a 100M No. 1 Taper or "L" Control (subject to the instructions in Note 70) for replacement. In some cases a UC511 Control is satisfactory.

A72—The EC240 is a 1/4" shaft coupler having an internal sleeve to reduce the diameter to 3/16".

A73—For this replacement we advise a change in the volume control circuit, to correspond to Circuit No. 8. Use an A3MP Control and a 4,500 ohm Fixed Resistor in series, in place of the original tapped control.

A74—Due to the many variations in both circuit and control, we advise measuring the original control carefully and duplicating with similar Yaxley Control, or returning original to Yaxley for duplication.

A75—This replacement recommendation is applicable only when the customer does not desire tone control operation on the broadcast band.

A76—Improved operation may often be obtained by removing the shunt (6M ohms) resistor across the control and using the Yaxley E Control. In extreme cases, use a Yaxley E7 Control and connect as per Circuit No. 6.

A77—If original control has 3/16" diameter shaft end, use Yaxley RS244 Extension Shaft.

A78—Replace with an A2MP Control and an EC240 and a portion of 1/4" shaft taken from the old control.

A79—If trouble with oscillation is encountered in this set, the addition of a 5M ohm resistor, connected from antenna to ground will usually effect a cure.

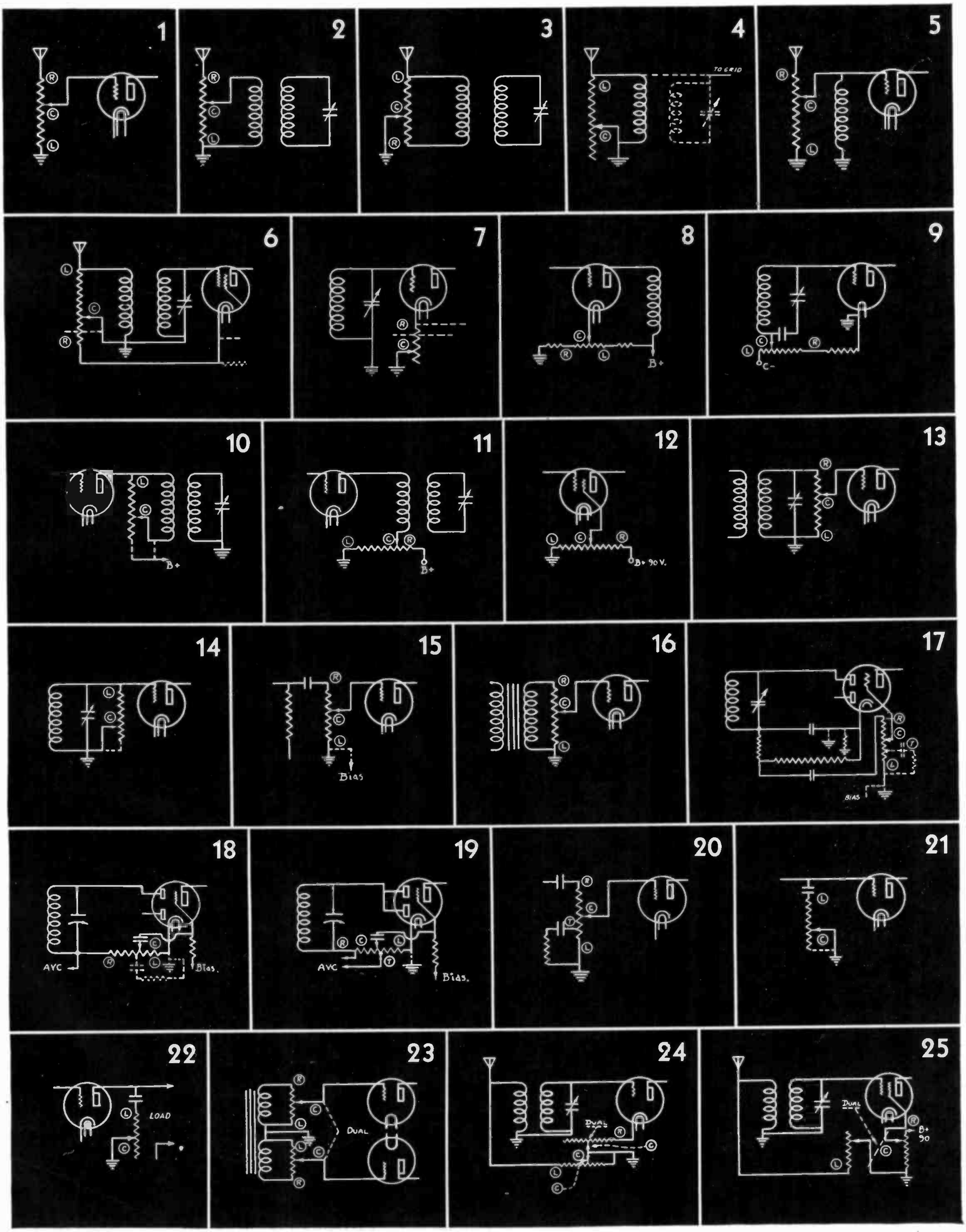
A80—Be Sure to check the series resistor between the screen circuit and B positive! It it is not a full 20,000 ohms or if it is of the carbon type **REPLACE** it with a **Wire Wound** 20,000 ohm resistor. This will prevent the control being burned out and the possibility of a dissatisfied customer.

A81—Select a Yaxley TRP Control of 500,000 ohms total resistance having a tap at the same resistance value (as measured from left-hand terminal) and slot the shaft.

A82—The voltage applied across the SRP-261 Control should not exceed a maximum of 170 volts. If the voltage exceeds this value, the control will burn out. **Important:** Be sure that the bias on the tubes is at the rated value when using the SRP261 Control aş a plate voltage control.

A83—The Yaxley DRP221 Control is an exact replacement for the dual control used on the 50, 60, and 70 Series receivers, although it was used interchangeably with the SRP261 Control in the earlier 50 and 60 series. In many cases a change of circuit to the antenna-bias type, and the use of the Yaxley H7 Control will give much better control action.

A84—Question as to available space. If sufficient for 1 1/2" diameter control use a Yaxley "Y" Control.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TO GRID
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B+
9
C-
10
B+
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B+
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13
14
15
Bias
16
17
BIAS
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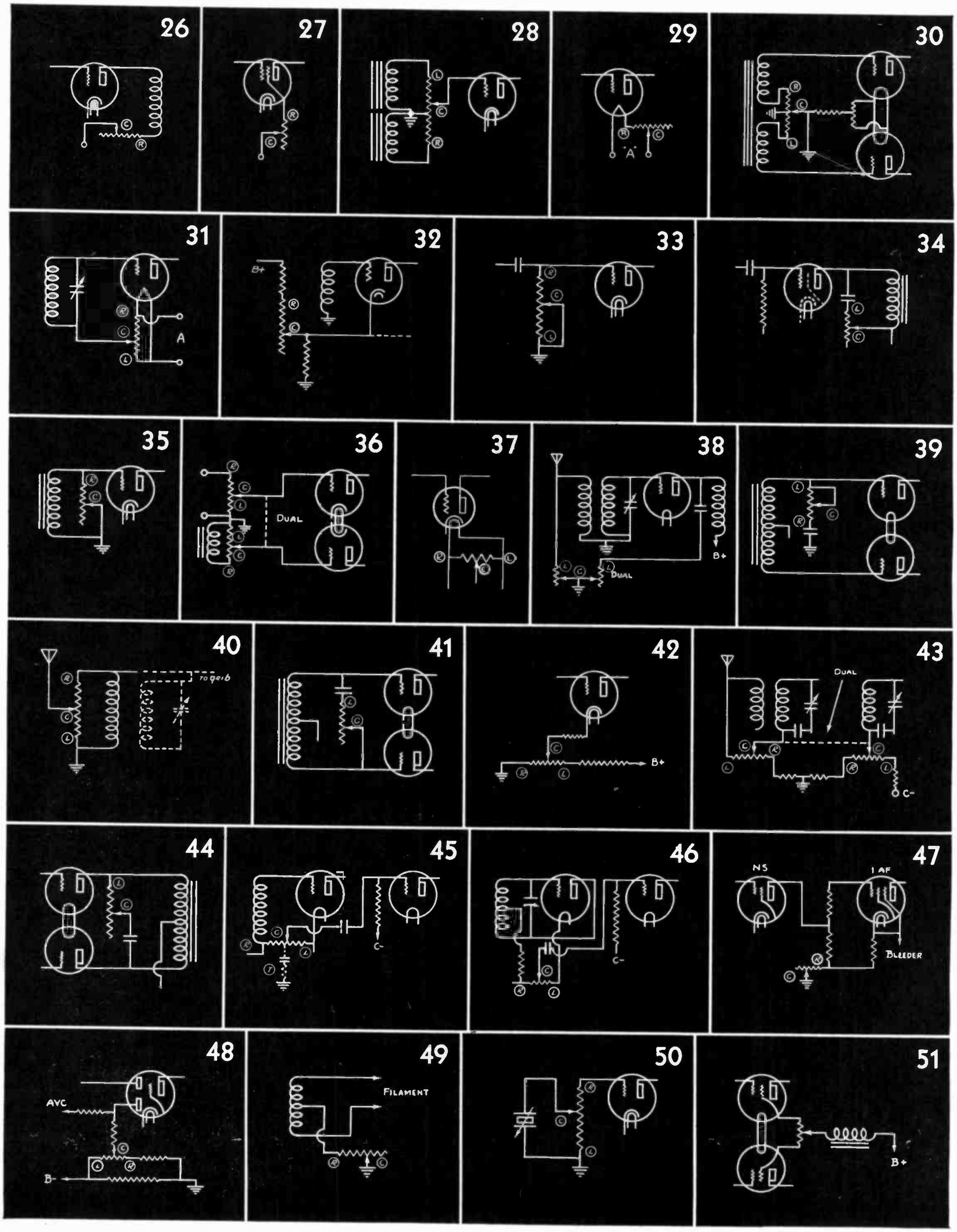
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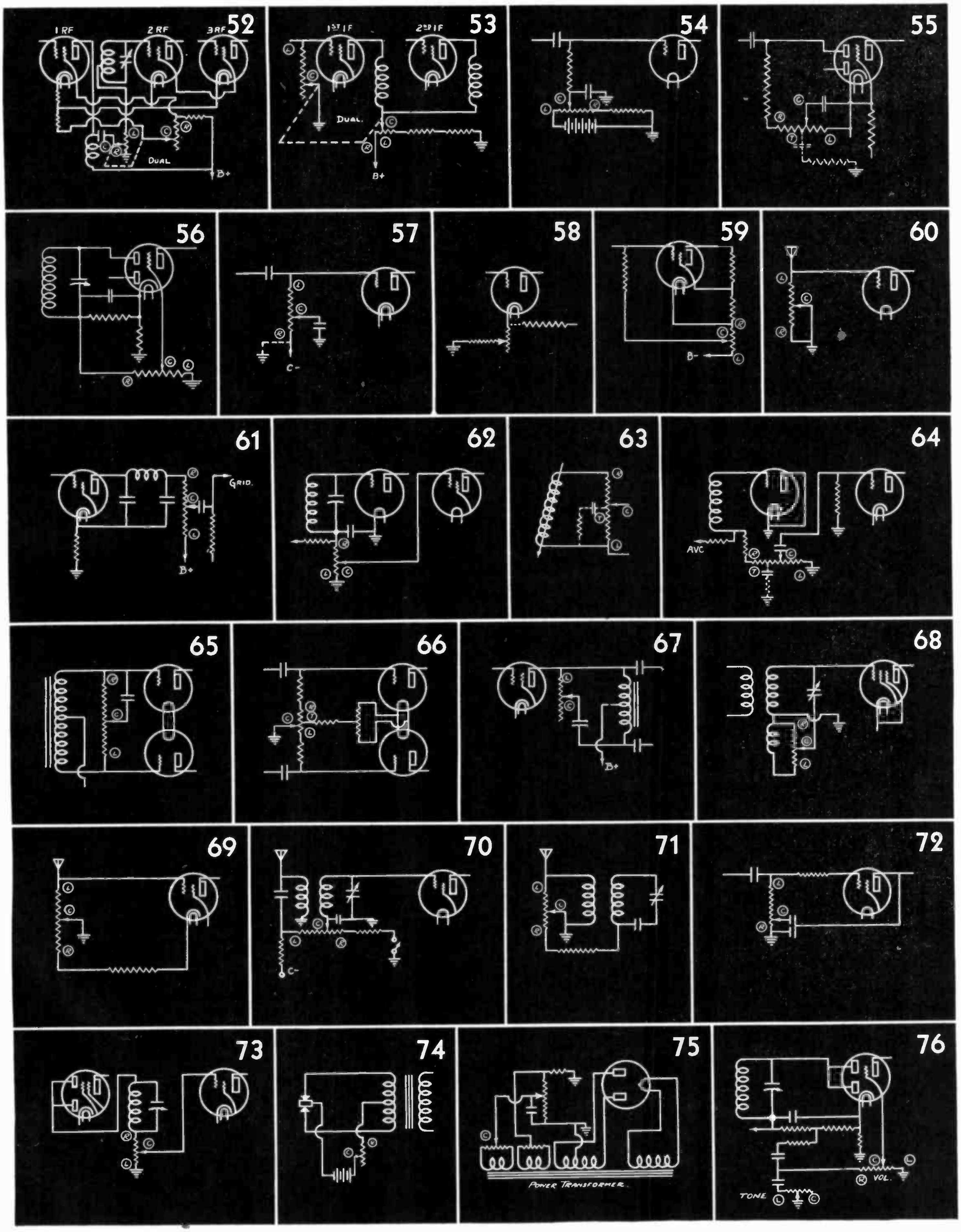
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63
64
AVC
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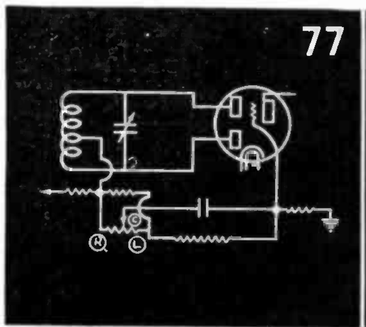
TONE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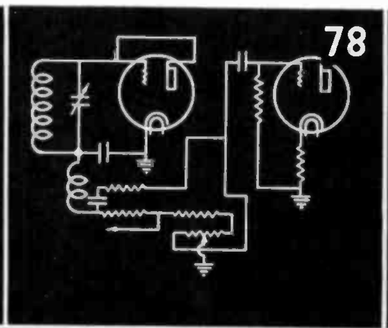
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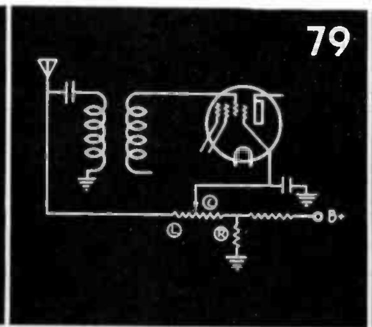
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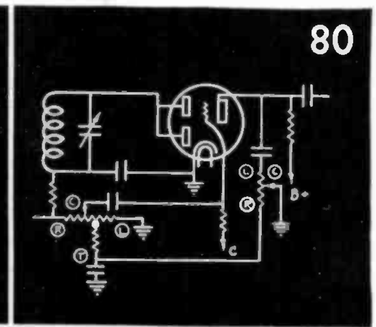
B+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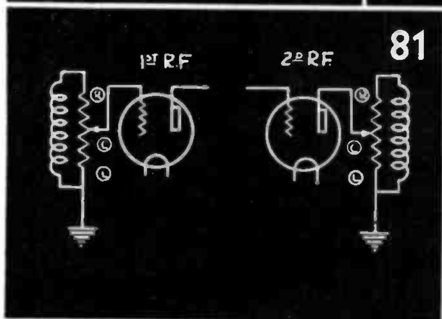
B+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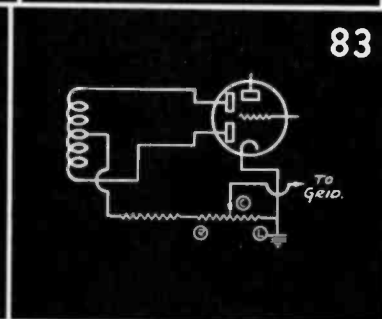
2nd R.F


82
DIODE
GRID
PHONO
TRP 1.09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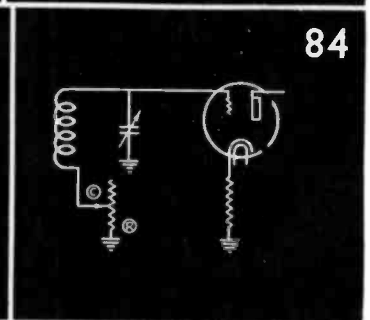
TO GRID.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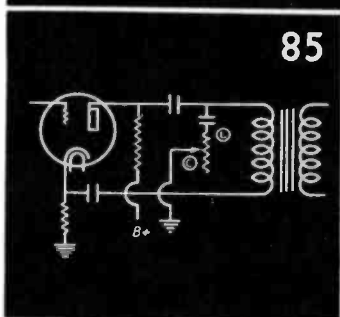
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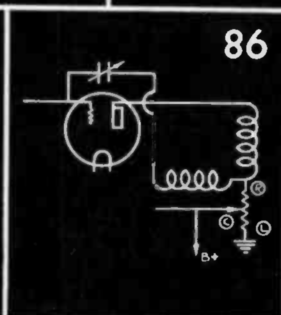
B+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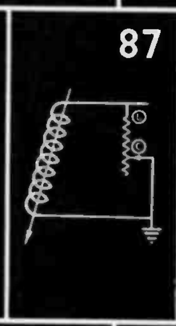
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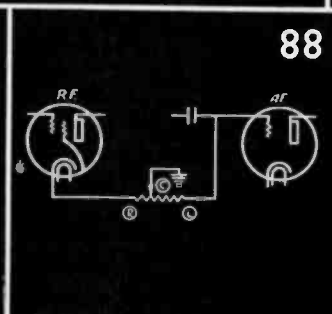
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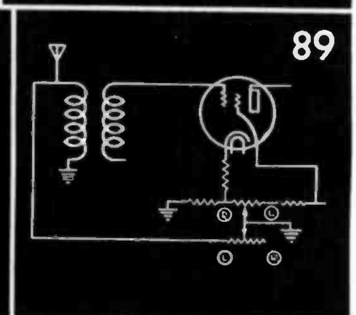
AF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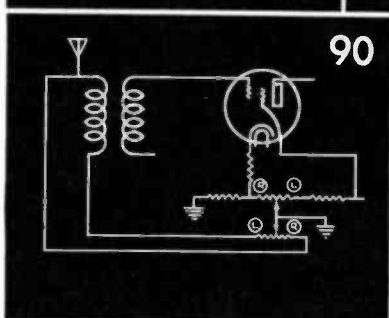
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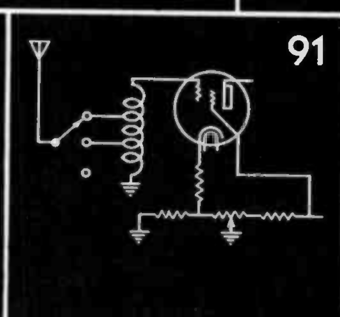
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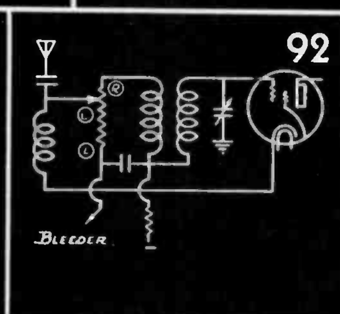
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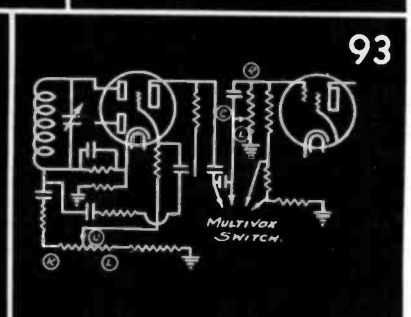
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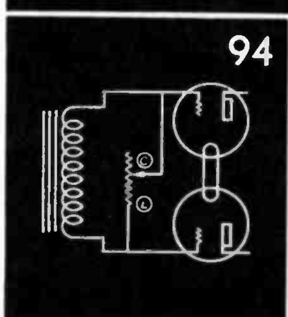
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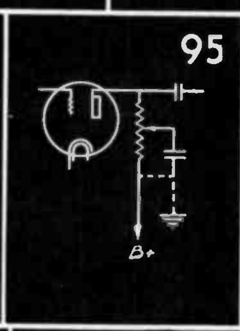
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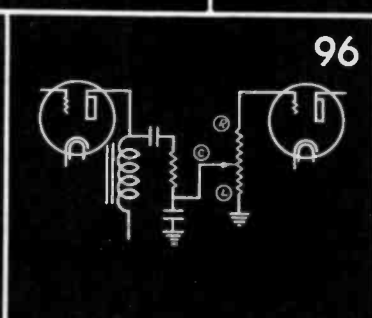
B+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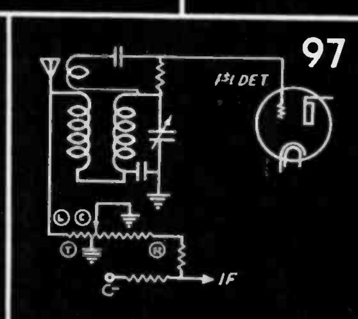
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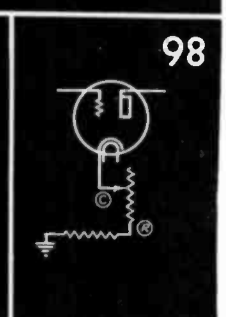
1st DET
IF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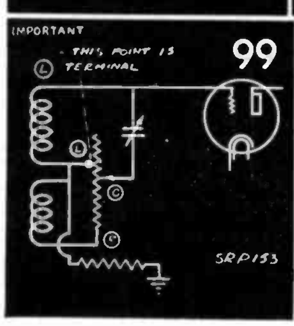
IMPORTANT
- THIS POINT IS TERMINAL
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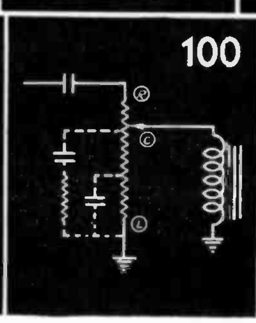
SRP153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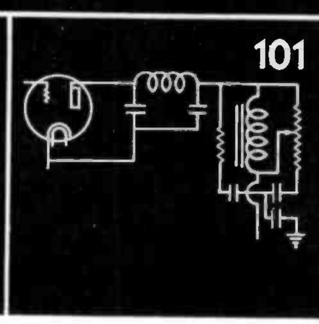
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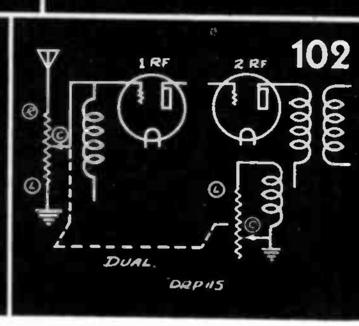
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2 RF
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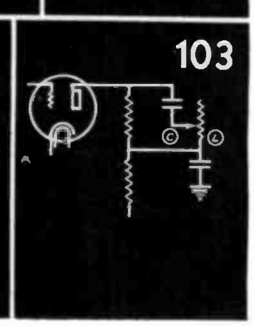
DUAL.
DRP115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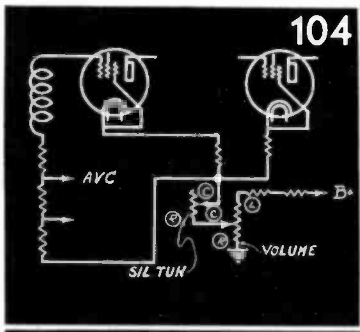
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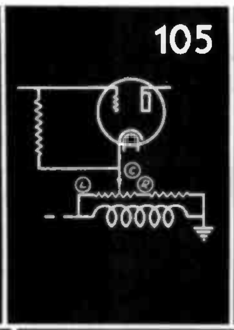
AVC
B+
VOLUME
SIL TUN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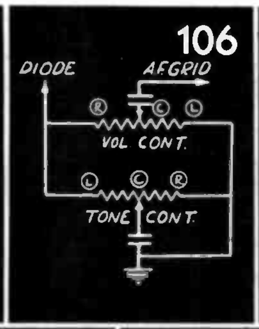
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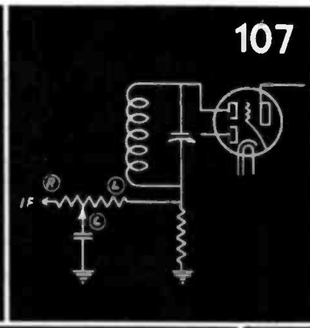
DIODE
AF GRID
VOL CONT.
TONE
CONT.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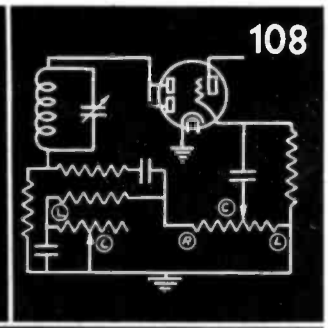
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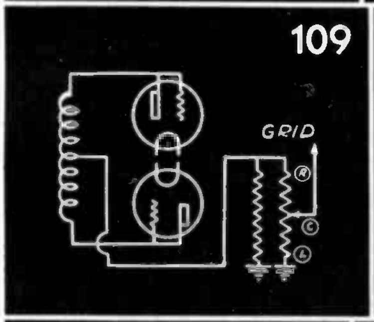
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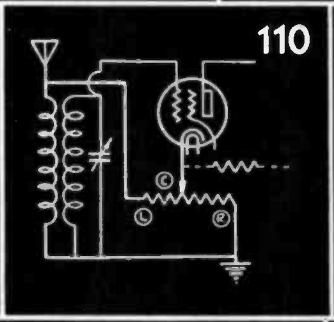
GRID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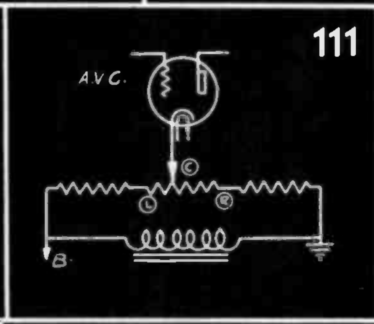
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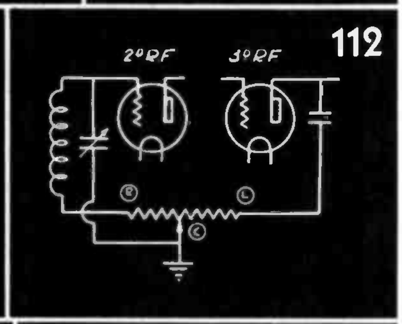
A.V.C.
B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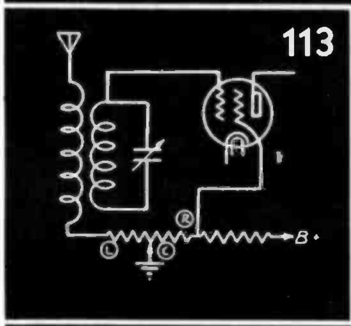
2° RF
3° RF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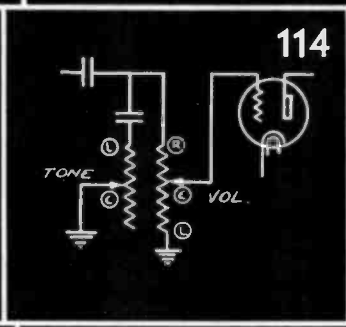
B+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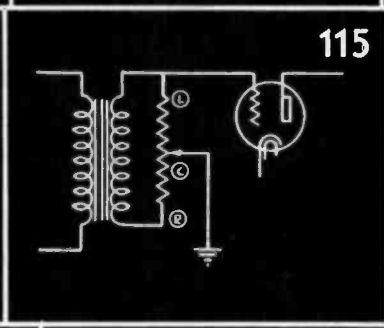
TONE
VOL.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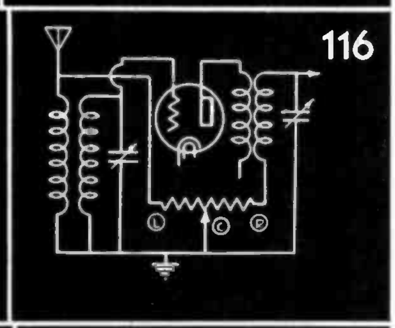
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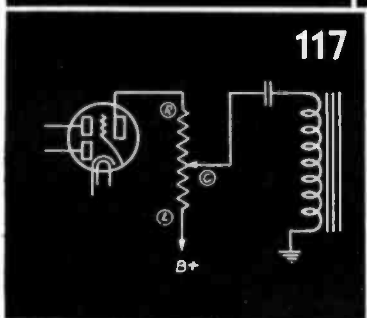
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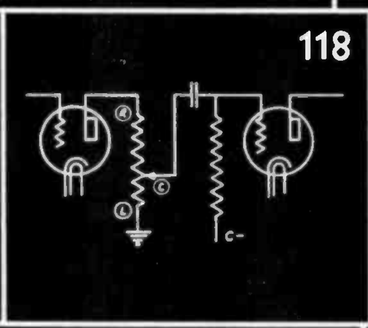
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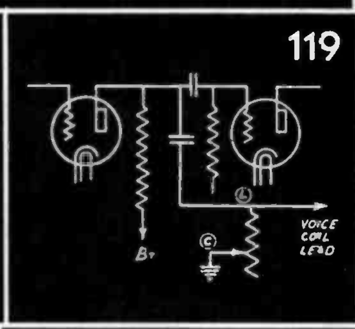
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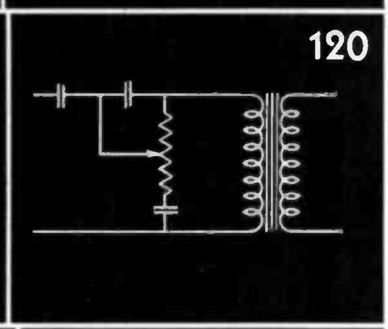
B+
VOICE
COIL
LEAD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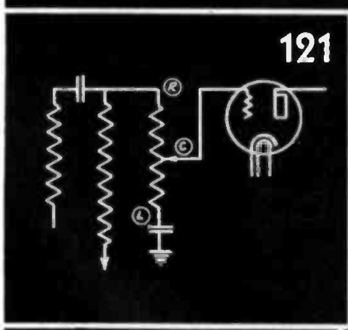
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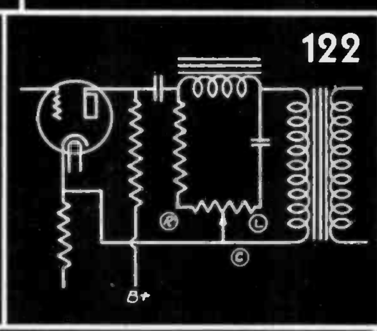
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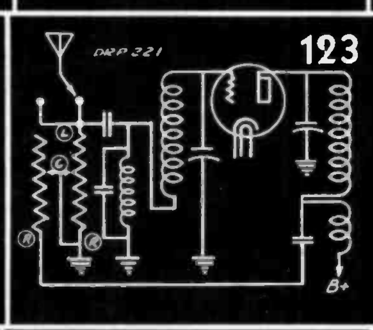
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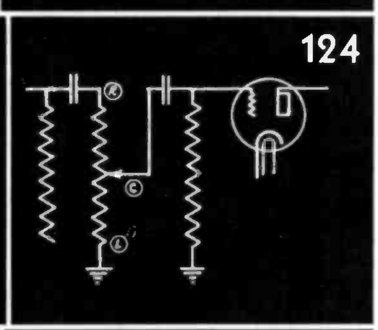
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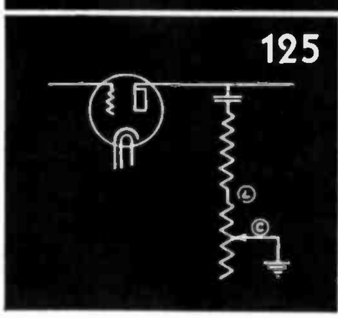
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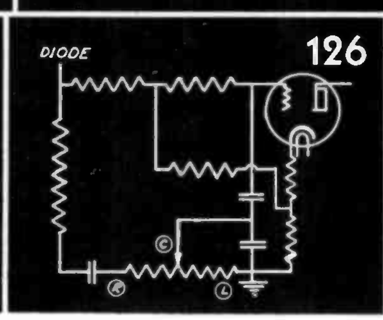
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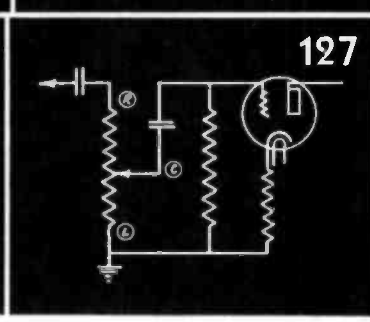
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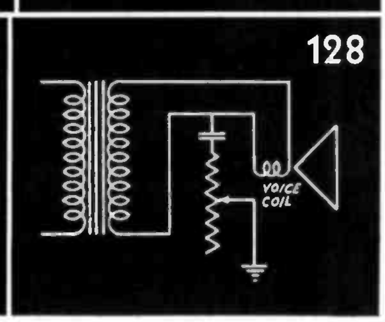

128
VOICE
COIL

YAXLEY

REPLACEMENT CONTROLS ACCESSORIES

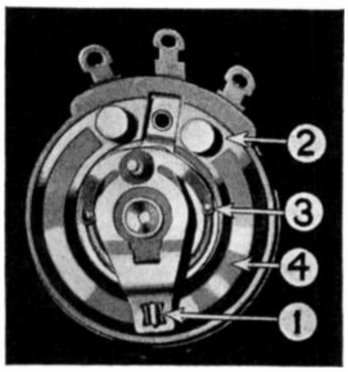
Here is a volume control line designed by service men for your convenience and benefit. A completely UNIVERSAL replacement line—Universal controls for 90% of your work, plus a minimum number of necessary special controls. Remember—90% of the usual "special" controls on the market are merely equipped with the correct length of shaft.

"UNIVERSAL." By this is meant that all products are deliberately and carefully designed so that you may make a dependable repair in the easiest and quickest manner.

EXCLUSIVE FEATURES OF YAXLEY CONTROLS

Three years of constant research and development have resulted in the best Volume Control ever known. Look at these features.

Silent operation. A new development—the result of design and engineering conducted for your benefit.



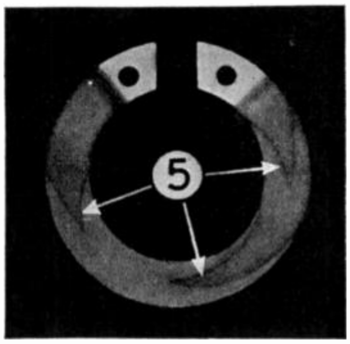
1. "The Roller That Does Not Roll." This exclusive Yaxley contact design maintains a constantly dust-free surface element and is further protected by Yaxley's dust-proof shield. The best type of contactor as recognized by leading contact engineers.

Yaxley engineers recognize the basic law of physics that there is friction between moving objects. Yaxley provides a firm pressure on the roller, but this is opposed by a carbon element that can "take it." It does not require mollycoddling as on ordinary elements where the pressure must be kept low to prevent destruction of the element.

2. Pure Silver Shortouts! Used for clean-cut, quick, positive switch action. Assure zero signal before switch action and a never failing contact between terminals and carbon on the element.

3. Silver to Silver Contacts! Used between all moving current carrying parts. Another Yaxley superiority. Silver oxide is a conductor. No trouble will ever be experienced due to oxide insulating films as would be the case with brass or copper.

4. Perfect Contact! Yaxley controls have perfect contact between moving arm and carbon element. A true and uniform area of contact is effected on the



element at all points. **Notice the track.** It does a real job of contacting! Other methods only hit the high spots.

5. Perfect Smooth Taper! Controlled by geometric design; no sudden changes in resistance value. There is no guesswork, or "cut and try" method with "Geometric Design." Yaxley elements are sprayed by mathematically designed methods. Tapers are feather-edged to insure electrical smoothness and are applied in rapid succession to permit flow between joints. That provides perfect mechanical smoothness. **Only Yaxley has such perfect control of taper.**

6. New Spring Wedge. Yaxley Wire Wound Controls are also new. They embody a **new spring wedge design,** which definitely eliminates any possibility of loose terminals. Expansion and contraction due to temperature changes are taken up by this patented spring which holds the element and terminals firmly in place.

Low Humidity Coefficient! Less than 15% resistance change when subjected to 110°F. 90% relative humidity for 100 hours. No need to fear "damp spots." **Yaxley controls will work in all climates.**

Negligible Voltage Coefficient! Yaxley controls are the same in all circuits, truly universal regardless of voltage. It is almost impossible to separate this coefficient from the temperature coefficient, but it will not exceed 4% or 5% per 100 volts.

Extremely Low Temperature Coefficient! Yaxley controls are not limited by climate. They give perfect performance everywhere. Temperature does not affect a Yaxley control. This coefficient does not exceed 5% for 80° C. change and the combined temperature and voltage coefficients will not ordinarily exceed 5% for 100 volts and 80° C. rise.

Highest Current Carrying Capacity of Any Carbon Control. Careful engineering has raised the dissipation factor of Yaxley carbon-type controls above the common one-watt rating.

Uniform Characteristics. All Yaxley controls are held to rigid, detailed specifications, and are manufactured for you to the same exacting specifications that are required by original equipment users. Inspection limits are rigidly enforced.

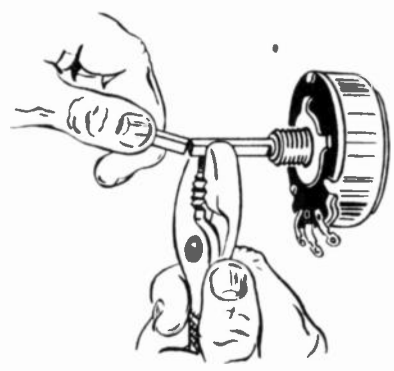
Long Life. 25,000 to 50,000 and over complete cycles, borne out in over 3 years testing. Yaxley controls have a longer operating life. Resistance changes 10% or less in 50,000 complete cycles, or 100,000 passes of the contactor.

Long Shelf Life. Yaxley controls will never go "stale." Age will not affect them nor in any way change their excellent characteristics.

Permanently Identified. A non-removable ink assures permanent identification for your convenience.

"UNIVERSAL SHAFT"

This long, specially designed, aluminum alloy shaft will save you time and labor, because it is so easy to cut (no saw required). Either type of **push-on** or any **set-screw** type of knob may be used **without filing.** The long 3" length is ample for ordinary work, and, where necessary, a greater length is easily secured by using Yaxley Extension Shafts. The illustration shows the easy breaking feature.



"Just notch it, then break." Always cut the notch rather deeply, with either a file or a pocket knife, then hold the shaft near the cut with pliers, and bend back and forth once or twice, as shown. Simple, easy, and no burrs.

PUSH-ON KNOBS requiring a 1/32" flat on the shaft (Philco) are easily attached. Place the insert in the groove at the end of the shaft, and press on the knob. The 3/32" type of push-on knob (Crosley and RCA) is readily attachable. The edges of the groove should be scraped or cut away until level with the bottom of the groove. This is easily accomplished with a file, a knife, or with the edge of a screw driver.

THE ADJUSTABLE BIAS RESISTOR

This time, labor and money saver is exclusively Yaxley. All Yaxley carbon and wire controls for cathode or Antenna Bias circuits, are provided with a simple minimum bias resistor (an adjustable stop plate), easily and quickly adjusted to the proper value.

(Some manufacturers use a portion of the volume control element, as a resistor, to supply the correct minimum bias to the tubes at full volume position of the control.)

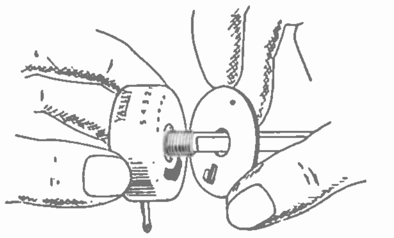


FIGURE 1

Figure 1 shows the Yaxley Stop Plate and the numerals 1 to 5 on the shell of the control.

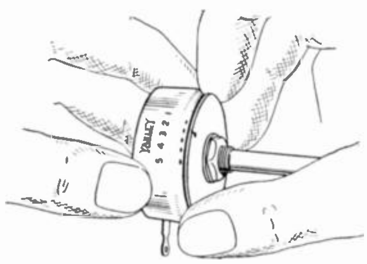


FIGURE 2

Figure 2 illustrates the setting of the plate. Position 1—100 ohms, position 2—200 ohms, position 3—300 ohms, position 4—400 ohms, position 5—500 ohms, all with the usual commercial tolerance of approximately plus or minus 10%.

For resistance values other than the values given, the indicating bump may be filed off the plate and an adjustment made with an ohmmeter.

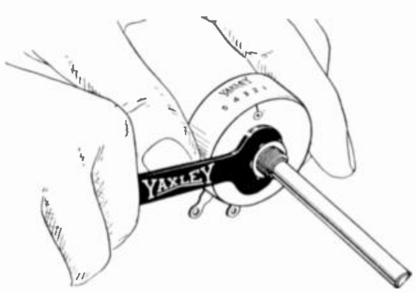


FIGURE 3

Figure 3 illustrates a method of locking the plate in its proper position while mounting the control. Some servicemen prefer to merely hold the plate in its proper position and let the mounting nut perform the dual function of mounting the control and holding the plate.

Yaxley carbon controls are equipped with a small easily adjusted external resistor, which has a total resistance of 500 ohms, for use as the bias resistor.

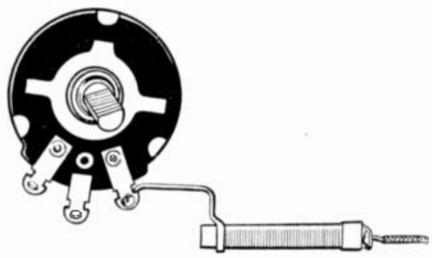


FIGURE 4

This unit is to be attached to the right-hand terminal of the control, as per figure 4, and the clip attached at the correct point and firmly clamped with ordinary slip-joint pliers, after which the unused portion may be clipped off with "diagonal" or "side" cutters. The lead from the cathode circuit connects to the end of the resistor.

YAXLEY ATTACHABLE SWITCHES

SWITCH PROBLEMS CLARIFIED

Yaxley attachable switches are equipped with a bayonet and slot arrangement which assures a definite location and placement on the back of the control. This unique feature of Yaxley controls is furnished for all Universal replacement controls, both wire and carbon.

Controls are covered with a protective dust plate (Figure 5) which is easily removed.

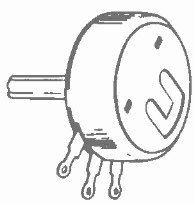
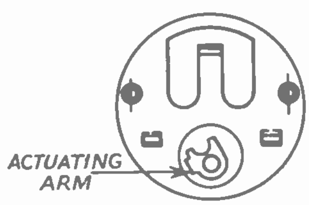


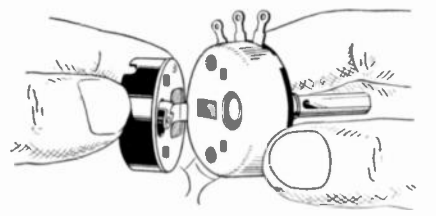
FIGURE 5

To attach the switch, first remove the cover from the back of the control.

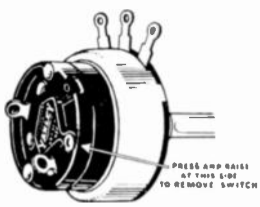
Second, holding the shaft in your hand, turn the shaft as far as it will go in a clockwise direction. Third, make certain actuating arm in switch is in proper position as shown.



Fourth, insert the tongue of the switch into the slot from which the cover was removed.



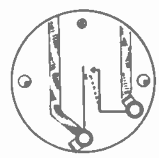
Fifth, push up slightly on the switch and it will snap into position, when it is again pushed down.



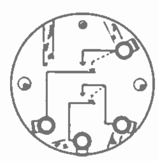
NOTE: If a switch does not fit properly, it is due to mishandling, and is easily restored to perfection by bending the tongue down into the switch by means of "small nosed" pliers.

Yaxley Attachable Switches:

- No. 6—Single pole, single throw.
- No. 7—Double pole, single throw.
- No. 8—Single pole, double throw.
- No. 13—Three pole, single throw, shorting.
- No. 14—Four pole, single throw, shorting.



No. 6 is a heavy duty switch for general use on both battery and power type receivers.



No. 7 is for use on battery receivers where it is necessary to break both the "A" and "B," or the "A" and "C" battery circuits.

In addition No. 7 may be paralleled to give a greater current handling ability than that of the No. 6; however, this is rarely necessary.

No. 7 may also be used as a Three pole, single throw shorting type of switch as illustrated in Figure 6.

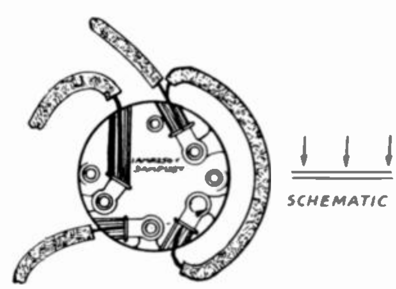


FIGURE 6

No. 8 is for use where it is desired to close one circuit during operation of a control, yet open this circuit and close another when the control is turned to the off position. This is usually found on radio-phonograph combinations. Figure 7 shows the proper connections of the No. 8 switch.

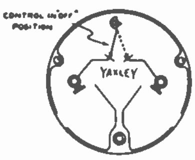


FIGURE 7

No. 13 is for use on battery receivers because it is often necessary to open the "A," "B," and "C" battery lines to prevent useless discharge of the batteries. Figure 8 shows connections.

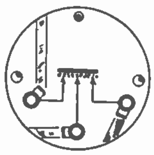


FIGURE 8

No. 14. Like the No. 13, this switch is for use on battery receivers. It allows one additional circuit to be opened and although there are only three battery circuits, the wiring of many late battery receivers is such that it is necessary to open four circuits. Figure 9 clearly shows the connections for this switch.

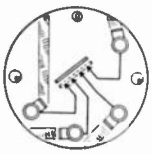


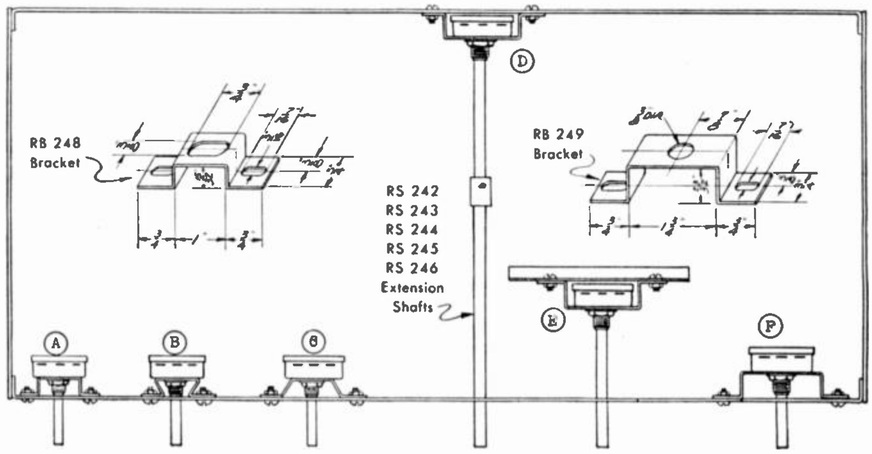
FIGURE 9

ACCESSORIES THAT QUICKEN AND EASE YOUR WORK

The few minutes spent in looking at the pictures of these parts and reading the clear explanation of their practical use will give you a tremendous advantage over your competitor. With this knowledge you can quickly estimate a repair. You will not be bothered with time-wasting mental questions about how to do the job.

Yaxley Universal replacement controls are so designed that they will service at least 90% of all your work. The remaining 10% require either a "special" control or an adaptation which will enable you to do the job with a Universal control. For your benefit and to assure you that you can always make the repair with easily obtainable Yaxley parts, we have designed **many accessories which enable you to make repairs quickly and easily and which therefore assure satisfied customers.**

Yaxley accessories enable you to make profits quickly.



MOUNTING BRACKETS

When needed, there is no substitute. Use them to replace old type controls which were mounted by means of screws. Use them to relocate old controls, thereby shortening lead length and avoiding oscillation.

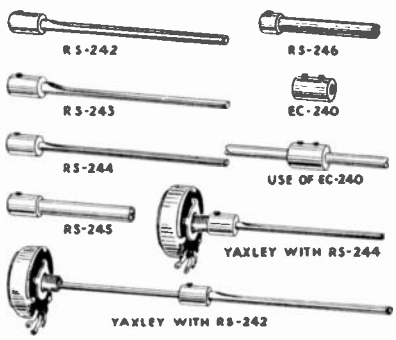
Experimental work is easy, particularly when the brackets are used to mount controls and other parts, either on a breadboard or panel job. STUDY THE ILLUSTRATION.

Note, also, the use of Yaxley extension shafts. See how easy it is to bend the brackets to meet the different requirements. "A," "B," and "C" show the use of the RB248. "D," "E," and "F" show the use of the RB249. They're inexpensive, too.

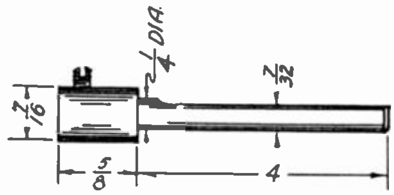
EXTENSION SHAFTS

So useful, widely used and in great demand.

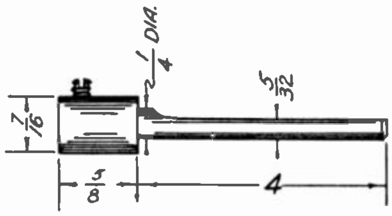
LOOK AT THIS PICTURE: See how every necessary type of shaft is made available for your use.



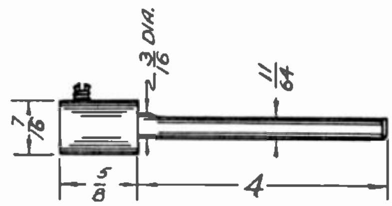
In their order are: RS242, RS243, RS244, RS245, RS246, each of which is explained. Notice Shaft Coupler EC240.



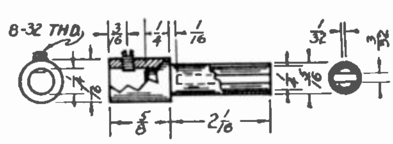
RS242 with its 1/32" flat is used wherever a push-on knob of this type or a set-screw type of knob is to be used.



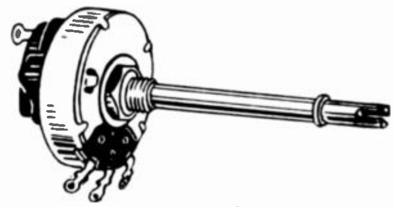
RS243 with its 3/32" flat is for the 3/32" type of push-on knob.



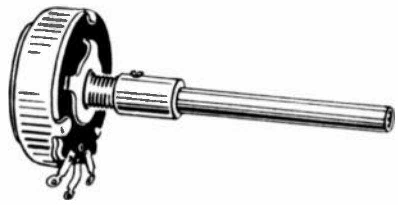
RS244! Look. Here is the answer to that 3/16" diameter shaft problem. Use the RS244 and a Universal Yaxley control whenever you meet a 3/16" shaft control.



RS245 for Auto Radio Control! Why wait for an exact control or rush around, losing time, hunting a replacement? RS245 with a Yaxley Universal control has saved many dollars for servicemen. **It's easy to use.** If the length of the original control shaft is two (2) inches or less, cut off the Yaxley control shaft at 1/4" from the bushing. Then cut the RS-245 to the proper length, attach it to the control and the job is done—and money in your pocket. If the original control shaft is over three inches long, either cut off (if necessary) the Yaxley control shaft or cut the RS245, so as to obtain the correct length. (See Figure 10).



Original Auto Radio Control

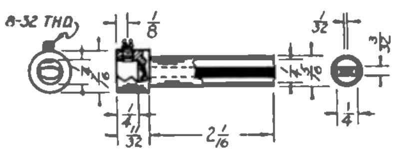


Yaxley Replacement with RS245

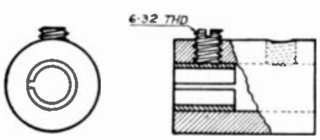
FIGURE 10

RS246 is also for **Auto Radio Controls** and should be used where a tongue-shaped shaft is required.

The tongue is roughly finished because it is often necessary to file this shaft to the desired dimensions. This is easy because of the soft brass material.

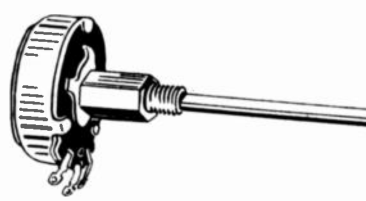


EXPERIMENTERS will find that by inserting the RS246 within an RS245, they can obtain a positive drive in a rotary direction, yet be able to vary the length of the shaft at will. This gives a "push-pull" and rotary motion with one shaft.

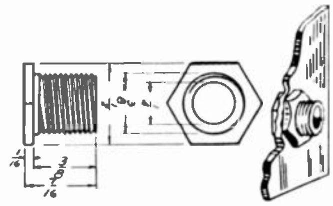


EC240. This is a real shaft coupler. It is very useful to couple two 1/4" diameter shafts, or a 1/4" shaft to a 3/16" diameter shaft. Remember the Yaxley EC240 the next time you have such a problem. Look at the illustration on page 124.

EB247. A necessary accessory where the control must "set back" from the chassis so as to clear a dial or switch. Easy to use. Just screw it on the bushing of a Yaxley control and then install the control. The effective length is 5/8". If necessary, use two. Extremely useful when servicing Philco receivers.



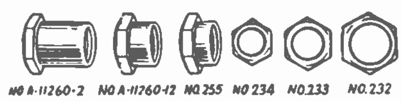
Yaxley Control with EB247



UB241. At last. A universal panel bushing! Now you can easily make that "gadget" for here is the necessary bushing.

NUTS ! ! !

No, we are not sarcastic! We are speaking of "nuts" for controls, switches and other parts. Look at this picture, here is every kind of a standard 3/8" nut that you will **ever** need.



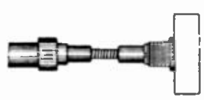
There is the common flat hexagon nut No. 232 as supplied on Yaxley controls. No. 255 nut is for 1/8" panels.

SHORT SHOULDER nut No. A11260-12 for use on medium thick panels and for jacks and other similar parts.

LONG SHOULDER nut No. A11260-2 for those **thick panels.** Will mount a control on a 3/4" **panel.** In addition it may be used as a "safety" to prevent tampering with the setting of a control or switch; just screw it on the bushing with the hexagon end next to the panel. It looks nice, too.

FLEXIBLE SHAFTS

Here IS something. Use them to replace "wire shaft" controls. Use them for your experimental work. Look at the pictures. See the different shaped ends. Look at the Yaxley control fitted with one so as to replace a "wire shaft" control.



Properly used, these shafts will equal or better the life of a "wire shaft" because they are not subject to steel "fatigue."

Made of special rubber compound surrounding a flexible copper wire core and covered with a varnish protected braid, they offer a very low "capacity" coupling between units.

Note: All types of flexible shafts are limited both as to the angle of the center lines of the driving and driven shafts and to the amount of "twist" or torque which may be applied. The illustration (Figure 31) shows the practical limits of these shafts as to angle of operation. The "load" should not exceed 50 "inch ounces" torque, for the least "whip" (which is useless rotation). These shafts will readily operate a dual volume control with a line switch attached, or a light multiposition switch.

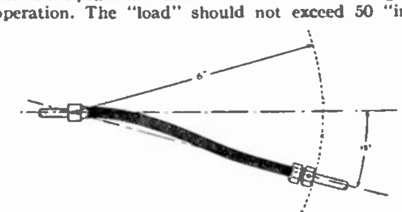
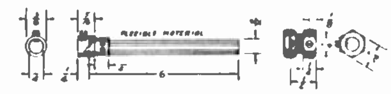
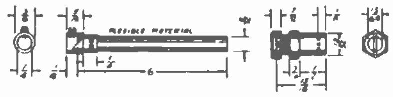


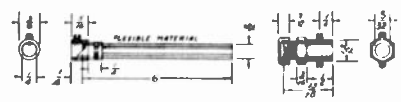
FIGURE 31



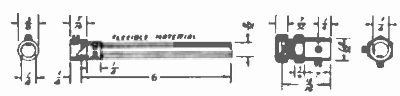
FS250 is for general use, where a flexible coupling is required between two 1/4" shafts.



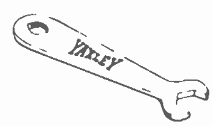
FS251 has a 15/64" diameter hole, 1/2" deep with a transverse pin to be used with a Universal Yaxley control to replace **Auto Radio Controls** having a slotted end on the driving shaft, such as used by Philco on their models 805, 806 and others.



FS252 has a 5/32" diameter hole approximately 1/2" deep and is equipped with two set screws opposite each other. It is for use with the proper Yaxley Control as a replacement for wire shaft controls which are used with a driving shaft having a small diameter round end, such as is used on Philco models D and AC989 (122).



FS253 has a 1/4" diameter hole, 1/2" deep and is equipped with two set screws located at 90 degrees to each other. It is for use with a Yaxley Control, to replace the original wire shaft such as is used on Chevrolet model 364141.



No. 178 Yaxley Volume Control Wrench is for all standard control hexagon nuts.

HARDWARE

Your attention is directed to Yaxley hardware items:

Bakelite head tip jacks and tip plugs.

Bar knobs, Round knobs.

Cable—Plugs, Jacks, Jack Switches—Push Button Switches—Circuit opening switches.

Jewels.

Dial lights—Panel lights.

Many other useful items are all beautifully illustrated and described in the new Yaxley catalogue. Look them over. You will find many uses for them.

SECTION "B" CONDENSERS

THE "HOW AND WHY" OF CONDENSERS

A condenser, or as it is more rightly termed, a capacitor, **consists of two conducting plates separated by a nonconducting medium called the dielectric.**

The popular explanation of a condenser **is**, that it **is an electrical device capable of storing a charge of current** when voltage is applied to its terminals. **Applying direct current to the condenser establishes a static charge** in the dielectric, the voltage of which is of opposite polarity to that of the charging or applied voltage. **The value of the static charge rises until the voltage is equal** to the **charging voltage. When this point is reached the charging voltage is opposed by the voltage of the electrostatic charge in the condenser, and there can be no further "flow" of current unless THE CHARGING VOLTAGE EITHER RISES OR FALLS.**

Let us see what happens when the applied voltage rises or lowers in value in respect to the voltage of the established electrostatic charge:

First—**If the charging voltage rises above the electrostatic voltage, additional current will "flow" through the condenser** until the electrostatic voltage again equals and opposes the applied voltage.

Second—**If the applied voltage falls below the voltage of the established electrostatic charge, CURRENT WILL FLOW FROM THE CONDENSER INTO THE CIRCUIT** until the electrostatic voltage again equals the applied voltage.

SUMMARY OF THE ACTION TAKING PLACE IN A CONDENSER

1. An electrostatic charge is established equal to, but of opposite polarity of the applied voltage.

2. Any rise of applied voltage causes the current to flow from the circuit into the condenser; i. e., "through" the condenser, and any fall in the applied voltage causes current to flow from the condenser into the circuit.

This is a clear explanation of the action of a condenser, especially so where it is used for filter circuits.

ELECTROLYTIC CONDENSERS

Condensers are classified according to the nature of the dielectric medium employed in their construction. Thus—**an oil condenser** is one in which oil is used as the dielectric; **an air condenser** is one in which air is used as the dielectric; **a paper condenser** is one in which paper is used as the dielectric.

From the description of the terminology applied to condensers, one might suppose that the **electrolytic condenser** uses an electrolyte—as the dielectric. This supposition, however, is inaccurate in that the electrolyte used in the electrolytic condenser is not the actual dielectric material but is one of the conducting "plates."

The dielectric material, or medium, in the electrolytic condenser consists of an extremely thin oxide "film" which is formed on the surface of the condenser anode or positive plate.

The nature and composition of the film which forms the dielectric in an electrolytic condenser is not definitely known. The formation and action of this film is understood and can be explained in rather simple terms.

It is a peculiar characteristic of aluminum and a few other metals that when they are immersed in certain electrolytic solutions, or electrolytes, and a current passed through the metal and electrolyte to another electrode, **a non-conducting film will be formed on the metal which will oppose the flow of current.**

Thus, if we take two pieces of aluminum and immerse them in a suitable electrolyte and pass a current from one plate to the other, the current will be very high when first applied, but it will taper off until there is little, if any, current flowing in the circuit. This is termed "forming," which means the establishment of a film upon the surface of one of the plates. In the case of aluminum, **the film is formed on that plate to which the positive wire is connected.**

The formation of the film on the plate retards the flow of current. If the polarity is reversed; i.e., the polarity of the charging voltage, current will flow. Thus we see that the **"film" acts as an insulator only as long as we maintain the same polarity as was used in forming.**

CAPACITY OF A CONDENSER

Capacity is the term applied to a condenser which **indicates the ratio of the quantity of the electrostatic charge, to the voltage.** The quantity of the charge in a condenser is expressed in coulombs, or, as it is usually expressed: $Q = C \times V$. Where Q is coulombs, **C is capacity in farads**, and V is voltage, which gives us the fundamentals for stating that the capacity is equal to the quantity divided by the voltage, or $C = \frac{Q}{V}$

The capacity of a condenser is dependent upon:

First—The area of the plates.

Second—The thickness of the dielectric.

Third—The "Dielectric Constant."

The "Dielectric Constant" of a material is the ratio of the capacity of a condenser using this material, to the capacity of a condenser of equal plate area, but using air as the dielectric. The usual formula for "Dielectric Constant" is $K = \frac{Cs}{Ca}$

Where Cs is the capacity with the dielectric in question, Ca is the capacity when using air as the dielectric, and K is the "Constant."

The "Dielectric Constant" of a material is not constant in value, but varies with the frequency of the applied current, moisture content, temperature, voltage applied, and other factors.

The dielectric constant of the "film" in an electrolytic condenser varies with the "forming voltage." Thus—for equal plate area, **a condenser "formed" at low voltage will have a higher capacity than one of the same area formed at high voltage.**

Another characteristic of the electrolytic condenser film **is** that it is **dependent upon the composition of the electrolyte**, inasmuch as the composition of **the electrolyte determines the maximum voltage at which the film can be formed or maintained.** Thus, if an electrolyte is said to be a "400 volt electrolyte," the meaning is, that if more than 400 volts is applied to a condenser using this electrolyte, the film will be punctured though not necessarily damaged. **This is the reason why, when electrolytic condensers are rated at "525 volts surge," it means that 525 volts is the maximum momentary voltage which can be applied to the plates without puncturing the dielectric film.**

A characteristic of electrolytic condensers is that **a constant DC voltage when applied aids in maintaining the dielectric film, and because the film is not perfect, there will be a small amount of current continuously flowing through the condenser. This current is called the "leakage current," and for a good electrolytic condenser, it is very small.** The value of the **leakage current is determined by the condition of the film on the plate and the length of time it has been without a polarizing voltage; i. e., "on the shelf."**

DRY ELECTROLYTIC CONDENSERS

In general, there are **two types of electrolytic condensers:** the **"WET TYPE,"** which uses a liquid electrolyte, and the **"DRY TYPE"** which uses a "PASTE" electrolyte.

The **"DRY"** electrolytic condenser possesses many **advantages. They will not spill or leak, may be mounted in any position, and in any type container.** For instance, a cardboard carton. In addition, it is **not necessary to provide for the escape of gas, a costly and inconvenient factor.**

NECESSITY OF ELECTROLYTIC CONDENSERS

Previous to the development of high voltage "DRY" electrolytic condensers, the general design of radio receivers and amplifiers was considerably below present standards, due to the fact that completely filtered plate voltage supplies were practically unknown. This is obvious because:

(a) The terriffic expense of the necessary high capacity for filtering, if paper condensers were used, or—

(b) The restricted mounting and unsightly appearance of the early wet electrolytic condensers.

The lack of pure direct current for plate voltage supply caused serious difficulties with hum. In order to obviate this condition, it was necessary to deliberately design the receiver or amplifier, so that frequencies below 130 cycles would be "cut-off" and would not appear at the loud speaker. Note that the principal "hum frequency" is twice the frequency of the supply voltage; i. e., 120 cycles for a 60 cycle supply current (except on a half-wave rectifier where the hum frequency is 60 cycles). This "cut-off" of the all-important "Bass" notes meant that music would sound "shrill and tinny."

The introduction of the "Dry Electrolytic Condenser," with its numerous advantages, meant that here was a low cost, compact condenser of high capacity which would **allow perfect filtering of the "B" supply current.** Thus, with pure "DC" plate supply, the way was open for the design of **receivers having high fidelity of response,** as it was no longer necessary to "cut-off" the bass notes in order to prevent hum.

CONDENSER CIRCUIT ACTION

There are **two main uses for Electrolytic condensers; the first and most important is in "Filter Circuits,"** which are used to convert pulsating direct current into a smooth "DC" plate supply.

The second is as "By-Pass" units. In audio frequency circuits, this generally calls for a much higher capacity in relation to the voltage than is encountered in filter circuit work. However, **the low voltage, high capacity electrolytic condenser is very small in physical size.** In addition it is often used to "by-pass" very low values of resistance, which requires a very high capacity value. **The high ratio of capacity to physical size** of the low voltage electrolytic condenser, is of great advantage, in that **it allows the use of the proper capacity value without requiring too much space.**

It is imperative that servicemen, as a group, should know more about condenser circuit action, because **this knowledge will enable them not only to make a quick and easy repair,** but also to diagnose those troublesome cases involving condensers and their actions upon associated circuits.

Because of the universal use of electrolytic condensers in filter circuits, and also because the filter circuit is of much more importance than the by-pass type of circuit, we will first discuss **the action of filter circuits.** Before entering upon this discussion, it will be best to have an **understanding of the different types of current which require "filtering."**

RECTIFIERS

The usual current to be "filtered," is obtained by rectifying a high voltage alternating current. There are a number of different types of rectifiers. For high voltage "B" supply, the thermionic rectifier tube is universally used.

There are two types of rectifier circuits—"half-wave" and "full-wave."

HALF-WAVE RECTIFIER

We will first discuss the "half-wave" rectifier.

Figure 1 illustrates the connections of a "half-wave" rectifier. This circuit is seen to consist of a transformer and half-wave rectifier tube. The transformer serves to supply the necessary high voltage alternating current. One side of the high voltage winding connects to the plate of the tube and the other side to ground. The filament of the tube is lighted by the current obtained from the low voltage winding on the transformer. The high voltage winding of the transformer, as previously mentioned, supplies an alternating current. **By alternating, we mean that the polarity, or direction of current flow, reverses itself periodically.** First one side of the transformer is positive, then the other. The voltage will rise to a peak and then fall to zero, at which point the polarity reverses; i. e., the side which was positive will now be negative, and the voltage will again rise to a peak value and fall to zero. **This completes one cycle of the current.**

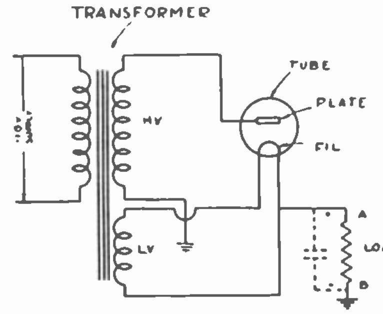


FIGURE 1

The general frequency of supply current is 60 cycles per second.

Figure 2 shows the voltage applied to the plate during the half-cycle wherein the plate is positive in respect to ground.

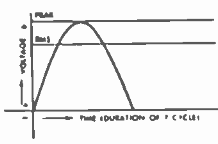


FIGURE 2

Notice that the voltage gradually rises to a peak value and then falls to zero. If we should connect a voltmeter across the transformer it would not indicate the peak value, but rather the **"RMS" value, which means—the root mean square voltage applied to the plate of the tube.**

The action taking place in the tube follows: When the plate is positive, electrons are attracted from the filament. The electrons flowing from the filament to the plate constitutes a current, the value of which depends on the voltage applied to the plate. Therefore the current is seen to rise and fall with the voltage applied to the plate. **When the plate of the tube is negative in respect to the filament, there can be no current flow** because the plate must be positive in order to attract electrons from the filament.

Figure 3 shows that during two cycles the plate will be positive for certain periods of time and negative for equal periods.

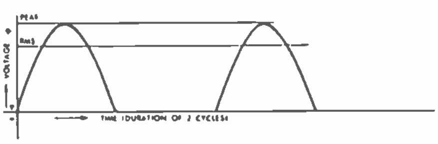


FIGURE 3

From our previous explanation of the action in the tube, and from Figure 3, we see that during two cycles of the supply voltage, the tube will deliver current for two periods of time, which is equal to the length of time during which the plate is positive, and that there will be a lack of current during two periods of time in which the plate is negative. Thus—we see that **for a half-wave rectifier we will have regular periods of current flow, each of which is followed by a period of time during which no current flows.** This, of course, is far different from the steady "Direct Current" plate supply, which is required to give successful operation of a radio receiver. A voltmeter connected across points "A" and "B" of Figure 1 would show the **average voltage** existing across the load connected to points "A" and "B." **This average voltage would be far below the RMS voltage supplied by the transformer, because of the periods of time during which there is no current flowing in the circuit.**

Now, if by some means we could provide a reservoir, which would absorb current during the periods of current flow, and then "feed" this stored current into the circuit during the periods when current is not flowing from the tube into the circuit, we would be able to raise our average voltage across the load. We would, in effect, have a more continuous flow of current and therefore a higher "average" voltage across the load. **A condenser provides just such a reservoir,** and when connected across the load as in Figure 1, it will act exactly as the imaginary reservoir action described.

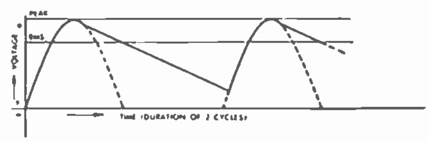


FIGURE 4

Figure 4 is a graph of the voltage across the load resistor shown in Figure 1, as plotted on the basis of time. **The two heavy and dotted curves** show the voltage supplied by the tube, and **the slanting line** shows the voltage which would be supplied to the circuit by a condenser connected from points "A" to "B." Notice that this condenser will act exactly as was described in the chapter headed "The How and Why" of Condensers. It will discharge current into the circuit during the period of time, where**in the charging voltage is falling,** and that this discharge continues, until the condenser is either entirely discharged or until a charging voltage is again applied to the circuit by the rectifier tube.

Inasmuch as the quantity of current is determined by the amount of load, it is easy to see that **a very large condenser would be required to totally "fill in," or supply voltage to the circuit** during the entire period of time in which the rectifier tube plate is negative.

In order to further smooth out the current, it will be necessary to provide some means whereby we can "hold down" the peaks, so that we may take full advantage of the action; i. e., **the "holding up" or maintenance of current** supplied by the condenser. Before going into this matter, we will first discuss the **"Full-Wave" rectifier.**

FULL-WAVE RECTIFIER

The full wave rectifier operates in exactly the same manner as the half-wave rectifier, with the exception that **the full-wave rectifier enables us to use both halves of each cycle of current.**

It was pointed out and carefully explained **in the description of the half-wave rectifier, that current flowed for a certain length of time and then was absent for an equal length of time,** due to the second half of the cycle being of reversed polarity. However, **the full-wave rectifier enables us to use the other "half" of the cycle, or, it enables us to "fill in holes"** which exist in the output of the half-wave rectifier.

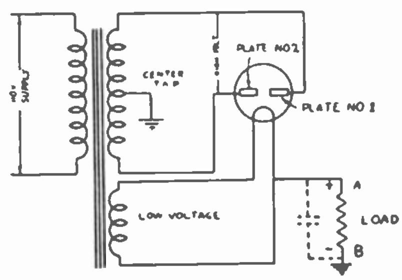


FIGURE 5

Figure 5 shows the circuit of a full-wave rectifier. This circuit consists of a transformer which supplies the high voltage, to be rectified, and the low voltage for lighting the filament of the rectifier tube. **Note that the high voltage winding is tapped at its center.** This center tap of the transformer provides a return path common to both sections of the high voltage winding.

The high voltage winding is arranged to supply a voltage between the two ends of the winding, which is twice the value of the voltage required across the load. **The reason for this is that only half of the winding is used at a time;** therefore, each half of the winding has to supply the desired output voltage.

Notice that the tube shown in Figure 5 has one more plate than the tube shown in Figure 1. However, the tube action is identical. Thus—**current will flow from the filament to that plate which is positive, but not to the plate which is negative.**

For explanation, **let us assume that plate No. 1 is positive.** Therefore, **plate No. 2**, since it is connected to the other end of the high voltage winding, **is negative. Current will flow** from the filament to plate No. 1 (but not to plate No. 2), and complete the circuit by leaving the center tap and going through the chassis and load, back to the filament. We will call this the "First Action."

In our previous study of the half-wave rectifier, it was pointed out that **the current and voltage rises, to a peak, and falls to zero and reverses polarity,** rises to a peak and again falls to zero, to complete one cycle. Therefore, in the "First Action," the voltage across the load (because of the current flowing through the plate No. 1), will gradually rise to a peak and then fall to zero. This is shown in Figure 6.

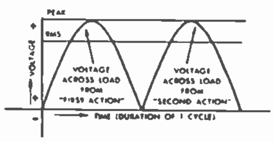


FIGURE 6

Remember that when the current supplied by the transformer reaches zero, the polarity reverses. Therefore, for the "Second Action," plate No. 2 of the rectifier tube, in Figure No. 5, will be positive and plate No. 1 will be negative.

Now, as the voltage rises and falls on plate No. 2, there will be a current flow from the filament of the rectifier tube to plate No. 2, and from the center tap of the high voltage winding through the chassis and load, back to the filament, thus completing the circuit.

The voltage across the load will gradually rise and fall. **It flows in the same direction as the current obtained in the "First Action." Therefore, the voltage across the load will rise and fall in the same manner and with the same polarity as that obtained by the "First Action."** This is shown in Figure 6.

By the use of a full-wave rectifier, we have a MORE CONTINUOUS CURRENT FLOW," or in other words, we have "filled in the holes" which we found to exist in the current supplied by the half-wave rectifier. **This means that we will not have to depend upon an extremely large condenser to maintain the flow of current in the load.** In the discussion of the "Half-Wave" rectifier, it was pointed out that the condenser would supply current to the load during the period of time when the voltage, from the rectifier, was "falling."

Refer to Figure 6 and note that we have a period of time, between each half cycle of the supply current, during which the voltage falls to zero. If a condenser is connected across the load, it will discharge current through the load as soon as the applied voltage starts to "Fall," and it will continue this discharge of current until its voltage falls to zero, or until the condenser voltage is opposed by the rising voltage of the second half of the cycle.

Figure 7 shows the meeting point between the discharge of the condenser and the increasing "charging voltage" of the second half of the cycle of current supplied by the rectifier.

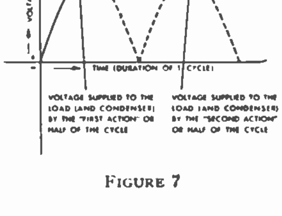


FIGURE 7

Compare the shape of the curve, illustrating the DC voltage existing across the load resistor, in Figure 6, with that of Figure 2, **and note that we have twice the number of peaks of current per cycle of the supply current. It will require less capacity to "smooth out" the current delivered by the full-wave rectifier than is required by the output of the half-wave rectifier. This is due to the fact that there are more "impulses" of current in the same length of time.** A **condenser of a given capacity will maintain a higher voltage level, in the load, with a full-wave circuit, than in the case of the half-wave rectifier circuit, because it needs supply current for much shorter periods of time between impulses of current.** This is evident if you will compare Figure 7 with Figure 4.

The pulsating current obtained from a rectifier, even with a condenser connected to the circuit, **is not suitable for "B" supply** in a radio receiver or amplifier, **because the remaining pulsations or ripple would still give rise to a very strong and objectionable hum** in the loud speaker.

Increasing the capacity of the condenser connected across the load, at the output of the rectifier, will not decrease the hum below a certain value, inasmuch as **the "charging voltage" applied to the condenser must fall to a certain extent before the condenser discharges its current into the circuit. Likewise, the "charging voltage" must rise to a certain extent before it can begin to replenish the charge in the condenser.** Thus—we see that **we can reduce the "amplitude,"** which means the height from the lowest to the highest point of the **voltage variation, or ripple, by the use of a condenser, but that above a certain value of capacity, depending upon the load and frequency of the supply voltage, there will be no further reduction in the amplitude of the ripple in the current supply. It will be necessary to use some means,** in addition to the condenser, **to entirely eliminate the ripple** from the supply voltage, in order that there may be a pure direct current for use in either the receiver or amplifier. The most convenient means of doing **this is by the use of a "choke."**

ACTION OF CHOKES

The word "CHOKE" is applied to a piece of equipment properly termed an "Inductor." An "Inductor" is a piece of apparatus having an electrical property which is termed "Inductance." **"Inductance" "Opposes" any sudden INCREASE of Current through an inductor, and "Delays" any Sudden Decrease of current through an inductor.**

The explanation of the action which causes the property of inductance follows:

Any conductor carrying a current has a magnetic field at right angles to the longitudinal axis of the inductor. **This magnetic field extends radially outward** from the conductor, **a certain distance, depending upon the intensity or amount of current flowing in the conductor. If the current** through the conductor **is increased, the magnetic field will expand. If the current is reduced, the magnetic field will contract.** Thus, we have a "Moving Magnetic Field," **the direction and speed of motion of which is determined by the "Rate" of increase or decrease of current in the conductor.** NOTE—There is no "motion" when the current is flowing at a steady rate.

A fundamental law of electricity is **"when a moving magnetic field 'cuts through' a conductor, there will be a voltage induced in the conductor, the polarity of the inducted voltage depending upon the direction of motion of the magnetic field."** If we take a straight conductor and coil it, we will have an arrangement whereby **if we "increase or decrease" a current flowing through the coiled conductor, we will have a "moving magnetic field,"** which, due to the proximity of turns, **will "cut through" several conductors;** i. e., adjacent turns of the coil. **If we increase or decrease the current flowing through a coil of** wire, **we will have a "self induced" current** in the coil **in addition to the "applied or driving" current. This "induced current" is of opposite polarity** to the "applied or driving" current. Therefore, AN INCREASE OF CURRENT THROUGH AN INDUCTOR IS OPPOSED BY THE SELF-INDUCED CURRENT IN THE COIL, WHICH IS USUALLY CALLED THE "COUNTER-ELECTROMOTIVE-FORCE."

In line with this explanation of the action taking place during **an increase of current**, it is easy to see that A DECREASE IN CURRENT WILL GENERATE A COUNTER-ELECTROMOTIVE-FORCE WHICH WILL OPPOSE THE DECREASE IN CURRENT.

The amount of inductance in a coil of wire is dependent upon the number of turns and the nature of the material used for the core. Air is the poorest material, in that it is not a good magnetic conductor. **If we use an iron core, the inductance will be much higher,** because iron is an excellent magnetic conductor.

In the discussion of rectifier circuits, it was pointed out that it was necessary to find some means of "holding down" the peaks of the ripple in the current supplied by the rectifier, so as to obtain a steady flow of current for use as "B" supply in a receiver or amplifier; therefore, it appears that an inductor or choke is ideally suited for this action.

BASIC FILTER CIRCUIT ACTION

At this point we are ready to describe the action taking place in **a "filter" circuit;** i. e., a circuit **composed of capacity and inductance** which will "smooth out" the pulsating current delivered by a rectifier; into the smooth pure direct current necessary for "B" supply. Figure 8 shows the connections of the iron cored inductor "choke," and two condensers which comprise the simplest and basic type of filter circuit.

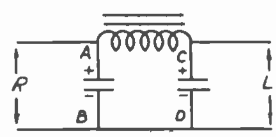


FIGURE 8

The letters "R" and "L" in Figure 8 indicate respectively, the rectifier and load. **The condenser at the "Input"** has the same action upon the circuit as the condenser described in the chapter on rectifiers. This condenser **acts as a reservoir to supply current to the load during the zero current periods** in the current supply from the rectifier.

The choke in the circuit of Figure 8 **opposes any sudden increase or decrease of current** because of its inductance.

At this point in our explanation, we have a current supplied to a load ("L" in Figure 8) through a choke which opposes and prevents any sudden increase in the current, and we have a condenser at the rectifier output which will supply current when the rectifier can not. **Thus, the choke prevents the "peak of the ripple" from getting into the load, and the condenser "fills in the hollows" in the supply.** Or, we may explain the action up to this point by saying that **we have reduced the "amplitude" of the "ripple" in the current.**

Inasmuch as the choke prevents any sudden increase in current, or in other words, maintains a steady current flow, **it is necessary to provide a means of supplying current to meet any sudden demand** for current **made upon the filter. Without such an "auxiliary" current supply, we would be forced to "wait" for an increase of current to come through the choke.** We have in reality, a need for a "reservoir," and in the chapter "THE HOW AND WHY OF CONDENSERS," we learned **that a condenser is just such an "electrical reservoir."** Therefore, we see **the reason for the condenser across the load side of the filter circuit** shown in Figure 8.

Due to the fact that all chokes have more or less resistance (because of the natural resistance of the wire used to wind them), **there is a voltage drop across the choke which subtracts from the effective voltage useful for plate supply.**

In addition to a tube requiring a plate voltage, it also requires a negative bias voltage which is applied to the grid. If we can obtain both our plate and bias voltages from the "B" supply, or, in simpler words, make full use of the voltage from the "B" supply, we will be effecting an economy.

Inasmuch as the bias voltage must be negative in respect to the cathode of the tube, we can easily accomplish the action of obtaining both our "B" and "C" "bias" voltages in the following manner:

Due to the fact that it is convenient and economical to use the chassis as the negative side of the circuit, **it is possible to insert a resistance, between the center tap, of the high voltage winding on the power transformer, and the chassis. This will make the center tap of the transformer negative in respect to the chassis.** If we connect the cathode, or filament center tap of our tubes directly to the chassis, and connect the grids to the center tap of the transformer, **the grid will be negative, in respect to the cathode, by the amount of voltage drop obtained across the resistance.**

The voltage drop obtained across the resistance, as outlined in the previous paragraph, is caused by the current in the "load;" i. e., the sum of all the plate currents and "bleed" currents of the receiver. The voltage drop across the resistance is equal to the current times the resistance. For any given current, **we can obtain any desired negative voltage by selecting the proper value of resistance.**

Before proceeding further on this phase of the use of the choke in the negative side of the circuit, we wish to point out that it is not the only reason for placing the choke in the negative lead, inasmuch as there are other considerations in certain designs. Because bias voltage is the usual reason for using the choke in this position, we shall proceed with a further explanation of this usage.

The introduction of the dynamic speaker enabled designers to "kill two birds with one stone," in that **the dynamic speaker could be used as the choke.** Inasmuch as the magnetic circuit of the field in a dynamic speaker must necessarily include a "gap" (for the movement of the voice coil), we have the makings of a choke, as we have a coil of wire on an iron core, and the core is provided with an air gap. **The use of the field of a dynamic speaker as a choke is economical as the saving in the cost of the choke offsets part of the cost of the speaker.**

An additional advantage, is that inasmuch as the field of the speaker requires several watts for its proper excitation, there will be considerable voltage drop across it.

If the speaker field were placed in the positive lead, the voltage drop across the field would be subtracted from the voltage available from the rectifier, which voltage of course, would have to be raised to offset this. In addition, if a separate voltage dropping resistor were used, either at the tube or in the negative lead to the transformer, to secure the necessary bias voltage, the rectifier output voltage would of necessity have to be large enough to include this voltage. **What could be more natural than to utilize the voltage drop across the field as the bias voltage, and thereby make a saving in the power transformer?** The result of this is the use of the field in the negative lead; i. e., between the chassis and center tap of the power transformer.

Figure 13 shows the simplest type of filter circuit wherein the choke is in the negative lead.

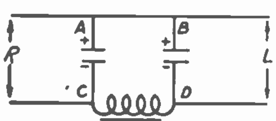


FIGURE 13

Because the same filtering action can be obtained with the choke in the negative lead as is obtained with the choke in the positive lead, we can expect to find the same types of circuits as previously described, with the chokes in the negative side of the circuit instead of in the positive. See circuits 4, 5, and 26 on pages 142 and 143.

Due to the fact that the wattage required to be expended in the field coil may not be of such a value as to give a convenient voltage drop, it is sometimes necessary to adopt the expedient shown in Figure 14.

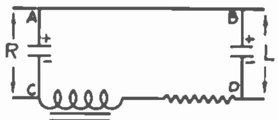


FIGURE 14

Here we see the same circuit as shown in Figure 13, **except that there has been a resistance added in series with the choke; i. e., the field coil; in order that the voltage drop between the load and rectifier may be sufficient for use as bias voltage.** It is of no great importance as to which side, of the choke, the resistor is connected, inasmuch as the resistor offers an "impedance" to the ripple voltage, the same as would an inductive "reactance" of the same ohmic value. In case the voltage drop across the field is too great, a divider network is placed across the field so as to tap off the desired voltage.

RESONANT ELEMENT FILTER CIRCUITS

Our discussion to this point has been confined to the type of filter circuit vulgarly known as the "Brute Force" type. However, there is another type of filter circuit wherein use is made of a resonant circuit.

Such a "resonant circuit" type of filter circuit is shown in Figure 15.

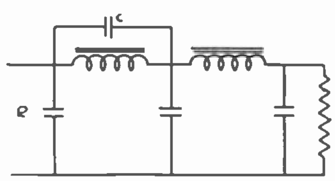


FIGURE 15

The circuit shown in Figure 15 is practically the same as that of Figure 11, **with the exception of the small condenser C which is shunted across the first choke.**

The capacity of the condenser "C" is so chosen that it "tunes" the choke to resonance with the "hum frequency." The result of tuning this choke is that **a tuned circuit of this type offers a very high "impedance," or more simply, "opposition" to the hum frequency.** The action of this tuned circuit is often described by saying that **it "absorbs" the particular alternating current,** in this case, the ripple current, **which is applied to it.**

The "tuned choke" type of filter circuit is nearly always used with the full-wave type of rectifier, although it is possible, but not convenient or advisable, to use it with the half-wave type of rectifier.

It is well to point out that all filter circuits described have been of the "Low Pass" type; i. e., CIRCUITS THAT WILL PASS ALL FREQUENCIES BELOW A CERTAIN VALUE and prevent all frequencies "above" this certain value from passing through the circuit.

The "cut-off" point; i. e., the frequency below which the filter is ineffective, must be below the frequency of the hum voltage, or ripple, and in good design, it should be below the lowest frequency which will be handled by the audio amplifier receiving "B" supply current from the circuit. In addition, it is very important that the resonant frequency of the filter circuit should not be the same as the frequency of the supply current fed to the transformer.

In addition to the low pass type of filter circuit, **there is a "high pass" filter ci[illegible]; i. e., one which prevents the pass[illegible] of [illegible] frequencies BELOW the "cut-off" point, but ALLOWS THE PASSAGE OF ALL FREQUENCIES ABOVE THE CUT-OFF POINT.**

A combination of the high pass and low pass filter would be most effective for use as a "B" circuit filter, **provided that the cut-off point of the high pass filter is ABOVE the ripple frequency and the cut-off point of the low pass filter is BELOW the ripple frequency.** The most effective arrangement of such a combination circuit would be to have the high pass filter between the rectifier and the low pass filter.

An "absorption" type of filter next to the rectifier is shown in Figure 16.

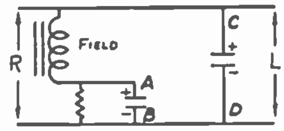


FIGURE 16

In this circuit **the field coil of a speaker is used as the inductance, which with the capacity of the series condenser, resonates at the ripple frequency. Inasmuch as it is a "series resonant" circuit, it offers a short circuit for the ripple frequency current.** This current is not suitable for use as a field supply. The resistor is shunted across the condenser in order to provide a path for the necessary DC current.

The resistor is of a much higher value than the value of the capacity reactance of the condenser at the frequency involved. The resistor does "broaden the peak of resistance" of the circuit and this offsets any slight discrepancy in capacity value of the condenser.

Figure 17 is a more practical, although more expensive, method of using a resonant circuit in a filter.

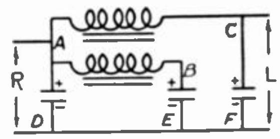


FIGURE 17

This circuit shows the use of an inductance and an electrolytic condenser, **the sole purpose of which is to "short circuit" the hum frequency.** In some instances, the two chokes shown in Figure 17 are in reality two windings on a common core. In other words, a transformer. There is a simpler and less expensive way of obtaining the same action. This method is shown in Figure 18.

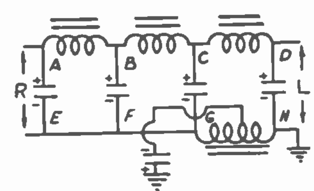


FIGURE 18

The portion of the circuit in which we are interested in Figure 18, is the tapped choke in the negative lead. **Note the condenser connected between the chassis and the tap on the choke. The action taking place in this circuit follows: The tapped inductance acts as an auto-transformer, the primary of**

which is the whole winding, as the secondary is the circuit formed by a portion of the winding and the condenser connected from the tap to one end (through the chassis) of the winding. The "resonant period" of this "tuned secondary" is equal to the disturbing ripple, and therefore, it appears as a short circuit to the ripple frequency, which means that the energy of the ripple frequency is expended in this circuit.

Before taking up the more complex rectifier-filter circuits, we wish to call your attention to the fact that under certain conditions a resistor may be used in place of a choke in a filter circuit. This is shown in Figure 19.

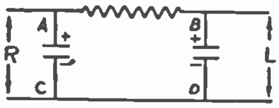


FIGURE 19

This circuit is seen to consist of a resistor and two condensers arranged in the same manner as the simplest and the first described filter circuit. **This type of circuit is not nearly as efficient as one using a choke.** It is much cheaper, as there is a large difference in cost between the price of a resistor and that of a good choke.

The action in this circuit is rather simple, in that **the resistor sets up a voltage drop in any current passing through it,** the voltage drop being determined by the current flowing through the resistor. **For use as a filter, there will be a greater voltage drop in the direct current than there will be in the ripple current, because of the fact that the DC current is greater than that of the ripple current,** or, we might state that the DC voltage applied to the resistor is much greater than the ripple voltage. **It will require a rather large resistor to give appreciable drop in the ripple current flowing through the resistor, and for this reason, such a circuit can not be used except where the load on the filter is small.** An additional disadvantage is that large capacitors must be used with such a circuit.

We now have a complete circuit consisting of a transformer, rectifier and filter, which enables us to draw a pure DC current from an alternating current source or supply. The true picture is not nearly so "rosy" as one might be led to believe by the description presented thus far. There are a number of factors which limit the efficiency of the various parts of our circuit, particularly the filter.

FILTER COMPONENT LIMITATIONS

In order to present a clear picture of the action of a filter circuit, we have deliberately avoided the introduction of any of the limiting factors which must be considered in the design, application and repair of a filter circuit, or parts thereof.

First, let us consider the limitations of our choke. A serious limitation in the action of a choke is that **if too large a current is passed through it, the core material will become "saturated;"** i. e., it cannot absorb or carry but a limited amount of magnetic lines of force. **When this point is reached, a sudden increase of current will be unopposed** because the magnetic field cannot increase. **There is a method of preventing this "saturation," and that is to leave a "gap" in the core.** This is a limited blessing, for, although the gap will prevent, to a certain extent, **"saturation" of the core, it also reduces the "inductance"** of the choke, which means that the "smoothing effect" of the choke will be reduced. Here we have a choice between two evils—**one of which is loss of inductance, and the other—loss of current capacity.** We can secure some relief from the former by increasing our condenser capacity. There is a sharp limitation even to this.

FIGURE 9—MALLORY DRY ELECTROLYTIC CONDENSER VOLTAGE RATINGS

DC Operating Volts	Maximum Surge	Maximum Peak AC Ripple Voltage at 120 Cycles							
		Mfd. 1-3	Mfd. 4-5	Mfd. 6-9	Mfd. 10-12	Mfd. 13-16	Mfd. 17-25	Mfd. 26-35	Mfd. 36-50
25	40	10	10	10	10	10	8	8	5
50	75	15	15	15	15	10	8	8	5
100	150	25	20	20	20	15	10	8	5
150	200	25	20	20	20	15	10	8	5
200	250	30	27	25	20	15	10	8	5
250	300	30	27	25	20	15	10	8	5
300	350	30	27	25	20	15	10	8	5
350	400	30	27	25	20	15	10	8	5
450	525	30	27	25	20	15	10	8	5
475	525	30	27	25	20	15	10	8	5
500	525	30	27	25	20	15	10	8	5

In our discussion of a condenser and its action, we have thus far omitted any reference to its limitations. One of these is resistance, which causes loss of power and heating of the condenser if it is not considered.

The effect of resistance in an electrolytic condenser is that it limits the amplitude (voltage variation) of the ripple which can be applied to the condenser. Remember—that this ripple must "flow through" the condenser, because it is an "increasing and decreasing" or alternating current.

Figure 9 is a table which gives full information on this subject.

SURGE VOLTAGE

When first turned on, many radio receivers and amplifiers develop an unusually high "surge" voltage across the filter circuit, because there is little, if any, load on the filter. This is especially true where heater type tubes are used, with a rectifier of the filament type.

In order to explain the effects of surge voltage, and the reason that it is a limiting factor in the use of electrolytic condensers, it is necessary to familiarize yourself with the chapter entitled "The How and Why" of Condensers.

In this article it was pointed out that an electrolytic condenser is limited in the amount of voltage which may be impressed upon it because of the puncturing of the dielectric film on the plate when the voltage exceeds the limitations imposed by the electrolyte. **The voltage at which the film of an electrolytic condenser starts to puncture is called the surge voltage. The highest value generally obtained is approximately 525 volts.** (Be sure to read "Mallory Replacement Condensers and Accessories", page 145).

Electrolytic condensers are correctly rated as follows:

Working voltage, 450; "Surge" voltage, 525.

The meaning of this is that **the condenser is designed to work continuously at a DC potential of 450 volts. Superimposed upon this is of course the ripple voltage. Figure 9 gives the practical limit for the ripple voltage** which may be applied to different electrolytic condenser ratings.

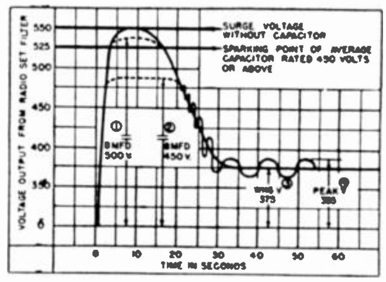
The term "Peak Voltage" is relatively unimportant but refers to the total of the DC working voltage plus the AC ripple safe for continuous operation. This term is often misused for "Surge Voltage."

The "Surge Voltage" is usually considered the maximum voltage that may be applied to the unit through some limiting resistance for a few seconds without damage. Continuously applied, it will generally ruin an ordinary condenser in a short time, because of the development of heat within the unit.

Few dry electrolytic condensers will withstand a surge greater than 525 volts. **You will note in Figure 9 that the 450, 475, and 500 volt DC ratings** all carry the same surge rating. **For this reason it is possible to replace 475 and 500 volt units with 450 volt Mallory units as far as the surge is concerned. We recommend this practice as long as the surge does not exceed 525 volts and the continuous working voltage does not exceed 450 volts.**

MALLORY CONDENSERS OF THE 450-VOLT RATING HAVE BEEN PURPOSELY DESIGNED TO SOMEWHAT LIMIT THE SURGE VOLTAGE AT THEIR TERMINALS. THE LEAKAGE CURRENT CHARACTERISTIC OF THESE UNITS IS SLIGHTLY HIGHER THAN WHAT MIGHT BE EXPECTED BY COMPARISON WITH MALLORY 250-VOLT CONDENSERS. THE SPECIAL PROCESS INVOLVED PROVIDES A MAXIMUM OF USEFULNESS FOR GENERAL REPLACEMENT SERVICE. RELATIVELY HIGH LEAKAGE AT VOLTAGES ABOVE THE WORKING VOLTAGE IN THIS CASE IS THEREFORE TO BE DESIRED.

Apparently, some manufacturers used 475 or 500 volt units in original equipment rather than 450 volt units, believing this would reduce field trouble from surges. **As a matter of fact, the 450 volt units are no more likely to break down from surges than the higher voltage units as they draw more current past their rating and help to hold the surge down.** This is clearly shown in Figure 9A.



Figs. 1 and 2 show how leakage of condenser regulates the surge voltage—note that surge with 450-volt condenser is greatly reduced. Excessively high working voltage ratings do not necessarily mean added safety

FIGURE 9A

MEASURING SURGE VOLTAGES

The best practical way to make this measurement is to disconnect all filter condensers and install a 1 mfd. paper condenser, at the output of the rectifier. A 1,000 ohm per volt meter applied at the paper condenser terminals, **will then indicate the voltage applied to the condensers during the heating cycle of the tubes. BE SURE THAT THE TUBES ARE COLD AND THE METER IS ATTACHED BEFORE THE SET IS TURNED ON. The maximum swing of the meter may then be taken as the maximum surge.** The paper condenser may be connected to the terminals of the voltmeter if this is more convenient.

It will pay you to make this measurement where high surges are suspected **as this initial surge affects all the filter sections.**

Surge voltage should always be measured wherever the line voltage is high; i. e., above the standard level of 110 volts, as **in many localities the line voltage may rise to 125 volts or more.**

Many servicemen are of the opinion that it is not necessary to measure the surge. This impression has probably been gleaned from statements that "it is not necessary to measure the surge." Following the above reasoning, "it is not necessary to look to see if the train is coming." However, just as with surge, it is the safest thing to do.

Obviously, where the ordinary type of condenser is used, the speaker plug should never be removed while the set is on as this removes all load and may damage the first filter condenser. If there is a possibility of this happening, as on amplifiers, we suggest the use of Mallory Type HS Condensers.

Should a particular receiver give trouble due to repeated failure of condensers, **we suggest using one of the Special Mallory High Surge units developed for this purpose.** These condensers are especially designed to withstand any surge condition likely to be met in the field. Since they cost more than ordinary units they are recommended only for severe cases.

FILTER CIRCUIT ACTION

In the previous chapters we have discussed the actions which take place in each part and component and their limitations with respect to the simple type of filter circuit which is shown in Figure 8. There is one type of filter circuit which is not covered.

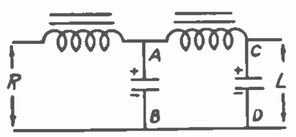


FIGURE 10

Figure 10 is a circuit wherein there is no condenser connected across the output of the rectifier. **This circuit is commonly known as the "choke input" type of circuit.** The choke, which is connected directly to the output of the rectifier, is often termed the "swinging choke."

Inasmuch as there is no "reservoir" action at the input to the filter, there will be a lower output voltage from the filter, because of the "hollows" in the current supply from the rectifier. Because we have an extra choke over that of the circuit shown in Figure 8, we will have a much smoother current.

The voltage output of the "choke input" type of filter circuit is smoother for lower values of load, than the corresponding capacity input type of filter. The voltage is lower except for higher loads. This type of circuit is useful where there is a large variation in load.

MULTIPLE CHOKE FILTER CIRCUITS

Due to the facts outlined in the chapter on "Limitations of Filter Circuits," it is often necessary to employ a filter circuit such as shown in Figure 11.

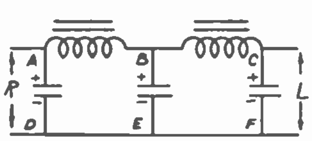


FIGURE 11

The circuit shown in Figure 11 is seen to consist of **two chokes with condenser input and output, and in addition, a condenser from the point of connection of the two chokes to the negative side of the circuit.** We have in reality two of the simple filter circuits placed end to end with the advantage that we can obtain a much better filtering action because we have two chokes and three condensers.

Since the introduction of the electrolytic condenser with its advantages of low cost and small size for an extremely large capacity, it is rare that one encounters a filter circuit of more than two "stages." In older receivers wherein the designers were forced to use paper condensers, which were uneconomical to use in capacity values greater than approximately 2 mfds., it was necessary to use a circuit as shown in Figure 12.

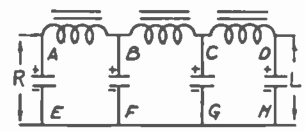


FIGURE 12

A three-section filter is shown in the circuit of Figure 12. This circuit is seen to consist of three chokes and four condensers. In other words, we have three of the common, or simple, filter circuits placed end to end.

Even with extremely low values of capacity, this circuit is capable of very good filtering, inasmuch as there is an over-abundance of inductance to counteract the usual lack of capacity which was pointed out in a previous paragraph on this circuit; i. e., the use of low capacity paper condensers.

In the filter circuits so far discussed, you will have noticed that the chokes are all located in the positive lead of the circuit. This is because of the general use of the chassis as the negative part of the circuit. **Just as good filtering can be obtained if the chokes are all in the negative side of the circuit.**

There are certain conditions of design wherein it would be advantageous to have the choke in the negative side of the circuit, in order to make some use of the otherwise wasteful voltage drop caused by the resistance of the choke.

COMPLEX FILTER CIRCUITS

Present day filter circuit design is for the most part simple and direct. Several years ago, and in occasional cases, even today, one may encounter rather complex filter circuits. These circuits often are not as complicated as they may seem at first glance, as **they are usually combinations of filter circuits and load distribution circuits** with associated by-pass condensers, arranged in such a manner that the schematic of the whole circuit with all the various connections involved, appears to be extremely complex.

Study will enable one to disassemble such a complex circuit into its various functions as to filter and load distribution. There are some complex and involved filter circuits designed to meet specific conditions existing in a receiver or amplifier. Even these more complex circuits are in reality made up of combinations of the circuits which we have discussed in the previous chapters. We will present two new circuits which have not been discussed. The first of these circuits is illustrated by Figure 20.

This circuit is seen to consist of the ordinary single section "Brute Force" filter with a choke connected

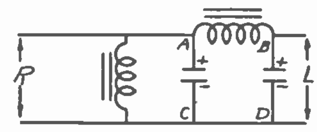


FIGURE 20

across the filter input. The purpose of connecting a choke, or in reality a field coil, across the circuit at this point is to effect an economy in the filter design. The current supplied to the field coil does not need to be as ripple free as that which is supplied to the plates of the tubes. In addition, the current drawn by the field coil is rather large. **If the field coil were connected across the output of the filter, it would increase the voltage drop across the choke, and in addition, would call for a much larger choke** (in physical size) **to obtain the necessary smoothness in the current to be applied to the load**; i. e., the tube plates. It is economical to place the field coil across the input to the filter, as this will enable the use of a smaller choke.

The principal use for such a circuit is in AC-DC receivers, wherein a half-wave rectifier is generally used, and inasmuch as a half-wave rectifier requires the use of large capacitors, and a good inductance, any unnecessary increase in these items would be uneconomical.

There is one point which must be borne in mind with such a circuit. **The combination of inductance of the field coil, together with the capacity of the input condenser, should not be of such values as to form a tuned circuit resonant at the ripple frequency. Such a tuned circuit in this position would cause a high voltage to be developed across it.**

The circuits shown in Figures 27 and 38 on page 142, are practically identical, except that the choke is in the negative lead. Note the unusual connection to the rectifier tube in the circuit of Figure 38. The two halves of the tube are in parallel. In addition, the tube is in the negative side of the circuit. This is unusual, as the tube is nearly always in the positive side of the circuit. **The tube acts in the ordinary manner, in that current flows through the entire circuit and the rectifier tube when the cathodes are negative in respect to the plates.** A much better circuit than that described is shown in Figure 21.

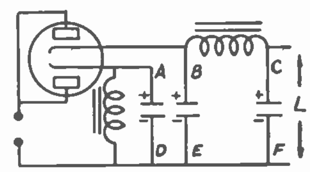


FIGURE 21

This circuit is really very simple. We have a rectifier tube which has two separate and distinct half-wave rectifiers within its envelope, such as the Type 25Z5 Tube. **We have a half-wave rectifier and filter system to supply current to the load, and another half-wave rectifier which supplies current to the field coil.**

The condenser connected across the field coil is for the purpose of filtering the current flowing through it. Otherwise there would be quite a bit of hum due to the ripple current passing through; whereas, **with the condenser in parallel with the field coil, the peak of the ripple is absorbed and the condenser discharges through the field coil during the period of no current flow from the rectifier. Steadier "average" current is maintained through the field coil.**

The circuit illustrated in Figure 11, on page 142 is identical, except that it has the choke for the load filter in the negative lead.

VOLTAGE DOUBLER CIRCUITS

Although the principal and action of the voltage doubling type of rectifier-filter circuit was known for many years, it was not until the introduction of the popular AC-DC receivers that there was any commercial reason for using such a circuit.

A "voltage doubler" circuit is one which will deliver twice the voltage applied to it. Off hand, one might think that this is done with an ordinary transformer. **The true voltage doubler circuit does not use a transformer, but rather obtains the voltage doubling by means of condenser action.**

The circuit shown in Figure 22 is one of the simplest types of voltage doubling circuit. However, to those **servicemen who are not "up on their toes" in regard to theory of current flow,** it may be a little difficult to understand. We will present a clear picture and ask that you thoroughly study it.

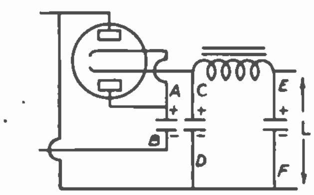


FIGURE 22

In order to facilitate the explanation of this circuit, we present Figure 23, which is a break-down of the circuit showing the action that takes place in the first half of a single cycle of the alternating current supply.

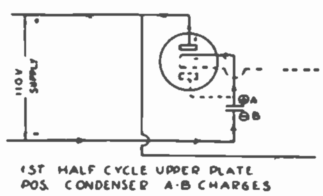


FIGURE 23

Notice the polarity marked on the supply line; i. e., positive at the top, and negative at the bottom.

In one of the earlier chapters devoted to rectifier action, it was explained that **whenever the plate of the tube becomes positive, electrons are attracted to it from the cathode. THIS ELECTRON MOVEMENT CONSTITUTES AN ELECTRIC CURRENT regardless of whether it is a flow of electrons from cathode to plate, or whether it is a current flowing in a wire. Remember this rule—"An electric current is a movement of electrons and is always in the direction of negative to positive polarity."**

In Figure 23, we see that the upper plate is positive. Therefore, current is attracted. This current flows in from the negative line through the condenser to the cathode. This completes the circuit. The actual current flow is of very short duration, because it establishes an electrostatic charge in the condenser. The action taking place in the circuit on the first half of the cycle, is merely THE CHARGING OF THE CONDENSER "AB." The direction of current flow during the first half of the cycle is indicated by the arrows.

The action which takes place in the second half of the cycle is shown in Figure 24.

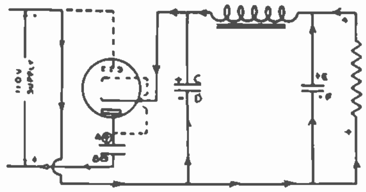


FIGURE 24

At this point **make sure that you clearly understand the explanation given so far.** It is not necessary to consider the other tube elements in the action up to this point. **It is also advisable that you be thoroughly familiar with all the subjects which have been treated in this article up to this point.** Otherwise, you may find some difficulty in understanding the explanation of this voltage doubling circuit.

We now have condenser "AB" fully charged to 110 volts, and with a polarity as marked in Figures 23 and 24.

Note that in the second half of the cycle of supply voltage, **that the polarity shown in Figure 24 is opposite that shown in Figure 23.** The bottom supply line is now positive, and the upper negative. **The positive polarity of the bottom line attracts current which flows from the negative line through the load and choke to the lower cathode of the rectifier tube. Inasmuch as the lower plate of the tube is positive,** because it is connected to the positive line through the condenser **"AB," the current will flow from the cathode to the plate.** It encounters the charge in condenser "AB."

We now have 110 volts applied to the circuit, and also 110 volts of charge in condenser "AB." NOTE THAT THE POLARITY OF THE CHARGE IN THE CONDENSER AND THE POLARITY OF THE CURRENT FROM THE LINE ARE ADDATIVE; I. E., POSITIVE TO NEGATIVE, AND NEGATIVE TO POSITIVE.

We have added two separate charges of 110 volts each together. Inasmuch as they are ADDATIVE, the resulting voltage is 220. In reality, the voltage is equal to twice the "peak" voltage of the supply circuit. **This exists** only in an extremely low load, and is not true in practical use. **The resulting voltage in such a circuit is usually equal,** or very nearly so, **to twice the RMS value of the applied voltage.**

From the description of the voltage doubler circuit, it is easy to see that **this circuit may only be used with an alternating current supply,** and can not be used in an AC-DC receiver which may be operated on direct current, inasmuch as **there is no reversal of polarity in a direct current circuit.** Therefore, the circuit illustrated in Figure 22 cannot be used where the line supply is direct current.

Circuit 9 on page 142 is a voltage doubler circuit with slightly different connections, but with the same action as that of the circuit which we have just described and illustrated.

In order to provide for the operation of a receiver using a voltage doubler on either AC or DC sources of supply, it is necessary to provide some means of changing the circuit. Such a means is the switch shown in the circuit of Figure 45, on page 144. A study of this circuit will reveal that when used on an AC supply, **with the switch in the AC position, the circuit is a voltage doubler,** but that when the receiver is to be used on a DC source of supply, the switch must be turned to the DC side and the circuit then acts as a common half-wave rectifier.

We sincerely hope that you have been patient and studious in reading this presentation on the action of filter circuits, inasmuch as the knowledge which you can gain from this article will be of inestimable value to you in your work.

We sincerely regret that space limitations prohibit going into the deeper subject of engineering and design of these circuits. Because of the scope of these subjects, it is impossible to attempt it.

REPLACEMENT OF FILTER CONDENSERS

It is practically impossible to present exact details for the replacement of condensers in every circuit. The extremely wide range of capacities, circuit connections and combinations prohibit a thorough discussion of this subject.

We suggest that you study the circuits on pages 142 to 144 and read the notes on pages 136 to 141, and familiarize yourself with customary condenser capacity values used in the various circuits in order that you may be thoroughly familiar with the entire subject in its practical aspects.

CAPACITY OF FILTER CONDENSERS

The capacity values assigned to condensers for filter circuit work is not extremely critical, and a shift of several mfds. in either direction will not introduce any observable changes, except in very rare instances, such as in replacing the capacity used to tune a filter choke or at the input to a filter circuit (see Chapter "Easy Replacement of Unmarked Condensers"—page 135).

The Mallory Universal replacement condenser line contains all the capacities or combinations of capacities necessary for replacement work, and in addition, the line is arranged **FOR YOUR CONVENIENCE.**

NON-POLARIZED CONDENSERS

There are quite a number of applications where it would be dangerous to use the usual DC electrolytic condenser. In cases where the polarity applied to the condenser may be reversed, the heat generated by the heavy current flowing through the condenser would severely damage, if not totally destroy the unit. This is due to the unidirectional property of the dielectric film which retards the current flow in one direction, but offers no resistance in the other or reversed polarity direction.

Note that we say "usual DC condenser" in the above paragraph, because **there is a simple means of providing an electrolytic condenser which may be used in any circuit wherein the polarity may be accidentally, or intentionally reversed.** Such a condenser is called a non-polarized type.

Properly speaking, a non-polarized condenser is one in which there is no polarity; i. e., either one of the terminals may be connected to the positive side of the potential source.

Such an electrolytic condenser is easily made by either one of two methods. The first method is to build the condenser with two "formed" plates, or second—**to connect two electrolytic condensers together negative to negative, using the remaining positive terminals for connection to the circuit.**

The most general use for non-polarized electrolytic condensers is in receivers to be operated from a DC line, although they are frequently used in receivers which are to be operated from batteries.

Inasmuch as there is not a very large number of direct current receivers in use, the demand for non-polarized condensers is not sufficient to enable a distributor to stock them.

We present a sensible and economical method, whereby you may replace a non-polarized condenser, quickly and easily.

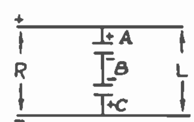


FIGURE 25

Figure 25 will clarify the method which is recommended for the replacement of non-polarized condensers.

Supposing you have need for a 4 mfd. non-polarized condenser in a round can to operate at 300 volts. The proper replacement is Type RN242. This condenser consists of two 8 mfd. units with a common negative lead.

To use the Type RN242, it is only necessary to connect the two red, i. e., positive, leads, to the circuit, and disregard the black negative lead. When making this installation, it is advisable to cut off the black negative lead and tape it, to prevent any accidental shorting.

The result of the foregoing procedure is clearly shown in Figure 25.

It should be noted that **the capacity resulting from such an arrangement of condensers is equal to one-half the capacity of either section.** In addition, **BOTH SECTIONS OF A CONDENSER SO USED SHOULD BE OF THE SAME CAPACITY.**

The working voltage of the capacity resulting from the connections described, and illustrated in Figure 25, **is that of one section, and not twice the rating of the one section.** Thus—two 450 volt condensers so connected will have a working voltage of 450 volts.

Although Type RN (common negative) type condensers were mentioned in the explanation of the method used to replace the non-polarized unit, we **would like to point out that two single unit condensers may be so connected.**

Where it is necessary, that the replacement should be in one container **and above 4 mfd. rating,** Type RM (Multiple separate section) type condensers may be used. For instance, the RM257 can easily be wired to replace an original 8 mfd. round can non-polarized unit, by connecting the two 8 mfd. sections in parallel and the negative leads of these two sections to the negative lead of the 16 mfd. section. This will give two 16 mfd. sections with their negative leads jointed ogether, resulting in a non-polarized capacity of 8 mfd.

The carton types corresponding to the round can types given for illustration, are as follows: CN152 and UR191.

THEORY OF CONDENSER ACTION

The explanation of condenser action given in the opening chapter is so arranged as to bring out the action taking place when a condenser is used as a filter condenser. This explanation does not go into the real action which takes place in a condenser; therefore, let us see what does happen in a condenser.

A condenser consists of two conducting plates separated by a dielectric material. By "dielectric material" we mean a non-conducting material; i. e., one that will not serve as a conductor of electric currents. In order to thoroughly explain the action taking place in a condenser we refer first to Figure 26, which shows a condenser, battery and switch.

The dielectric of this condenser is the cross-hatched block between the two plates.

Now, in order to thoroughly understand the action of a dielectric material, it is necessary to go into the structure of such a material.

The structure of all materials, including dielectrics, is as follows: A molecule is generally considered the smallest individual part of the material which has all the characteristics of the material. However, a molecule is made up of one or more atoms. An atom is the smallest possible particle of one of the known 92 elements, and an atom is composed of an arrangement of electrons and protons. It is sufficient to say that an electron is a negatively charged particle and a proton is the positively charged particle of greater mass than an electron.

An atom is composed of a certain arrangement of protons and electrons. However, there may be more electrons than protons. In addition, some of the electrons, or in rare cases, even a proton, may not be firmly attached to the atomic structure, although in the main the arrangement of an atom and the balance of electrons and protons is something that cannot be disturbed. Thus—if by some means one of the loosely attached electrons is drawn away from the atom, **the atom looses its "state of balance" and acquires an attractive power for any other "loose" electron which is in its immediate vicinity.**

At this point, we have shown that under certain circumstances, an atom may lose an electron, and that when it loses this electron, it is immediately attractive to any other electron which is "free." This situation might be expressed by saying that if we remove a negatively charged particle from the atom, we destroy the balance, or, "neutrality;" i. e., neutral state, of the atom. Thus—since we have removed a negative particle; i. e., an electron, from our atom, it is no longer in the state of balance, or, neutrality, but is positive. By positive, we mean that it has an attraction for a negative particle; i. e., an electron.

We have previously explained that a molecule is the smallest particle of a material which has all the characteristics of that material, but that a molecule is made up of atoms. Thus—a molecule of steel will be composed of atoms of iron, carbon, and atoms of various other substances which go to make up the material known as steel. The same thing is true of a dielectric material such as paper.

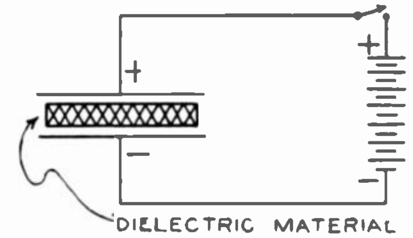


FIGURE 26

Returning to Figure 26, note that if the switch is closed, there will be an electrical potential applied to two sides of the dielectric material. The result of such an action is that the free electrons existing in atomic structure of the dielectric material are attracted and drawn toward the positively charged plate. Those atoms in contact with the positive plate loose their free electrons, which travel from the plate to the battery, and around to the negative plate, thus creating a preponderance of electrons at the dielectric material in contact with the negative plate and a scarcity of electrons at the positive plate. The atoms which lose their free electrons to the positive plate now have a terrific attraction, or affinity, for electrons. However, **the nature of the material;** i. e., not conducting, **prohibits the free motion of electrons** from neighboring atoms deeper within the dielectric material. Thus—a greatly magnified cross section of the dielectric material would reveal that on one side there is a positive affinity, and (progressing from the positive toward the negative side of the material), there is a decreasing intensity in the positive attraction until a point is reached where there is a state of balance.

Further progress along this same line of direction will reveal an ever increasing negative, or repulsive condition; i. e., the positive is attractive, and the negative is repulsive in nature. This repulsive; i. e., negative, intensity increases until its maximum is reached at the surface of the dielectric material which was in contact in the negative plate.

It is possible to plot a curve showing the lack of electrons on one side of the material, and the abundance of electrons on the other side of the material. When this is "plotted" with intensity on the vertical scale, and distance on the horizontal scale, the resulting curve will be that of the potential difference existing across a charged condenser.

The action so far described, is that which is known as "charging" a condenser, and, in a previous paragraph we abandoned the description with a full charge in the condenser.

Now, that we have a "charged" condenser, let us see what happens when the condenser discharges. This is shown in Figure 27.

Figure 27 shows the charged condenser, which is prevented from discharging by the open switch. **Remember the situation existing in the dielectric material when the condenser was charged.**

Before explaining what happens in the circuit when the switch in Figure 27 is closed, it is necessary to point out that **the difference between a non-conducting and a conducting material is that the conducting material has such atomic structure that the free electrons are easily displaced. If electrons are removed from one end of a conductor, a corresponding number of electrons MUST ENTER THE OTHER END OF THE CONDUCTOR.**

When the switch in the circuit of Figure 27 is closed, electrons are attracted from the positive plate by the atoms in the dielectric material, which is in contact with the plate, remembering from our previous discussion, that these atoms had been robbed of their free electrons, and therefore, they were attractive toward any free electrons in their immediate vicinity. Therefore, when the switch is closed, these atoms attract the free electrons from the atoms composing the molecules of the positive plate, the atoms of which in turn attract the free electrons in the conducting path which extends around to the negative plate. **Remember—That there existed an over abundance of electrons in the atomic structure of the dielectric material next to the negative plate.** Therefore, the attraction for free electrons begins in the dielectric material next to the positive plate and extends around through the circuit to the negative plate, where there is an over-abundance of electrons. These "extra" electrons are enough to satisfy the attraction existing throughout the circuit. Therefore, when the switch is closed, the dielectric material absorbs electrons from the plate, the plate from the conducting circuit, and the conducting circuit absorbs the free electrons in the negative side of the dielectric material. **A discharge of a condenser in reality is the restoration of balance of electrons in the atomic structure of a dielectric material.**

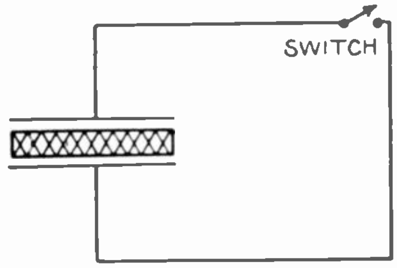


FIGURE 27

At this time, it is well to point out that the electron movement in the discharge circuit described and illustrated in Figure 27, is not of any great length; i. e., the electrons do not move from the negative plate around to the positive plate; they merely move from one atom to another. Thus—the flow of current which occurs through the circuit when a condenser is discharged, is nothing but the movement of electrons from one atom to an adjacent atom, which is a distance far too small to be conceived by the human mind.

An alternating current apparently flows through a condenser, but a direct current does not. To be more explicit, when a direct current potential is applied to the terminals of a condenser, there is a very small surge of current which flows through the circuit, but not through the condenser, **because there is not a progressive motion of electrons from one atom to another along the path of the circuit which is occupied by the dielectric.**

If you do not understand this statement, read the description of the charge and discharge of a condenser.

When the statement is made that alternating current flows through a condenser, it is in the very strict sense of the word, not exactly so, because the dielectric material in a condenser offers no more conductance to an alternating current than it does to a direct current. However, due to the reversal of polarity which occurs in an alternating current circuit, the condenser charges and discharges on each half cycle of the applied current. Therefore, there is current flowing in the circuit, but not "through" the condenser.

This statement may be "hard to swallow," but it is an absolutely true statement, because the dielectric material in the condenser is not a conductor. How, then, does alternating current flow through a circuit containing a condenser? the answer is to be found in the actions which take place in the charge and discharge of a condenser. When a condenser is charged, there is an abundance of electrons at the negative plate, and a scarcity of them at the positive plate. If the polarity of a circuit attached to a condenser is such that **the positive side of the circuit** is connected to the negative plate, **and the negative side of the circuit** is connected to the positive plate of the condenser, the extra electrons existing at the negative plate of the condenser will move into the circuit, establishing an over-abundance of electrons in the circuit. The electrons leave the circuit to satisfy the deficiency of electrons existing at the positive plate of the condenser. **WHEN THE ELECTRONIC BALANCE OF THE ATOMIC STRUCTURE FOR THE ENTIRE CIRCUIT IS RESTORED, THE POTENTIAL DIFFERENCE; I. E., VOLTAGE, IS ZERO.**

CONDENSER ACTION IN A. C. CIRCUITS

We are now ready for the explanation of the action of a condenser when used in an alternating current circuit. Remember, that the "apparent" flow of alternating current through a non-conducting material; i. e., dielectric of a condenser, is not possible in the strict sense of the word. However, there is a flow of current in an alternating current circuit which includes a condenser.

In order to thoroughly explain this action, we must have recourse to illustrations. The first of these is Figure 28.

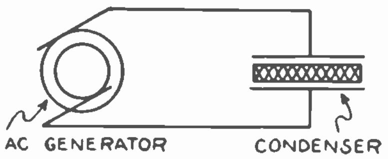


FIGURE 28

This illustration shows a condenser connected in a circuit with an alternating current generator. As the generator revolves, and starts a cycle, we will assume that the upper portion of the circuit is positive, and the lower part of the circuit is negative. The voltage rises from zero to a maximum, and then falls to zero, thus completing one-half of a cycle. At this point, the polarity of the circuit reverses; i. e., the top half of the circuit becomes negative, and the bottom half positive, and again the voltage rises to a peak and falls back to zero, whereupon the polarity again reverses and becomes the same as at the start, that is, one cycle has been completed.

When the voltage rises on the first half of the cycle, the condenser is charged. After the voltage reaches the peak, it falls to zero (at the same rate at which it rose to the peak). We now have a condition wherein we **have a charged condenser, and a conducting circuit from one plate of the condenser to the other** (through the generator).

Remember—**That a charged condenser will discharge, if there is a conducting path from one terminal of the condenser to the other.**

Therefore, the condenser will discharge through the circuit. However, before this discharge is complete, the voltage from the generator is rising on the second half of the cycle.

The rising voltage of the second half cycle of the alternator is of such a polarity that it aids the completion of the discharge of the condenser, and then recharges the condenser (but with opposite polarity to that of the first charge). The voltage from the alternator again falls to zero, and of course, the condenser discharges through the circuit.

The peculiar part of this whole action of charge and discharge, is that **THE CURRENT IN THE CIRCUIT "LEADS" THE VOLTAGE**; i. e., the current in the circuit reaches its maximum intensity before the voltage reaches its highest value.

So far, our discussion has been centered around a perfect condenser; i. e., one in which there is no losses. In actual practice, all condensers have a certain amount of loss. These losses which occur in condensers are of two types; first, there is a "hysteriesis" loss which is due to molecular friction. Friction is generated in the molecules or molecular structure of the dielectric by the atoms attempting to rearrange themselves when under the stress of the applied voltage.

The second type of loss is that due to leakage in the dielectric. **All insulating materials; i. e., dielectrics have a certain amount of conductance,** that is, they are not perfect insulators but allow the passage of minute currents. We find that even the best insulating materials have a resistance of several megohms when measured by sensitive instruments. The first type of loss in a condenser is usually pictured by a symbol of a perfect condenser with a "series" resistor which represents the loss. This is illustrated in Figure 29.

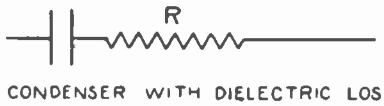


FIGURE 29

The second type of loss in a condenser is pictured as a resistance in "shunt" with a condenser as shown in Figure 30.

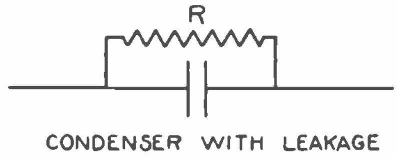


FIGURE 30

The result of these losses in a condenser is a decrease in efficiency; i. e., a loss of power. The efficiency of a condenser is expressed in the term "Power Factor." The meaning of this term is that if a condenser has a "power factor" of 2% that there is a loss of 2% of the applied power.

The power factor of a condenser (expressed in percentage) is equal to $\frac{W \times 10^6}{w\,C\,V^2}$ wherein W is the wattage lost, "w" is twice "pi" or 6.28, C is the capacity (in microfarads). V^2 is the voltage squared and 10^6 is 10 to the sixth power or 1 million.

BY-PASS CONDENSER CIRCUITS

Many circuits in radio receivers or amplifiers carry both alternating and direct current. It is necessary to provide separate paths for the flow of these two different currents, in order to accomplish certain actions. A circuit may carry direct current for plate supply and an AC signal current at the same time. It is necessary to provide a path for the signal voltages so that they may be applied only to certain portions of the circuit. In other words, it is necessary to separate the direct current and the alternating signal current.

A convenient means of obtaining this separation is to use a condenser to provide a path for the alternating current, because the direct current does not flow through a condenser, therefore we can obtain the desired separation.

This action is perhaps best illustrated by Figure 31.

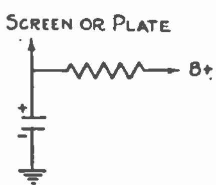


FIGURE 31

This circuit shows the use of a condenser to allow the passage of alternating signal current, from the screen circuit of a tube to ground, the resistor prohibits the AC current from getting into the "B" supply where it might cause trouble; i. e., feed back and howls. In most instances the resistor is necessary to provide the correct voltage for the screen, therefore it readily serves two purposes.

The action of the condenser whereby it provides the path for the alternating current, is described in the chapter headed "Condenser Action in Alternating Current Circuits."

An additional illustration of the use of a condenser to provide a path for alternating current, is illustrated in Figure 32.

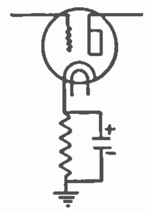


FIGURE 32

The action taking place in the circuit of Figure 32 follows: The resistor shown connected from the cathode of the tube to ground, is for the purpose of supplying a bias voltage for the grid of the tube. This resistor is usually of several thousand ohms resistance, and would offer an impedance of this value to the flow of the signal current. Such an impedance to signal currents at this point would introduce regeneration, and this is usually to be avoided. If we connect a condenser across the resistor, we will provide a path for the alternating current, which will not affect the required voltage drop across the resistor necessary for bias supply.

CAPACITY OF BY-PASS CONDENSERS

The capacity of a by-pass condenser is regulated by the frequency of the current to be handled, and in addition, the resistance of the circuit to be by-passed. It is a general rule, that the capacitive reactance of a condenser should be approximately one-tenth, or less, the resistance value of the circuit to be by-passed.

Capacitive reactance is the "impedance;" i. e., opposition of a condenser to the flow of an alternating current. This reactance is expressed in ohms by the formula $X = \frac{1}{w\,F\,C}$, where w is 6.28, F is the frequency in cycles per second, and C is the capacity in Farads.

To those mathematically inclined, the above formula shows that for a given value of capacity, the reactance decreases with increasing frequency. For practical illustration, let us say that a 1 mfd. condenser has a reactance of 1592 ohms at 100 cycles, but that for 200 cycles, the reactance is only 796 ohms.

To find the correct capacity value to be used for by-pass condensers, it is only necessary to know the resistance of the circuit to be by-passed, and the lowest frequency which will appear in the circuit. Then find the capacity value, the reactance of which is approximately one-tenth or less of the resistance of the circuit to be by-passed, at the lowest frequency which appears in the circuit.

ELECTROLYTIC BY-PASS CONDENSERS

Inasmuch as many circuits to be by-passed are of very low resistance, or are carrying a low frequency current, it requires a large capacity to affect the proper by-passing action.

Previous to the introduction of the electrolytic condenser, large values of capacity were extremely expensive. However, in electrolytic condensers, particularly at low voltages, it is possible to obtain a very large value of capacity at low cost, and in a small space. For instance, the usual capacity required for by-pass in the circuit of Figure 32, is in the order of 20 mfds. at a potential difference of approximately 25 volts or less.

An electrolytic condenser suitable for use in this circuit will occupy a space of only 7/8" diameter x 2 1/4" long. These are the dimensions for the Type TS102, which has a capacity of 20 mfds., and a working voltage of 25 volts. Such a capacity value in a paper condenser would occupy quite a few cubic inches of space.

Wherever a large capacity is required for a by-pass condenser, and where there is a DC voltage, it is advisable to use an electrolytic condenser. For very high frequencies, a paper condenser should be used, inasmuch as electrolytic condensers are not suitable for use as by-pass condensers at frequencies above several kilocycles.

Where a circuit to be by-passed carries both Audio and RF currents it is often advisable to use both an electrolytic condenser and a paper condenser. Such arrangements are found in many receivers.

EASY REPLACEMENT OF UNMARKED CONDENSERS

Read this chapter and save yourself time and labor when it is necessary to replace a condenser which is not marked as to capacity and working voltage.

This easy, quick, step-by-step method requires quite a few words to explain, but is easy to follow and saves a lot of time in repairing a receiver.

First: **Ascertain the working and surge voltages.** A method of doing this is outlined in the chapter "Surge Voltage."

Second: With the voltage known, the condenser is semi-classified, and the replacement will necessarily fall in one of the three groups of condensers; i. e., 250 volts, 450 volts, or High Surge types.

The next most important step is to ascertain the capacity value.

PROCEDURE FOR FILTER CONDENSERS

A. **FOR SINGLE UNIT CONDENSERS** of either the can or carton type, use 8 mfd. or larger, **except at the input to a filter.**

Note—When replacing original paper condensers, which rarely exceed 2 mfd., it is advisable not to use more than 4 mfd., as values above this may cause the output voltage to rise to too high a value. On the other hand, half-wave rectifiers require a large capacity value at the input to the filter. In AC-DC receivers, the input capacity for half-wave rectifier is usually in the order of 25 mfd. (for further details refer to note at the end of this chapter).

B. **FOR BLOCK OR MULTI-SECTION CONDENSERS.**

First. Sketch the circuit and note the connection of the leads of the condensers and their color. For illustration, let us suppose you are working on an AC-DC receiver, and your sketch looks like this:

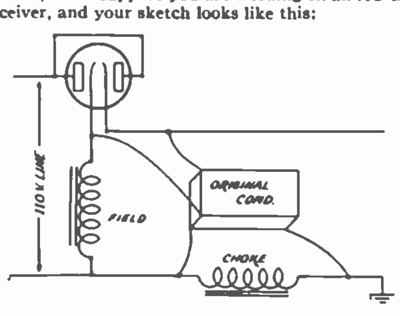


FIGURE 33

Second. **Carefully open the condenser and trace and sketch the connections of the various units.** This will help you to ascertain the way in which the various sections are connected in the circuit.

Next, sketch in the condenser connections to the various parts of the circuit as per Figure 34.

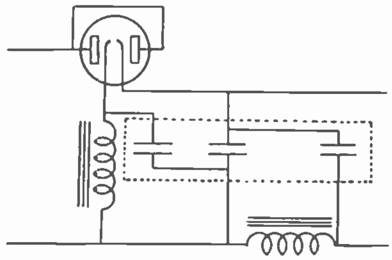
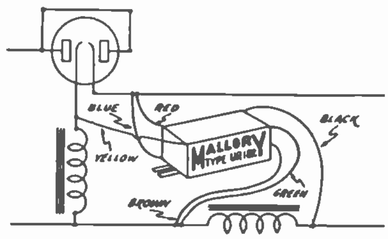


FIGURE 34

Now, refer to the condenser circuits given on pages 142 to 144 and find a circuit such as the one you have sketched. This turns out in this instance to be Circuit 11 (note the figures given beneath the circuit).

Now turn to the "Replacement" section and go up and down the "Circuit" column under the heading "Condensers," until you find this circuit number. When you have found this number, you will also find the correct replacement condenser, because it is given in the next column to the right of the circuit column. For instance, Circuit 11 will be found in the replacement section on page 97 (Zenith Model 710), where you will note that the UR182 is listed as the replacement.



With some circuit numbers you may have to search over several pages. This is advisable, because there are many combinations of condensers which may be used as replacements. Thus, by consulting two or three pages of the replacement section, you may ascertain several different combinations which may be used as a replacement and from these select the types of condensers most suited to your particular job.

Note—The numbers given beneath the circuits on pages 142 to 144 refer to the "B" or condenser notes, given on pages 136 to 141. These notes not only state the replacement condenser, but also give detailed instructions for connecting the replacement condensers into the circuit.

Note—Filter input condensers regulate the output voltage of the filter. With full wave rectifiers, this is not so noticeable as with half wave rectifiers.

There is generally no harm in raising or lowering the input capacity 2 or 3 Mfds. but with half wave rectifiers, too great a reduction in input capacity will cause a loss of voltage.

Figure 35 shows the relation between load and input capacity for various output voltages of a half-wave rectifier.

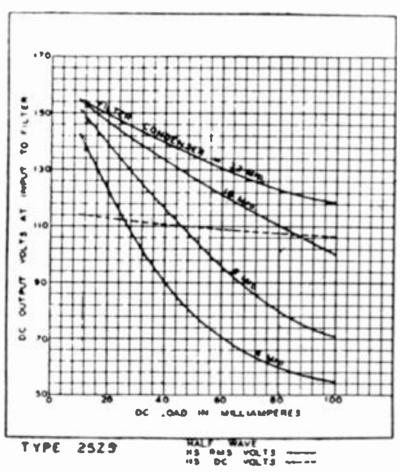


FIGURE 35

BY-PASS CONDENSER REPLACEMENT

When replacing by-pass condensers, follow the same procedure as is given in the preceding paragraphs devoted to filter condenser replacement. Note—Low voltage condensers may always be replaced with condensers of a higher voltage rating. Thus, a 5 mfd. 20 volt condenser may be replaced by an 8 mfd. 450 volt condenser. Although the higher voltage condenser may cost a few cents more than the low voltage condenser, there are many times when such a replacement will save you much more than the difference in cost, in the time saved.

HOW TO USE THE "B" NOTES

The extreme right-hand column under the general heading "CONDENSERS" in the replacement section of the encyclopedia is the "NOTE COLUMN," in which is listed various numerals preceded by the letter "B," such as "B16."

"B16" refers to one of the notes on the following pages. These notes pertain to the replacement of condensers, and enables us to tell you exactly **WHAT TO DO AND HOW TO DO IT. These notes guide you so that you may make a quick and easy repair.** They also enable us to warn you to watch for certain things, and most of all **TELL YOU HOW TO WIRE IN A CONDENSER REGARDLESS OF THE ORIGINAL COLOR CODE, CHANGE DURING MANUFACTURE, OR PREVIOUS REPAIR.**

CONDENSERS			
Original Part	Circuit	Correct Replacement	*Note
8-8	1	See Note	B3

Here is an illustration of part of the replacement section. **The meaning expressed** in the apparently cryptic message **is that the original condenser combination in the particular receiver is two 8 mfd. units used in Circuit 1, as shown on page 142, and that you are to read "B" note No. 3, which states "B3—Physical characteristics are unknown. We suggest replacing with equivalent Mallory type of equal or higher capacity. Check voltage for higher rating."** You are told that there are two 8 mfd. units used in Circuit 1, but you alone know whether there are two single 8 mfd. units or a single unit containing two 8 mfd. sections. You also know the physical specifications; i. e., whether it is a round can or carton type of condenser, or, condensers.

You have the original before you in the receiver. You know the physical appearance and permissible size. We have given you the capacity and a schematic of the circuit. THIS IS ALL THE INFORMATION ONE COULD ASK TO MAKE A REPLACEMENT. You may now select the proper condenser. The voltage rating should not bother you, for—if the receiver is of an AC type using a transformer, a 450 volt condenser should be used. If the receiver is an AC-DC type, a 250 volt condenser should be used, inasmuch as even with a voltage doubler, the 250 volt rating is always sufficient.

Let us take a more complicated note, for example: No. B18, which states: **"Refer to schematic No. 6 and connect UR182 as follows: Green, Brown and Black to points 'C,' and 'D,' Red to point 'A,' Yellow and Blue to point 'B.'"**

Figure 37 shows Circuit 6 with the UR182 connected as per the instruction in Note No. B18.

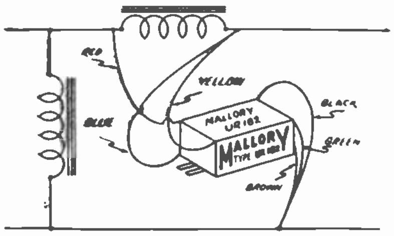


FIGURE 37

Note the procedure. This is clear, direct and saves your time. No longer do you need to puzzle over the question as to which lead goes where.

Let us take up a still more complicated note; for example, No. B49. **"Refer to schematic No. 9 and connect CM165 as follows: One Red to point 'A,' corresponding Black to point 'B,' and other Red to 'B,' corresponding Black to point 'C,' remaining Red to point 'D' and Black to 'E.' Note—In some cases there are two pig-tail resistors between the field and point 'E' which is connected to the chassis."**

Figure 38 shows a pictorial view of Circuit 9 with the CM165 installed as per instructions in note No. B49.

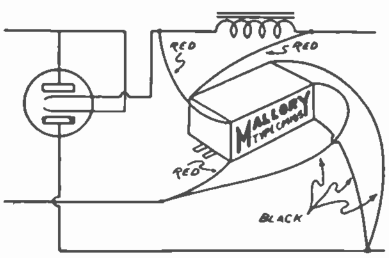


FIGURE 38

This illustration shows how simple and easy it is to make what would otherwise be a difficult installation. Think of the time you might lose in waiting for an exact duplicate which would be no better than the original, whereas, **the readily obtainable Universal Mallory condenser is easily installed and gives you a profit quickly.**

These "B" notes have been written by practical men for practical every-day use. USE MALLORY CONDENSERS AND BE SURE TO LOOK AT THE CIRCUITS AND READ THE NOTES.

"B" NOTES

B1—Originally equipped with paper condensers. Electrolytics of equal or greater capacity are O.K. for replacement. Check voltage to determine proper condenser rating.

B2—Input condenser may be paper type. In such cases we suggest the replacement be made with a paper condenser or Mallory HS or HD high voltage units, the choice being determined by the voltage requirements.

B3—Physical characteristics are unknown. We suggest replacing with equivalent Mallory type of equal or higher capacity. Check voltage for proper rating.

B4—Filter condensers may be of paper; if so, replace with Mallory HS or HD types. Working voltage, capacity and mounting will determine type.

B5—Use types UR188 or UR189 to replace a combination such as 16-12, 16-8, 12-12, etc. The dual mfd. low voltage units are intended for by-pass circuits and may be connected in parallel (Yellows together) to obtain a single 10 mfd. section. Connect the two Red leads together to obtain the higher capacity filter section. The UR188 and UR189 contain the same capacities and voltage ratings. Select the unit which may be installed most conveniently.

B6—It is not necessary that the cathode by-pass condensers be in the same container as the filter condenser. Mallory TS units are easily installed within the chassis, the wire leads offering firm support.

B7—Originally equipped with paper condensers. Replace with combination of Mallory TP units of proper voltage and capacity.

B8—When a Mallory Multi-section condenser is recommended to replace an original single section condenser, connect the sections in parallel. This gives a capacity that is equal or greater than the original. Note: After going to press the RS216 was added to the Mallory Line. It may be used in place of the RN242 when replacing an original single section condenser.

B9—This condenser is enclosed in the original block and tunes the filter choke to the ripple frequency. Replace with Mallory TP unit or combination of units giving the same capacity as the original.

B10—This condenser is used only on the later type of this model.

B11—Requires a non-polarized type of electrolytic for replacement. To obtain a non-polarized capacitor use a Mallory RN or CN type having the same capacity in both sections. Cut off the black lead close to the container and tape to prevent shorting against chassis. Use the two Red leads as the terminals of the condenser. The resulting capacity is equal to one-half the capacity of one section; i. e., CN150 will have an effective non-polarized capacity of 2 mfd. at 450 volts. Thus to secure 4 mfd. non-polarized, it requires the use of a Mallory RN242 or CN152. (See Circuit 39 in the "B" condenser circuit section.) Note: the RM or CM units may also be used by paralleling the sections and then connecting the negative leads together and taping as above.

B12—This additional capacity used on 25 cycle models only.

B13—This power pack is used in many early Mohawk models. Color code of the filter condensers are: Green 2 mfd., Blue 2 mfd., Yellow 1 mfd. In addition there is a .5 mfd. from B positive to B negative. See note B1.

B14—These condensers are used across the secondary of the vibrator transformer. Replace with Mallory VB or OT type condensers of the same capacity value.

B15—Remove old condenser from can and place CN151 in can if desired.

B16—Mount in hole in chassis or use Mallory bracket No. 104-1.

B17—Refer to schematic No. 11 and connect UR182 as follows: Black and Brown to points "D" and "E," Red to point "A," Blue to point "B," Yellow to point "C," and Green to point "F."

B18—Refer to schematic No. 6 and connect UR182 as follows: Green, Brown and Black to points "C" and "D," Red to point "A," Yellow and Blue to point "B."

B19—For this replacement we suggest the use of three CS126 units.

B20—This condenser is used only on later models.

B21—Install beneath chassis and connect Red leads together to positive, Black to negative. Leave old unit in place if desired, but be sure to remove leads from it.

B22—Refer to schematic No. 9 and connect CM165 as follows: One Red to point "A," corresponding Black and another Red to point "B," remaining Red to point "D," remaining Blacks to points "C" and "E."

B23—When Mallory Stud type condensers such as the SR602, SR605, etc., are recommended to replace condensers of the ring clamp mounting type, the stud may be cut off flush with the top of the can. Be careful not to cut into the can.

B24—Connect RN241 or RN231, Blue to positive 4 mfd., Red to positive 8 mfd., Black to chassis. Connect positive of TS101 to cathode of output tube, negative to chassis.

B25—Refer to schematic No. 4 and connect CM172 as follows: Red leads together and to points "A" and "B," one Black to point "C," remaining Black to point "D."

B26—Refer to schematic No. 1 and connect RN241 as follows: Blue to point "A," Red to point "C," Black to chassis at points "B" and "D."

B27—Later type of Model 856 used a 16 mfd. condenser in place of the 8 mfd. No. 27585; in which case use the RS216.

B28—There were two types of filter circuits used in this model; the older type used a dual 4 mfd. as first and second filter with an 8 mfd. in the output. The later type used the same combination but with the 8 mfd. as the input condenser.

B29—Refer to schematic No. 1 and connect UR189 as follows: Blue to point "A," both Reds to point "B," Brown, Black and Green to chassis. Connect one Yellow to cathode of output tube, the other Yellow to cathode of detector tube.

B30—Mount the SR611 by means of the metal flange, cut off and disregard the Blue lead. Two CS133 units may be used if desired.

B31—Refer to schematic No. 11 and connect UR182 as follows: Yellow to point "A," Red and Blue to points "B" and "C," Green and Brown to points "D" and "E," Black to point "F" (chassis).

B32—Join two of the CM165 Red leads together and to B positive, one Red lead to Blue lead from switch, corresponding Black to plate of 25Z5, remaining Black to chassis.

B33—Refer to schematic No. 29 and connect CM162 as follows: one Red to point "A," corresponding Black and remaining Red to point "B," remaining Black to point "C." The additional 8 mfd. unit is beneath the chassis and connected Red to point "D," Black to point "E."

B34—Refer to schematic No. 1 and connect one Red to point "A," another Red to point "C," remaining Red to cathode of output tube, Black to chassis.

B35—We suggest the use of UR190 for this replacement. See note B89.

B36—Refer to schematics Nos. 6 and 15 and connect UR189 as follows: Blue to point "A," both Reds to "B," Brown, Black and Green to chassis at points "C" and "D," one Yellow lead to cathode of detector, remaining Yellow to cathode of output tube.

B37—May require use of condenser bracket No. 104-1.

B38—On some chassis of the model 525 the condenser was in two cartons, the C525C (5 mfd.—25 mfd.) and the C525D (5 mfd.). We recommend the UR182 which replaces both of the units.

B39—Install Mallory condenser in the old can or beneath the chassis.

B40—Use the BN type of by-pass condenser.

B41—Install the RN245 in the chassis hole provided for the original wires. Discard the old condenser cover if desired.

B42—Refer to schematic No. 1 and connect the CN152 as follows: one Red to point "A," remaining Red to point "C," Black to chassis at points "B" and "D."

B43—An .05 condenser was used for buffer on first type only, value of second type unknown.

B44—Models using the F312 vibrator have a .005 mfd. buffer; those using the F221 vibrator have an .04 mfd. buffer.

B45—The original block No. P80902 contained two 4 mfd. condensers and a .1 mfd. paper. Replace with a CN140 and TP438 connected as follows: one Red of CN140 to screen circuit, remaining Red to first audio cathode, Black to chassis. Connect TP438 from RF screen to ground.

B46—Substitute TP441 for TP438 and connect as in note B45.

B47—Refer to schematic No. 29 and connect CM165 as follows: Red to point "A," corresponding Black to "B," another Red to point "B," corresponding Black to "C," remaining Red to "D," and Black to "E."

B48—Refer to schematic No. 4 and note that a resistor is used in place of the choke shown. The RM262 should be mounted in the chassis hole or by means of Mallory bracket No. 104-1; connect both Red leads to points "A" and "B," one Black to point "C," remaining Black to point "D" (chassis).

B49—Refer to schematic No. 9 and connect CM165 as follows: one Red to point "A," corresponding Black to point "B," another Red to "B," corresponding Black to point "C," remaining Red to point "D" and Black to "E." Note—In some cases there are two pigtail resistors between the field and point "E" which is connected to the chassis.

B50—Refer to schematic No. 23 and connect RM262 as follows: Blue and Red to points "A" and "B," Brown to point "C," and Black to point "D." If necessary use Mallory bracket No. 104-1.

B51—Refer to schematic No. 29 and connect CM165 as follows: one Red to point "A," corresponding Black to point "B," another Red to point "B," corresponding Black to point "C," remaining Red to point "D" and Black to "E." Note—In this receiver there may be a pigtail resistor between the field and point "E."

B52—This condenser connects between points "A" and "C" on schematic No. 29.

B53—Refer to schematic No. 29 and connect UR190 as follows: one Red of one of the independent sections to point "A," corresponding Black to point "B," Red of the other independent section to point "B," corresponding Black to point "C," one Red of the common section to point "D," the other Red to 6A7 plate supply, Black to ground at point "E."

B54—This chassis is the same as the Majestic 300, 300A.

B55—When using the UR190 to replace a 16-16 mfd. unit, connect the Red leads of the independent sections together for positive of one 16 mfd., and the corresponding Blacks together for the negative of this 16, connect the two Reds of the common negative section together for the other 16 mfd.; the remaining Black is the negative.

B56—Refer to schematic No. 11 and connect RM259 and TS101 as follows: Green of RM259 to point "A," Yellow and Brown to points "D" and "E," Blue and Red to points "B" and "C," Black to "F." Connect TS101 positive to second detector cathode, negative to point "F."

B57—Connect Black leads to chassis; other lead connections are obvious.

B58—Refer to schematic No. 4 and connect RM265 as follows: Red and Blue to points "A" and "B," Black to point "C," Brown and Yellow to point "D," Green to screen circuit.

B59—Refer to schematic No. 1 and connect RM257 as follows: Red to point "A," Black to point "B," Blue and Green to point "C," Brown and Yellow to point "D."

B60—Connect one 8 mfd. section to rectifier side of choke, combine two sections and connect to speaker side of choke, the remaining section to voltage divider at output side of speaker field.

B61—Refer to schematic Nos. 1 and 15 and connect RN232 as follows: one Red to point "C," Black to "D," remaining Red to output cathode.

B62—Combine two of the RN235 Red leads to output screen, remaining Red to detector plate resistor, Black to chassis; positive of TS101 to cathode of output tube, negative to chassis.

B63—Refer to schematic No. 1 and connect RM257 as follows: Brown, Yellow and Black together and tape, Red to choke at point "C," Blue and Green together to point "D," Note—It may be necessary to use two CS126 units installed beneath the chassis. See note B11.

B64—Refer to schematic No. 4 and connect UR182 as follows: Red, Blue and Green to points "A" and "C," Black and Brown to "B," Yellow to "D."

B65—Refer to schematics Nos. 6 and 15 and connect RM257 and TS101 as follows: connect Blue and Green (of RM257) together and to point "A," Brown and Yellow to point "C," Red to point "B," Black to point "D." Connect TS101 positive to cathode of output tube, negative to point "D."

B66—The capacity values given for this circuit are independent units, each of which is replaceable with the condenser given; thus 8-8-8...... RS213 means that three of the RS213 condensers are required for complete replacement of filter.

B67—Refer to schematic No. 8 and connect RM259 as follows: Green to point "A," Red to point "B," Blue to point "C," Yellow, Brown and Black to points "D," "E," and "F."

B68—Refer to schematic No. 11 and connect RM259 as follows: Green to point "A," Yellow and Brown to points "D" and "E," Blue and Red to points "B" and "C," Black to point "F."

B69—Refer to schematic Nos. 28 and 13 and connect RM265 as follows: Connect Red and Blue together and to point "B" in place of the original red, Black to point "E," Brown and Yellow to chassis at "F," Green to screens of power tubes.

B70—Refer to schematic Nos. 4 and 14 and connect RM265 as follows: Red and Blue to "A" and "B," Black to "C," Brown and Yellow to chassis at "D," Green to bleeder resistor.

B71—Refer to schematic No. 11 and connect the UR190 as follows: Connect the two Red leads (that exit from the same hole in the carton) together and to one of the other Red leads, then connect this assembly to the cathode of the rectifier at point "A;" the three Black leads connect to the line at points "D" and "E," the remaining Red lead connects to the rectifier cathode at point "B."

B72—Refer to schematic No. 29 and connect UR190 as follows: Combine two Reds (that exit from same hole in carton) and connect to point "A," corresponding Black lead to point "B," connect one other Red lead to point "B," corresponding Black lead to point "C," connect remaining Red lead to point "D" and remaining Black to point "E." Point "B" is connected to DC side of switch.

B73—Refer to schematic No. 4 and connect RM262 as follows: Red and Blue to points "A" and "B," Brown to "C" and Black to "D."

B74—Refer to schematics Nos. 1 and 15, and connect RM257 as follows: Blue to "A," Green to "B," Brown, Yellow and Black to chassis at "B" and "D." Red to cathode of output tube. If necessary, use Mallory 104-1 bracket.

B75—Refer to schematics Nos. 1 and 15, connect CM173 as follows: All three Black leads to ground at "B" and "D," one Red each to "A," "C" and cathode of output tube.

B76—Refer to schematics Nos. 1 and 15, and connect RM257 as follows: Red to cathode of output tube, Blue to "A," Green to "B," Brown, Yellow and Black to chassis.

B77—We suggest the use of two UR190 condensers connected as follows: Both Red leads of the common section to cathode of 25Z5, the two other Red leads of this condenser together and to cathode of 12Z3. On the other UR190, connect both Red leads of the common section to the output of the choke, one of the remaining Red leads to cathode of 6C6 and the other Red lead to the cathode of 43, all Black leads to negative line.

B78—See note 68 for installation instructions.

B79—Connect a TS102 from 6F6 cathode to chassis in addition to one section of the BN225.

B80—This condenser is 8-8-12 mfd., and we suggest that either RM257 or UR190 be used for replacement; connect 16 mfd. across the filter output, and 8 mfd. from 38 cathode to chassis, and 8 mfd. from screen circuit to ground.

B81—Most of these original condensers employ a Red and Yellow lead; the 8 mfd. section (Red) should be connected on the rectifier side of choke.

B82—Condensers which are of unusual characteristics will be supplied on order. To avoid confusion, send in the original condenser, properly marked as to make and model number of the receiver, and shipment will be made promptly.

B83—Refer to schematic No. 3 and connect one section of the MN277 to "A," connect two of the sections together and to point "B," connect the other section to point "C."

B84—Refer to schematics Nos. 1 and 15, connect both Reds to point "A," Blue to "C," Black, Brown and Green to chassis at "B" and "D," one Yellow to cathode of second detector and the other to cathode of output tube.

B85—Mount the Mallory condenser in the original can.

B86—Refer to schematic No. 4 and connect RM261 as follows: Red and Blue to points "A" and "B," Brown to "C" and Black to "D."

B87—Refer to schematic No. 1 and connect CN141 as follows: Blue to point "A," Red to point "B," Black to "C" and "D."

B88—Refer to schematic No. 27 and connect CM165 as follows: All three Red leads to "A," "B" and "C," two Black leads to "D," "E," remaining Black lead to "F."

B89—Refer to schematic No. 6 and connect UR190 as follows: The two Red leads (having a common exit from the carton) to point "A," the other two Red leads to "B," all Black leads to "C" and "D."

B90—In case the RN232 is too long, try the SR605; cut off the mounting stud on the SR605 if necessary.

B91—Refer to schematic No. 1 and connect RN241 as follows: Red to "A," Blue to "C," Black to chassis at "B" and "D."

B92—Refer to schematic No. 1 and connect CN151 as follows: Red to "A," Blue to "C," Black to chassis at "B" and "D," mount by means of one flange, and cut off the other. If desired, cut off or bend the flanges and install in original can.

B93—Refer to schematic No. 4 and connect CM171 as follows: Red and Blue to "A" and "B," Black to "C," Brown to "D." Mount by one flange bent at right angle to support condenser in vertical position, cut off other flange. If preferred, mount condenser in original can.

B94—Refer to schematic No. 27 and connect UR189 as follows: The two Red leads to "A" and "B," Blue to "C," Black to "F," Brown and Green to "D" and "E," Yellow leads together and to cathode of detector.

B95—Refer to schematics Nos. 27 and 15 and connect the UR182 as follows: Red and Blue to "A," "B" and "C," Black and Green to chassis at "F," Brown to line at "D" and "E," Yellow to cathode of Detector (or in some cases the first AF stage).

B96—See Note B3; if round can unit can be installed we suggest RM259 for this installation.

B97—Refer to schematics Nos. 1 and 44, connect all Black leads of the UR190 to B−, the two Red leads (with common exit) together and to chassis, one of the remaining Red leads to each side of the choke.

B98—Refer to schematics Nos. 6 and 15 and connect UR189 as follows: Both Red leads to "A," Blue to "B," Yellow leads to cathode of Detector and output tubes respectively, Brown, Black and Green to chassis.

B99—The chassis type number is the group prefixing the serial numbers. The first run of this chassis used schematic No. 27 with 16 mfd. from cathodes (in parallel) to line, 8 mfd. from cathodes to chassis and 4 mfd. from 6A8 plate supply to chassis, also a .25 paper across the choke. For the first run, connect UR182 as follows: Refer to schematic No. 27, connect Blue to "A" and "B," Red to "C," Brown to line at "D," "E," Black and Green to chassis, Yellow to 6A8 plate supply. In the second run the cathodes of the 25Z5 were separated thus changing the circuit to schematic No. 11 and the .25 mfd. condenser was removed from across the choke and a separate 4 mfd. tubular connected across the field. For this circuit refer to schematic No. 11 and connect UR182 as follows: Blue to "B," Red to "C," Brown to line at "E",' Black and Green to chassis at "F," Yellow to 6A8 plate supply. Use an additional CS121 with Red to "A," Black to "D."

B100—Refer to schematic No. 27 and connect CM165 as follows: All Red leads to "A," "B," "C," two Black leads to "D," "E," one Black lead to chassis at "F."

B101—Replacement supplied on order (send sample) or use the following: One UR190 to replace the 16-16 mfd. section, all Black leads to chassis, two Red leads to each side of the choke. One CN141 to replace the 8-4 mfd. section. Black to chassis, Red to screen of 6A7, Blue to cathode of 25Z5 supplying field. One TS101, positive to 43 cathode, negative to chassis.

B102—Use one UR190 and one UR183; refer to schematics Nos. 8, 13 and 15, and connect units as follows: Black leads of UR190 to chassis, two Red leads to each side of the choke. Black and Brown leads of the UR183 to chassis, Yellow to cathode of output tube, one Red to rectifier cathode supplying the field, one Red to 6A7 screen supply.

B103—Refer to schematic No. 6 and connect two Red leads of the RN235 to point "A," the remaining Red to "B," and Black to chassis at "C," "D."

B104—When AC-DC switch is in AC position the filter circuit is the same as schematic No. 8 with the exception that there is an additional choke connected at point "C." Connect UR182 as follows: Red to point "C," Black to point "F," Yellow to point "A," Blue to point "B," Green to the AC side of the AC-DC switch connected to the speaker field, and Brown to points "D" and "E."

B105—Refer to schematic No. 45 and connect UR190 as follows: One each of the two Red leads (having a common exit from the carton) to points "D" and "E," the Black of this section to chassis at "F," one of the remaining Red leads to point "A," corresponding Black connects to the remaining Red and to point "B," the remaining Black to the chassis at point "C."

B106—Refer to schematics Nos. 4 and 17 and connect RM265 as follows: Red and Blue to points "A" and "B," Black to "C," Brown and Yellow to "D," Green to filament center tap resistor.

B107—Connect CM173 as follows: One Red to junction of filter choke and RF choke, another Red to the screen of the first detector, remaining Red to "B" plus of the audio-transformer, and all Blacks to chassis.

B108—Refer to schematics Nos. 8 and 15 and connect RM259 as follows: Blue and Green together to point "C," Red to point "B," Black, Brown and Yellow to chassis at "E" and "F." Connect RN232 Black to chassis at "D," one Red to point "A," and remaining Red to cathode of output tube.

B109—To replace RC501 refer to schematics Nos. 13 and 15, and connect CN152 as follows: one Red to osc. plate supply, remaining Red to cathode of output tube, and Black to chassis. For RC502 refer to schematics Nos. 13 and 14, and connect CN150 as follows: one Red to junction of 20M ohms and 500M ohms resistors in the first AF plate supply, remaining Red to first AF screen, and Black to chassis.

B110—If the filter and by-pass condensers are all in one block, refer to schematics Nos. 6 and 15, and use UR182 connected as follows: Connect Blue to point "A," Yellow to point "B," Black, Green and Brown together to points "C" and "D," remaining Red to detector cathode.

B111—Refer to schematics Nos. 1 and 15, connect CN155 and TN111 as follows: Two Reds of CN155 to point "A," remaining Red to point "C," Black of CN155 and negative of TN111 to chassis (that is, points "B" and "D"). Connect one positive of TN111 to detector cathode, remaining positive to cathode of output tube.

B112—Refer to schematic No. 25 and connect CM172 and TS102 as follows: One Red of CM172 to point "A," corresponding Black to point "C," remaining Red to point "B," the other Black to point "D," connect TS102, positive to point "D," negative to point "C."

B113—Refer to schematic No. 4 and connect UR182 as follows: Red, Blue and Yellow to points "A" and "B," Green and Brown to point "C," Black to point "D." Some of these sets used a can type unit for which we recommend an RM259 connected as follows: Red, Blue and Green to points "A" and "B," Black and Brown to point "C" Yellow to point "D."

B114—Refer to schematics Nos. 6 and 15 and connect UR182 and TS101 as follows: Blue to point "A," Red and Yellow to point "B," Black, Brown, Green and negative of TS101 to chassis. Positive of TS101 to cathode of output tube.

B115—Refer to schematic No. 27 and connect UR182 as follows: Red, Blue and Yellow to points "A," "B" and "C," Brown and Green to points "D" and "E," Black to chassis at point "F."

B116—Refer to schematics Nos. 3 and 14 and connect HS692 as follows: Red to point "A," Black to point "D." Connect UR191, the two Red leads (with common exit) together and to point "B," corresponding Black to point "E," one of the two remaining Red leads to point "C," the other to the 100-volt tap on the voltage divider, both remaining Black leads to point "F."

B117—Refer to schematic No. 4 and connect CM165 as follows: All Red leads together and to points "A" and "B," two Blacks to switch (point "C") and the remaining Black to chassis (point "D").

B118—Refer to schematic No. 11 and connect UR182 as follows: Yellow to point "A," Red and Blue together and to points "B" and "C," Green and Black together and to point "F," and Brown to point "E." This connection is not the same as the standard described in note 31. However, the wiring used in note 31 is applicable in some cases of noticeable hum.

B119—Refer to schematics Nos. 6 and 15 and connect CN145 and TS102 as follows: two Reds of CN145 to point "A," remaining Red to point "B," Black to point "C." Connect TS102 positive to output cathode, negative to point "D."

B120—Refer to schematics Nos. 2 and 13 and connect CN155 and CN142 as follows: Two Reds of CN155 to point "A," remaining Red to point "C," Black to chassis at points "C" and "D." Connect one Red of CN142 to terminal 6 of original block, remaining Red to original terminal 4, and Black to chassis.

B121—If receiver should be disconnected from the power pack the voltage rises to 900 volts for 9P6 and correspondingly for the other similar power packs; therefore, we advise the use of HS (High Surge) units for replacement.

Schematic No. 47 gives a view of a replacement made with HS carton units.

The by-pass sections of the original may be replaced with larger capacity units of electrolytic type, thereby giving better filtering action at the by-pass point.

The illustration in schematic No. 47 shows an installation of two HS692 and two HS690 condensers replacing the original block.

B122—Mount CN145 and TS101 in the original can. Refer to schematics Nos. 6 and 15 and connect as follows: Two Reds of CN145 to point "A," remaining Red to point "B," and Black to points "C" and "D." Connect Positive of TS101 to output cathode, and negative to point "D."

B123—Mount CN151 and TS101 in the original can. Refer to schematics Nos. 1 and 15 and connect as follows: Red of CN151 to point "A," Blue to point "C," and Black to points "B" and "D" (chassis). Positive of TS101 to output cathode, and negative to chassis.

B124—Refer to schematic No. 6 and connect CN145 as follows: Two Reds together and to point "A," remaining Red to point "B," and Black to points "C" and "D."

B125—Condenser supplied on order. Send sample or if this is not possible state part, make and model number of receiver.

B126—To replace P80956 refer to schematic 25 and connect RM262 and TS102 as follows: Red of RM262 to point "A," Black to point "C," Blue to point "B," and Brown to chassis. Connect TS102 negative to point "C," and positive to chassis. Duplicate condenser supplied on order. Give part, chassis and model number of receiver.

B127—To replace P80937 refer to schematics Nos. 14 and 15 and connect RN231 as follows: One Red to IF screen, the other Red to second detector cathode, and Black to chassis. Duplicate condenser supplied on order. Give part, chassis and model number of receiver.

B128—Original is a dual 12 mfd. unit, physical characteristics unknown. If of the can type, an RN245 may be used. Combine two of the sections and connect to the input side of speaker field, the other section to the output side of the field, Black to chassis.

Although the CN152 will satisfactorily replace the original part (No. B166143) some may desire to use a CS133 and TS101, which is entirely satisfactory in every way.

B129—Since these condensers originally had a screw-socket base, we recommend replacement with a carton beneath the chassis.

B130—Refer to schematics Nos. 1 and 15 and connect CN151 and TS101 as follows: Blue of CN151 to point "A," Red to point "C," and Black to points "B" and "D." Connect TS101 positive to AF output cathode, negative to chassis.

B131—Connect CN151 as directed in note 130.

B132—Refer to schematic No. 1 and connect RN241 as follows: Blue to point "A," Red to point "C," Black to chassis at points "C" and "D."

B133—Original unit was combination of .25 mfd. and .5 mfd. paper, and 8 mfd. electrolytic. Replace with combination of TP420, TP432 and TS101 respectively.

B134—Refer to schematics Nos. 8 and 15 and connect UR189 as follows: Blue to point "A," one Red to point "B," the other Red to point "C," Black, Brown and Green to points "D," "E" and "F," one Yellow to cathode of detector and output tube respectively.

B135—Refer to schematics Nos. 14 and 15 and connect CN152 and TP420 as follows: One Red of CN152 to oscillator plate supply, remaining Red to cathode of first audio tube, and Black to chassis. Connect TP420 to the junction of 25M ohms and 250M ohms resistors in the second Detector plate lead, and to the chassis.

B136—The original condenser had two .25 mfd. and one .5 mfd. paper sections, and one 20 mfd. electrolytic. To replace electrolytic section, use TS102, connecting positive to cathode of output tube, negative to chassis.

B137—Refer to schematics Nos. 13 and 14 and connect UR181 as follows: Red lug to driver plate supply, Blue lug to IF screen circuit, and Green lugs to first AF plate resistor.

B138—Refer to schematics Nos. 13 and 14 and connect UR181 as follows: Red lug to IF screen circuit, Blue lug to driver plate supply, Green lugs to plate resistor.

B139—Refer to schematics Nos. 1 and 19 and connect RN242 as follows: One Red to point "C," remaining Red to chassis, Black to points "B" and "D."

B140—Refer to schematic No. 49 and connect RN235 as follows: To replace first section, connect Red to point "A," two Reds to point "B," Black to point "C." To replace second section connect Red to point "D," two Reds to point "E," Black to point "F" (chassis).

B141—Refer to schematics Nos. 1 and 19 and connect RN245 as follows: One Red to point "A," one Red to point "C," remaining Red to chassis, Black to points "B" and "D."

B142—Refer to schematic No. 13 and connect UR181 as follows: Red lug to anode grid supply of first detector, Blue lug to IF plate supply, Green lugs to screen circuit.

B143—Refer to schematics Nos. 1 and 15 and connect RM259 as follows: Red to point "A," Blue to point "C," Black, Brown and Yellow to chassis, Green to cathode of output tubes.

B144—We advise the use of two CS126 and one CN142 units connected as in schematics Nos. 41 and 15 as follows: Red of one CS126 to point "A," Red of the other CS126 to point "B," one Red of CN142 to point "C," remaining Red to cathode of output tube, all Blacks to points "D," "E," and "F."

Note—The UR190 may be used in place of the two CS126's.

B145—Refer to schematics Nos. 1 and 19 and connect RN245 as follows: Two Reds to point "A," one Red to chassis, Black to points "B" and "D."

B146—Refer to schematics Nos. 13 and 14 and connect UR181 as follows: Red lug to audio plate supply, Blue lug to IF screen circuit, Green lugs to anode grid supply of first detector.

B147—Refer to schematics Nos. 13 and 14 and connect UR181 as follows: Red lug to second detector plate supply, Blue to IF screen circuit, Green lugs to anode grid supply of first detector.

B148—Refer to schematics Nos. 13 and 14 and connect UR181 as follows: Red lug to driver plate supply, Blue lug to IF screen circuit, one Green lug to first audio screen, remaining Green lug to oscillator plate supply.

B149—Refer to schematics Nos. 13 and 14 and connect UR181 as follows: Red lug to first detector screen, Blue lug to driver plate supply, one Green lug to second detector plate resistor, remaining Green lug to first detector anode grid supply.

B150—Refer to schematics Nos. 13 and 14, connect UR181: Red lug to IF screen circuit, Blue lug to first detector anode grid supply, Green lugs to driver plate supply.

B151—Refer to schematic No. 13 and connect UR181 as follows: Red and Blue lugs to first detector screen circuit, and Green lugs to second detector plate resistor.

B152—Connect Red leads in place of original lugs, Black to chassis.

B153—Refer to schematics Nos. 13 and 14 and connect UR181 as follows: Red lug to oscillator plate supply, Blue lug to RF plate supply, one Green lug to second audio plate supply, and remaining Green lug to second detector plate resistor.

B154—Refer to schematic No. 11 and connect UR182 and CS121 as follows: Yellow of UR182 to point "A," Red and Blue to points "B" and "C," Green and Brown to points "D" and "E," Black of UR182 and CS121 to point "F," Red of CS121 to osc. anode resistor.

B155—Refer to schematic No. 27 and connect UR182 as follows: Blue, Red and Yellow together and to points "A," "B," and "C," Brown to points "D," "E," and Black and Green together and to point "F."

B156—These two 4 mfd. sections are contained in the same unit with several small capacity condensers of the paper type. For the replacement of the filter section use a non-polarized unit as in note B11. The 4 mfd. by-pass section may be replaced with TS105 installed at the socket.

B157—Refer to schematic No. 50 and connect RM257 as follows: Red to point "A," Black to point "C," Blue and Green together to point "B," Brown and Yellow to point "D."

B158—These condensers are contained in a capacitor block with several small paper condensers. To replace these units we recommend for external replacement a CM175 connected as follows: Two Reds to points "A" and "B," one Black to point "C," two remaining Blacks to point "D," remaining Red to screens.

B159—Refer to schematics Nos. 6 and 15 and connect RM259 as follows: Red to point "A," Blue to point "B," Black, Brown and Yellow to points "C" and "D," Green to cathode of output tube.

B160—The original block contained two 10 mfd. electrolytics and a .5 mfd. paper. Replace with CN152 and TP431. Connect one Red of the CN152 to the screen of output tubes, the remaining Red to the cathode of detector tube, Black to negative line. TP431 replaces the coupling condenser between the 37 plate and the interstage transformer.

B161—Refer to schematics Nos. 13, 14, 15 and 19, and connect SR612 and TS101 as follows: One Red of SR612 to RF screen, remaining Red to driver plate supply, Black to HV. center tap, Blue to first audio cathode (be sure to ground can). Connect TS101 positive to driver cathode, negative to chassis.

B162—Refer to schematics Nos. 13, 14, 15 and 19 and connect SR612 as follows: One Red to RF screen, remaining Red to the junction of the resistors in the first AF plate supply, Black to center tap of high voltage, and Blue to first AF cathode (be sure can is grounded).

B163—Refer to schematics Nos. 13, 14 and 19 and connect CN151 and TS101 as follows: Red of CN151 to RF screen, Blue to first AF plate supply, Black to chassis. Positive of TS101 to chassis, negative to high voltage center tap.

B164—Refer to schematics 13 and 14, connect CN151 and TS101 as follows: Red of CN151 to RF screen, Blue to first AF plate supply, Black to chassis. Connect TS101 positive to shield wire, negative to chassis.

B165—Refer to schematics Nos. 15 and 19 and connect CM162 as follows: One Black to transformer center tap, corresponding Red to chassis, remaining Red to first AF cathode, Black to chassis.

B166—This block contains the filter condensers and the output choke and condenser. When replacing by section by sure to leave output assembly intact.

B167—For replacement of this entire block, we recommend purchase of original block from manufacturer. However, in case of emergency, the block may be taken apart and replacement accomplished by using the CN150 unit or exterior application may be made. Precaution should be taken to preserve the original block wiring, not affected by the replacement.

B168—Refer to schematics Nos. 1, 14 and 15 and connect CN155 and TS101 as follows: One Red of CN155 to screen of AF output, another Red to RF screen, remaining Red to oscillator plate supply, Black to chassis. Connect TS101 positive to second detector cathode, negative to chassis.

B169—This condenser is contained in a block with several paper condensers and this replacement is suggested to replace this section only and the rest of the block must be left in the receiver as connected.

B170—Refer to schematics Nos. 27 and 19 and connect RM259 and TS101 as follows: Red, Blue and Green of RM259 together and to points "A," "B" and "C," Black and Yellow together and to points "D" and "E," Brown to point "F." Connect TS101 positive to output tube cathode, negative to resistor tap in output tube grid circuit.

B171—Refer to schematics Nos. 9 and 15 and connect UR190 and CM161 as follows: One Red of common negative section of UR190 to point "B," remaining Red to point "A," Black to point "C," Red of one independent section to point "A," Black to point "B," remaining Red to point "D," Black to output cathode. Connect CM161, Blue to point "D," Brown to point "E," Red to output cathode, Black to point "E."

B172—Connect UR189 as follows: One Red to rectifier cathode, Green and Black to negative line, remaining Red to RF screens, Blue to output plate supply, Brown and both Yellow to output cathode.

B173—For replacement of this entire block we advise purchase of a duplicate from the manufacturer. In case of emergency, the block may be taken apart and replacement accomplished by using the CN152 unit. Wiring to parts of the block not affected by the replacement should be left intact.

B174—This assembly contains an 8 mfd. electrolytic, a .5 mfd. and a .25 mfd. paper condenser and the driver transformer. We advise the CS133 unit for external replacement of the 8 mfd. section.

B175—Refer to schematics Nos. 1, 13 and 15 and connect CN151 and CN140 as follows: Red of CN151 to point "C," Blue to anode grid supply of first detector, Black to chassis. One Red of CN140 to RF screen, remaining Red to detector cathode, Black to chassis.

B176—Refer to schematics Nos. 13 and 15 and connect CN150 and CN141 as follows: One Red of CN150 to output plate supply, remaining Red to anode grid, Black to chassis. Red of CN141 to Det. cathode, Blue to screen supply, Black to chassis.

B177—Refer to schematics Nos. 13 and 15 and connect RN245 as follows: One Red to first AF plate supply, another Red to RF screen supply, remaining Red to first AF cathode and Black to chassis.

B178—Refer to schematics Nos. 14, 15 and 19 and connect RN231 and TS101 as follows: Red of RN231 to first Audio cathode, Blue to RF screens, Black to chassis. Pos. of TS101 to chassis, negative to power transformer HV. center tap.

B179—Refer to schematics Nos. 13, 14 and 19 and connect RN241 and TS106 as follows: Red of RN241 to screen circuit, Blue to second Det. plate supply, Black to chassis. Pos. of TS106 to chassis, negative to power transformer HV. center tap.

B180—Refer to schematics Nos. 9 and 15 and connect CM173, CM160 and TS102 as follows: One Red of CM173 to point "A," corresponding Black to point "B," another Red to point "B," remaining Black to point "C," remaining Red to point "A." Red of CM160 to point "D," corresponding Black to cathode of output tube, remaining Red to RF screen circuit, Black to point "E." Pos. of TS102 to output cathode at tube socket, negative to point "E."

B181—Refer to schematic No. 3 and connect CN151 as follows: Blue to point "B," Red to point "C," and Black to "E" and "F."

B182—The UR182 replacement has higher capacity values than the original. However, the UR182 will not cause any change in the operation of the set.

B183—Refer to schematics 12, 13 and 19 and connect CN142 and TS104 as follows: One Red of CN142 to screen of AF output, remaining Red to RF screen, Black to chassis. Connect TS104 positive to chassis, negative to B minus.

B184—Substitute TS101 for TS104 and connect as in Note 183.

B185—Refer to schematic No. 9 and connect RM257 as follows: Blue to point "A," Red and Green to points "B" and "C," Black and Brown to points "D" and "E," Yellow to point "F."

B186—Refer to schematic No. 52 and connect RM259 and TS101 as follows: Red and Green of RM259 to point "A," Black and Yellow to point "D," Blue to point "B," Brown to point "E." Connect TS101 Positive to point "F," negative to point "D."

B187—Substitute TS102 for TS104 and connect as in Note B183.

B188—Substitute TS103 for TS104 and connect as in Note B183.

B189—Refer to schematics Nos. 24 and 15 and connect UR189 as follows: Both Reds to point "A," Blue to point "B," Black, Brown and Green to points "C" and "D," one Yellow to output cathode, remaining Yellow to Det. cathode.

B190—The original condenser had three leads, Red-positive 10, Yellow-positive 20 and Black-common negative. Due to lack of circuit information we can give replacement instructions for the oirginal only. Use RN245 and connect one Red to the original Red, the two remaining Reds to the original Yellow, and Black to the original Black. The Mallory bracket 104-1 should be used for installation.

B191—Refer to schematics Nos. 1 and 13 and connect RM259 as follows: Red to point "A," Black to point "B," Blue to point "C," Brown to point "D," Green to original bypass lead, and Yellow to chassis.

B192—Refer to schematics Nos. 4 and 13 and connect RM265 as follows: Red to point "A," Black to point "C," Blue to point "B," Brown to point "D," Green to oscillator plate supply, and Yellow to chassis. Use Mallory No. 104-1 mounting bracket for this installation.

B193—Refer to schematics Nos. 1 and 15 and connect RN245 and TS101 as follows: Two Reds of RN245 to point "A," remaining Red to point "C," Black of RN245 and negative of TS101 to "B" and "D," Pos. of TS101 to output cathode.

B194—This model originally used two 8 mfd. carton type condensers. If both units are defective, CN152 affords an ideal replacement.

B195—The filter condenser for this receiver is contained in a block which is of the plug-in type. We advise replacing the defective sections with Mallory Carton type units of the same voltage and capacity beneath the chassis.

B196—When two units are specified for a non-polarized replacement, connect the negative leads together and tape. Use the two positive leads for wiring into the circuit. Also see Note B11.

B197—Refer to schematics Nos. 6 and 15, and connect UR192 and TN111 as follows: Connect UR192, one Red to point "A," remaining Red to point "B," both Blacks to chassis. Connect TN111, one positive to detector cathode, remaining positive to output cathode and negative to chassis.

B198—Refer to schematic No. 25 and connect CM171 as follows: Blue to point "A," Red to point "B," Brown to point "C," and Black to point "D."

B199—Refer to schematic No. 25 and connect CM171 as follows: Red to point "A," Blue to point "B," Black to point "C," Brown to point "D."

B200—Refer to schematics Nos. 30 and 14 and connect UR191 as follows: the two Red leads (having common exit) to points "A" and "B," and corresponding Black to points "D" and "E," one remaining Red to point "C," the other to the IF plate supply, both remaining Blacks to chassis at point "F."

B201—Refer to schematics Nos. 3 and 13 and connect UR191 as follows: One Red each to points "A," "B," and "C," remaining Red to first AF plate supply, all Black leads to chassis (points "D," "E," and "F").

B202—Refer to schematic No. 25 and connect CM171 and TS102 as follows: Red of CM171 to point "A," Blue to point "B," Black to point "C," and Brown to point "D." Connect TS102, positive to point "D," and negative to point "C."

B203—Refer to schematic No. 57 and connect CN155 as follows: One Red to each of the following points: "B," "D" and "G." Black to point "H" (chassis).

B204—Refer to schematic No. 57 and connect CS131 and CN152 as follows: Red of CS131 to point "A," one Red of CN152 to point "C," remaining Red to points "E" and "F," all Blacks to points "H" (chassis).

B205—Refer to schematic No. 56 and connect CM175 as follows: two Red leads to point "A," the two corresponding Black leads to point "C," remaining Red to point "B," remaining Black to point "D" (chassis). This unit may be installed in the original case.

B206—Refer to schematic No. 30 and connect CM175 as follows: One Red to point "A," corresponding Black to point "D," another Red to point "B," corresponding Black to point "E," remaining Red to point "C," remaining Black to point "F" (chassis).

B207—Refer to schematics Nos. 8 and 15 and connect RM257 and TS101 as follows: Blue of RM257 to point "A," Red to point "B," and Green to point "C." Connect Brown, Yellow and Black together and to points "D," "E" and "F." Connect TS101, positive to AF output cathode and negative to point "F."

B208—To replace with CM173 and TS107, connect as follows: Connect one Red of CM173 to center tap of output transformer, another Red to the driver plate supply, remaining Red to IF plate supply, all Blacks to chassis. Connect TS107 positive to driver cathode, negative to chassis.

B209—Connect RN231, Blue to "B" plus 135V., Red to RF screen, and Black to chassis. Some models used a non-polarized filter condenser. RN231 is satisfactory for this replacement if the proper battery polarity is observed. Be sure to check this point, as a reversal of polarity may result in serious damage to the receiver.

B210—Refer to schematics Nos. 8 and 15 and connect UR182 and TS101 as follows: Connect Yellow of UR182 to point "A," Blue to point "B," Red to point "C," Black, Brown and Green together and to points "D," "E" and "F." Connect TS101 positive to output tube cathode, negative to point "F."

B211—Refer to schematics Nos. 1 and 15 and connect RN245 as follows: One Red to point "A," another Red to point "C," remaining Red to output tube cathode, and Black to points "B" and "D" (chassis).

B212—Refer to schematics Nos. 1, 13 and 15 and connect RN245 as follows: One Red to screen of output tube, another Red to the first detector plate supply, remaining Red to cathode of output tube, and Black to chassis.

B213—Refer to schematic No. 25 and connect RM261 and TS102 as follows: Red of RM261 to point "A," Blue to point "B," Black to point "C," and Brown to point "D." Connect TS102, positive to point "D," and negative to point "C."

B214—Refer to schematics Nos. 11 and 15 and connect UR182 and TS101 as follows: Connect UR182, Yellow to point "A," Blue and Red together and to points "B" and "C," Green and Brown together and to points "D" and "F," and Black to point "F." Connect TS101 positive to detector cathode and negative to point "F."

B215—Refer to schematic No. 11 and connect RM257 as follows: Blue to point "A," Green and Red to point "B," Black, Brown, and Yellow to points "D" and "E."

B216—In some cases this condenser is a single 8 mfd. unit; we recommend the use of RS213 for these cases in place of RM262.

B217—Refer to schematics Nos. 13 and 15 and connect RN241 as follows: Blue to oscillator plate supply, Red to cathode of output tube, and Black to chassis.

B218—Refer to schematic No. 11 and connect RN235 as follows: One Red to point "A," two Reds to point "B," Black to point "D." To replace second condenser connect RN231, Red to point "C," Blue to osc. anode grid supply, Black to point "F."

B219—Refer to schematics Nos. 1 and 15 and connect SR611 as follows: One positive 8 mfd. lug to point "A." The other positive 8 mfd. lug to point "C," Black lead to points "B" and "D," Blue lead to second AF cathode. It may be of assistance in installing if the leads of the old unit are cut close to the carton and these leads used for connecting the new unit.

B220—Refer to schematics Nos. 1 and 15 and connect CN152 and TN110 as follows: One Red of CN152 to point "A," remaining Red to point "C," Black to points "B" and "D." One positive of TN110 to detector cathode, remaining positive to output cathode and negative to chassis.

P. R. MALLORY & CO. Inc.
MALLORY

The Dry Electrolytic Condensers
Sold by P. R. Mallory & Co., Inc., are manufactured under one or more of the following U. S. Letters Patent:

2,020,408	1,891,207
1,989,129	1,891,206
1,981,533	1,774,455
1,981,352	1,715,789
1,918,717	1,714,191
1,918,716	1,710,073
1,912,223	2,052,962
1,909,506	Re. 18,673

and other pending patents.

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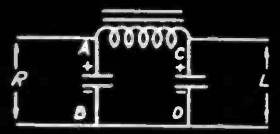

Notes 59, 75, 91, 97, 111

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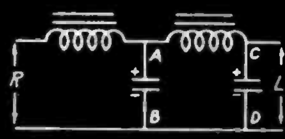

Note 120

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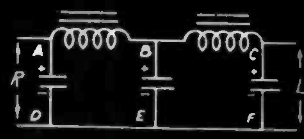

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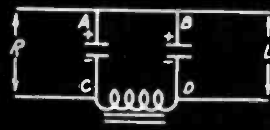

Notes 25, 58, 70, 73, 113

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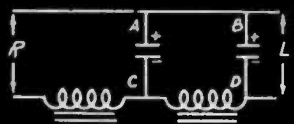

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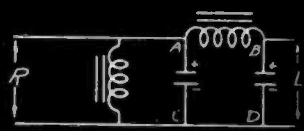

Notes 18, 36, 65, 103, 119

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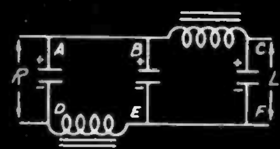

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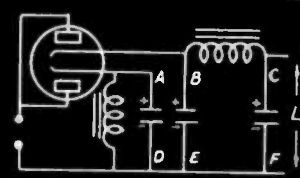

Notes 67, 104, 134, 207, 210

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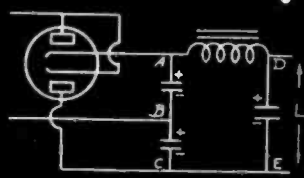

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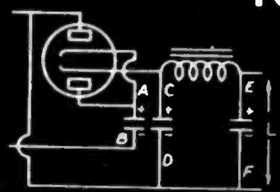

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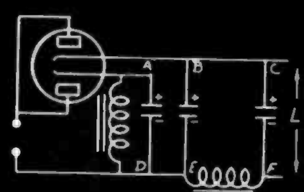

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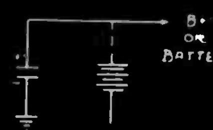

Note 183

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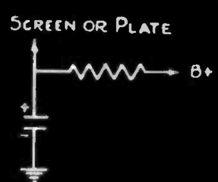

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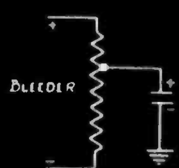

Note 70

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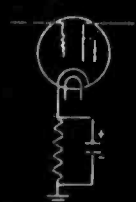

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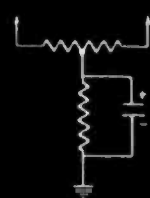

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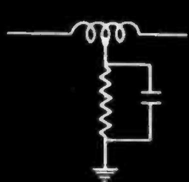

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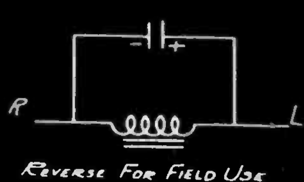

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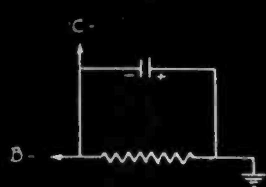

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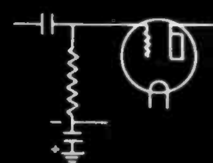

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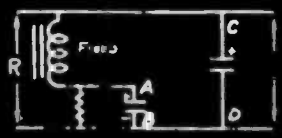

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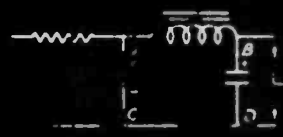

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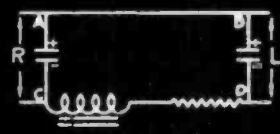

Note 50

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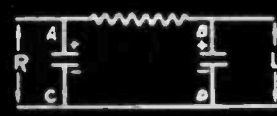

Note 189

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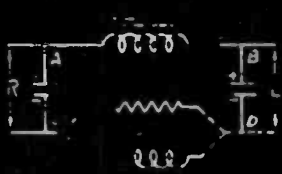

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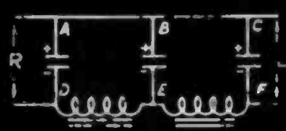

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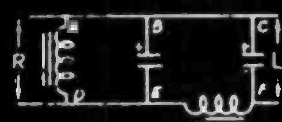

Notes 88, 94, 1?5, 170

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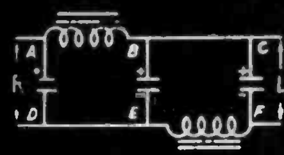

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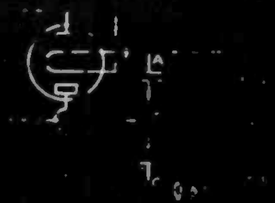

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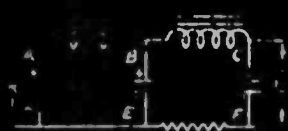

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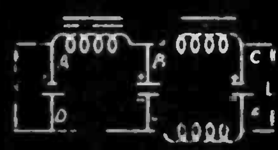

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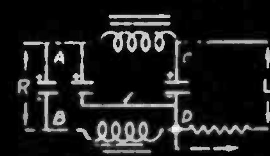

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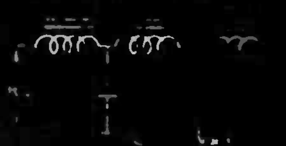

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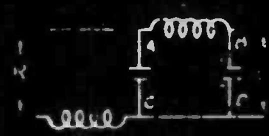

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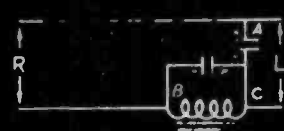

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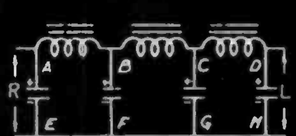

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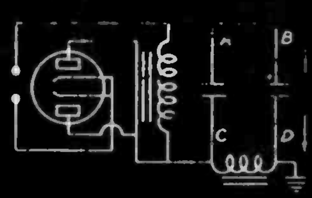

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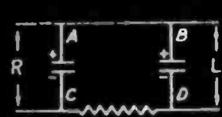

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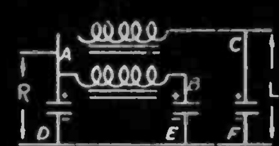

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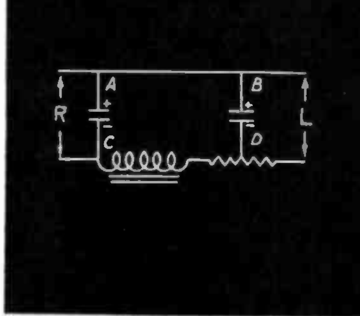

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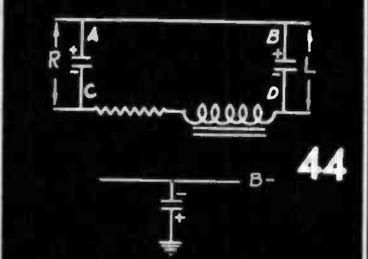

Note 97

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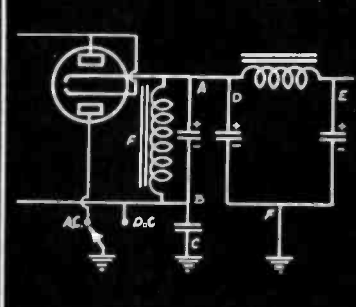

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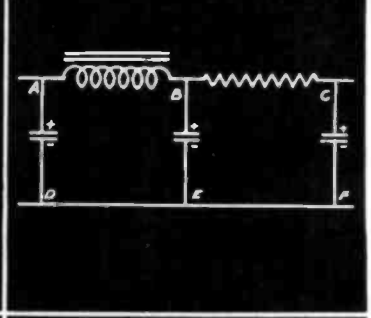

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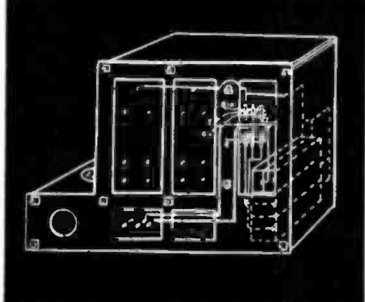

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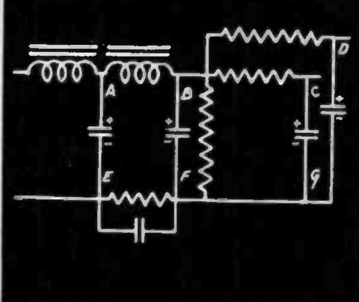

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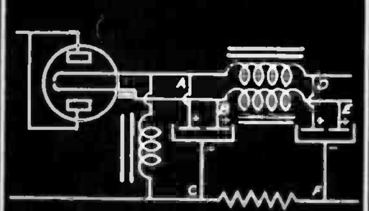

Note 140

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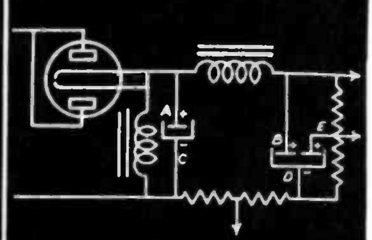

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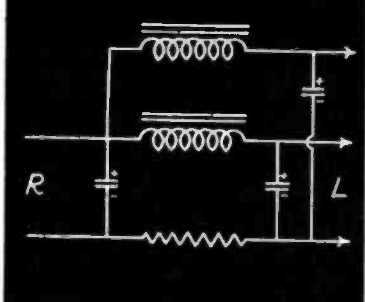

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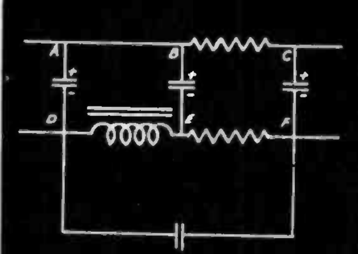

Note 186

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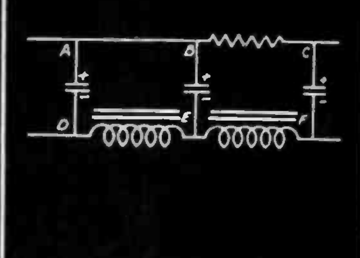

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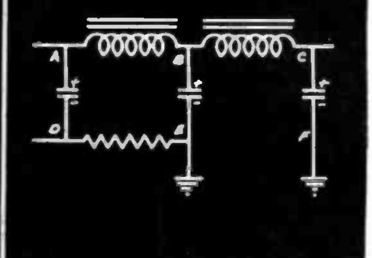

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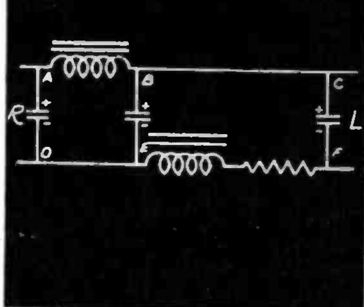

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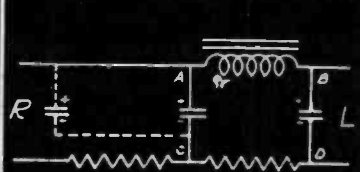

Note 205

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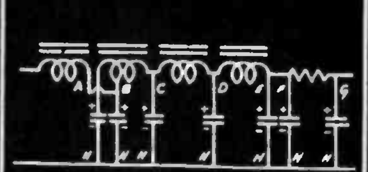

Notes 203, 204

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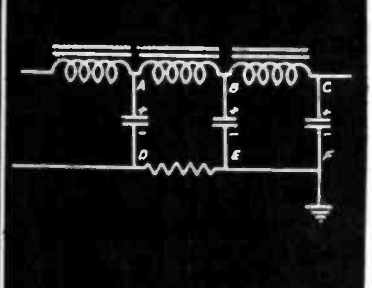

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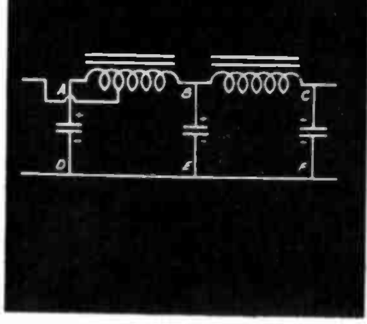

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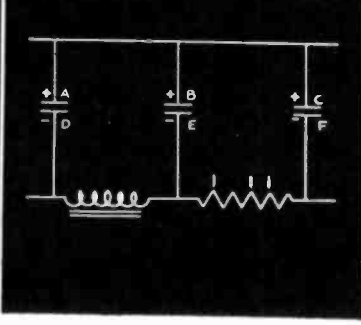

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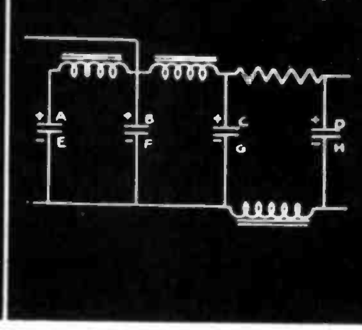

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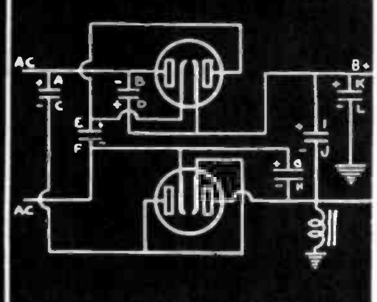


P. R. MALLORY & CO., Inc.

MALLORY
REPLACEMENT CONDENSERS AND ACCESSORIES

The Dry Electrolytic Condenser is the invention of Samuel Ruben, long an associate of the Mallory Co., and the pioneer patents in the field are the two Ruben Patents 1710073 and 1714191.

INTELLIGENT and systematic research is the backbone of all progress. Experience and common sense the medium for the successful application of any new development. P. R. Mallory & Co., Inc., have for many years been the major supplier of original condenser equipment to radio receiver manufacturers. Representing the pioneer manufacturer in the dry electrolytic condenser field, it is not surprising that the majority of worthwhile contributions to the art have been made by Mallory. These contributions were the direct result of extensive research, efficiently applied to the problems involved. For several years the need for a systematic and efficient replacement condenser program has been acknowledged by the Mallory management personnel. Time and again the thought of launching such a program was discussed—only to be shelved temporarily as not worthy of the standards of progress set by those who have led the Mallory Company to its present successful standing in the industry. Finally, after a diligent investigation of the requirements of the radio replacement field, and with the help of thousands of radio service engineers throughout the country, the Mallory Company announced the now famous "Universal Condenser Replacement Program." This announcement was made in January, 1936, just one year ago. It marked a new departure in the replacement field. The success of the Mallory program is now history, but it is gratifying indeed to review the outstanding acclaim it received and the precedents set. While imitation has been called the sincerest form of flattery, it is amusing to record the extent to which this has been attempted.

With pardonable pride we reveiw a few of the outstanding and revolutionary Mallory achievements in the replacement condenser field.

1. **First Replacement Condenser Manual**—the greatest assistance ever offered the service engineer.
2. **First Complete Universal Condenser Line**—Made condenser servicing a pleasure and took it out of the penny profit class.
3. **First Practical Mounting for Carton Type Condenser**—The famous metal flange. Everyone wonders why it was never done before.
4. **First Universal Mounting for Round Type Condensers**—Astounding! But so simple and practical.
5. **First Complete Line of Compact, Space-Saving Condensers**—Every condenser the right size for all applications.
6. **First Internal Metal Seal for Carton Condensers**—Even the Pittsburgh flood failed to harm them.
7. **First With Correct Size Lead Wires**—Not designed for 5 Horsepower motors, but for radio condenser replacements.
8. **First Really High Surge Condensers**—They can take it. If one didn't—we haven't heard about it.
9. **First With Cellophane Separators**—Surge voltage breakdown? What is it?
10. **First With the "Terminal Connector"**—Change a "haywire" job to a neat assembly.

In spite of these innovations, and many others, Mallory is still not satisfied. They are constantly striving to improve the original program.

Use Mallory and you'll save time, have success with your work, a healthy profit, and no regrets.

MALLORY CONDENSER TYPE CODE

- **CS** Carton Type Condensers Single Units.
- **RS** Round Can Type Condensers Single Units
- **CN** Carton Type Condensers Multiple Units Common Negative
- **RN** Round Can Type Condensers Multiple Units Common Negative
- **CM** Carton Type Condensers Multiple Separate Sections
- **RM** Round Can Type Condensers Multiple Separate Sections
- **TS** Tubular Single Units
- **TN** Tubular Dual Section Common Negative Units
- **UR** Universal Replacements
- **SR** Special Replacments
- **HD** Heavy Duty Units
- **HS** Special High Surge Units
- **BN** Round Can By-Pass Units Common Negative
- **MN** Large Round Can Units Multiple Common Negative
- **HC** High Capacity Low Voltage Units
- **WE** Wet Electrolytics
- **TP** Tubular Paper Units
- **AG** Auto Generator Units
- **VB** Vibrator By-Pass Units
- **VL** Vibrator By-Pass Units Long Type
- **VO** Vibrator Oval Type Units
- **OT** Oil Filled Tubular Units
- **MS** Motor Starting AC Capacitors

SMALL SIZE PRECISION QUALITY

Small size without High Quality would defeat any practical advancement in this field. Mallory policy prohibits any sacrifice of quality. The introduction of new Mallory Replacement Condensers, **all small in size,** is in strict accordance with this policy. **Every size is the right size!**

Every Mallory condenser has equal or better characteristics, including life expectancy, to any unit offered heretofore.

Every unit is designed expressly for outstanding performance. **Size was a secondary consideration.**

Mallory Condensers must undergo a severe life test before release for sale is permitted. In this respect, not a few, but hundreds of units are placed on life test. This life test is not only conducted under actual conditions as experienced in the field but is much more severe. Besides subjecting condensers to their **maximum** DC working voltage on life test, an AC component greater than ever present in field service is also imposed over and above the DC voltage.

Radio sets in general and Midget sets in particular produce relatively high internal temperatures. Therefore **life tests run at room temperature have no significance. The Standard Mallory life test specifications call for the use of an industrial oven constantly maintained at 140° F. for the duration of the test! A thousand hours in this oven under the severe voltage applied is equal to over a year's service in the field.** No Mallory unit is acceptable for service if it shows any inclination to change appreciably in characteristics at this interval. **All Mallory life tests are continued even after the 1,000 hour mark** and several thousand hours' life under these extreme conditions is the rule and not the exception.

GENERAL CONSTRUCTION AND DESIGN

Mallory, to make the ideal condenser, has given a great deal of thought to design and constructional points that at first might seem relatively unimportant.

All Mallory carton type units utilize standard wax impregnated fibre-board exactly the same as used universally on large production orders for radio set manufacturers. This type of material is used because it actually impregnates better than coated types of board having a silver or gold finish. This wax impregnation is highly important to the proper performance of the unit.

All Mallory carton units have square **corners and sides** that do not **bulge.** Besides adding to their appearance this indicates proper engineering. By designing the condenser correctly, no attempt to squeeze it into the carton is necessary.

The wire supplied on all Mallory units is especially selected for ample insulation and ease of installation. For this reason, on all but the tubular units, stranded push-back wire of the correct size and flexibility is used.

All Mallory replacement condensers are stamped with the necessary information directly on each container rather than on paper labels pasted to the container. **This type of marking provides permanent identification.** Paper label types are apt to become unglued and leave the unit without identity.

There are no common positive units in the Mallory line. These list at the same prices as the separate section type where each unit has its own pair of leads. The separate section type may, of course, be connected, when installing, either with the positives or the negatives common as well as other combinations. In the interests of reduced stock, the common positive type was purposely omitted.

SEALED IN METAL HUMIDITY-PROOF

Temperature is an extremely important factor. The use of Dry Electrolytic Condensers where high temperatures are involved may severely affect their life. All Mallory Condensers are designed to function in temperatures up to 140° F. This is ample to cover the usual temperature rise to be expected in the field. Care should be taken, however, not to install the condenser next to, or between other components producing high temperatures in or on the radio chassis. This refers to rectifier tubes, power tubes and voltage divider resistances and transformers. In some Midget sets, it is impossible to make an ideal installation in this respect.

A certain amount of moisture is included in the electrolyte of all Dry Electrolytic Condensers. The proper operation of the condenser is greatly dependent upon this moisture. In unprotected condensers this moisture may be lost, or on the other hand, the condenser may absorb more moisture, affecting the balance originally provided. **Mallory Condensers have** been designed with this point in view. All units are **effectively sealed including the cardboard carton types.** This is accomplished in the latter case by the **use of a metal seal of ingenious construction inside of the carton which has been found to stabilize this characteristic.**

You will note from the above illustration that the **metal seal completely seals the unit enclosed inside of the carton.** This Mallory feature throws the burden of stabilized humidity on the metal seal and not the carton alone as in ordinary condensers. The carton is thoroughly impregnated in wax affording double protection against humidity.

Because of this metal seal, these units will perform satisfactorily in tropical climates.

CELLOPHANE SEPARATORS
Etched Anodes—Stitched Anode Leads

All recent important improvements pioneered or developed by Mallory—are incorporated into Mallory Condensers wherever they add to quality and utility.

MALLORY TERMINAL CONNECTOR

AGAIN MALLORY SOLVES A PROBLEM IN A PRACTICAL WAY

This device will prove a great help whether used with condensers or for other purposes.

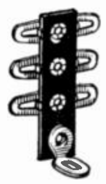


FIGURE 1

The Mallory Terminal Connector (Figure 1) is designed to provide an anchorage for the lead wires from the condenser where ordinarily splicing would be necessary. For example, when replacing an original unit having soldering lugs, the leads from the replacement unit may be cut short and the Terminal Connector used to join them with the set wiring.

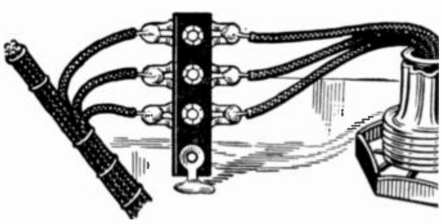


FIGURE 2

Solder (or bolt) the Connector strip to the chassis in an upright position as near as possible to the replacement condenser unit. Cut off the lead wires from the condenser to the proper length to reach the Terminal Connector and solder each one to a lug on the Connector as in Figure 2. (Note—All Mallory leads are push-back wire.) Now solder the circuit wires to the opposite lugs on the Terminal Connector in their proper order.

Obviously if more than three wires are involved, it will be necessary to use more than one Terminal Connector or splice the remaining leads. Generally, the black or negative lead is soldered to the chassis and need not use a lug.

Should the Terminal Connector be too high for the depth of the chassis it may be bent over to reduce its height.

MALLORY UNIVERSAL MOUNTING FLANGES for Carton Types

The mounting of carton type condensers has always been a problem from a replacement standpoint. An almost unanimous appeal for something new and practical was noted in the response to the Mallory Service Questionnaire. Mallory Engineers have studied the problem from the service man's angle.

All Mallory carton type condensers are equipped with a new type of mounting flange—**the first practical Universal mounting feature ever designed.**

Since there are several ways in which it may be used, complete instructions are given:

A. The unit may be mounted by the use of nuts and bolts or self-tapping screws in the usual manner as in Figure 3.

FIGURE 3

B. One end may be pushed under any screw head on the chassis without removing the screw as in Figure 4. The other end may be left loose or soldered to the chassis as in Figure 5.

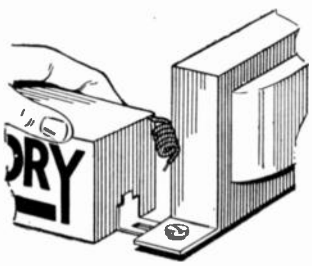


FIGURE 4

C. One flange or both flanges may be soldered to the chassis as in Figure 5. Tin the chassis first, then solder in place.

D. One half of the flange may be bent down as in Figure 6 and pushed through any convenient hole in the chassis. Bend back the flange after it is through the hole.

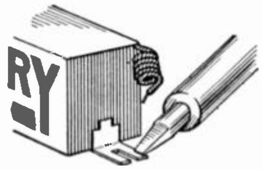


FIGURE 5

FIGURE 6

E. Both flanges may be bent flat against the side of the carton and the unit held in place by its wire leads.

In bending the flanges, hold your thumb tightly on the part attached to the carton to prevent tearing the carton.

Mallory Universal Mounting flanges have been widely copied, proving their merit and worth to service men. Constant improvement may be expected from Mallory—as their leadership in the replacement parts field will be maintained.

MALLORY UNIVERSAL MOUNTING FEATURES for Round Can Types RS, RN and RM

Round can condensers in general have been mounted by the use of one of five different methods, each varying enough to prohibit the use of any other type in making a replacement. This situation has now been overcome by the special features provided on all Mallory round can replacements. The universal nature of the newly designed units does away with the necessity of stocking duplicate ratings in several mounting types and consequently reduces the stock investment. **It is the first practical universal mounting feature for round can type condensers.**

The five methods of mounting referred to are:

1. **Stud mounting having a 5/8" neck.**
2. **Stud mounting having a 3/4" neck.**
3. **Stud mounting having a 7/8" neck.**
4. **Ring Clamp mounting.**
5. **Spade bolt mounting.**

STUD MOUNTING

Types 1, 2 and 3 are so familiar they require no illustration. The originals having the 5/8" or 3/4" neck generally had but one lug or one or more flexible leads. The 7/8" neck was usually of the moulded composition type and was generally equipped with from one to three lugs, this type seldom being supplied with flexible leads.

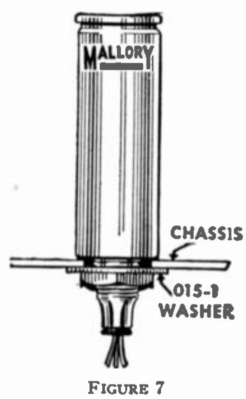


FIGURE 7

Due to tneir reduced size many Mallory round can units are supplied with 5/8" necks and a few of higher ratings have 3/4" necks. There are no 7/8" necks in the Mallory Replacement Condenser line. Obviously no instructions are needed to mount a 5/8" neck type Mallory unit in a 5/8" hole. You will find, however, that the 5/8" neck may be also satisfactorily mounted in a 3/4" hole without special accessories by simply centering the unit as the mounting nut is tightened. This holds true for the 3/4" neck unit when mounting in a 7/8" hole.

If the 5/8" neck is to be mounted in a 7/8" hole Mallory Type 015-1 washer supplied with the unit should be used beneath the chassis to afford the lock nut a better grip on the chassis (See Figure 7). No washer is necessary on top of the chassis in this case.

RING CLAMP MOUNTING

Where clamp mounting was used originally and the Mallory replacement is of the 1 3/8" can size it may be mounted in the same way as the original (See Figure 8); the threaded neck portion will protrude when mounted.

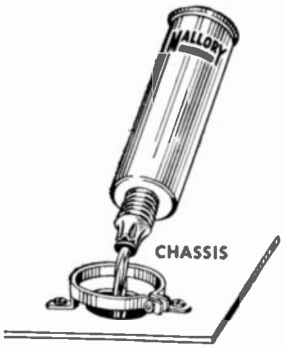


FIGURE 8

In replacing a clamp mounted unit with a 1" Mallory can size use the special Mallory 1 3/8" washer Type No. A-017. (Not supplied with the unit—List price $0.05). This washer is put on the unit and the nut tightened first, then fitted to the clamp as in Figure 9. The washer may be used with the flanged

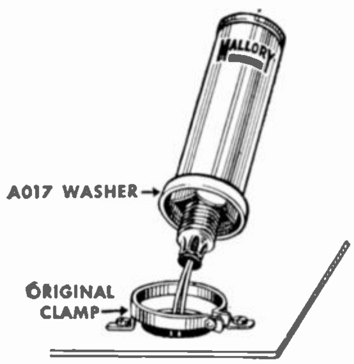


FIGURE 9

side up or down according to the space available for the threaded neck portion of the condenser below the chassis. The washer is not supplied with the unit due to the relatively few cases in which they are required. Their cost is so nominal compared to the reduced stock affected that a supply should always be kept on hand.

In cases where a 1 1/2" unit was used originally, if the clamp will not contract enough to fit the 1 3/8" diameter of the replacement, pad the clamp with a small strip of cardboard. Mallory units are insulated from their containers. It is not necessary that the clamp make electrical contact to the unit.

These features are not provided in the large 2 1/2" and 3" round can units. (See Type MN).

SPADE BOLT MOUNTING

Pictured in Figure 10, it should be noted that generally the holes punched in the chassis to accommodate this type were made with the same punch used for the wafer type tube sockets. The large center hole is about 1" in diameter but the Mallory 1 3/8" can units will mount satisfactorily using the Mallory Type No. 015-2 washer (supplied with the unit)

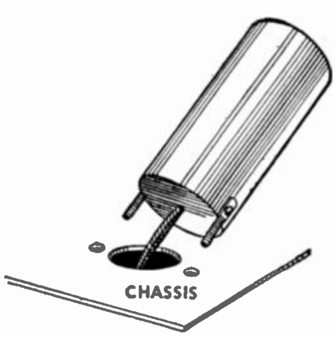


FIGURE 10

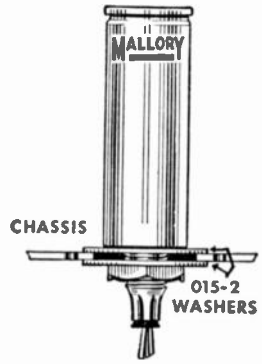
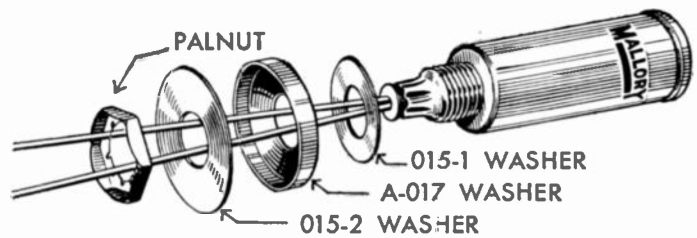


FIGURE 11

beneath the chassis similar to Figure 7. The unit should be centered, of course, when tightening the mounting nut.

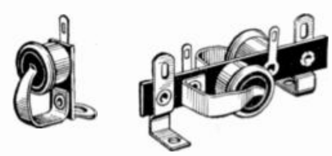
The 1" can type units require two Mallory Type No. 015-2 washers one above and one below the chassis to replace the spade bolt type (See Figure 11). These washers are not supplied with the 1" can units and list for $0.03 each. We suggest that you save these washers when using 1 3/8" Mallory units in mountings not requiring them. (All 1 3/8" units are supplied with one of these washers.) These flat washers are not lock washers and since the nut is self-locking, need not be used except as stated.

All Mallory round can dry electrolytic replacement units are insulated internally so that the can is not the terminal in any case. A separate wire is always brought out for the cathode connection. It is never necessary to use insulating washers with Mallory round can dry electrolytic units. **This does not apply to type MN.**



Mallory Grid Bias Cell

AN EXCLUSIVE MALLORY PRODUCT



Essentially the Mallory Grid Bias Cell is an electro-chemical cell capable of producing indefinitely a potential of approximately one volt. Its current supplying capacity is purposely made very small; i.e., less than one micro-ampere. Mechanically it is an acorn-shaped device, the outside cup or shell being the negative electrode and the black disc being the positive electrode. The black disk is insulated from the outside shell and sealed in place by means of a rubber gasket around its edges. Suitable mounting brackets have been developed for this cell which usually consist of a cup into which the cell is placed, and a spring contactor which presses down against the black electrode, holding the cell firmly in position. Mounting brackets holding and connecting up to nine cells in series are available for applications requiring more than one volt.

The cell is widely used in radio circuits to supply the fixed bias or negative voltage required by radio tubes in amplifying circuits.

Since the cell is incapable of supplying current, its **application is limited to Radio Frequency and Audio Amplifier stages** where the grid is not driven positive so as to cause it to draw current.

Other methods of obtaining the fixed or residual bias voltage are:

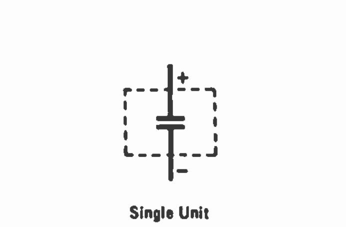
1. By inserting a resistance in series with the cathode of the tube to ground so that the voltage drop across it, due to the plate current flow, would provide the desired fixed bias. In RF circuits the disadvantages of this system are that the tube cathodes are above ground to RF giving rise to unwanted coupling between stages, causing oscillations, motor-boating, etc., unless extreme preventative precautions are taken. In audio circuits the cathode resistor gives rise to the commonly known degenerative effects (unless the resistor is by-passed by an extremely high capacity condenser), causing decreased power output, lack of low frequency response and introducing distortion. In high gain audio pre-amplifiers, cathode resistors give rise to feed back, motor-boating and hum troubles which are difficult to overcome. By grid bias cells in series with the grid returns to ground, troubles caused by cathode resistor biasing can be eliminated, resulting in improved performance. **The tone quality and power output of small AC-DC sets for example can be remarkably improved by using bias** cells to bias the first audio tube in place of the cathode resistor condenser combination.

2. By grounding the cathodes of the tubes and connecting the grid returns to a point the desired amount negative with respect to ground. This arrangement requires a suitable filter, usually a resistance-capacity network, to eliminate any hum which would otherwise be picked up by the grid circuit and amplified. Grid Bias Cells used in place of such circuits eliminate the grid filtering network and eliminate any hum or coupling difficulties often encountered with this method of obtaining bias.

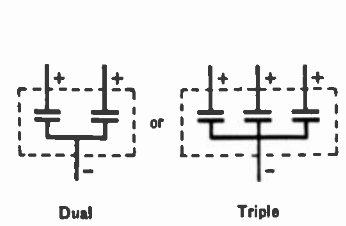
Many manufacturers use Mallory grid bias cells in their late model receivers in order to effect a savings and to improve performance. In fact, **there are several million Mallory Grid Bias Cells in use in the field giving an excellent service record over a period of the last two years.** Practically all the field troubles encountered with the bias cells have been found **due to poor contacts between the mounting bracket terminal and the rivet in** earlier type mounting brackets, instead of the cell itself. This is easily **remedied by soldering the rivet connection** and has been overcome in the later type mounting brackets by eliminating the rivet joint. **In checking bias cells, they must be measured with a vacuum tube type voltmeter which draws no current,** since the cell is incapable of supplying the current necessary for operating a conventional type voltmeter and an erroneous reading would be obtained. **When replacing a bias cell it is only necessary to slip the old cell out of the mounting and slip in a new one, care being taken to have appreciable spring tension between the spring arm and the black electrode surface. In mounting the bias cell it should be mounted so that the black electrode surface is either down or in a vertical plane.**

The Grid Bias Cell is an exclusive Mallory-Yaxley Product and is covered by patents numbers 1920151, 2063524, *et al.*

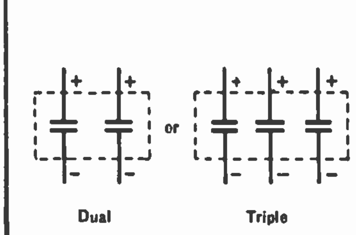
CS (CARTON) OR RS (CAN) TYPE



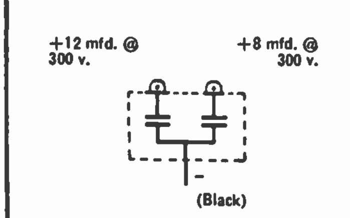
CN (CARTON) OR RN (CAN) TYPE



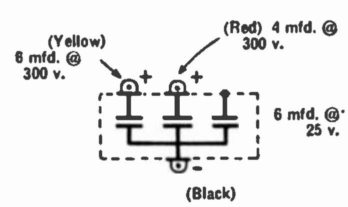
CM (CARTON) OR RM (CAN)



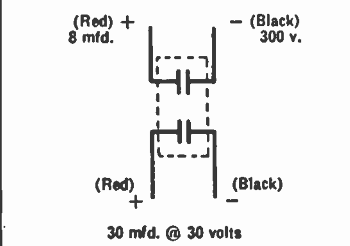
SR 601 (CARTON)



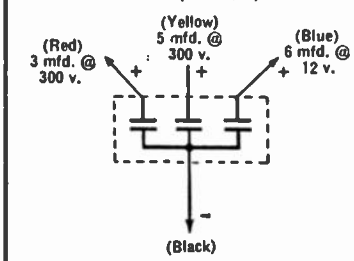
SR602 (STUD MOUNTING CAN)



SR603 (CARDBOARD TUBE)



SR 604 (CARTON)



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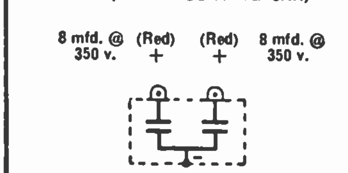

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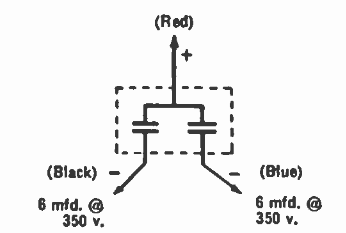

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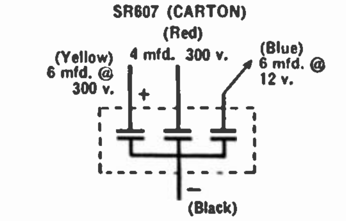
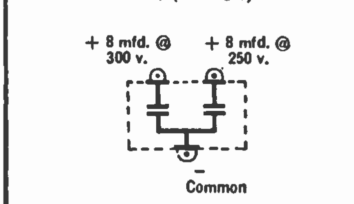
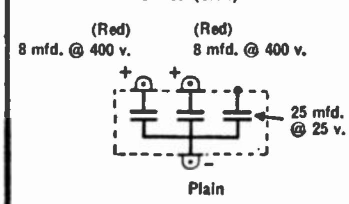


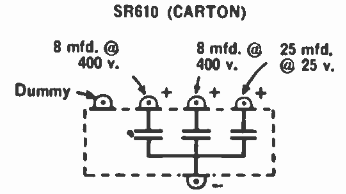
UR180 (CARTON)



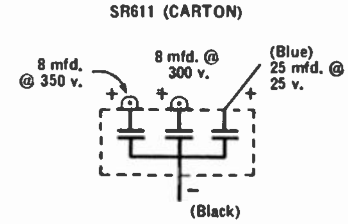
SR609 (CAN)



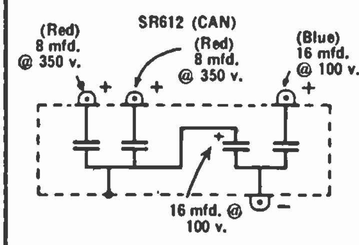
SR610 (CARTON)



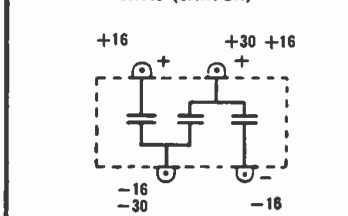
SR611 (CARTON)



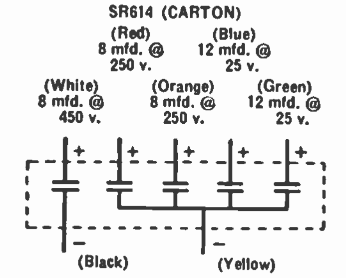
SR612 (CAN)



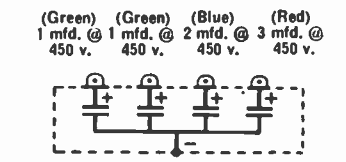
SR613 (CARTON)



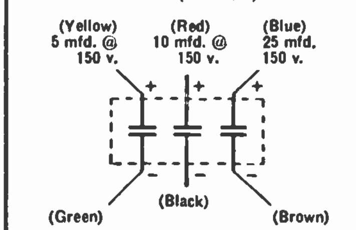
SR614 (CARTON)



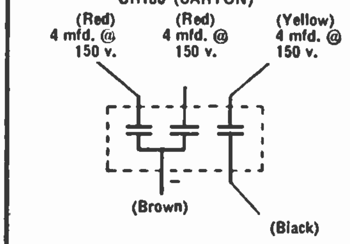
UR181 (CAN)



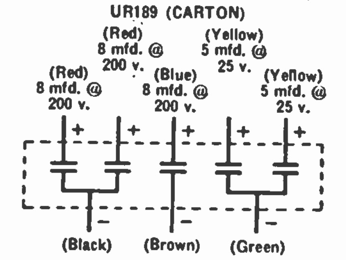
UR182 (CARTON)



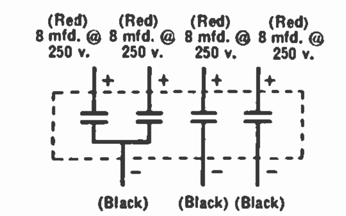
UR183 (CARTON)



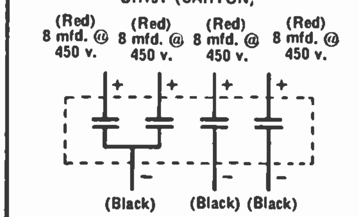
UR188 (SPADE BOLT MOUNTING)
UR189 (CARTON)



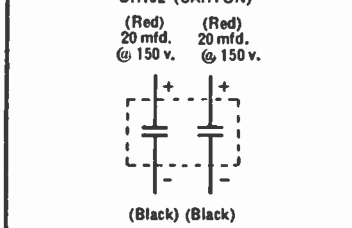
UR190 (CARTON)



UR191 (CARTON)



UR192 (CARTON)



Dry Electrolytic Filter Units—Cardboard Carton Type
CS—Single Section Type

Capacity	Wkg. V.	Max. Surge	Size C B A	Catalog Number
4	250	300	3/8 x 3/4 x 2 1/16	CS121
8	250	300	3/8 x 7/8 x 2 1/16	CS123
10	250	300	3/8 x 1 x 2 1/16	CS124
12	250	300	3/8 x 1 x 2 1/16	CS125
16	250	300	11/16 x 1 1/8 x 2 1/16	CS126
2	450	525	3/8 x 3/4 x 2 1/16	CS130
4	450	525	3/8 x 7/8 x 2 1/16	CS131
6	450	525	3/8 x 1 x 2 1/16	CS132
8	450	525	3/8 x 1 x 2 1/16	CS133
10	450	525	11/16 x 1 1/8 x 2 1/16	CS134
12	450	525	11/16 x 1 1/8 x 2 1/16	CS135
16	450	525	1 x 1 1/8 x 2 1/16	CS136

CN—Multiple Section Common Cathode Type (Common Negative)

Capacity	Wkg. V.	Max. Surge	Size C B A	Catalog Number
4-4	250	300	3/4 x 1 x 2 3/8	CN140
4-8	250	300	3/4 x 1 x 2 3/8	CN141
8-8	250	300	3/4 x 1 1/8 x 2 3/8	CN142
8-8-8	250	300	7/8 x 1 1/8 x 3	CN145
4-4	450	525	3/4 x 1 1/8 x 2 3/8	CN150
4-8	450	525	7/8 x 1 1/8 x 2 3/8	CN151
8-8	450	525	7/8 x 1 1/4 x 2 3/8	CN152
8-8-8	450	525	1 1/8 x 1 1/4 x 3	CN155

CM—Multiple Separate Section Type

Capacity	Wkg. V.	Max. Surge	Size C B A	Catalog Number
4-4	250	300	3/4 x 1 1/8 x 2 3/8	CM160
4-8	250	300	3/4 x 1 1/8 x 2 3/8	CM161
8-8	250	300	7/8 x 1 1/8 x 2 3/8	CM162
8-8-8	250	300	1 1/8 x 1 x 3	CM165
16-16	250	300	1 1/8 x 1 x 2 3/8	CM164
4-4	450	525	3/4 x 1 1/8 x 2 3/8	CM170
4-4-4	450	525	1 1/8 x 1 1/8 x 3	CM173
4-8	450	525	7/8 x 1 1/8 x 2 3/8	CM171
8-8	450	525	1 1/8 x 1 x 2 3/8	CM172
8-8-8	450	525	1 1/8 x 1 1/4 x 3	CM175

Dry Electrolytic Bypass Units Cardboard Tubular Type
TS—Single Section Type

Capacity	Wkg. V.	Max. Surge	Size A B	Catalog Number
10	25	40	1 3/8 x 3/8	TS101
20	25	40	2 1/4 x 1/2	TS102
25	25	40	2 1/4 x 1/2	TS103
50	25	40	2 3/8 x 1	TS104
5	50	75	1 3/8 x 3/8	TS105
10	50	75	2 1/4 x 1/2	TS106
25	50	75	2 3/8 x 1	TS107
50	50	75	3 1/2 x 1 1/2	TS108

TN—Dual Section Common Cathode Type (Common Negative)

Capacity	Wkg. V.	Max. Surge	Size A B	Catalog Number
5-5	25	40	1 3/8 x 3/4	TN110
10-10	25	40	2 1/4 x 1/2	TN111
5-5	35	50	1 3/8 x 1/2	TN112
5-5	50	75	2 1/4 x 1/2	TN113

Dry Electrolytic Filter Units Round Aluminum Can Type
RS—Single Section Type

Capacity	Wkg. V.	Max. Surge	Size A B	Catalog Number
4	250	300	2 3/8 x 1	RS201
8	250	300	2 3/8 x 1	RS203
12	250	300	2 3/8 x 1	RS205
4	450	525	2 3/8 x 1	RS211
8	450	525	2 3/8 x 1	RS213
12	450	525	2 3/8 x 1	RS215
16	450	525	3 1/2 x 1	RS216

RN—Multiple Section Common Cathode Type (Common Negative)

Capacity	Wkg. V.	Max. Surge	Size A B	Catalog Number
4-8	250	300	3 x 1	RN231
8-8	250	300	3 x 1	RN232
8-8-8	250	300	3 x 1 3/8	RN235
4-8	450	525	3 x 1	RN241
8-8	450	525	3 x 1 3/8	RN242
8-8-8	450	525	3 1/2 x 1 3/8	RN245

RM—Multiple Separate Section Type

Capacity	Wkg. V.	Max. Surge	Size A B	Catalog Number
4-8	250	300	3 x 1 3/8	RM251
8-8	250	300	3 x 1 3/8	RM252
8-8-8	250	300	3 1/2 x 1 3/8	RM255
8-8-16	250	300	3 1/2 x 1 3/8	RM257
8-16-16	250	300	3 1/2 x 1 3/8	RM259
4-8	450	525	3 x 1 3/8	RM261
8-8	450	525	3 x 1 3/8	RM262
8-8-8	450	525	4 x 1 3/8	RM265

Accessories for Round Can Units

Description	Size	Cat. No.
Washer for clamp mounting on 1" cans		A-017
Washer for 3/8" hole mounting on 1" cans		015-1
Washer for spade bolt mounting both 1" and 1 3/8" cans		015-2
Ring clamp for round can condenser	1"	105-1
Ring clamp for round can condenser	1 3/8"	106-1
Ring clamp for round can condenser	1 1/2"	107-1
Ring clamp for round can condenser	2 1/8"	108-1
Ring clamp for round can condenser	3"	109-1
Mounting bracket		104-1

Dry Electrolytic Bypass Units Round Can Aluminum Type
BN—Dual Section Common Cathode Type (Common Negative)

Capacity	Wkg. V.	Max. Surge	Size A B	Catalog Number
10-10	50	75	1 3/4 x 1	BN225
10-10	50	75	1 3/4 x 1	BN226

Dry Electrolytic Units Heavy Duty and High Surge Types
HD—Single Section Type

Cap.	D.C. Wkg. V.	Container	Size	Catalog Number
4	500	Carton	5/8 x 1 x 2 7/16	HD680
4	500	Rd. Cn.	1 x 2 3/4	HD681
8	500	Carton	11/16 x 1 1/8 x 2 7/16	HD682
8	500	Rd. Cn.	1 x 3 1/8	HD683

HS—Single Section Type

Capacity	D.C. Wkg. V.	Container	Size	Catalog Number
4	600	Carton	7/8 x 1 1/4 x 3	HS690
4	600	Rd. Cn.	1 3/8 x 3 1/2 ...	HS691
8	600	Carton	1 1/4 x 1 1/2 x 3	HS692
8	600	Rd. Cn.	1 3/8 x 4 1/4	HS693

Universal and Special Types
UR Special Universal Units

Capacity	Wkg. V.	Container	Size	Cat. No.
8-8	250-300	Carton	1 1/8 x 1 1/4 x 2 1/4	UR180
3-2-1-1	450	Round Can	1 3/8 x 2 3/4	UR181
5-25-10	150	Carton	1 5/16 x 1 3/8 x 2 3/8	UR182
4-4-4	150	Carton	5/8 x 1 1/4 x 2 1/4	UR183
8-8-8, 5-5	200, 25	Card. Tube	1 3/8 x 3 3/4	UR188
8-8-8, 5-5	200, 25	Carton	1 1/4 x 1 1/2 x 3	UR189
8-8-8-8	250	Carton	1 1/4 x 1 1/2 x 3	UR190
8-8-8-8	450	Carton	1 3/8 x 1 3/4 x 3	UR191
20-20	150	Carton	1 5/16 x 1 3/8 x 2 3/8	UR192

SR Special Universal Units

Capacity	Wkg. V.	Container	Size	Cat. No.
8-12	300	Carton	1 1/4 x 1 1/2 x 2 3/8	SR601
6-4-6	300-300-25	Round Can	1 3/8 x 2 3/8	SR602
8-30	300-30	Card. Tube	1 1/4 x 4 3/8	SR603
3-5-6	300-300-12	Carton	1 1/8 x 1 3/16 x 2	SR604
8-8	350	Round Can	1 3/8 x 3 1/8	SR605
6-6	350	Carton	1 1/16 x 1 9/16 x 2 1/8	SR606
6-4-6	300-300-12	Carton	1 1/16 x 1 9/16 x 2 1/8	SR607
65	30	Card. Tube	1 1/4 x 2 1/4	SR608
8-8-25	400-400-25	Round Can	1 3/8 x 2 3/4	SR609
8-8-25	400-400-25	Carton	1 9/16 x 1 9/16 x 2 3/8	SR610
8-8-25	350-300-25	Carton	2 x 2 x 2 1/8	SR611
8-8, 16-16	350, 100	Round Can	1 3/8 x 4 3/8	SR612
16-30-16	200	Carton	1 3/4 x 1 15/16 x 4	SR613
8, 8-8, 12-12	450, 250, 25	Carton	1 7/8 x 2 3/4 x 2 15/16	SR614

Large Round Can Units Dry Electrolytic Type MN
MN—Multiple Section Common Cathode Type (Common Negative) (All Cathodes to Can)

Capacity	Wkg. V.	Max. Surge	Size A B	Catalog Number
8-8	450	525	4 1/8 x 2 1/8	MN272
5-15	450	525	4 1/8 x 2 1/8	MN273
8-8-8	450	525	4 1/8 x 3	MN275
8-8-8-8	450	525	4 1/8 x 3	MN277
9-9-18-18	450	525	4 1/8 x 3	MN278

Dry Electrolytic Old Style Units Original Large Size
Single Section in Carton with Leads

Capacity	Wkg. V.	Max. Surge	Size C B A	Catalog Number
4	450	525	11/16 x 1 3/8 x 4 1/8	14450
8	450	525	15/16 x 1 3/8 x 4 1/8	18450

Dual Section in Carton with Four Leads

Capacity	Wkg. V.	Max. Surge	Size B C A	Catalog Number
4-8	450	525	1 3/4 x 1 1/8 x 4 3/8	148450
8-8	450	525	2 x 1 1/8 x 4 3/8	188450

Single Section in Round Can with One Lug and Negative Terminal Grounded to Can

Capacity	Wkg. V.	Max. Surge	Size B A	Catalog Number
8	450	525	1 3/8 x 3 3/4	TM2-8

Single Section in Round Can with Two Leads Insulated from Can

Capacity	Wkg. V.	Max. Surge	Size B A	Catalog Number
8	450	525	1 3/8 x 4 1/16	M2-753

Dual Section in Round Can with Four Leads Insulated from Can

Capacity	Wkg. V.	Max. Surge	Size B A	Catalog Number
8-8	450	525	1 1/2 x 4 1/16	M2-585

Auto Vibrator Condensers
VB, VL and VO Vibrator Types

Capacity	Wkg. V.	Size A B C	Type Construction as per Fig.	Catalog Number.
.0075	1600	1/4 x 5/8 x .3	1	VB470
.01	1600	1/4 x 7/8 x .3	1	VB471
.0125	1600	5/8 x 1 x .3	1	VB472
.015	1600	7/8 x 1 1/16 x .3	1	VB473
.02	1600	7/8 x 1 1/16 x .3	1	VB474
.03	1600	1 x 13/16 x 13/16	1	VB475
.04	1600	1 x 15/16 x 7/16	1	VB476
.05	1600	1 x 1 x 1/2	3	VB477
.01	2000	3 3/16 x 5/8 x 11/16	4	VL478
.5	200	3 3/16 x 3/4 x 27/32	4	VL479
.5	120	2 1/2 x 1/16 x 3/4	5	VO480

OT—Oil Filled Tubular Type

Capacity	Wkg. V.	Size A B	Catalog Number
.0025	2000	1 1/4 x 5/8	OT458
.005	2000	1 1/2 x 5/8	OT459
.0075	2000	1 15/16 x 5/8	OT460
.01	2000	1 15/16 x 5/8	OT461
.0125	2000	2 1/8 x 5/8	OT462
.015	2000	2 1/8 x 5/8	OT463
.02	2000	2 1/4 x 3/4	OT464
.03	2000	2 1/4 x 3/4	OT465
.04	2000	2 3/4 x 3/4	OT466
.05	2000	2 3/4 x 3/4	OT467

Auto Generator Suppressor Units

Capacity	Wkg. V.	Size A B	Catalog Number
.5	200	2 1/16 x 3/4	AG451
1.0	200	2 1/4 x 1 1/4	AG452
.5	200	2 1/2 x 3/4	AM454

Special Chokes

No. Turns	Size Wire	Choke Size	Catalog Number
Approx. 55	No. 12	1 5/16 x 1 1/4	RF583
Approx. 55	No. 16	1 x 1 5/16	RF582
Approx. 90	No. 16	1 x 1 1/2	RF581

Special RF Bypass Tubular Condensers

Capacity	Wkg. V.	Size	Catalog Number
0.5	50	3/4 x 1 3/4	RF481
1.0	50	15/16 x 1 3/4	RF482

Wet Electrolytic Units
WE—Wet Electrolytic Type

Capacity	Wkg. V.	Size B A	Catalog Number
4	475	1 x 3 1/16	WE447
8	475	1 x 4 1/2	WE847
12	475	1 3/8 x 4 1/2	WE1247
16	475	1 3/8 x 4 1/2	WE1647
18	475	1 3/8 x 4 1/2	WE1847
35	400	1 1/2 x 4 1/2	WE3540

AC Electrolytic Capacitors
MS—Motor Starting Capacitors

Capacity	Wkg. V.	Size B	Catalog Number
60	110	2	MS540
70	110	2	MS541
80	110	2	MS542
100	110	2	MS543
115	110	2	MS544
135	110	2 1/2	MS545
150	110	2 1/2	MS546
100	150	2 1/2	MS547
30	220	2 1/2	MS548
40	220	2 1/2	MS549

Tubular Bypass Units
TP—Tubular Paper Dielectric Type

Capacity	D.C. Wkg. V.	Size A B	Catalog Number	Quantity Packed per Carton
.05	200	1 3/16 x 9/16	TP436	10
.1	200	1 3/8 x 1/2	TP438	10
.25	200	1 3/8 x 5/8	TP440	5
.5	200	2 x 13/16	TP441	5
1.0	200	2 3/8 x 1 1/8	TP443	5
.01	400	1 3/16 x 1/2	TP421	10
.02	400	1 3/16 x 1/2	TP423	10
.05	400	1 3/16 x 5/8	TP426	10
.1	400	1 9/16 x 5/8	TP428	10
.25	400	2 1/8 x 13/16	TP430	5
.5	400	2 5/16 x 1	TP431	5
.0001	600	1 3/16 x 1/2	TP401	10
.00025	600	1 3/16 x 1/2	TP402	10
.0005	600	1 3/16 x 1/2	TP403	10
.001	600	1 3/16 x 1/2	TP404	10
.002	600	1 3/16 x 9/16	TP405	10
.005	600	1 3/16 x 9/16	TP408	10
.006	600	1 3/16 x 9/16	TP409	10
.01	600	1 3/16 x 9/16	TP410	10
.02	600	1 3/16 x 9/16	TP412	10
.03	600	1 1/2 x 11/16	TP413	5
.05	600	1 7/8 x 5/8	TP415	5
.06	600	1 5/8 x 3/4	TP416	5
.1	600	2 1/8 x 13/16	TP418	5
.25	600	2 5/16 x 7/8	TP420	5
.5	600	2 5/16 x 1 1/8	TP432	5

Explanation of Abbreviations

(Used in Control Listings, Pages 1 to 100)

AVC.......Automatic Volume Control.
Band.......Band Adjustment Control.
Batt........Battery Voltage Control.
BFO.......Beat Frequency Osc. Control.
Bias........Bias Adjustment Control.
B. Tone....Bass Tone Control.
Clr'ty......Clarity Control.
Equal......Equalizer Control.
Exp........Expander Control.
Exp. Bias...Expander Bias Adjustment Control.
Fid.........Fidelity Control.
Fidlty......Fidelity Control.
Fil.........Filament Control.
F.O.G......Flashograph Adjustment Control.
Gain.......Gain Control.
H.F. Tone..High Frequency Tone Control.
Hum.......Hum Control.
L.F. Tone..Low Frequency Tone Control.
Loc'lzr.....Localizer Control.
Meter......Meter Adjustment Control.
Mic........Microphone Adjustment Control.
Mike.......Microphone Adjustment Control.
Mod........Modulator Control.
Mon........Monitor Control.
M. Vol.....Manual Volume Control.
Osc. Adj....Oscillator Adjustment Control.
P.E. Adj....Photo-Electric Cell Adjustment Control.
Phantom...Phantom Tuning Control.
Phono......Phonograph Pick-up Control.
Power......Line Voltage Control.
Primary....Primary Voltage Control.
QAVC......Q.A.V.C. Adjustment Control.
Reg........Regeneration Control.
Regen......Regeneration Control.
Relay......Relay Adjustment Control.
Screen.....Screen Voltage Control.
Sel........Selectivity Control.
Sen.........Sensitivity Control.
Sil..........Silencing Control.
Supp.......Suppressor Control.
Tone.......Tone Control.
Tone B'm..Tone Beam Adjustment Control.
T. Tone....Treble Tone Control.
Tunlgt.....Tuning Light Adjustment Control.
Vol.........Volume Control.
Voltage....Plate Voltage Adjustment Control.
V. R.........Voltage Regulator Control.
EX 100.....EX followed by a numeral indicates that an external resistor of the stated value must be connected between the right hand terminal of the control and the cathode circuit of the receiver.

Chart Showing Automobile Antenna and Battery Grounds

Car	1930	1931	1932	1933	1934	1935	1936	1937
Auburn	P......No	P......No	P......No	P......No	P.....Yes	P.....Yes	P.....Yes	P.....Yes
Austin	....	P......No	P......No	P......No	P.....Yes	....	....	....
Buick	N......No	N......No	N......No	N.....Yes	N.....Yes	N.....Yes	N......No	N.....Yes
Cadillac	P......No	P......No	P......No	P.....Yes	P.....Yes	P.....Yes	P......No	N.....Yes
Chevrolet	N......No	N......No	N......No	N.....Yes	N.....Yes	N......**	N......No	N......No
Chrysler	P......No	P......No	P......No	P.....Yes	P.....Yes	P.....Yes	P.....Yes	P....††No
Continental	....	....	....	N......No	N......No	....	....	....
Cord	P......No	P......No	P......No	P......No	....	....	P.....Yes	P.....Yes
Cunningham	N......No	N......No	N......No	N......No	N......No	....	....	....
DeSoto	P*.....No	P......No	P......No	P.....Yes	P.....Yes	P.....Yes	P.....Yes	P......No
Dodge	P......No	P......No	P......No	P.....Yes	P.....Yes	P.....Yes	P.....Yes	P......No
Duesenberg	N......No	N......No	N......No	N......No	N......No	N......No	N......No	....
Durant	N......No	N......No	N......No	....	....	....	....	....
Essex	N......No	N......No	N......No	N......No	....	....	....	....
Ford	P......No	P......No	P......No	P......No	P.....Yes	P.....Yes	P.....Yes	P......No
Franklin	P......No	P......No	P......No	P......No	P.....Yes	....	....	....
Graham	P......No	P......No	P......No	P......No	P.....Yes	P.....Yes	P......No	P........§
Hudson	N......No	N......No	N......No	N......No	P.....Yes	P.....Yes	P......No	P......No
Hupmobile	P......No	P......No	P......No	P.....Yes	P.....Yes	P.....Yes	P.....Yes	....
Lafayette	....	....	....	....	P.....Yes	P.....Yes	P......No	P......No
LaSalle	P......No	P......No	P......No	P.....Yes	P.....Yes	P.....Yes	P......No	N.....Yes
Lincoln	N......No	N......No	N.....Yes	N.....Yes	N.....Yes	N.....Yes	N.....Yes	N.....Yes
Marmon	P......No	P......No	P......No	P......No	P......No	....	....	....
*Nash	P......No	P......No	P......No	P.....Yes	P.....Yes	P.....Yes	P.....†No	P......No
Oldsmobile	N......No	N......No	N......No	N.....Yes	N.....Yes	N......No	N......No	N......No
Packard	P......No	P......No	P......No	P.....Yes	P.....Yes	P.....Yes	P.....Yes	P.....Yes
Pierce-Arrow	P.........	P.........	P.....Yes	P.....Yes	P.....Yes	P.....Yes	P.....Yes	P.........
Plymouth	N......No	P......No	P......No	P.....Yes	P.....Yes	P.....Yes	P.....Yes	P......No
Pontiac	N......No	N......No	N......No	N.....Yes	N.....Yes	N......No	N......No	N......No
Reo	N......No	N......No	N......No	N.....Yes	N......No	N.....Yes	N.....Yes	....
Rockne	....	....	P.....Yes	P.....Yes	....	....	....	....
Studebaker	P.........	P.........	P.....Yes	P.....Yes	P.....Yes	P.....Yes	P.....Yes	P.....Yes
Stutz	N......No	N......No	N......No	N......No	N......No	N.........	N.........	N......No
Terraplane	....	....	....	....	P.....Yes	P.....Yes	P......No	P......No
Willys	N......No	N......No	N......No	N.....†No	....	N......No	N......No	N......No

*Some models have N. ground **Standard, Yes; Master, No. †Some models have built-in antenna. ††Airflow, Yes.
N—Negative battery terminal grounded to chassis. Yes—Car equipped with built-in antenna. §Small Models, No; Large Models, Yes.
P—Positive battery terminal grounded to chassis. No—Car not equipped with built-in antenna.

SECTION "C" VIBRATORS

SUCCESSFUL SERVICING OF VIBRATOR TYPE POWER PACKS

Vibrators for power packs, both the interrupter (tube-type) and synchronous-rectifying types, have for years been used almost exclusively in automobile and storage battery powered household radio receivers. **The reliability of the vibrator has become such an established fact that it has been given a definite place in aviation radio, where dependable communication is often a matter of life and death.**

The successful servicing of the vibrator type power supply systems depends largely uppn how well the service man understands the fundamental circuit and its characteristics. **When vibrators were first introduced,** service men regarded them with suspicion and uncertainty. They were inclined to attribute many auto radio receiver troubles, such as unaccountable noises, low plate voltages, etc., to the vibrator when actually its operation was perfectly normal. The unquestionable proof of this statement lies in the fact **that more than one-half of all vibrators returned as defective are perfectly good in every respect.**

During the past few years many service men have come to know the vibrator, its circuits and characteristics, and through this knowledge they work in confidence and increase their profits.

It seems that many men and organizations would have this type of power supply cloaked with a shroud of mysticism. Therefore, only **those service men who** possess the rare **ability to sift the golden nuggets of truth from the chaff have gained a thorough understanding** of vibrator circuits.

Vibrator type power packs are NOT complicated. They are not difficult to service nor is there anything mysterious about them, except what has been artificially created. Let us tear aside the "mystic veil" and expose the simple truth.

INTERRUPTER (TUBE-TYPE) VIBRATORS

It is impossible to believe that there is a single successful radio service man who does not thoroughly understand the power circuit of the modern AC radio receiver. A typical circuit of this type is shown in Figure 1.

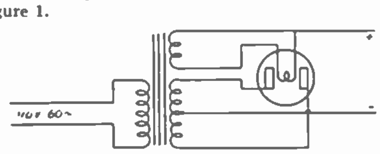


FIGURE 1

If an AC voltage is applied to the primary, in this circuit, there is a voltage developed in the secondary windings proportional to the turn ratio. The low voltage winding is used to light the "heater" of the tube. (A separate battery could be used just as effectively for this purpose.) The high voltage secondary is center-tapped and so connected that, through action of the rectifier tube, one-half of the secondary is delivering power on the first part of the cycle and the other half is delivering power on the last part of the cycle. In this manner the alternating current is converted to unipotential or DC voltage. Although this voltage is unipotential, it is not constant; so a filter system must be used to obtain a constant DC voltage. So far we have explained only the simple action of the power supply system of a simple AC receiver.

"ALTERNATING" A DC VOLTAGE

Now if a DC voltage were applied to the primary of the transformer, there would be no flux change and, therefore, no transformation of power from the primary to the secondary. On the other hand, if the circuit could be so arranged as to "alternate" this same DC voltage, first in one direction and then in the other direction through the primary, there would be essentially an alternating current (AC) flowing, and the transformer would again operate the same as it did on conventional AC.

A theoretical circuit describing this method of "alternating" the DC is shown in Figure 2.

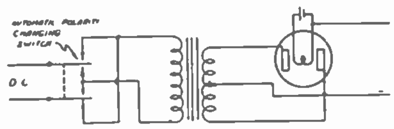


FIGURE 2

This type of automatic switch could be made in the form of a vibrator but it would be far too complicated and critical for economical manufacturing or commercial use. In order to simplify this switching circuit a second primary, identical to the first, is wound on the transformer. This may be in the form of two separate windings or one double winding center-tapped. Figure 3 shows this revised circuit and simplified automatic pole changing switch.

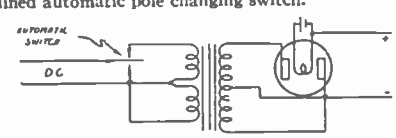


FIGURE 3

Now the automatic switch connects to the DC first through one primary and then through the other which produces essentially an "alternating current" which can be transformed and rectified by the tube into high voltage DC.

When the contact connects and disconnects the DC from the primary of the transformer, there are certain power surges of current developed that must be "arrested" in order to prevent damage to the contact points. The "arresting" of these surges could be accomplished by connecting a condenser across the primary of the transformer, but it would necessarily be so large and costly that its use would be prohibitive. Since the capacity required to secure the same results drops rapidly with an increase in voltage applied, a very small capacity high voltage condenser is connected across the secondary. The capacity in the secondary circuit is reflected directly into the primary so that exactly the same results are obtained as with a large primary condenser.

Let us simplify this by stating that the secondary "buffer" condenser is used to control the surge voltages developed in the circuit.

Figure 4 shows the basic circuit in which the interrupter type vibrator "alternates" the DC in the primary of the transformer.

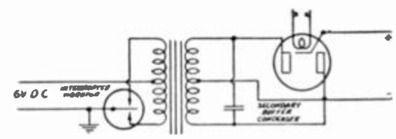


FIGURE 4

Interrupter type vibrators (commonly called tube type), are now clearly explained. What of the synchronous rectifying type?

SYNCHRONOUS (Rectifying Type) VIBRATORS

As explained, the purpose of the rectifier is to pass current in only one direction so that during the first part of the cycle, one-half of the secondary is delivering current. During the second part of the cycle the other half is delivering current in the same direction. If the rectifier tube were replaced with an automatic switch so arranged that it would "keep in step" with the automatic switch or vibrator in the primary circuit, the same rectifying action would be obtained as with the tube rectifier. The polarity of the DC output would depend on the polarity of the input. This need offer no problem since the reversing of the two wires of the transformer primary makes possible, the selection of polarity of output. Figure 5 shows how a circuit of this type might be arranged.

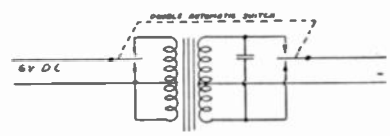


FIGURE 5

Since one side of the DC (6-volt battery) and B— are usually grounded, the circuit can be inverted and the polarity of the rectified current changed by reversing the primary wires to the vibrator. The "double automatic switch" could then be arranged so both "blades" are grounded or connected together as shown in Figure 6.

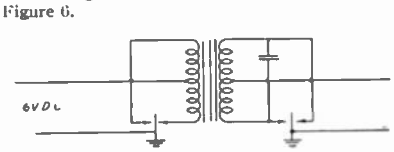


FIGURE 6

Now that both "blades" of this "double automatic switch" or synchronous type vibrator are grounded they can be connected directly together or even made into one piece. In this manner they become economical to manufacture and practical to use.

7

The basic synchronous rectifying type vibrator circuit is shown in Figure 7.

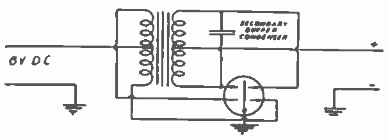


FIGURE 7

Two basic vibrator circuits have been shown: Figure 4 for interrupter type vibrators and Figure 7 for synchronous type vibrators.

Even with all the different lead and plug arrangements and all of the various sizes of containers that have been used, ONLY these TWO basic circuits have been used in the modern automobile and six-volt household radio receivers since 1933. There is a slight variation of the synchronous type as shown in Figure 6 where the reed is "split" into two parts but mechanically, not electrically, connected together. This is basically the same as Figure 7. There is a slight difference in the method used to obtain the magnetic force to drive the vibrators; however, these are always incorporated in the vibrator internally and should not offer any problems to the service man.

CAUSES OF VIBRATOR TROUBLE

Vibrators can only be damaged by two causes: (1) Serious overloads from short circuits and/or (2) Defective buffer condensers. Rarely, if ever, do power transformers give any trouble.

Vibrators should never need replacement until the contacts are worn to such an extent that the output of the power pack is unsteady or the vibrator fails to start properly on a very "low" (5.5 volts) 6-volt battery. If this suggestion is followed it will save many unnecessary replacements and give more time to locate the real trouble.

"HASH" SUPPRESSION

Basic vibrator circuits have been clarified. Only one problem remains—that of radio frequency interference developed by the vibrator. This interference is commonly referred to as "hash." **Hash is caused by transient voltage surges, at radio frequency. These surges cannot be controlled by a "buffer" condenser. The only known methods of suppressing hash are:**

First—Shielding—Both magnetic and electrostatic.

Second—Proper grounds, and

Third—Proper RF filtering in the leads to and from the pack.

The amount of "hash suppression" depends mainly on:

First—The sensitivity of the receiver and

Second—the mechanical arrangement of the receiver.

Engineers do, as a rule, thoroughly design their receivers to have adequate shielding, proper grounds and a sufficient amount of RF filtering. They cannot be assured that screws holding the shielding, chassis, and case together will remain tight after hours of jolts and vibration in the automobile nor can they be assured of permanence of efficiency of the old style RF by-pass condensers under varying climatic conditions. Under these conditions it would seem that the only action that could be taken to eliminate hash in a troublesome receiver would be to tighten all the screws and to replace all the by-pass condensers thought to be defective. Figure 8 shows a typical interrupter-type circuit with its associate hash suppression filters.

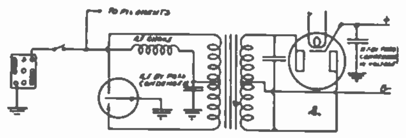


FIGURE 8

The circuit for synchronous vibrators is the same except the rectifier part of the vibrator replaces the tube rectifier as in Figure 7.

Through the combined efforts of the Mallory vibrator and condenser research engineers new types of RF condensers and RF chokes, which are far more efficient and permanent under widely varying climatic conditions have been perfected. It is now possible to do something about the hash caused by ineffective filtering.

On Page 33 of the new Mallory-Yaxley General Catalog these condensers and chokes are listed.

Figure 9 shows the way they are to be used in the circuit.

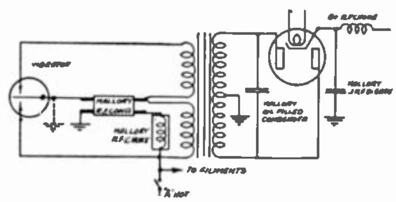


FIGURE 9

The vibrator reed connection to ground, shown in dotted lines in Figure 9 should be removed, and connected to one of the double lugs on one end of the Mallory-Special low voltage RF By-Pass Condenser. The other double lug on the same end should be connected to ground as shown. The center tap of the transformer should be connected to one of the double lugs on the other end of the condenser and the RF choke connected to the other double lug on the same end of the condenser as shown in Figure 9. The original RF choke in the primary circuit should be replaced with one of the new Mallory high-efficiency, multiple pie-wound RF chokes. **In most cases of slight "hash"** the Mallory No. RF-481, .5 mfd. 50-volt condenser will be sufficient. **For other cases more pronounced,** the Mallory No. RF-482, 1.0 mfd., 50-volt condenser will be adequate. **When severe cases are encountered** it may be necessary to use either Mallory RF-582, 55 turn RF choke or the No. RF-581, 90 turn RF choke in addition to one of the two condensers mentioned above depending on the severity of the case. **For the greatest amount of "hash" suppression** Mallory No. RF-581, 90 turn RF choke and Mallory No. RF-482, 1.0 mfd. 50 volt RF condenser should be used in the primary circuit and a 200-300 turn RF choke in the B+ lead with a Mallory No. TP-418, .1 mfd. 600 volt by-pass condenser in the secondary circuit as shown in Figure 9.

Exactly the same methods are used for synchronous type vibrator circuits. In these circuits the "rectifier" part of the synchronous vibrator replaces the tube and the center tap of transformer secondary becomes B+ instead of ground." For the sake of simplicity no conventional filter circuits are shown.

The 200-300 turn RF choke can be obtained from most parts distributors if not in the set. The Mallory No. RF-583 55 turn RF choke is wound with No. 12 wire and should be used with high output power packs where space will permit.

This method of "hash" suppression is by no means a "Cure-all." It will not suppress "hash" caused by inadequate shielding or improper grounds. If used intelligently, it will eliminate many cases of annoying chronic complaints.

These basic principles will prove to be a valuable aid in the successful servicing of vibrator-powered radio receivers. The problem of "hash" has been treated in a manner that it should no longer be a serious obstacle, yet **other common troubles are often encountered.**

ELIMINATING TROUBLE

If vibrator servicing problems are to be simplified, specific troubles and the recommended remedy must be shown. A list of these troubles is given along with the best way of determining the exact trouble and the method of elimination.

NO "B" VOLTAGE

If the vibrator is operating and still there is no "B" voltage, first disconnect the lead from the B+ output of the filter. If the voltage becomes much higher than normal when this lead is disconnected, the trouble is in the radio receiver proper. The procedure for making receiver checks and repairs are outlined in other sections of the encyclopedia.

If, after disconnecting the B+ lead, there is still no voltage, the trouble is in the power pack circuit.

The following list shows the **probable defects, in the order of their importance:**

1. **Shorted Filter Condenser.**
2. **Shorted Buffer Condenser.**
3. **Shorted Rectifier Tube.**
4. **Shorted "B+" Bypass Condenser.**
5. **Grounded Filter Choke.**
6. **Shorted Transformer Secondary.**
7. **Ground in Wiring.**

If the vibrator does not operate, remove the vibrator and check for the following defects:

1. **Low Battery Voltage.**
2. **Blown Fuse.**
3. **Burned Switch.**
4. **Broken "A" Lead.**

All of these points may be quickly checked by measuring the voltage between the center tap of the transformer primary and the REED terminal of the vibrator socket. This voltage should read 5.5 volts or more.

If the check is satisfactory, the vibrator should be tested for proper operation either in a vibrator tester or by the substitution of a new Mallory Replacement vibrator. Sticking or shorted vibrators are usually caused by "projections" being built up on the contact points. These "projections" (contact transfer) are the result of an unbalanced condition in the circuit. A careful check of the "buffer" condenser should be made. If this condenser is open or the capacity not as specified, it should be replaced with a Mallory Oil Filled Condenser, Type VB or OT having the specified capacity. NEVER CHANGE THE SPECIFIED CAPACITY OF THIS CONDENSER unless specifically instructed to do so.

LOW "B" VOLTAGES

Check the points given below as the **cause for low "B" voltage.**

1. **Battery Voltage Low.**
2. **Corroded Fuse Clips.**
3. **High Switch Resistance.**
4. **Weak Rectifier Tube.**
5. **Defective Buffer Condenser.**
   (Caution: See preceding instruction on buffer condenser replacement).
6. **Defective Filter Condenser.**
7. **Worn Vibrator.**
   (Check in tester or substitute new Mallory Replacement Vibrator).
8. **Check for troubles in radio which will cause low voltage such as shorted cathode resistor, by-pass condenser, shorted transformer, defective tubes, etc.**

INTERMITTENT OPERATION

1. Generally caused by troubles in the receiver, such as defective antenna insulation or connections, defective wiring, defective tubes, etc. Other sections of the encyclopedia specifically explain this method of servicing these troubles.
2. Intermittent vibrator operation usually caused by worn vibrator nearing the end of its life.
3. Loose connections in the power pack.
4. Defective Rectifier Tube.

UNUSUAL MECHANICAL NOISE

Unusual mechanical noise from the vibrator may be caused by:

1. Vibrator touching other parts and vibrating against them or causing other parts to vibrate. Correct this trouble with a cardboard pad around the vibrator.
2. An old vibrator nearing the end of its life.
3. Loose case screws, or loose parts in the radio set.

ELECTRICAL HUM FROM SPEAKER

Hum from the speaker is usually caused by:

1. Defective filter condensers (low capacity).
2. Microphonic Tubes.
3. Microphonic Condensers. (Usually variable condenser).
4. Loose chassis screws.
5. Poor Grounds in Radio.

DON'TS

1. Never change the SPECIFIED capacity of the buffer condenser.
2. Never attempt to repair a vibrator. Filing contacts or bending springs destroys the factory adjustment which has been carefully made with expensive instruments.
3. Never replace the vibrator until you are sure it is defective.
4. Never hesitate to write Mallory for specific information and help.

SELECTING UNLISTED VIBRATORS

If a Mallory replacement vibrator is needed for an unlisted set, refer to the "C" notes 6 or 8. These notes simplify the selection of the proper vibrator. Any Mallory-Yaxley distributor will gladly assist in this selection. If an authentic replacement is desired, have the distributor send the original vibrator together with the NAME and MODEL NUMBER of the receiver, to the Mallory Factory. The proper Mallory Replacement Vibrator will be promptly supplied.

The mystic veil has been torn from the vibrator type power pack and specific service helps have been listed. Service men should find that they can now work in an enlightened manner that will pay dividends in satisfied customers and extra profits.

"C" NOTES

C1—Use Mallory Replacement Vibrator Type 312T in early models and Type 292 in late models of this receiver. See Note C3.

C2—Use Mallory Replacement Vibrator Type F312 in early models and Type F221 in late models of this receiver. See Note C3.

C3—When unusual vibrator troubles are experienced a thorough check should be made of all of the power pack parts and the circuit. It is especially important that the secondary buffer condenser, connected across the secondary of the transformer be in good operating condition and within plus or minus 10% of the specified capacity. **Be Sure to Check Buffer Condenser.** In some instances this condenser may be two condensers with the common lead grounded. In certain sets resistors have been used in series with these condensers. If the replacement of a buffer condenser is necessary use the Mallory Oil Filled, high voltage condenser, Type "OT" or "VB" as required. NEVER SUBSTITUTE A DIFFERENT VALUE—USE ONLY THE SPECIFIED CAPACITY. The wrong buffer capacity may cause serious damage to the vibrator in a very short time. See Condenser listing for specified capacity.

C4—Use Mallory Replacement Vibrator Type 312T in early models and Type 225 in late models of this receiver. See Note C3.

C5—Use Mallory Replacement Vibrator Type 210-237 (210 Series) in both the "Standard" and the "Master" models. See Note C3.

C6—These sets use an interrupter type (tube type) vibrator; however the size and method of connection are unknown. **For an emergency selection of a replacement vibrator** refer to the Vibrator Connection Charts, pages 156 to 158. Select an interrupter type vibrator which is approximately the same size and has identically the same connection arrangement as the original. For plug-in vibrators the pin-base must have the same arrangement and connections. For lead type vibrator the reed lead is red and the interrupter contact leads (two) will be yellow. Any Mallory-Yaxley Distributor will gladly assist in making this selection. **If an authentic replacement is desired, have your distributor send the original vibrator, together with the name and model of the receiver to the Mallory Factory. The proper Mallory replacement vibrator will be promptly supplied. See Note C3.**

C7—No information available on this vibrator circuit. See Notes C6 or C8.

C8—These sets use a synchronous (self-rectifying) type vibrator; however, the size and method of connection are unknown. **For the emergency selection of a replacement vibrator refer to the Vibrator Connection Charts, pages 156 to 158.** Select a synchronous type vibrator which is approximately the same size and has identically the same connection arrangement as the original. If the original vibrator has condensers connected from the rectifier springs to the reed BE SURE the selected replacement vibrator also has condensers. For plug-in type vibrators the pin-base must have the same arrangement and connections. For lead type vibrators refer to the Vibrator Connection Charts, pages 156 to 158, for the color of leads and connections. Any Mallory-Yaxley distributor will gladly assist in making this selection. **If an authentic replacement is desired, have the distributor send the original vibrator, together with the name and model of the receiver, to the Mallory Factory. The proper Mallory Replacement Vibrator will be promptly supplied.** See Note C3.

C9—See Note C6. Two Types of Power Packs are used: one with 25Z5 and the other an 84. Suggest Type F221, F292, F294, F297. See Note C3.

C10—Use Mallory Replacement Vibrator Type F221. See Note C3.

C11—Early type with vibrator mounted on the power transformer uses an F220C, late or plug-in type uses an F294.

C12—The **first series** of this receiver used a carbon point vibrator for which there is NO replacement. Obtain a new transformer (latest type for this set) from the manufacturer. (Wells-Gardner Co., Chicago, Ill.) After the new transformer has been installed use the Mallory Replacement Vibrator Type 292. A small amount of "hash," which cannot be eliminated, will be experienced with this receiver. See Note C3.

C13—This Mallory Replacement Vibrator used in early models. See Note C3.

C14—This Mallory Replacement Vibrator used in late models. See Note C3.

C15—Use Mallory Cup Adapter with Mallory Replacement Vibrator Type 273. See Note C3.

C16—12 Volt Receiver. See Note C3.

C17—Use Mallory Replacement Vibrator Type 285X for 1935 models. See Note C3.

C18—Use Mallory Replacement Vibrator Type 245 for early 1936 models. See Note C3.

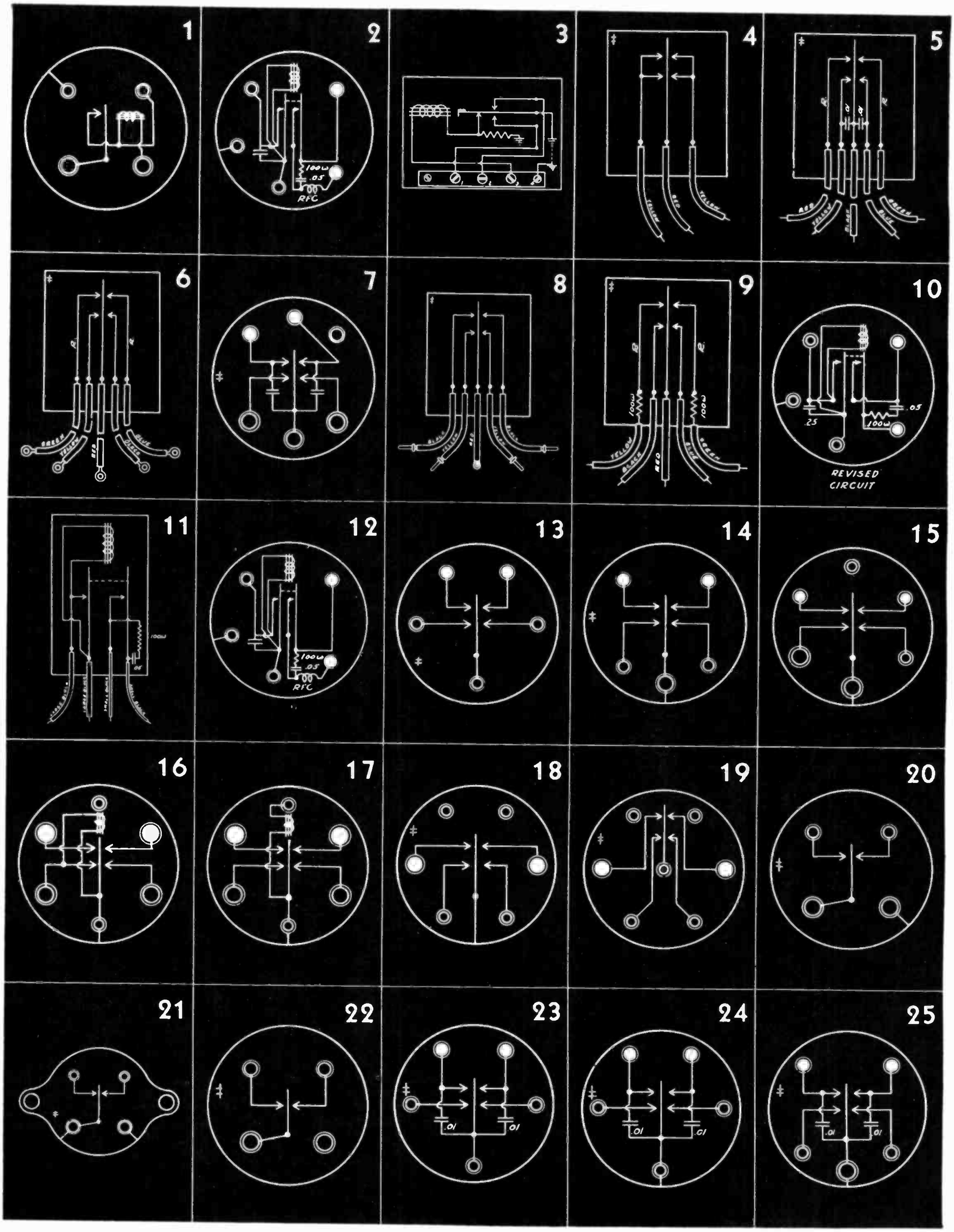
C19—Use Mallory Replacement Vibrator Type 245A for late 1936 models. See Note C3.

C20—Use Mallory Replacement Vibrator Type 296 for six prong socket and Type 294 for four prong socket. See Note C3.

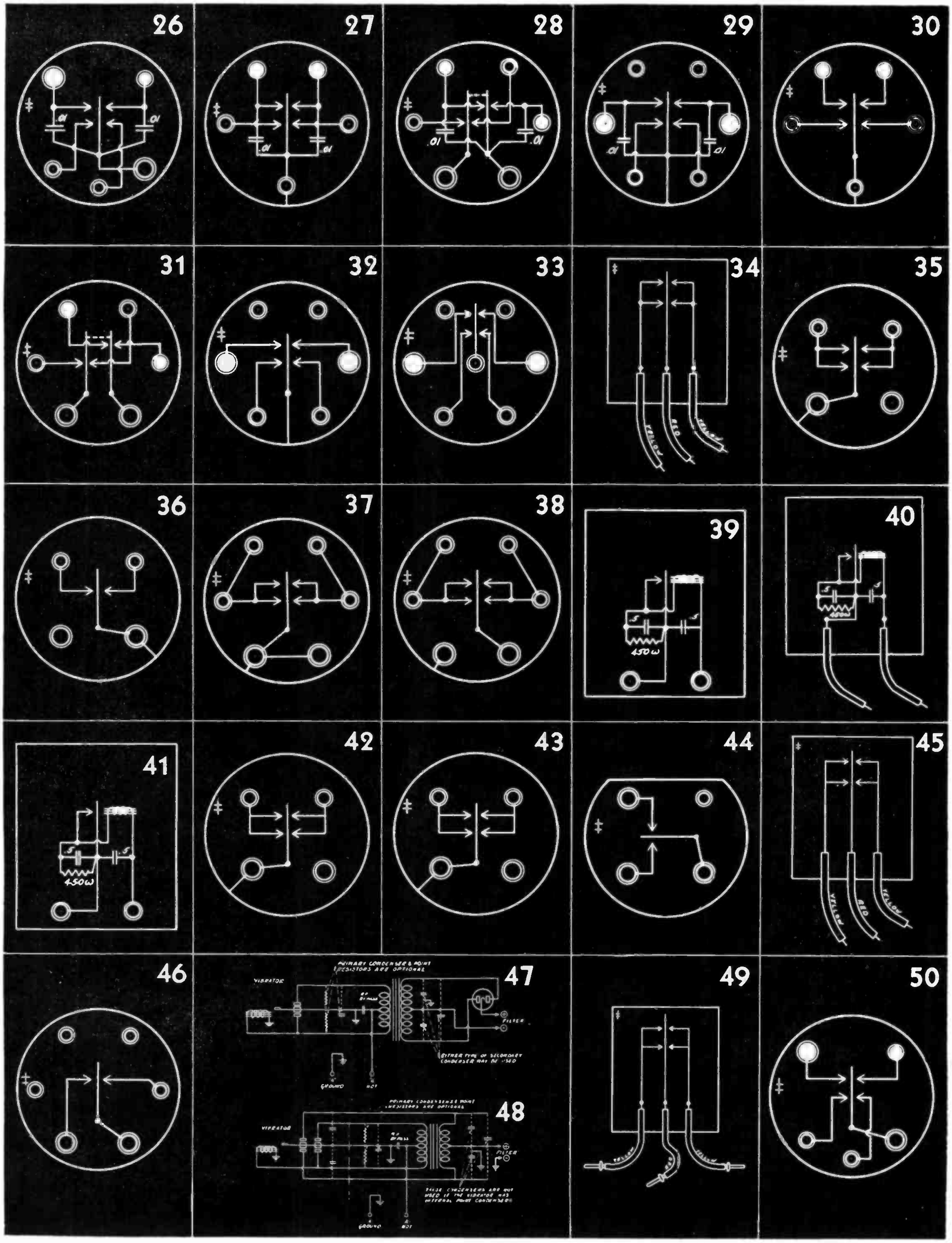
C21—Disregard recommendation—Order from manufacturer. See Note C3.

C22—A few early models of this receiver used Mallory Vibrator Type 75X as original equipment. Use the Mallory Replacement Vibrator Type 275XS in these early models. Use the Mallory Replacement Vibrator Type 285XS in all later models. See Note C3.

C23—Some production on this model used a plug-in type vibrator instead of the lead type. Select the proper Mallory Replacement Vibrator as outlined in C6. See Note C3.

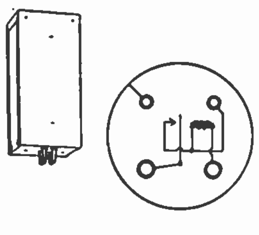


 ‡ Uses Shunt Type Driver Coils.



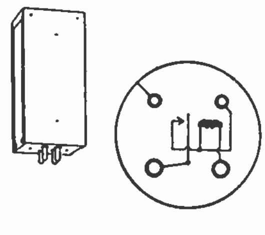
‡ Uses Shunt Type Driver Coils.

TYPE 201, 202, 203, 204 SERIES



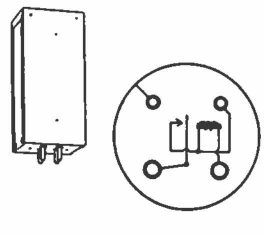
Half Wave......2 Contacts
Rectifier.........Tube (BR)
Size............2 11/16" x 2 7/8" x 5 3/8"
Prong Length....Standard
Operating Voltage....6

TYPE 205-206 SERIES



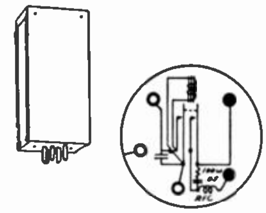
Half Wave......2 Contacts
Rectifier.........Tube (BR)
Size............2 11/16" x 2 7/8" x 5 3/8"
Prong Length....Standard
Operating Voltage....6

TYPE F204-F206 SERIES



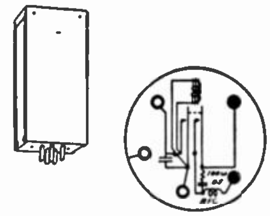
Half Wave......2 Contacts
Rectifier.........Tube (BR)
Size............2 11/16" x 2 7/8" x 5 3/8"
Prong Length....Standard
Operating Voltage....32

TYPE 210, 211, 212, 213, 214, 219, 236, 237 SERIES



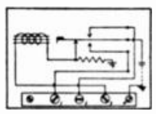
Half Wave......4 Contacts
Rectifier.........Synchronous
Size............2 7/8" x 2 1/4" x 5 5/16"
Prong Length....Standard
Operating Voltage....6

TYPE F211



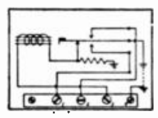
Half Wave......4 Contacts
Rectifier.........Synchronous
Size............2 7/8" x 2 1/4" x 5 5/16"
Prong Length....Standard
Operating Voltage....32

TYPE 220B.



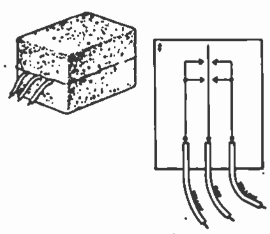
Full Wave......{4 Power Contacts / 2 Driver Contacts}
Rectifier.........Tube
Size............3 5/16" x 2" x 1"
Screw Terminal Connections
Operating Voltage....6

TYPE F220C



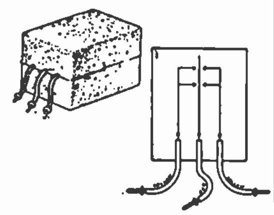
Full Wave......{4 Power Contacts / 2 Driver Contacts}
Rectifier.........Tube
Size............3 5/16" x 2" x 1"
Screw Terminal Connections
Operating Voltage....32

TYPE 221



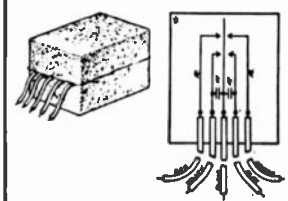
Full Wave.......8 Contacts
Rectifier.........Tube
Size............4 1/2" x 1 9/16" x 1 9/16"
Lead Lengths...{Red 4 1/2" / Yellow 3 1/2"}
Operating Voltage....6

TYPE F221



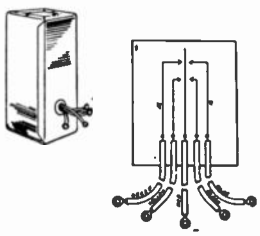
Full Wave.......8 Contacts
Rectifier.........Tube
Size............4 1/2" x 1 9/16" x 1 9/16"
Lead Lengths....4 1/2"
Operating Voltage....32

TYPE 222



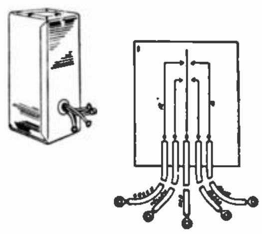
Full Wave.......8 Contacts
Rectifier.........Synchronous
Size............4 1/8" x 1 7/8" x 1 15/16"
Lead Lengths...{Blue 7 1/4" / Yellow 6 1/4" / Green and Red 3 1/2" / Black 2 1/2"}
Operating Voltage....6

TYPE 223



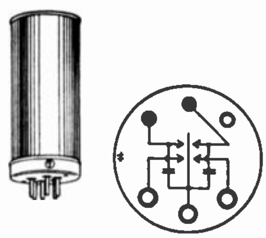
Full Wave.......8 Contacts
Rectifier.........Synchronous
Size............4 1/8" x 1 3/4" x 1 13/16"
Lead Lengths....7"
Operating Voltage....6

TYPE F223



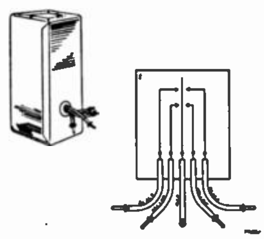
Full Wave.......8 Contacts
Rectifier.........Synchronous
Size............4 1/8" x 1 3/4" x 1 13/16"
Lead Lengths....7"
Operating Voltage....32

TYPE 224



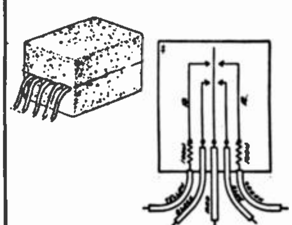
Full Wave.......8 Contacts
Rectifier.........Synchronous
Size............2 3/8" dia. x 4 3/4"
Prong Length....Standard
Operating Voltage....6

TYPE 225



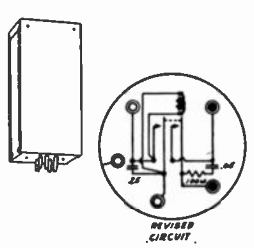
Full Wave.......8 Contacts
Rectifier.........Synchronous
Size............4 1/8" x 1 3/4" x 1 13/16"
Lead Length.....4"
Operating Voltage....6

TYPE 226



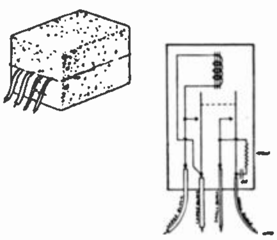
Full Wave.......8 Contacts
Rectifier.........Synchronous
Size............4 1/2" x 1 9/16" x 1 9/16"
Lead Length....{Blue and Black 4 1/2" / Red, Yellow and Green 3 1/2"}
Operating Voltage....6

TYPE 230.



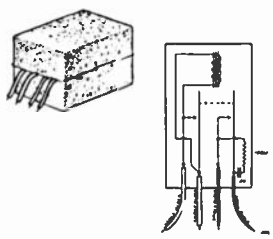
Half Wave......4 Contacts
Rectifier.........Synchronous
Size............2 7/16" x 2 1/4" x 5 5/16"
Prong Length....Standard
Operating Voltage....6

TYPE 231, 234 SERIES



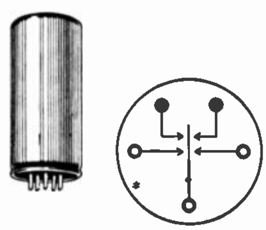
Half Wave......4 Contacts
Rectifier.........Synchronous
Size............2 5/16" x 2 1/8" x 5 3/16"
Lead Lengths....3"
Operating Voltage....6

TYPE 235



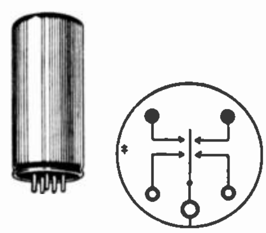
Half Wave......4 Contacts
Rectifier.........Synchronous
Size............2 7/16" x 2 1/4" x 5 3/16"
Lead Length ....4"
Operating Voltage....6

TYPE 245



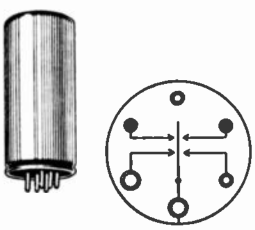
Full Wave.......8 Contacts
Rectifier.........Synchronous
Size............1 1/2" dia. x 3 1/4"
Prong Length....Standard
Operating Voltage....6

TYPE 245C



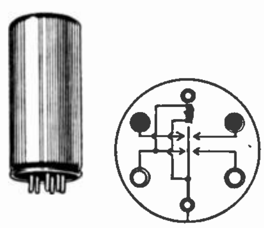
Full Wave.......8 Contacts
Rectifier.........Synchronous
Size............1 1/2" dia. x 3 1/4"
Prong Length....Standard
Operating Voltage....6

TYPE 246



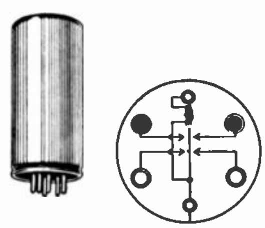
Full Wave.......8 Contacts
Rectifier.........Synchronous
Size............1 1/2" dia. x 3 1/4"
Prong Length....Standard
Operating Voltage....6

TYPE 247



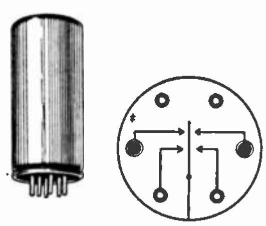
Full Wave.......8 Contacts
Rectifier.........Synchronous
Size............1 1/2" dia. x 3 1/4"
Prong Length....Standard
Operating Voltage....6

TYPE F247



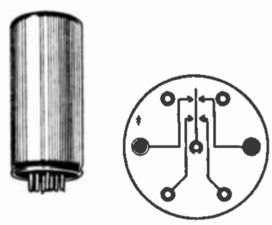
Full Wave.......8 Contacts
Rectifier.........Synchronous
Size............1 1/2" dia. x 3 1/4"
Prong Length....Standard
Operating Voltage....32

TYPE 248

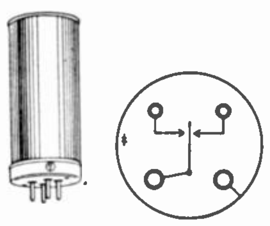


Full Wave.......8 Contacts
Rectifier.........Synchronous
Size............1 1/2" dia. x 3 1/4"
Prong Length...{4 small standard / 2 large 11/16"}
Operating Voltage....6

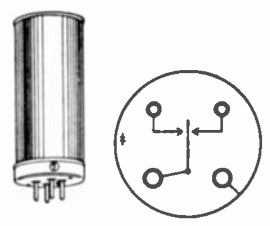
TYPE 249



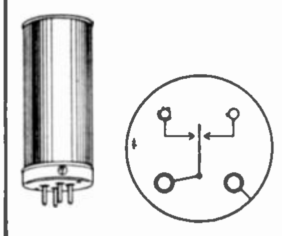
Full Wave.......8 Contacts
Rectifier.........Synchronous
Size............1 1/2" dia. x 3 1/4"
Prong Length....Standard
Operating Voltage....6

TYPE F251-F253 SERIES


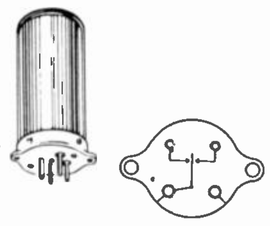
Full Wave.......4 Contacts
Rectifier.........Tube
Size............2" dia. x 4½"
Prong Length ...Standard
Operating Voltage....32

TYPE 253


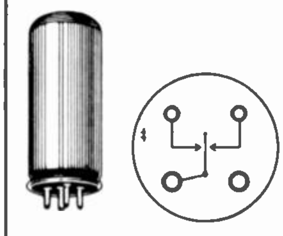
Full Wave.......4 Contacts
Rectifier.........Tube
Size............2" dia. x 4½"
Prong Length....Standard
Operating Voltage....6

TYPE G253


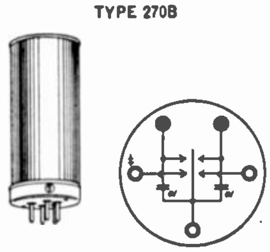
Full Wave.......4 Contacts
Rectifier.........Tube
Size............2" dia. x 4½"
Prong Length....Standard
Operating Voltage....12

TYPE 253T


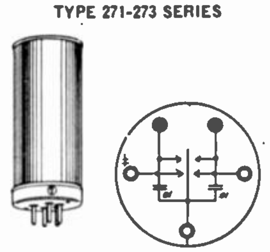
Full Wave.......4 Contacts
Rectifier.........Tube
Size............2" dia. x 4½"
Prong Length....11/16"
Operating Voltage....6

TYPE 253Y


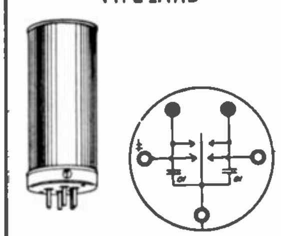
Full Wave.......4 Contacts
Rectifier.........Tube
Size............1¾" dia. x 4¼"
Prong Length....Standard
Operating Voltage....6

TYPE 270B


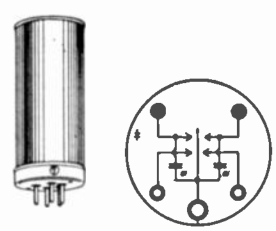
Full Wave.......8 Contacts
Rectifier.........Synchronous
Size............2" dia. x 4½"
Prong Length....Standard
Operating Voltage....6

TYPE 271-273 SERIES


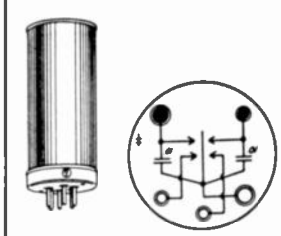
Full Wave.......8 Contacts
Rectifier.........Synchronous
Size............2" dia. x 4½"
Prong Length ...Standard
Operating Voltage....6

TYPE 271HD


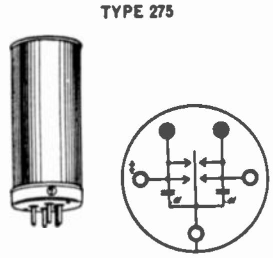
Full Wave.......8 Contacts
Rectifier.........Synchronous
Size............2" dia. x 4½"
Prong Length....Standard
Operating Voltage....6

TYPE 273C


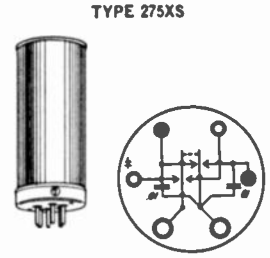
Full Wave.......8 Contacts
Rectifier.........Synchronous
Size............2" dia. x 4½"
Prong Length ...Standard
Operating Voltage....6

TYPE 273D


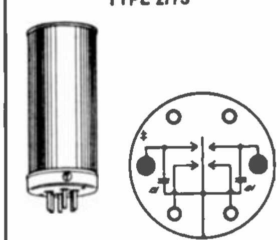
Full Wave.......8 Contacts
Rectifier.........Synchronous
Size............2" dia. x 4½"
Prong Length....Standard
Operating Voltage....6

TYPE 275


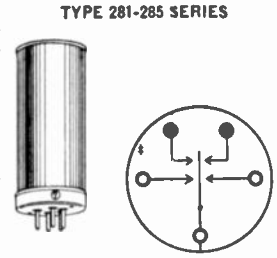
Full Wave.......8 Contacts
Rectifier.........Synchronous
Size............2" dia. x 4½"
Prong Length....Standard
Operating Voltage....6

TYPE 275XS


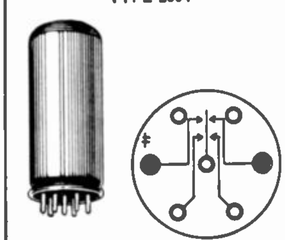
Full Wave.......8 Contacts
Rectifier.........Synchronous
Size............2" dia. x 4½"
Prong Length....11/16"
Operating Voltage....6

TYPE 277S


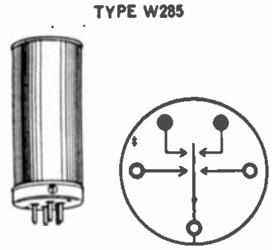
Full Wave.......8 Contacts
Rectifier.........Synchronous
Size............2" dia. x 4½"
Prong Length....Standard
Operating Voltage....6

TYPE 281-285 SERIES


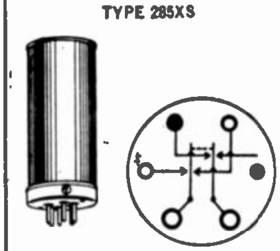
Full Wave.......8 Contacts
Rectifier.........Synchronous
Size............2" dia. x 4½"
Prong Length ...Standard
Operating Voltage....6

TYPE 289Y


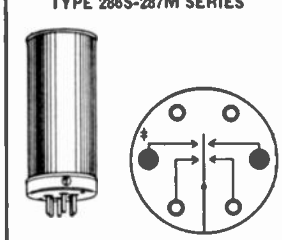
Full Wave.......8 Contacts
Rectifier.........Synchronous
Size............1¾" dia. x 4¼"
Prong Length....Standard
Operating Voltage....6

TYPE W285


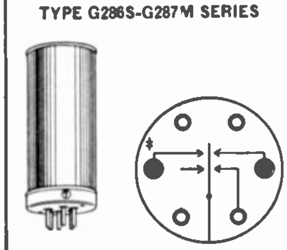
Full Wave.......8 Contacts
Rectifier.........Synchronous
Size............2" dia. x 4½"
Prong Length....Standard
Operating Voltage....4

TYPE 285XS


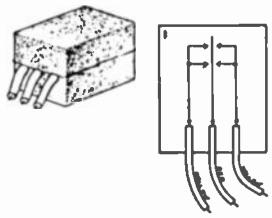
Full Wave.......8 Contacts
Rectifier.........Synchronous
Size............2" dia. x 4½"
Prong Length....11/16"
Operating Voltage....6

TYPE 286S-287M SERIES


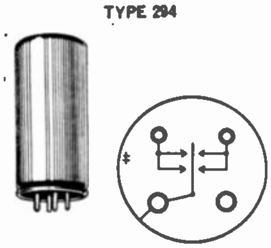
Full Wave.......8 Contacts
Rectifier.........Synchronous
Size............2" dia. x 4½"
Prong Length....Standard
Operating Voltage....6

TYPE G286S-G287M SERIES


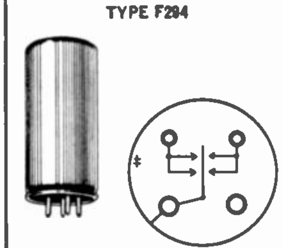
Full Wave.......8 Contacts
Rectifier.........Synchronous
Size............2" dia. x 4½"
Prong Length....Standard
Operating Voltage....12

TYPE 292


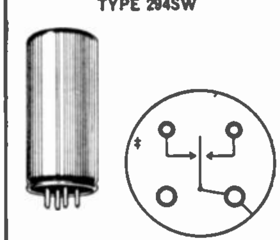
Full Wave.......8 Contacts
Rectifier.........Tube
Size............1½" x 1¾" x 2⅞"
Lead Lengths....3"
Operating Voltage....6

TYPE 294


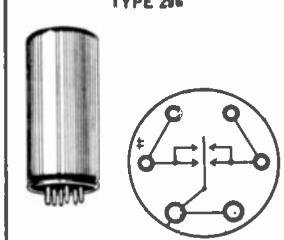
Full Wave.......8 Contacts
Rectifier.........Tube
Size............1½" dia. x 3¼"
Prong Length....Standard
Operating Voltage....6

TYPE F294


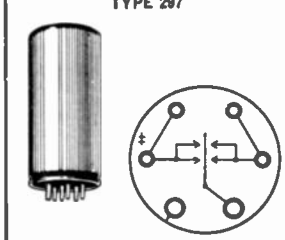
Full Wave.......8 Contacts
Rectifier.........Tube
Size............1½" dia. x 3¼"
Prong Length....Standard
Operating Voltage....32

TYPE 294SW


Full Wave.......8 Contacts
Rectifier.........Tube
Size............1½" dia. x 3¼"
Prong Length....Standard
Operating Voltage....6

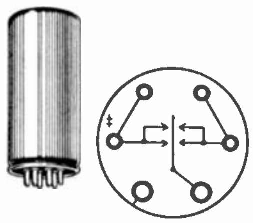
TYPE 296


Full Wave.......8 Contacts
Rectifier.........Tube
Size............1½" dia. x 3¼"
Prong Length....Standard
Operating Voltage....6

TYPE 297


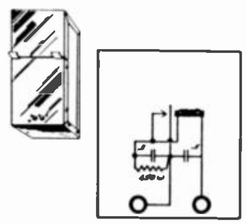
Full Wave.......8 Contacts
Rectifier.........Tube
Size............1½" dia. x 3¼"
Prong Length ...Standard
Operating Voltage....6

TYPE F297



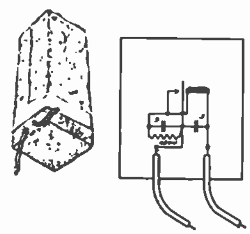
Full Wave.......8 Contacts
Rectifier.........Tube
Size............1½" dia. x 3¼"
Prong Length....Standard
Operating Voltage....32

TYPE 302S, 303S, 312T Series



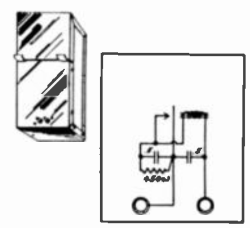
Half Wave......2 Contacts
Rectifier.........Tube (BR)
Size............2¹⁵⁄₁₆" x 2¹³⁄₁₆" x 6⁵⁄₁₆"
Prong Length....Standard
Operating Voltage....6

TYPE 311S



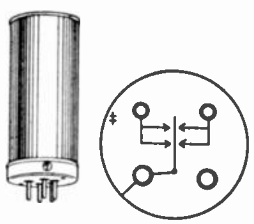
Half Wave......2 Contacts
Rectifier.........Tube (BR)
Size............2¾" x 2⅝" x 6⅞"
Lead Length.....3"
Operating Voltage....6

TYPE F312



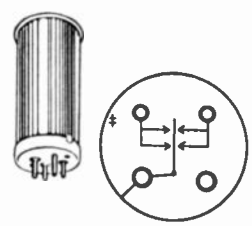
Half Wave......2 Contacts
Rectifier.........Tube (BR)
Size............2¹³⁄₁₆" x 2¹³⁄₁₆" x 6⁵⁄₁₆"
Prong Length....Standard
Operating Voltage....32

TYPE 500P



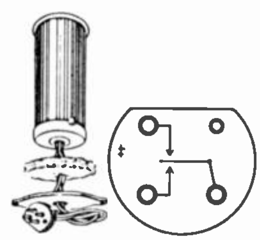
Full Wave.......8 Contacts
Rectifier.........Tube
Size............2⅜" dia. x 4¾"
Prong Length ...Standard
Operating Voltage....6

TYPE 501P



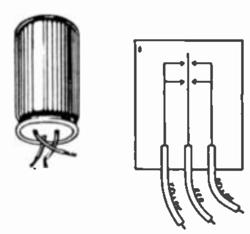
Full Wave.......8 Contacts
Rectifier.........Tube
Size............1⅝" dia. x 3½"
Prong Length....Standard
Operating Voltage....6

TYPE F502P



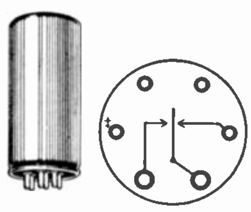
Full Wave.......8 Contacts
Rectifier.........Tube
Size............1⅝" dia. x 3½"
Special Leads and Plug
Prongs..........Standard
Operating Voltage....32

TYPE 503



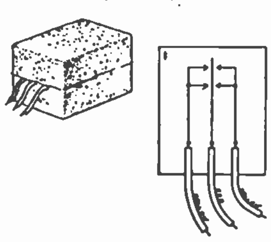
Full Wave.......8 Contacts
Rectifier.........Tube
Size............1½" dia. x 3"
Lead Lengths....3"
Operating Voltage....6

TYPE 504



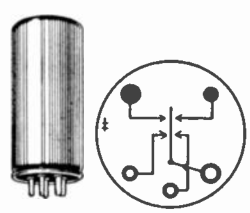
Full Wave.......8 Contacts
Rectifier.........Tube
Size............1½" dia. x 3¼"
Prong Length....Standard
Operating Voltage....6

TYPE F292



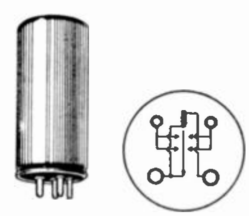
Full Wave.......8 Contacts
Rectifier.........Tube
Size............1½" x 1⅝" x 2⁷⁄₁₆"
Lead Lengths....3"
Operating Voltage....32

TYPE 514



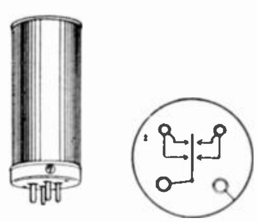
Full Wave.......8 Contacts
Rectifier.........Synchronous
Size............1¹⁵⁄₁₆" dia. x 3½"
Prong Length....Standard
Operating Voltage....6

TYPE F290



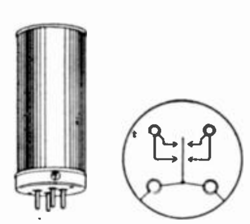
Full Wave.......8 Contacts
Rectifier.........Tube
Size............1½" dia. x 3¼"
Prong Length....Standard
Operating Voltage....32

TYPE 282P



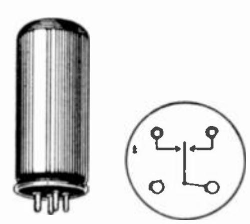
Full Wave.......8 Contacts
Rectifier.........Tube
Size............2" dia. x 4½"
Prong Length....Standard
Operating Voltage....6

TYPE 282B



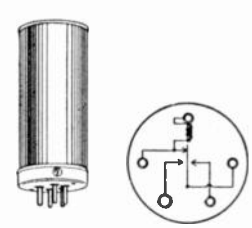
Full Wave.......8 Contacts
Rectifier.........Tube
Size............1½" dia. x 3⅞"
Prong Length....Standard
Operating Voltage....6

TYPE 254Y



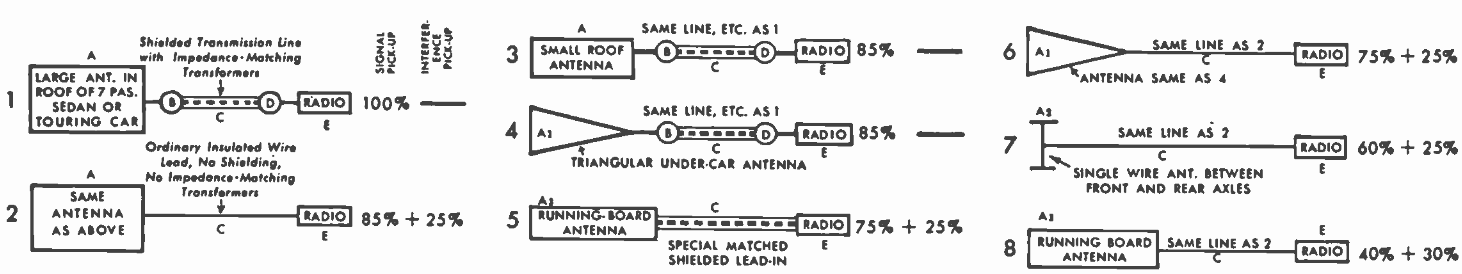
Full Wave.......4 Contacts
Rectifier.........Tube
Size............1¾" dia. x 4¼"
Prong Length....Standard
Operating Voltage....6

TYPE H240



Full Wave......{4 Power Contacts / 2 Driver Contacts
Rectifier.........Tube
Size............2⅜" dia. x 4¾"
Prong Length....Standard
Operating Voltage....110

CHART OF AUTO ANTENNA PERFORMANCE



Here is a complete chart showing the performance to be had from seven different car antenna arrangements.

A, A1, A2, A3 = ANTENNAS
B = ANT. TO LINE, IMPEDANCE-MATCHING TRANSFORMER
C = TRANSMISSION LINE
D = LINE TO RECEIVER IMPEDANCE-MATCHING TRANSFORMER
E = RADIO RECEIVER

Mallory Replacement Vibrators

WHEN it is realized that 2 out of 3 automobile radio and household battery receivers in service are equipped with Mallory Vibrators, it becomes apparent at once that Mallory is and always has been the leader in the vibrator field.

When you buy a Mallory Replacement Vibrator you are assured of the following benefits: 1. Lowest cost per hour of actual use. 2. Trouble-free long life. 3. Positive starting. 4. Easy installation. 5. Freedom from lead breakage. 6. Freedom from failures due to lead corrosion. 7. Absolute freedom from broken reeds.

Mallory Replacement Vibrators are built by the most highly specialized group of technicians in the vibrator industry. The majority of these employees have been with Mallory since the beginning of the vibrator industry. Such a highly trained personnel can only assure the highest quality of workmanship possible.

Mallory pioneered vibrators for automobile radios and has always led in all new developments in the vibrator industry.

Because Mallory is the world's largest manufacturer of electrical contacts, you are assured the highest contact quality in vibrators. Outstanding quality construction features are: 1. Selected pure tungsten contacts. 2. Special high tensile reed. 3. The highest quality of bakelite insulation specially processed in the Mallory factory. 4. Sturdy construction. 5. Low loss of magnetic circuit. 6. Pure rubber insulated tubing. 7. Extra flexible tinned copper lead wires. 8. High contact pressure. 9. Sealed tamper-proof condensers.

Mallory Replacement Vibrators for Auto Radios and Household Receivers

Catalog Number	6-VOLT TYPES
201	
202	No. 201 Series
203	
204	
205	No. 205 Series
206	
210	
211	
212	
213	No. 210 Series
214	
219	
236	
237	
220B	
221	
222	
223	
224	
225	
226	
230	
231	No. 231 Series
234	
235	
236	No. 210 Series
237	
245	
245C	
246	
247	
248	
249	

Catalog Number	6-VOLT TYPES
250	See new replacement No. 500P
253	
253T	
253Y	
270B	
271HD	
271	No. 271 Series
273*	
273C	
273D	
275	
275XS	
277S	
280	
281	No. 281 Series
285	
282B	
282P	
285	See No. 281 Series
285XS	
W285	
286S	No. 286S Series
287M	
289Y	
292	
294	
294C	
294SW	
296	
297	
302S	
303S	No. 302S Series
312T	

Catalog Number	6-VOLT TYPES
311S	
312T	See No. 302S Series
500P	
501P	
503	
504	
514	
12-VOLT TYPES	
G253	
G286S	No. G286S Series
G287M	
32-VOLT TYPES	
F204	No. F204 Series
F206	
F211	
F220C	
F221	See F292 Series
F223	
F247	
F251	No. F251 Series
F253	
F292	No. F292 Series
F221	
F294	
F297	
F312	
F502P	

Replacement Vibrators for Vibrator-Operated Inverters

H240
F290

Alignment of Modern Radio Receivers

MANY VOLUMES have been written on this subject, both from a technical and a serviceman's viewpoint, and justly, because improper alignment is one of the most common ailments encountered in service work today, especially in receivers of the allwave type. Many servicemen are somewhat afraid to make adjustments on receivers, as long as the set plays at all, because they are not familiar with the various functions and workings of modern receivers. This article is intended to help clarify to the serviceman who wishes to learn the why of such adjustments, how the various radio frequency circuits of a radio receiver function, and how to make practical adjustments necessary in order to restore a set to its original factory performance and efficiency.

A vitally important part of a radio receiver is the small compensating condenser used to make adjustments of the various tuned circuits. These small adjustable condensers, usually called padders or trimmers, are constructed in various ways. They usually consist of two or more plates insulated from each other, one plate being made of spring material, so it will hold the adjustment or spacing given it by means of turning a screw or nut.

These condensers are used to obtain fine adjustment of the tuned circuits, so that they may be completely in resonance and perform at their highest efficiency. Since it is commercially impractical to construct coils or tuning condensers which would be accurate at every point on the dial, these trimmer condensers are placed across them so as to provide an accurate and easy means of making each circuit resonate at the proper dial position.

T. R. F. RECEIVERS

In a tuned radio frequency type of receiver the adjustments of these padders are usually made at the high frequency end of the dial using a signal generator or a station as a signal source, and adjusting the trimmers until maximum output is obtained. In some of the older type receivers, where the tuning coils were not properly impregnated, they absorbed moisture through exposure, which causes considerable losses or reduces their Q, and appreciably reduces the already none too abundant selectivity. Replacement or a baking and re-impregnating process is recommended for such cases before adjusting the trimmers.

In some of the older sets not using screen grid tubes, it is necessary to neutralize the circuits to prevent oscillations or howling, before the resonant circuit trimmer condensers are adjusted. Neutralization was usually accomplished by means of small trimmer type condensers, which served to compensate for the grid to plate energy transfer due to the grid to plate capacity of the triode tubes then used.

SUPERHETERODYNES

The modern superheterodyne is considerably more complicated than these older type receivers and a brief review of the elementary theory involved in this type of receiver is necessary, so that the importance of making accurate adjustments on these receivers may be more fully appreciated. In this type of receiver circuit, the incoming R.F. signal is usually impressed across the primary of an antenna coil. The antenna coils' secondary is tuned over the desired frequency range by a variable condenser, which in turn is adjusted by means of the trimmer condenser connected across it. The signal usually goes from there into the grid of the first tube. In smaller sets the tube may be a detector oscillator or in larger sets it may be the first R.F. tube. In other cases, the signal may be fed from the first coil into another coil which is also tuned over the range by a condenser across it. This is commonly called a band pass filter type circuit. The signal then goes to the first tube. In the circuits having a combination detector oscillator tube, the incoming signal is mixed with the local oscillator signal producing a beat note, or the frequency difference between the incoming R.F. signal and the local oscillator signal.

Some of the larger sets employ a separate oscillator tube and a separate first detector tube. In such cases, the oscillator tube generates the oscillator signal frequency which is combined with the R.F. signal in the first detector or modulator tube. In both cases the two frequencies are mixed in the first detector tube, so as to produce another frequency, which is the difference between the two. When the circuits are operating correctly, this frequency difference is equal to the intermediate frequency (I.F.) of the set. The local oscillator and the R.F. sections of the set are both tuned by means of variable condensers and the circuits are so adjusted that the beat note produced by the mixing of the two frequencies is always equal to the I.F. frequency of the set throughout their tuning range.

Commercial design uses an oscillator frequency higher than the incoming R.F. signal, because it is more economical to build a set with less capacity and inductance (required to produce the higher osc. frequency) than when it is lower, requiring more capacity and inductance. Capacity and inductance values when higher oscillator frequencies are employed, are much lower than would be required if the oscillator frequency were lower than the incoming frequency (R.F.). When a gang type tuning condenser is employed this requires that the capacity of the oscillator section be less than that of the R.F. sections. Commercially, this is done by either making all condenser sections alike and inserting a small padder type condenser in series with the oscillator section capacity across the oscillator coil, or by using a cut plate type oscillator section, which has the required reduced capacity. In either case, a small trimmer condenser is also connected across the oscillator condenser so as to correctly adjust the minimum capacity of the combination or adjust the highest frequency end of the oscillator range.

The signal resulting from the mixing of the incoming R.F. signal and the local oscillator is fed into the intermediate frequency amplifier. The first I.F. transformer serves to couple the output from the first detector into the grid circuit of the first I.F. amplifier tube. The signal is amplified by this tube and then passes through a second I.F. transformer, which may feed it into a second I.F. tube or the second detector tube, depending on the size of the set. I.F. transformers are designed so that their natural resonant frequency is approximately the required I.F. frequency. In order to obtain maximum selectivity and sensitivity, both their primaries and secondaries are tuned to the exact I.F. frequency of the set by means of trimmer condensers.

The advantages of this system are: that since it is easier to design an amplifier for lower frequencies, an I.F. amplifier can be designed to operate at one fixed frequency much more efficiently, resulting in far higher amplification and increased sensitivity and selectivity than an amplifier designed to operate at higher frequencies and over a wide frequency range.

ADJUSTING COMPENSATING CONDENSERS

Adjustment of these condensers should be made when the set lacks selectivity or sensitivity after other possible sources of this trouble have been checked and eliminated; such as weak tubes, poor aerial, improper tube voltages, etc.

I. F. ALIGNMENT

The I.F. trimmer condensers should be adjusted before the R.F. section is adjusted. This is best done by using a signal generator with an audio modulated signal tuned to the exact I.F. frequency of the set. The signal from the generator is fed into the grid of the first detector tube. In some cases it is desirable to "kill" the local set oscillator by placing a bypass condenser across the oscillator section of the tuning condenser to eliminate any erroneous beats which may be produced. An output meter should be connected from the plate of the last audio tube to ground or from plate to plate in case of push pull output.

If one owns a meter of sufficient sensitivity, it may be connected across the voice coil of the set. Sets using automatic volume control should be adjusted either by reducing the signal output of the service oscillator to a point where the AVC does not function, and using the output meter, or by inserting a milliameter in series with the load resistor in the AVC network, or connecting a vacuum tube voltmeter across the AVC network, so as to read the AVC voltage developed.

If the set is provided with a resonance indicator such as the "Shadow Meter" or cathode ray "Magic Eye" this will provide an excellent indicator for adjustment purposes. After having made suitable provision for indicating resonance, the I.F. trimmer condensers should be adjusted for maximum output, or so as to tune the I.F. circuits to their exact resonant frequency.

A signal generator should always be used for aligning the I.F. transformers. If a station signal is used, one is apt to get the entire I.F. system "off" frequency, although it may be set for maximum output, thus causing poor tracking of the oscillator and R.F. circuits, producing dead spots on the dial and in many cases whistles and birdies. In high fidelity sets where the fidelity is variable, it is usually advisable to set the fidelity control to the low fidelity or sharp tuning position of the I.F. circuits, and adjust the I.F. trimmers so as to produce an overall I.F. tuning curve with a "flat top." Possibly the most accurate method and easiest of adjusting such high fidelity sets is to use a cathode ray tube in conjunction with a frequency modulated test oscillator, so as to reproduce the entire tuning curve of the I.F. system on the screen of the tube. However, this is a subject requiring volumes for satisfactory explanation, and cannot be included in this article. Sets which are equipped with automatic frequency control should be adjusted with the A.F.C. control turned off. See article on A.F.C., page 161.

After these adjustments have been made, the I.F. system of the set will respond to a signal which is exactly equal to a frequency for which the circuit has been adjusted.

In many modern superheterodynes, a wave trap is provided in series with the antenna circuit which is tuned to the I.F. frequency of the set, so as to prevent any unwanted signals of this frequency from entering the set and getting to the first detector and coming on through the I.F. system. The proper adjustment of such a wave trap is to connect the signal generator to the antenna post of the set and then adjust it to the I.F. frequency. Then turn the generator to maximum output. The trimmer condenser across the wave trap should be adjusted until minimum response is obtained in the output of the set.

R. F. ALIGNMENT

After the I.F. section of the set has been aligned to the proper frequency, the next job is to align the R.F. and oscillator sections. Compensating or trimmer condensers are connected across the R.F. and oscillator coils in order to provide a means of accurately adjusting these circuits.

The test oscillator should be connected to the antenna and ground terminals of the set and adjusted for a frequency close to the highest frequency portion of the range being adjusted. On the broadcast band, the adjustment is usually made at 1400 kc. Then adjust the R.F. trimmers for maximum output when the receiver dial is set at 1400 kc. The trimmer condenser provided across the oscillator condenser is for the purpose of making the oscillator track at the high frequency end of the dial.

For instance, in a superheterodyne with an I.F. frequency of 465 kc., when the R.F. sections are tuned to 1400 kc., the oscillator must oscillate at 1400 kc. plus 465 kc. or 1865 kc. This frequency difference must be maintained between the oscillator and R.F. sections throughout the tuning range of the set. In order to maintain this frequency difference at the low frequency end of the dial, there is a compensating condenser placed in series with the oscillator gang.

On broadcast this adjustment is usually made at 600 kc. If the R.F. is set at 600 kc., a set with a 465 kc. I.F. would have the oscillator oscillating at 600 kc. plus 465 kc., or 1065 kc. Therefore, the high and low frequency padders provide the necessary tracking adjustments for two points on the dial.

Modern receivers are designed for three point tracking, for instance, on the broadcast band at 1400 kc., 900 kc., and 600 kc. The tracking at the third point, or 900 kc., is determined by the oscillator coil inductance. Although this is entirely a matter of set design, occasionally a serviceman gets a set in which oscillator inductance trouble is suspected and in which case he usually tries to obtain a new one. Unfortunately, however, they are sometimes unobtainable at any price, so the only choice he has is to repair the one available. A few hints on how this can be done will be given.

TRACKING OSCILLATOR COIL WITH R. F. COILS

First, the local set oscillator should be killed by shunting a bypass condenser across the oscillator gang section, and the set operated as a T.R.F. set and the dial calibration checked at several points across the band. The R.F. should be adjusted so that the dial corresponds as nearly as possible with the R.F. tuning. Also, the extreme ends of the range should be noted. Say that they are 1500 kc. and 550 kc.

Second, connect the test oscillator so that it will beat with the local set oscillator into the first detector. The R.F. tubes should be taken out so as to prevent any unwanted signal coming through. A pair of bypassed ear phones in the oscillator plate or first detector plate circuit, will allow one to detect the beat between the two oscillators. Then set the dial exactly to the previously noted high position, say 1500 kc., and set the test oscillator to 1965 kc. (I.F. frequency equals 465 kc. plus R.F. frequency). Then adjust the high frequency padder ...

Ac
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F
sep
cast
gen
doul
ante.
gener
porti
treme
as rec... This is usually a carbon resistor and a small condenser.

Then the oscillator trimmer (shunt) condenser should be adjusted until the generator's signal comes in at the desired point on the dial. Incidentally, it is extremely important that the oscillator trimmer be adjusted to the fundamental and not the image frequency. This can be assured by backing the trimmer screw entirely out, then slowly turning it in, until a maximum peak occurs. Turning the condenser slightly beyond this point will bring in another peak somewhat weaker than the first which is the image frequency.

Another check is to set the trimmer on the fundamental and leaving the generator at the same frequency, rotate the gang condenser to a lower frequency position until the image signal is heard. This signal should be lower in frequency than the generator frequency by twice the value of the set's I.F. frequency.

Double responses or image interference is due to a lack of R.F. selectivity before the first detector tube, and is especially noticeable in the higher frequency bands. Very few manufacturers use more than one tuned R.F. stage ahead of the first detector on their high frequency bands, and some do not use any.

After the oscillator has been adjusted, the R.F. trimmers for the band being adjusted should be adjusted for maximum output. Then if there is a low frequency oscillator padder for the band concerned, it should be adjusted so as to make some known signal generator frequency near the low frequency end of the band come in at the correct dial setting.

Each band is adjusted in the same manner until the R.F. section of the set is completely adjusted. In some allwave sets, the circuit arrangement is such that there is an interlocking of adjustments between bands. In this case, the highest frequency band must be adjusted first, the next highest frequency band, and so on, until all bands have been adjusted, unless otherwise recommended by the set manufacturer. It is very helpful when adjusting allwave receivers to obtain a chassis layout showing location of all trimmer con... e alignment process is attempted.

DJUSTING NAL GENERATOR

t that portable oscillators or sig... radio service work be checked calibration.
ave compensating condensers t to correct for any shifting of ave occurred. Their adjustment involves:
roadcast station near the high he generator's band.
he generator to the antenna of gainst the station.
generator's compensating conding obtained on the generator ds with the known station

same process for some known he low frequency end of the generator's dial and adjusting the series padder condenser until zero beat is obtained between the station and the generator, until the calibration of the generator corresponds to the known station frequency.

Some signal generators are not provided with a means of making their generated frequency track with the dial at the low frequency ends of the various bands. In such cases nearly perfect tracking can be effected by arranging a means of varying the inductance of the oscillator coil. If the inductance is too high, it can be lowered by moving a copper penny on a screw into the coil, or if it is too low by moving a piece of R.F. iron on a screw into the coil. There is probably nothing more time-wasting in adjusting a set, than attempting to correctly adjust it with a generator whose dial calibration is incorrect.

CHANGING THE I. F. FREQUENCY

In some parts of the country interference is experienced from nearby powerful code stations operating on a frequency near that of the I.F. peak of the receiver. The first remedy for this trouble is to install a wave trap in the antenna circuit tuned to the frequency of the unwanted signal. If this does not reduce the interference to a negligible amount it may be necessary to shift the I.F. frequency slightly until the unwanted interference is eliminated. Another cause of interference in the form of whistles and birdies, sometimes on every station received, is two powerful local stations whose frequencies are such that the beat between the two is nearly equal to the I.F. frequency of the set. For example, powerful locals broadcasting on 1400 kc. and 1230 kc. would produce a beat frequency of 170 kc., which is very close to 175 kc., a common I.F. frequency. Unless the set has an unusual amount of R.F. selectivity it will be full of unwanted whistles. This can usually be remedied by shifting the I.F. frequency up to approximately 200 kc., and re-tracking the oscillator to match the R.F. for maximum response over the band. It is also helpful in some extreme cases to install a wave trap in the antenna circuit tuned to one of the interfering signal frequencies.

omatic Frequency Control

cy control is probably the ut development of the year. are employing it in their loyed by various manufac... l, but basically they are

vary the frequency of the ermined range) so that the between the set oscillator lways equal to the I.F. en takes care of improper r drift, tracking inaccu... ally possible mechanical

rate functions must be

ator. The purpose of the frequency changes into ning I.F. frequency is quency of the set, the oltage varying in one equency is lower than the resonant I.F. frequency of the set, the discriminator must produce a voltage varying in the opposite direction.

The second function is that of varying the frequency of the set oscillator. A separate tube known as the "Frequency Control" performs this task. The frequency control must be arranged so that voltage variations in one direction tend to increase the frequency of the set oscillator, and voltage variations in the other direction tend to decrease the frequency of the set oscillator.

DISCRIMINATOR

As previously mentioned, the purpose of the discriminator is to change frequency variations from the resonant I.F. frequency into D.C. voltage variations. Figure 1 shows the essential parts of the discriminator circuit.

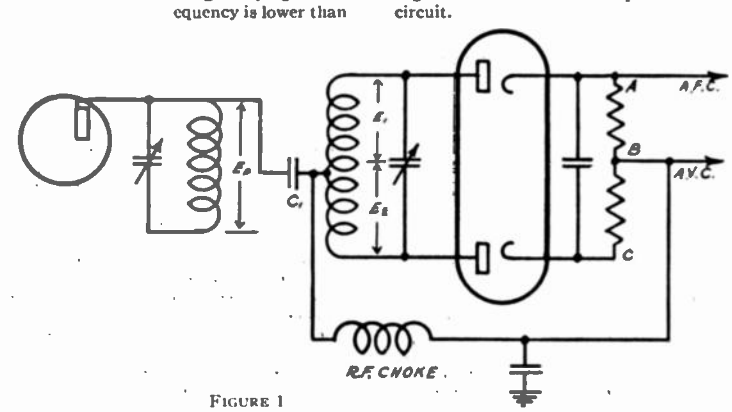


FIGURE 1

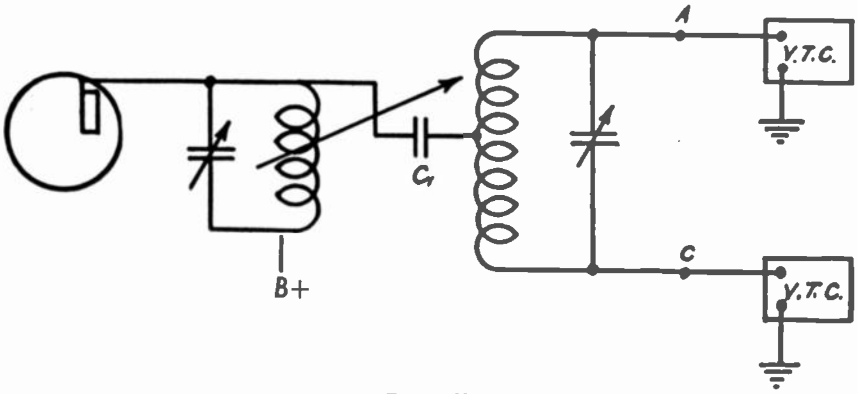


FIGURE II

The discriminator transformer is similar to the other I.F. transformers in the set, except the secondary is center-tapped and the high side of the primary is coupled to the secondary center-tap by means of C_1 so that in addition to the usual magnetic coupling between coils, we have the primary voltage coupled to the center-tap of the secondary coil.

Supposing, in order to simplify the explanation of how this AFC transformer works, we consider for the moment that there is no magnetic coupling between the primary and secondary coils; therefore, there would be no induced voltage in the secondary coil and no current will flow in the tuned secondary circuit—see Figure II. However, the primary voltage is coupled to the secondary center-tap by C_1, which is large enough to have a negligible R.F. voltage drop across it, and both coils are tuned to the I.F. frequency of the set. If vacuum tube voltmeters were connected at points A and C to ground it would be found that the primary voltage E_p would appear at both points, and, when the incoming signal was varied above and below resonance the voltage would vary exactly as the primary voltage E_p, rising to a peak at resonance and falling off on both sides. In other words, the primary voltage E_p, transferred by C_1 would appear at points A and C.

Then, supposing we couple the coils magnetically so that the primary flux links with the secondary, inducing a voltage E_s in the secondary winding. This induced voltage will start a current flowing in the tuned

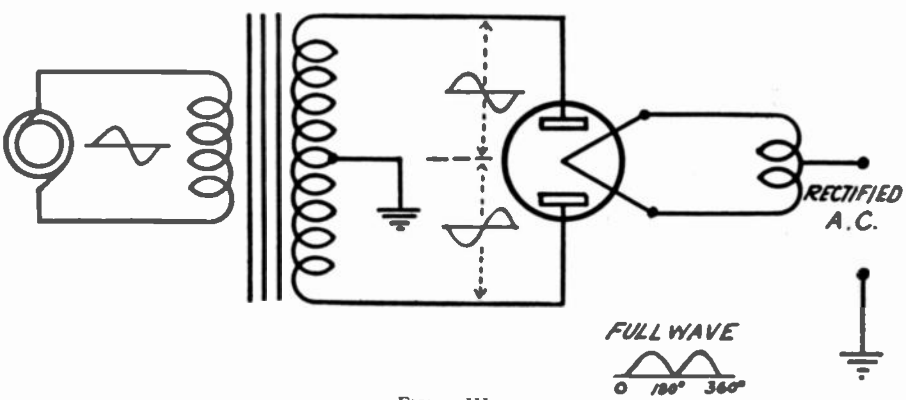


FIGURE III

secondary tank circuit. Since the same flux produces both the induced secondary voltage E_s and the induced primary voltage E_p, these voltages will be in exact time phase.

Also, it follows that, since at resonance the secondary circuit offers only resistance impedance, the circulating secondary current will be in phase with the induced secondary voltage E_s, or the primary coil voltage E_p will be in phase with the circulating secondary current.

Since the circulating current in the secondary coil induces a voltage in the coil, which at resonance is quite large compared to the induced voltage E_s, and this voltage E_{sr} across the coil is necessarily 90 electrical degrees ahead of the current producing it, the resonant voltage E_{sr} across the coil is 90 electrical degrees ahead of the primary voltage E_p. However, the secondary is center-tapped, so that the voltages developed across each half will be equal, but as seen from the center-tap will be 180° out of phase. This point is clarified when one reviews what happens in a push pull transformer or a full wave rectifier circuit. See Figure III.

Then, returning to Figure II again, and tracing the R.F. circuit from points A to ground or B+ (since B+ is practically ground to R.F.) and from point C to ground, it is apparent that whatever voltage appears across the upper half of the coil, plus the primary voltage will appear at point A, and whatever voltage appears across the bottom coil plus the primary voltage, will be found from point B to ground.

Then assuming that the primary voltage E_p is equal to the voltages appearing across each half of the secondary coil E_1 and E_2, we can draw the following vector diagrams to illustrate what happens at resonance. Since these voltages are not in phase they cannot be added directly but must be added vectorially as illustrated. See Figure IV.

From these vector diagrams we see that equal R.F. voltages will appear at each diode plate with respect to ground at resonance. The heavy lines show the resultant voltage wave when E_p is added to E_1 and E_2.

Then it follows that if equal R.F. voltages appear at each diode plate to ground, equal D.C. voltages will appear across AB and BC at resonance, Figure I. However, A will be positive with respect to B, and C will be positive with respect to B, therefore, the total D.C. voltage from A to C will be zero, and we will have no AFC control voltage developed when the incoming I.F. signal is at the resonant frequency of the AFC transformer.

BELOW RESONANCE

Now, supposing the incoming I.F. signal impressed on the AFC transformer is LOWERED. The induced secondary voltage E_s will still be in phase with primary voltage E_p. However, the circulating current in the secondary tank circuit will no longer be in phase with it, but will begin to lead.

This follows, because at frequencies lower than resonance in a series tuned circuit, the capacitive reactance is large and the inductive reactance small, so that most of the voltage drop is across the condenser. The circulating current leads the applied voltage E_s, depending on the amount off resonance of the incoming signal. This, in turn, causes the induced voltage E_{sr} to lead the primary voltage E_p by a like amount, or the voltages developed in each half secondary begin to shift as illustrated, with the result that the vector sum of the primary and each half secondary voltages becomes unequal, the top diode (Figure 1) receiving a higher R.F. voltage than the bottom diode. For convenience, we have shown a phase shift of 30°.

Since the top diode receives more R.F. voltage than the bottom diode, the rectified D.C. voltage appearing across AB will be greater than that across BC. Also, since A will be positive with respect to B, the resulting D.C. voltage appearing across AC will be a positive AFC control voltage.

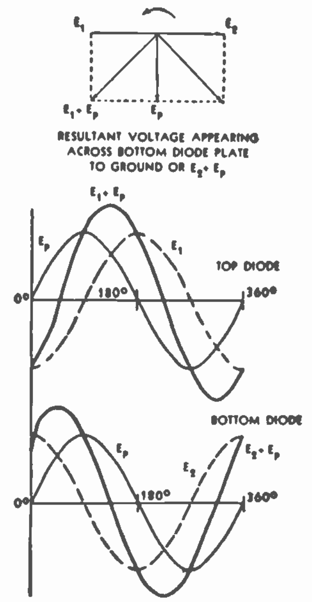


FIGURE IV

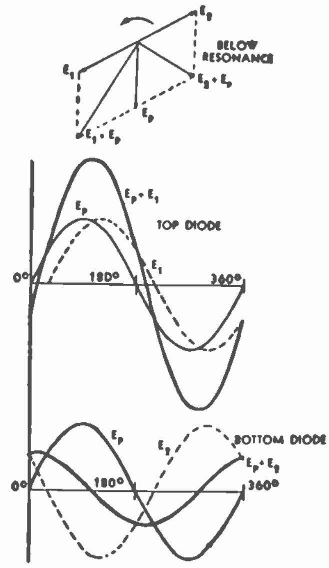


FIGURE V

ABOVE RESONANCE

Supposing now that the incoming I.F. signal frequency is higher than the resonant AFC frequency. The circulating secondary current will begin to lag the primary voltage, E_p.

This is because at higher frequencies, the inductive reactance is large and the capacitive reactance low, resulting in the circulating current lagging the induced secondary voltage E_s, or lagging the primary voltage E_p. This circulating current in turn induces the resonant voltage E_{sr} in the coil, causing the secondary voltages E_1 and E_2 to lag the primary voltage E_p in our vector diagram, Figure VI, or to lag its original resonant position. For convenience a 30° phase shift is again shown.

From Figure VI, we see that the bottom diode receives more R.F. voltage when the incoming I.F. signal is above resonance; therefore, more voltage will be developed across the bottom diode resistor than across the top and since B will be negative with respect to ground or C, this negative voltage will overpower the

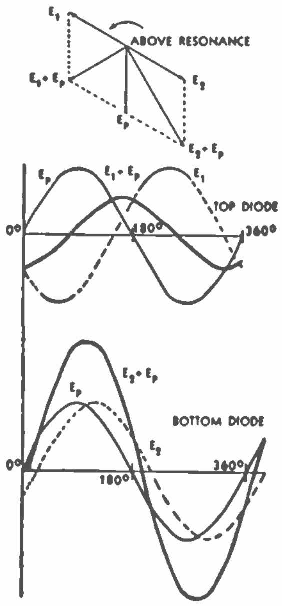


FIGURE VI

voltage from the top diode resulting in a negative AFC control voltage.

This varying voltage is then fed to the grid of the frequency control tube. A typical resonance curve of an AFC transformer showing AFC control voltage developed, vs. kc. off resonance is shown in Figure VII.

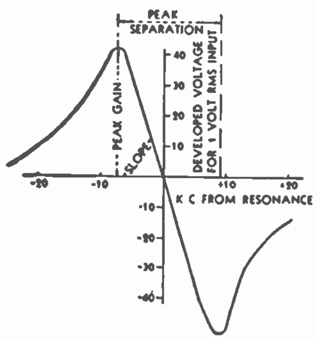


FIGURE VII

FREQUENCY CONTROL

Figure VIII shows the essential parts of the frequency control circuit.

To accomplish its purpose, that is, to provide some way of either increasing or decreasing the set oscillator frequency from normal, without changing the gang condenser position, we connect an imaginary inductance across the oscillator coil and provide a way of making this imaginary inductance either larger or smaller by means of the discriminator voltage. The imaginary inductance is the frequency control tube.

Reviewing elementary circuit theory, we find that the current in a condenser leads the voltage by 90°; also that the current in an inductance lags the voltage by 90°. We also find that when two inductances are connected in parallel, the resultant inductance is always less than that of the lowest of the two inductances.

WHY THE CONTROL TUBE ACTS AS AN INDUCTANCE

In order for the control tube to act as an imaginary inductance in shunt with the oscillator coil "L," it must cause a lagging current to flow through coil "L" (Figure VIII) with respect to the oscillator voltage already across coil "L" since this is exactly what would

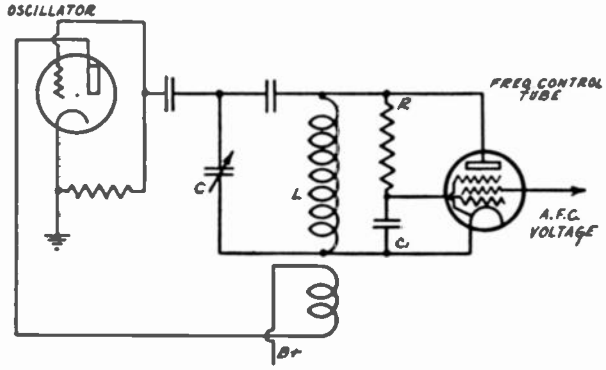


FIGURE VIII

happen if an inductance coil were connected in shunt with coil "L."

Supposing the control tube was connected across coil "L," but without any AC excitation on its grid. In this case, it would shunt the coil "L" with a definite resistance or impedance, the magnitude of which would depend on the bias voltage applied to the tube. Therefore, the tube would draw current from the coil "L". However, this current would be in phase with the oscillator voltage since the tube acts as a resistance and increasing or decreasing the bias on the tube would not affect the oscillator frequency. However, the network R.C. is also connected across the oscillator coil "L" and the voltage across "C" is applied to the grid of the control tube. This causes the tube to act as an imaginary inductance, explanation as follows:

Looking at Figure VIII we find a resistance "R" and a capacity "C_1" connected in series across the oscillator coil "L." The values of "R" and "C_1" are so chosen that the resistance of "R" is greater than the reactance of "C_1," therefore, this combination has nearly unity power factor, or appears to the oscillator coil "L" or oscillator voltage source as a resistance load. The current through R and C_1, therefore, is nearly in phase with the oscillator voltage. Then, since the current through condenser "C_1" is nearly in phase with the oscillator voltage across the coil "L," it follows (from the statement above) that the voltage appearing across a condenser lags the current through it by 90°, that the voltage appearing across condenser "C_1" is lagging the oscillator coil voltage by nearly 90°.

This voltage is then applied to the grid of the control tube. If the control tube is properly biased, plate current will flow in phase with the grid voltage (peak plate current with peak grid voltage). This means that the plate current will lag the voltage across coil "L" or oscillatory circuit by nearly 90°, making the tube act as an imaginary inductance.

HOW CONTROL VOLTAGE AFFECTS INDUCTANCE

Since the plate current of the control tube draws a lagging current with respect to the oscillator voltage across "L" and since the plate current can be varied by varying the amount of bias on the tube, we have in effect a variable inductance in shunt with the oscillator coil, the amount of which inductance is directly controlled by the discriminator control voltages.

A COMPLETE CYCLE

Referring to Figure I again, when the local oscillator is generating the correct signal to produce an I.F. signal equal to the resonant I.F. frequency of the set, there is no need of any further adjustment. The differential voltage is zero across points A to C; Figure I, therefore, there is no effect upon the control tube and oscillator circuit.

However, on signals lower than the I.F. set frequencies, "A" becomes positive with respect to ground causing the "Frequency Control" tube to draw more plate current, or decreasing the effective inductance of the coil "L" causing the oscillator frequency to raise, therefore raising the I.F. frequency produced until it equals the resonant I.F. frequency. On signals higher than the I.F. frequency, "A" becomes negative with respect to ground, causing the "Frequency Control" tube to draw less plate current, and therefore increasing the oscillator coil's effective inductance and decreasing the oscillator frequency, until it is correct to produce the resonant I.F. frequency.

The action finally stops in either case, with about one volt as the differential voltage actually remaining. This action is quite rapid, taking place in less than 1 second of time. It is possible with this system to correct the I.F. frequency to within 100 cycles of the I.F. frequency peak, if the receiver is mistuned as much as 10 kc. off resonance.

ALIGNMENT OF AFC-EQUIPPED SETS

First, the I.F. transformers of the set should be carefully aligned according to the standard practice as recommended by the manufacturer. (Usually it is a good practice to allow the set to warm up thoroughly before making any adjustments, so as to allow for inductance or capacity changes due to thermal expansion.) Then the test oscillator should be connected to the first detector or first I.F. stage and tuned to the exact I.F. frequency of the set, as determined by peak on an output meter. A vacuum tube voltmeter should be connected across the discriminator control voltage, points "A" and "C", Figure I. Usually one diode cathode connects to ground or chassis, so it is only necessary to connect the V.T.V. to the chassis, and the other diode cathode.

Then the secondary trimming condenser of the AFC transformer (Figure I), should be backed out with alignment tool until trimmer is completely open.

Then adjust the primary trimmer condenser (Figure I), until maximum reading is obtained on the V.T.V. either positive or negative.

Then realign secondary trimmer until zero voltage reading is obtained on the V.T.V. Be sure that the test oscillator is not changed during this alignment, and that it is at the exact I.F. frequency. Do not readjust the primary trimmer, unless the entire operation as outlined is repeated.

The adjustment of the secondary trimmer condenser is critical in most AFC-equipped sets, and adjustment should not be attempted without proper equipment. After the secondary trimmer is adjusted to produce zero voltage across point "AC" (Figure I), slowly increase the test oscillator frequency until the maximum voltage reading appears across "AC." Obtain this voltage reading, then slowly decrease the test oscillator frequency until the maximum voltage reading is obtained in the **reverse** direction. **These two voltages should be closely the same.** If not, readjust the secondary trimmer until they are. This completes the AFC alignment.

A quick check of the functioning of the AFC circuit can be made as follows: Tune in a local station without the AFC switch on. Then detune the set a measured amount off resonance, say 8 kc. Then turn the AFC control on. The AFC should lock in and tune the set to resonance. Then repeat the same test 8 kc. the opposite side of resonance and see if the AFC again locks in, tuning the set to resonance. The AFC should control an equal amount from either side of resonance when properly aligned. Also when the set is tuned to resonance on a weak signal with the AFC control off, turning the AFC control on should not cause the set to be mistuned. If it does, the AFC control adjustments are not properly aligned.

Transformers

THE design of a reliable power transformer, having high efficiency, requires fairly elaborate calculations, and to take into account the d.c. which flows in a transformer secondary when a half-wave rectifier is used, some interesting equations have been derived.

A simple approximate-design method will be given, for the construction of single-phase low-powered transformers up to 180 volt-amp., or 180 watts for approximately unity power factors. This design is especially suited to transformers which supply a full-wave rectifier and filament energy to an a.c. powered radio receiver, three factors making it possible to secure a satisfactory transformer without complicated design methods, these factors being:

1. There is no urgent need for high efficiency. An 80 per cent efficient transformer which takes 60 watts to supply 48 output watts is fairly satisfactory, if it can radiate the heat which it generates.

2. These transformers are operated at a fairly constant load. This improves the maintenance of the various output voltages as each secondary winding will have a constant *IR* drop.

3. The load on the transformer secondary is nearly of unity power factor. The filament power load is essentially a resistance load, with unity power factor. The current supplied to the filter has slightly less than unity power factor, but this can be disregarded in low-powered transformers. The indirect heated receiving tubes, such as the 227 requires less than half as much d.c. power in their plate and grid circuits, as that which is needed to heat their cathodes. This would mean a unity power-factor heater supply and (assuming a series voltage divider) less than half as many additional watts for plate and grid supply, at a lower power factor. It is true that a power tube, such as 250 at its maximum rating, uses slightly over three times the wattage in its $B + C$ circuit than in its filament. It is rare, however, to have more than two power tubes in a receiver, and the assumption that the power factor of the secondary is unity is usually not over 20 per cent off. This means that the wire of the high-voltage secondary and of the primary should be increased to allow for this added current.

Small Transformer Details—Economy in a transformer is secured when the winding encloses a maximum of core area with a minimum of wire, and the magnetic path should be as short as possible.

The core form of a small transformer can be of several shapes, but it is usual to use standard punchings shaped like capital letter E's. As a rule, two punchings are used, one having longer legs than the other so that the magnetic circuit "breaks joints" in stacking the iron. Another convention usually followed in small transformers is the use of a single-winding form, all secondaries and primary being on the middle leg of the E core.

The spool form is usually an insulating tube, and side pieces may be fitted on which terminals are placed, or, if the coil is to be machine wound with interwoven cotton, the side pieces can be omitted, and flexible leads provided.

Ten Steps in Designing a Small Power Transformer—1. *Determine the Volts and Amperes Needed for Each Secondary.*

a. Find the total maximum secondary watts $= W_s = E_1I_1 + E_2I_2 + \cdots$ (where $E \times I$ refers to the wattage in each secondary winding)

b. Find the total watts needed for primary (W_P)
Assuming 90 per cent efficiency $W_P = W_s/0.9$. Where W_s = Secondary watts.

c. Find primary amperes assuming 90 per cent power factor

$$I_P = \frac{W_P}{E_P \times 0.9} = \frac{W_s}{0.81E_P}$$

where $E_P = 110$ volts, $I_P = W_s/89.1$ amp.

2. *Size of Wire.* Knowing the current for each winding, the wire size is determined by the circular mils per ampere which it is desired to use. A safe rule is to use 1,000 cir. mils per ampere for transformers under 50 watts, and 1,500 cir. mils per ampere for higher powers—however, most commercial designs use 800 cir. mils per ampere.

3. *Core Considerations.* A curve showing core areas for different powers is Figure "A" which shows the area for 40 watts to be 1 sq. in., 70 watts, 1.5 sq. in., 120 watts, 2 sq. in. The area of the core is the same as the inside dimensions of the spool, making a 10 per cent allowance for stacking; for example, a spool 1 by 2 in. inside would enclose 2 sq. in., but, allowing for a 10 per cent loss, only 90 per cent or $0.9 \times 2 = 1.8$ sq. in. is the net core area. The core area is needed to determine the turns per volt.

4. *Core-Loss and Induction.* The flux density at which the core is to be worked determines the iron (core) loss. Figure "B" gives several curves of different core materials, watts per pound being plotted against flux densities in kilolines per square inch. Sixty-five kilolines per square inch is an average value of the induction. The making of a curve such as Figure "B" depends largely on experimental data, not directly on a theoretical basis. For this reason, no definite value of the core loss can be given; it depends on the quality of core material which is available. Standard core material generally has a power loss of .86 watts per pound. It should be noted that better and better core material is constantly being made, having lower loss per pound, so that the use of higher flux densities is becoming possible. Up to 15 kilolines is not uncommon, but unusual for this application. The core loss increases with frequency, a typical curve being Figure "C."

5. *Induced-voltage Equation, Turns per Volt.* The elementary definition, that 10^8 magnetic lines cut, per second, will induce one volt pressure, is the basis of the equation

$$E = \frac{BANf}{10^8} \times 4.44$$

where E is the voltage, A the area of the core, B the flux density in the same units as A, f the cycles per second, and N the number of turns. A more useful working equation for small power transformers is obtained by solving for N/E in turns per volt:

$$\frac{N}{E} = \frac{10^8}{BAf4.44}$$

Figure "D" is an alignment chart of this equation. The left column is B the flux density, in both kilolines per square inch and kilogausses (kilolines per square centimeter), the center column is the net core area in both square inches and square centimeters, the right column giving the turns per volt for both 25 and 60 cycles per second.

Using a flux density of 65 kilolines per square inch and the net core area mentioned in step 3 (1.8 sq. in.), the turns per volt for 60 cycles are found to be 3.1 turns per volt. Thus for each volt on the transformer, there must be 3.1 turns. It is customary to change the turns per volt to an even number so that the proper center taps can be made. In this case, by using 4 turns per volt, with the same core area, the induction will be lower, with a corresponding lower core loss. It is also quite possible, and sometimes advisable,

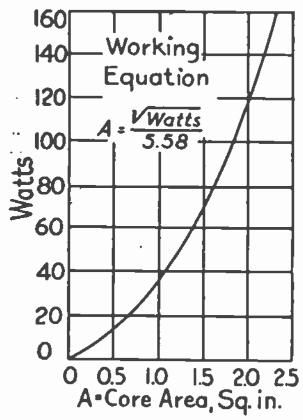


FIGURE A—*Small power transformer core area as a function of watts.*

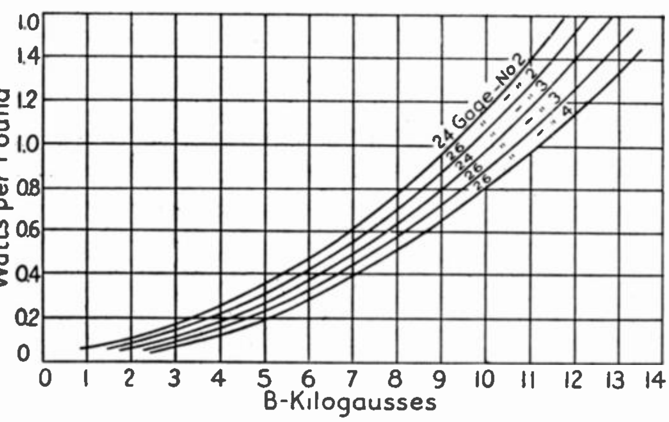


FIGURE B—*Core-loss curves Armco Radio grades (60 volts).*

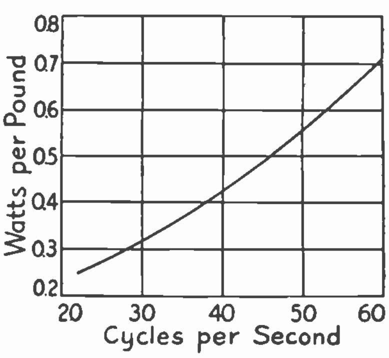


FIGURE C—*Core-loss vs. frequency* $B = 10{,}000$.

to change the core area so that an even number of turns per volt is given. For example, by increasing the core area to 2.8 sq. in. 2 turns per volt could be used, or decreased to 1.4 sq. in. so that 4 turns per volt would be used. The reason for desiring the even numbers of turns per volt is to supply the 1/2-volt steps for receiving tubes, such as 7 1/2 volts, which would require an integral number of turns when the turns per volt are used.

The voltage drop in the transformer winding should be mentioned here. For instance, the load voltage at a tube filament is lower than the no-load voltage by the amount of

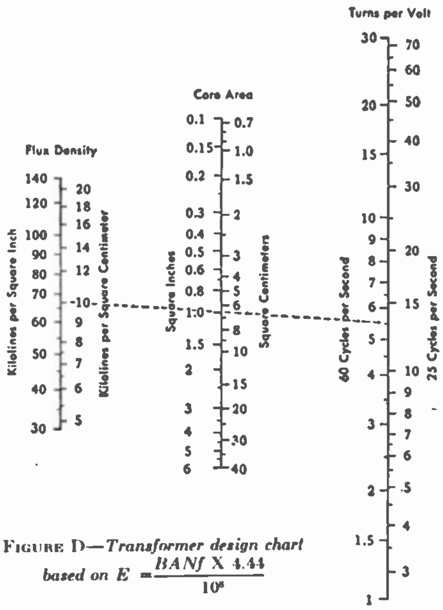


FIGURE D—*Transformer design chart based on* $E = \frac{BANf \times 4.44}{10^8}$

IR drop in the winding and the connecting wires to the tube. Thus, it may be that to secure 7 1/2 volts at the tube filament, the transformer no-load voltage will have to be 8. In this case, any integral number of turns per volt, either odd or even, will suit the design.

6. *Turns for Each Winding.* In step 1 the desired voltages were given, E_1, E_2, etc. Using the value of turns per volt in step 5, the total turns for each winding are found. For example, with 4 turns per volt, a 110-volt winding should have $4 \times 110 = 440$ turns.

7. *Winding Space Required.* From the total turns for each winding, and the wire size, the total area of winding space is calculated. Different wires and insulations have definite turns per square inch. The method of insulation, however, may have these values vary by factors of as much as three to one. That is, a 900-turn coil wound in layers with enamel wire may take up one square inch of cross-section area. By interleaving thin insulating paper between layers, only 600 turns can be wound in a square-inch area; and by using a certain size of cotton interwoven between turns, only 400 turns can be wound in a square inch. Thus, the space of winding depends to a large degree on the kind and thickness of insulation. Double cotton-covered wire takes up considerably more space than enameled wire. Yet, if the extra-needed insulating space for the interlayer protection is considered, the space ratio may not be so great.

After adding up the winding space of all the windings the area should be compared with that of the core. If the winding will go in the core space, this part of the design is finished.

If the wires will not go in the available space, the winding may be redesigned, or the core area increased. Using thinner coverings for wire, fewer secondaries or fewer circular mils per ampere will decrease the space needed for the wire. A larger iron size or a thicker stack of the same sized iron will increase the core area and allow a smaller number of turns per volt, thus decreasing the cross section of the winding.

8. *Copper Loss.*

a. Find the length of the mean (average) turns in feet.

b. Find the length of each winding in feet by multiplying the number of turns by the mean turn length.

c. From the following wire table find the ohms per 1,000 feet for the size wire used, and then from 8-*b* the actual ohms for this length.

d. Multiply the current squared for each winding by the ohms for that winding.

e. Add the I^2R's for each winding to get the copper loss L_1.

9. *Core Loss.* The core loss in watts L_2 is found from the weight of the core and flux density and kind of core used in step 4. A useful factor is that 4 per cent silicon steel weighs 0.27 lb. per cubic inch.

10. *The approximate percentage efficiency is*

$$\frac{W_s \times 100}{W_s + L_1 + L_2},$$

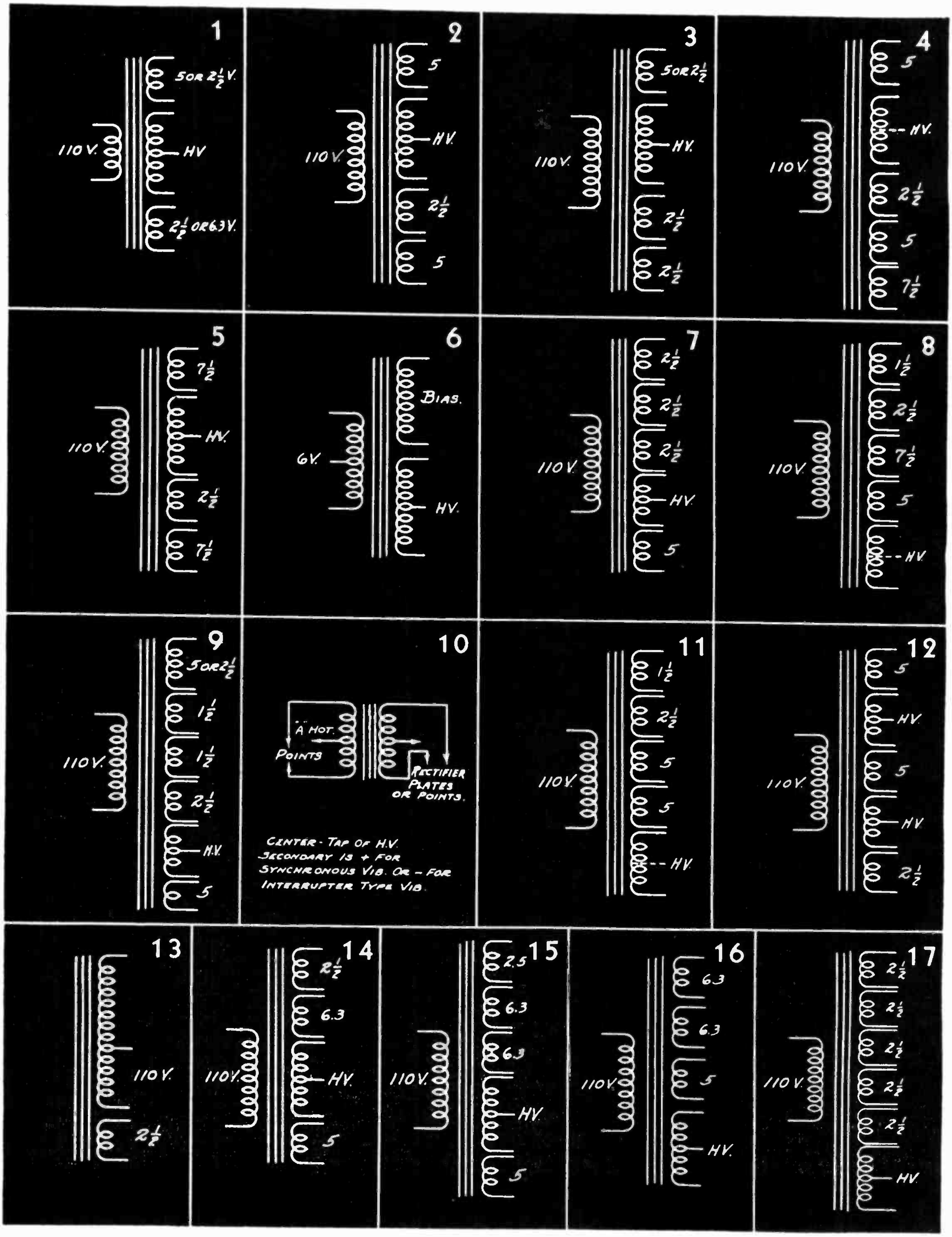
W_s being the secondary watts (see step 1).

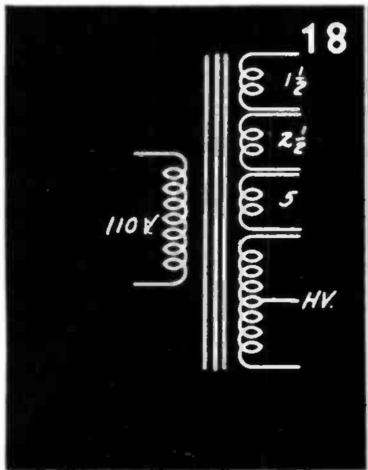
Note: If step 10 shows about 90 per cent efficiency, the design is complete. If much less than 90 per cent, step 1*a* must be modified, a new, larger value of *Ip* being used in finding a larger primary wire. This will not change the efficiency, but will prevent overloading the primary winding due to its carrying a greater current than that for which it was designed. It is desirable, as a rule, to keep the efficiency above 90 per cent, and this can be done by reducing L_1 and L_2, by using larger wires, or larger cores.

COPPER WIRE TABLE

Gauge No. B. & S.	Diam. in Mils[1]	Circular Mil Area	Turns per Linear Inch[2]				Turns per Square Inch[3]			Feet per Lb.		Ohms per 1000 ft. 250 C.	Correct Capacity at 100 C.M. per Amp.[3]	Diam. in mm.
			Enamel	S.S.C.	D.S.C. or S.C.C.	D.C.C.	S.C.C.	Enamel	D.C.C.	Bare	D.C.C.			
1	289.3	82690	—	—	—	—	—	—	—	3.947	—	.1264	55.7	7.348
2	257.6	66370	—	—	—	—	—	—	—	4.977	—	.1593	44.1	6.544
3	229.4	52640	—	—	—	—	—	—	—	6.276	—	.2009	35.0	5.827
4	204.3	41740	—	—	—	—	—	—	—	7.914	—	.2533	27.7	5.189
5	181.9	33100	—	—	—	—	—	—	—	9.980	—	.3195	22.0	4.621
6	162.0	26250	—	—	—	—	—	—	—	12.58	—	.4028	17.5	4.115
7	144.3	20820	—	—	—	—	—	—	—	15.87	—	.5080	13.8	3.665
8	128.5	16510	7.6	—	7.4	7.1	—	—	—	20.01	19.6	.6405	11.0	3.264
9	114.4	13090	8.6	—	8.2	7.8	—	—	—	25.23	24.6	.8077	8.7	2.906
10	101.9	10380	9.6	—	9.3	8.9	87.5	84.8	80.0	31.82	30.9	1.018	6.9	2.588
11	90.74	8234	10.7	—	10.3	9.8	110	105	97.5	40.12	38.8	1.284	5.5	2.305
12	80.81	6530	12.0	—	11.5	10.9	136	131	121	50.59	48.9	1.619	4.4	2.053
13	71.96	5178	13.5	—	12.8	12.0	170	162	150	63.80	61.5	2.042	3.5	1.828
14	64.08	4107	15.0	—	14.2	13.8	211	198	183	80.44	77.3	2.575	2.7	1.628
15	57.07	3257	16.8	—	15.8	14.7	262	250	223	101.4	97.3	3.247	2.2	1.450
16	50.82	2583	18.9	18.9	17.9	16.4	321	306	271	127.9	119	4.094	1.7	1.291
17	45.26	2048	21.2	21.2	19.9	18.1	397	372	329	161.3	150	5.163	1.3	1.150
18	40.30	1624	23.6	23.6	22.0	19.8	493	454	399	203.4	188	6.510	1.1	1.024
19	35.89	1288	26.4	26.4	24.4	21.8	592	553	479	256.5	237	8.210	.86	.9116
20	31.96	1022	29.4	29.4	27.0	23.8	775	725	625	323.4	298	10.35	.68	.8118
21	28.46	810.1	33.1	32.7	29.8	26.0	940	895	754	407.8	370	13.05	.54	.7230
22	25.35	642.4	37.0	36.5	34.1	30.0	1150	1070	910	514.2	461	16.46	.43	.6438
23	22.57	509.5	41.3	40.6	37.6	31.6	1400	1300	1080	648.4	584	20.76	.34	.5733
24	20.10	404.0	46.3	45.3	41.5	35.6	1700	1570	1260	817.7	745	26.17	.27	.5106
25	17.90	320.4	51.7	50.4	45.6	38.6	2060	1910	1510	1031	903	33.00	.21	.4547
26	15.94	254.1	58.0	55.6	50.2	41.8	2500	2300	1750	1300	1118	41.62	.17	.4049
27	14.20	201.5	64.9	61.5	55.0	45.0	3030	2780	2020	1639	1422	52.48	.13	.3606
28	12.64	159.8	72.7	68.6	60.2	48.5	3670	3350	2310	2067	1759	66.17	.11	.3211
29	11.26	126.7	81.6	74.8	65.4	51.8	4300	3900	2700	2607	2207	83.44	.084	.2859
30	10.03	100.5	90.5	83.3	71.5	55.5	5040	4660	3020	3287	2534	105.2	.067	.2546
31	8.928	79.70	101.	92.0	77.5	59.2	5920	5280	—	4145	2768	132.7	.053	.2268
32	7.950	63.21	113.	101.	83.6	62.6	7060	6250	—	5227	3137	167.3	.042	.2019
33	7.080	50.13	127.	110.	90.3	66.3	8120	7360	—	6591	4697	211.0	.033	.1798
34	6.305	39.75	143.	120.	97.0	70.0	9600	8310	—	8310	6168	266.0	.026	.1601
35	5.615	31.52	158.	132.	104.	73.5	10900	8700	—	10480	6737	335.0	.021	.1426
36	5.000	25.00	175.	143.	111.	77.0	12200	10700	—	13210	7877	423.0	.017	.1270
37	4.453	19.83	198.	154.	118.	80.3	—	—	—	16660	9309	533.4	.013	.1131
38	3.965	15.72	224.	166.	126.	83.6	—	—	—	21010	10666	672.6	.010	.1007
39	3.531	12.47	248.	181.	133.	86.6	—	—	—	26500	11907	848.1	.008	.0897
40	3.145	9.88	282.	194.	140.	89.7	—	—	—	33410	14222	1069	.006	.0799

[1] A mil is 1/1000 (one thousandth) of an inch.
[2] The figures given are approximate only, since the thickness of the insulation varies with different manufacturers.
[3] The current-carrying capacity at 1000 C.M. per ampere is equal to the circular-mil area (Column 3) divided by 1000.


1
5 OR 2½ V.
110 V.
HV
2½ OR 6.3 V.
2
5
110 V.
HV.
2½
5
3
5 OR 2½
110 V.
HV.
2½
2½
4
5
HV.
110 V.
2½
5
7½
5
7½
110 V.
HV.
2½
7½
6
BIAS.
6V.
HV.
7
2½
2½
2½
110 V.
HV.
5
8
1½
2½
7½
110 V.
5
HV.
9
5 OR 2½
1½
1½
110 V.
2½
H.V.
5
10
"A" HOT.
POINTS
RECTIFIER PLATES OR POINTS.
CENTER-TAP OF H.V. SECONDARY IS + FOR SYNCHRONOUS VIB. OR - FOR INTERRUPTER TYPE VIB.
11
1½
2½
5
5
110 V.
HV.
12
5
HV.
5
110 V.
HV.
2½
13
110 V.
2½
14
2½
6.3
110 V.
HV.
5
15
2.5
6.3
6.3
110 V.
HV.
5
16
6.3
6.3
5
110 V.
HV.
17
2½
2½
2½
2½
2½
110 V.
HV.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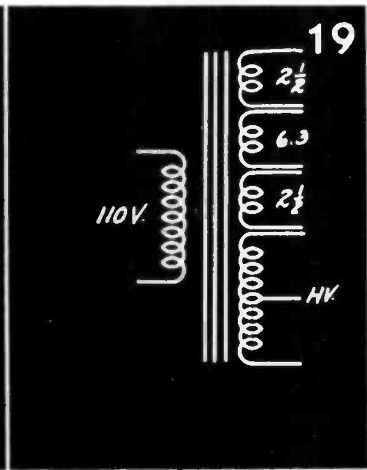
1½
2½
5
HV.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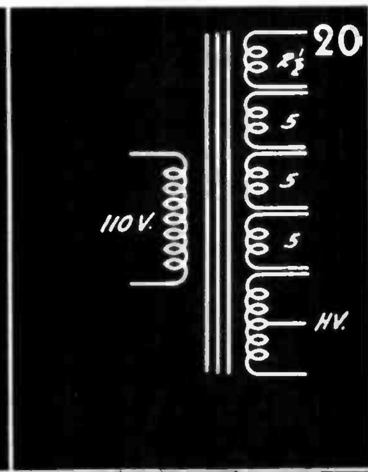
2½
6.3
2½
HV.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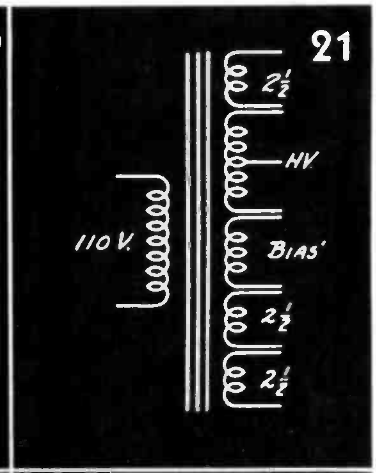
5
5
5
HV.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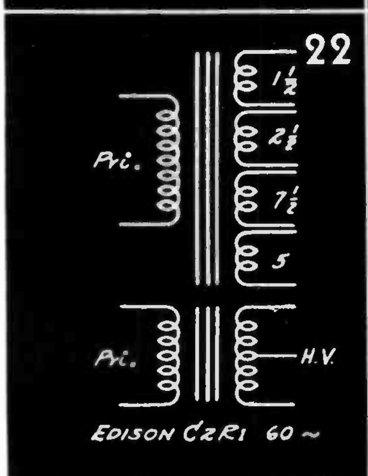
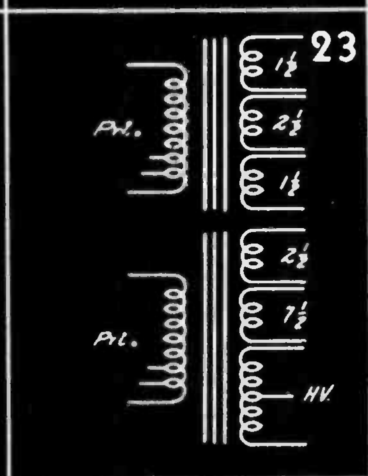
2½
HV.
BIAS
2½
2½


22
Pri.
1½
2½
7½
5
Pri.
H.V.
EDISON C2R1 60 ~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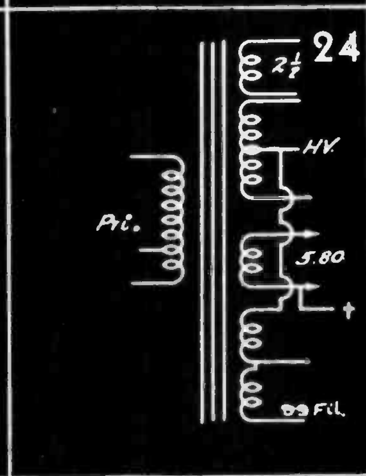
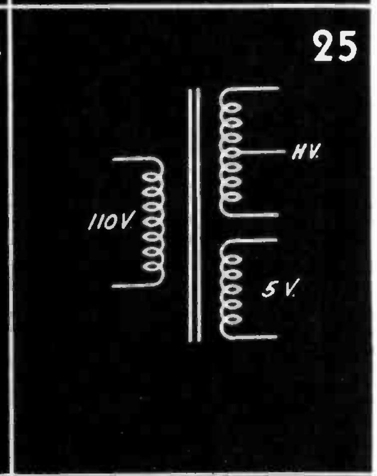
Pri.
1½
2½
1½
Pri.
2½
7½
HV.


24
Pri.
2½
HV.
5.80
+
Fil.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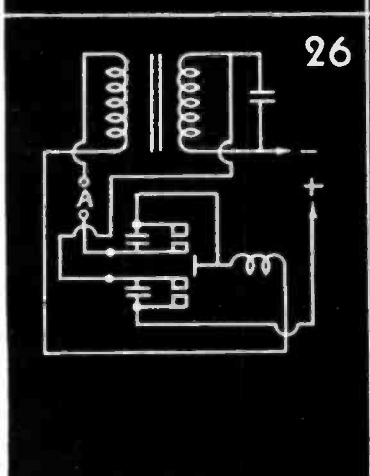
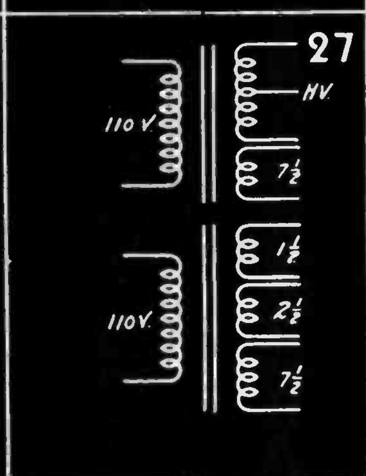
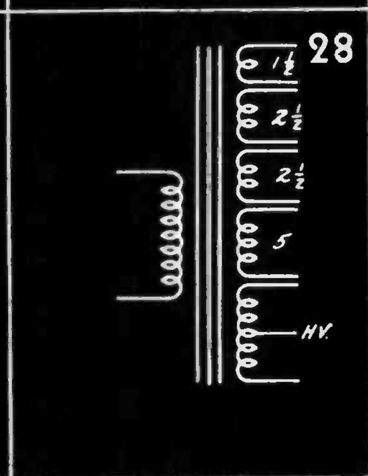
HV.
5V.


26
A
-
+


27
110V.
HV.
7½
110V.
1½
2½
7½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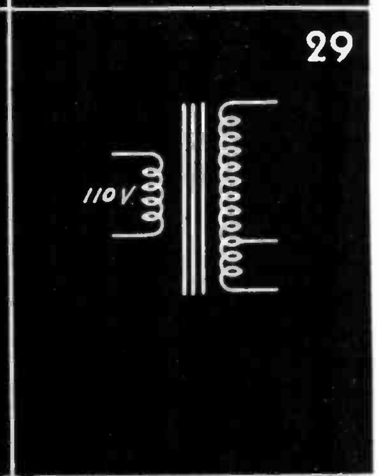
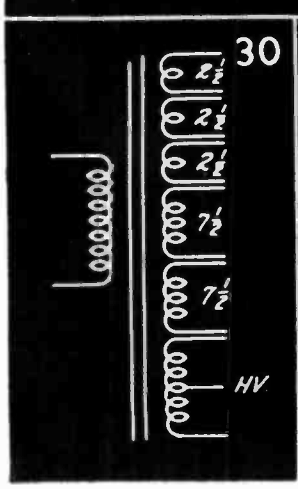
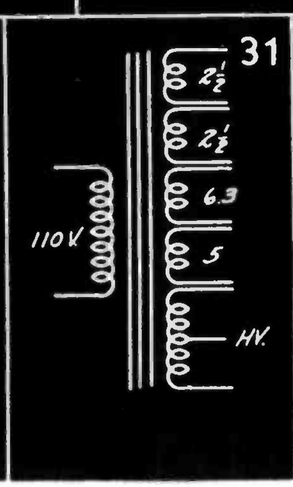
1½
2½
2½
5
HV.


29
110V.


30
2½
2½
2½
7½
7½
HV.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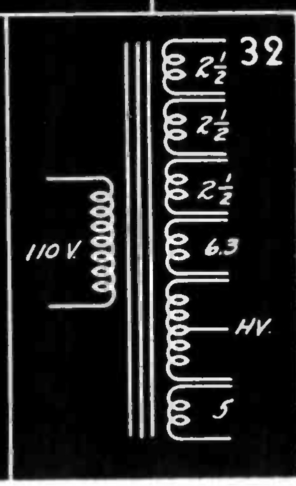
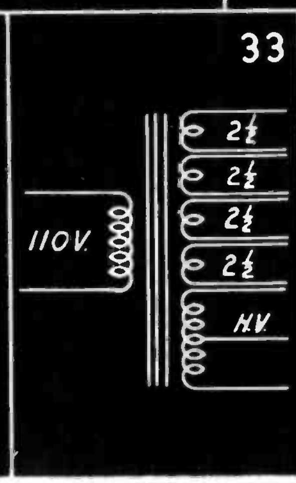
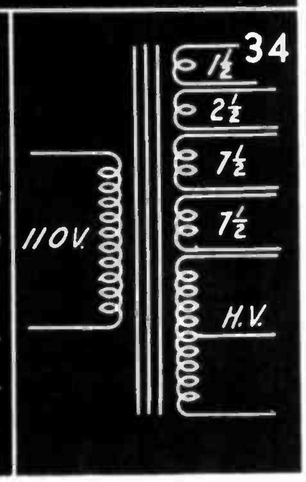
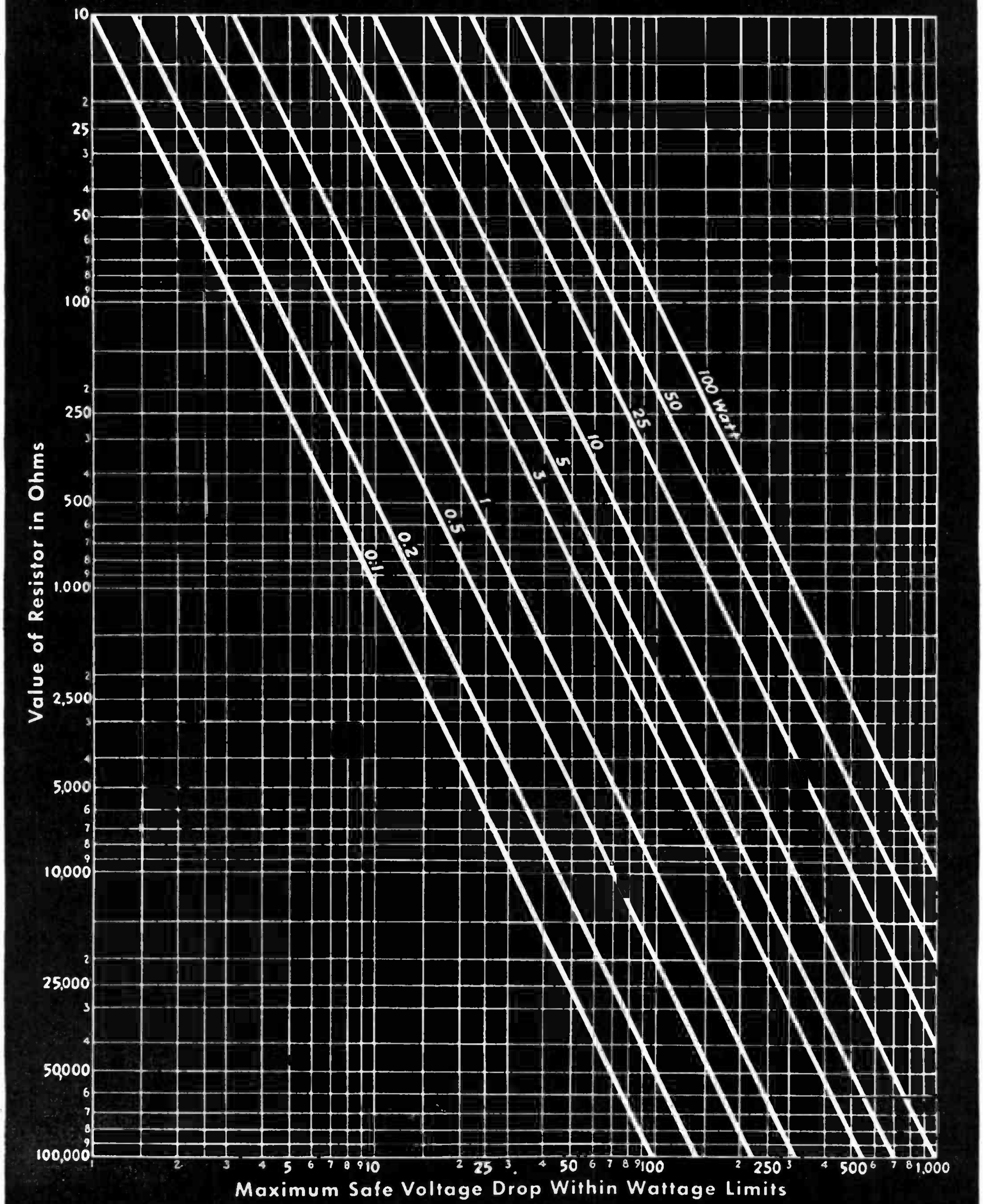
110V.
2½
2½
6.3
5
HV.


32
110V.
2½
2½
2½
6.3
HV.
5


33
110V.
2½
2½
2½
2½
HV.


34
110V.
1½
2½
7½
7½
H.V.

RESISTOR WATTAGE CHART

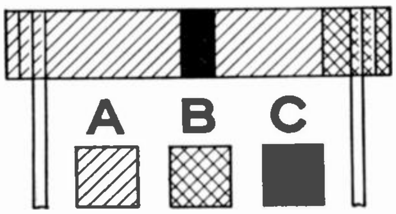


10

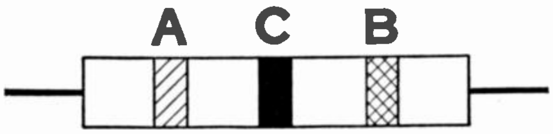
R M A Standard Color Coding for Resistors

Standardized coding for resistance value identification is confined to ten colors and figures as shown:

Figure	Color	Figure	Color
0	Black	5	Green
1	Brown	6	Blue
2	Red	7	Violet
3	Orange	8	Gray
4	Yellow	9	White



LATE TYPE MIDGET RESISTORS



The body (A) of the resistor is colored to represent the first figure of the resistance value. One end (B) of the resistor is colored to represent the second figure. A band, or dot (C) of color, representing the number of ciphers following the first two figures, is located within the body color. The two diagrams illustrate two interpretations of this standard method of coding resistance value.

NOTE: The problem of coding two resistors of the same nominal value when tolerances are different is solved in a practical manner by using the next higher or lower coded value for the unit with the larger tolerance. For example: if the nominal values of two resistors are 2,500 ohms, one with 10% tolerance and the other with 20%, the unit with 10% tolerance will be 2,500 ohms and be coded as such. The unit with 20% tolerance will be assigned a nominal value of either 2,400 ohms or 2,600 ohms and be so coded.

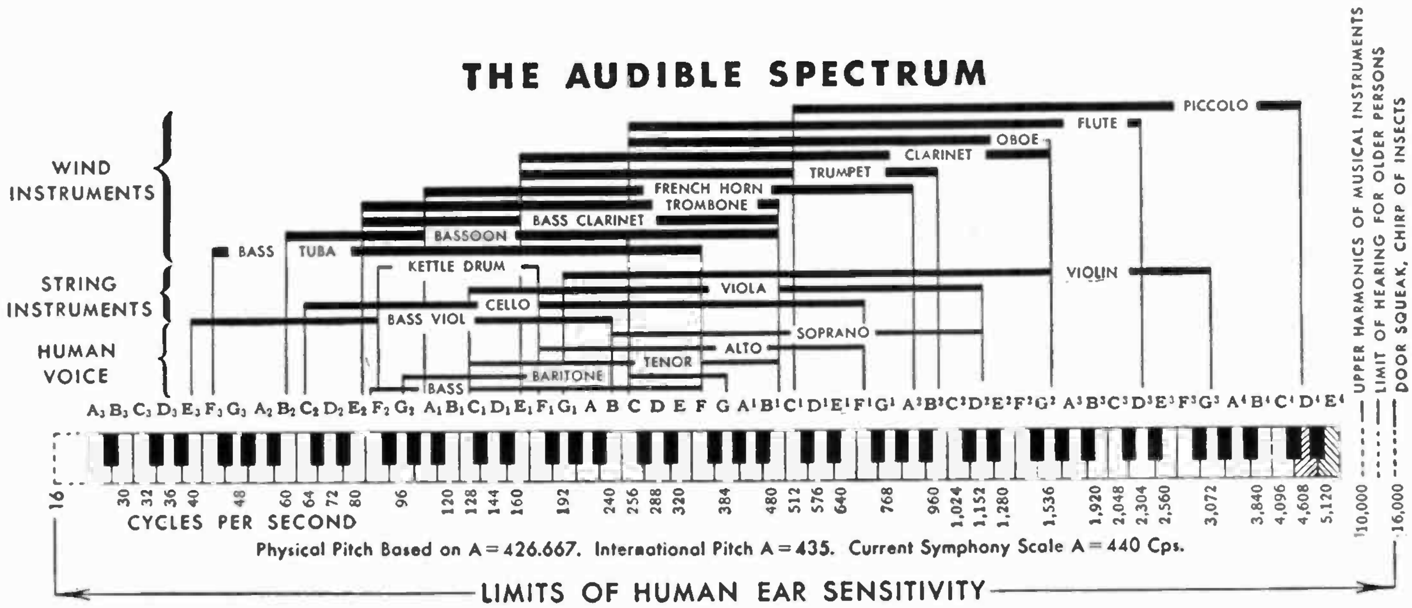
Some of the larger radio set manufacturers employ mercury vapor lighting in their factories. Certain colors are hard to distinguish in this lighting and in order to overcome this difficulty, odd value of resistors are apparently used, such as 490,000 ohms. In every case where this is found, the next higher value of resistor may be used with success.

Value	Body	Tip	Dot
50 Ω	Green	Black	Black
75 Ω	Violet	Green	Black
100 Ω	Brown	Black	Brown
150 Ω	Brown	Green	Brown
200 Ω	Red	Black	Brown
250 Ω	Red	Green	Brown
300 Ω	Orange	Black	Brown
350 Ω	Orange	Green	Brown
400 Ω	Yellow	Black	Brown
450 Ω	Yellow	Green	Brown
500 Ω	Green	Black	Brown
600 Ω	Blue	Black	Brown
750 Ω	Violet	Green	Brown
1,000 Ω	Brown	Black	Red
1,250 Ω	Brown	Red	Red
1,500 Ω	Brown	Green	Red
2,000 Ω	Red	Black	Red
2,500 Ω	Red	Green	Red
3,000 Ω	Orange	Black	Red
3,500 Ω	Orange	Green	Red
4,000 Ω	Yellow	Black	Red
5,000 Ω	Green	Black	Red
7,500 Ω	Violet	Green	Red
10,000 Ω	Brown	Black	Orange
12,000 Ω	Brown	Red	Orange
15,000 Ω	Brown	Green	Orange
20,000 Ω	Red	Black	Orange
25,000 Ω	Red	Green	Orange
30,000 Ω	Orange	Black	Orange
40,000 Ω	Yellow	Black	Orange
50,000 Ω	Green	Black	Orange
60,000 Ω	Blue	Black	Orange
75,000 Ω	Violet	Green	Orange
100,000 Ω	Brown	Black	Yellow
120,000 Ω	Brown	Red	Yellow
150,000 Ω	Brown	Green	Yellow
200,000 Ω	Red	Black	Yellow
250,000 Ω	Red	Green	Yellow
300,000 Ω	Orange	Black	Yellow
400,000 Ω	Yellow	Black	Yellow
500,000 Ω	Green	Black	Yellow
600,000 Ω	Blue	Black	Yellow
750,000 Ω	Violet	Green	Yellow
1 Meg Ω	Brown	Black	Green
1½ Meg Ω	Brown	Green	Green
2 Meg Ω	Red	Black	Green
3 Meg Ω	Orange	Black	Green
4 Meg Ω	Yellow	Black	Green
5 Meg Ω	Green	Black	Green
6 Meg Ω	Blue	Black	Green
7 Meg Ω	Violet	Black	Green
8 Meg Ω	Gray	Black	Green
9 Meg Ω	White	Black	Green
10 Meg Ω	Brown	Black	Blue

The Radio Spectrum

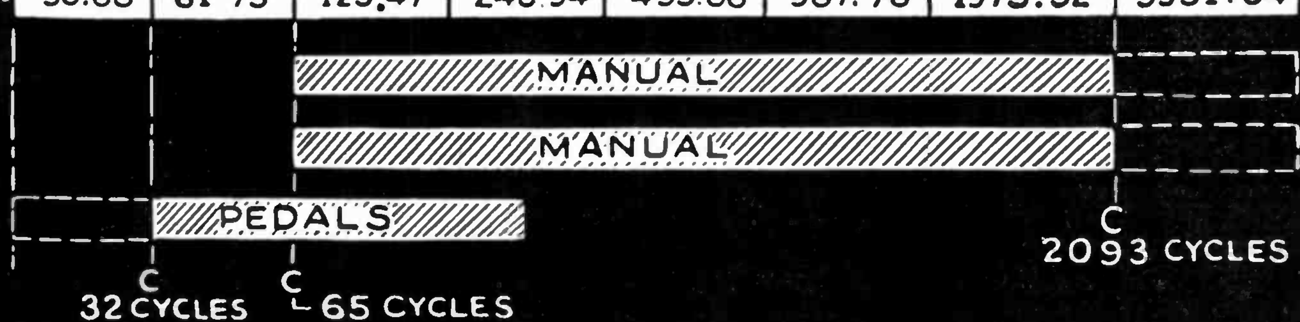
Meters	Service	Kilocycles
30,000		10
	Fixed Point to Point Long Wave, Trans-Oceanic, High Power Govt., and Commercial	
3,000		100
	Fixed Point to Point and	
Konigsw'h'sen (Germany) Daventry (England)	Maritime Mobile Ship to Shore	
		195
Eiffel Tower (France)	Government Point to Point	
		225
	Government, Air Point to Point	
		282
1,000	Government Radio Compass	375
		390
	Maritime Mobile	
	Aircraft, Govt.	
		485
SOS Call 600 Meters	Government	
547		550
	Clear Channels (BROADCASTING BAND)	
	—650—WSM	
	—670—WMAQ	
	—700—WLW	
	—720—WGN	
	—870—WLS-WENR	
300	—980—KDKA	
	—1090—KMOX	
200		1,500
	Broadcast	
		1,600
	Police, Etc.	
		1,715
	Amateur	
150		2,000
	Television	
		2,300
	Police, Fire, Etc.	

Meters	Service	Kilocycles
		2,500
	Ship, Air, Police, Etc.	
		2,604
100	Television, Aviation	
		3,100
	Govt., Air, Etc.	
		3,500
	Amateur, Govt.	
		4,000
	Ship, Govt., Air	
		4,535
	Point to Point Aviation, Etc.	
		5,365
DJC 6020 kc.	Relay Broadcast Air, Foreign	
		6,160
	Ships, Coastal	
		6,520
	Air, Point to Point	
		7,000
	Amateur	
		7,300
	Point to Point	
		8,000
	Govt., Ship to Shore	
		8,900
GSB 9,510 kc.	Pt. to Pt.—Relay Bdcst.	
		9,600
	Point to Point	
		11,000
W8XK (KDKA) 11,870 kc.	Govt., Point to Point, Ships, Relay Broadcast	
		13,330
	Point to Point	
		14,000
	Amateur	
		14,400
W2XAD (WGY) 15,330 kc.	Point to Point Relay Broadcast	
		15,355
	Ship, Government Point to Point, Misc.	
		18,120
	Point to Point	
		20,000
	Ship to Shore, Etc.	
		23,000
	Government Amateur (28-30 Mc.)	
10		30,000
	Government Experimental Television 42-46 Mc. 51-56 Mc. Amateur 56-60 Mc.	
5		60,000
	Govt., Television	
		86,000 110 MC.
	Amateur and Experimental	



A Correct Table of Musical Frequencies, Pitch A=440

	0	1	2	3	4	5	6	7
C =	16.35	32.70	65.40	130.81	261.62	523.26	1046.52	2093.04
C#=	17.32	34.64	69.29	138.59	277.18	554.36	1108.72	2217.44
D =	18.35	36.70	73.41	146 83	293.67	587.34	1174.68	2349.36
D#=	19 44	38.89	77.78	155.56	311.13	622.26	1244.52	2489.04
E =	20.60	41.20	82.41	164.82	329.63	659.26	1318.52	2637.02
F =	21 82	43.65	87.30	174.61	349.23	698.46	1396.92	2793.82
F#=	23.12	46.24	92.49	184 99	369.99	739.98	1479.96	2959.95
G =	24.49	48.99	97.99	195.99	391 99	783.98	1567.96	3135.96
G#=	25 95	51.91	103.82	207.65	415.31	830.62	1661.24	3322.48
A =	27.50	55.00	110.00	220.00	440.00	880.00	1760.00	3520.00
A#=	29.13	58.27	116.54	233.08	466.17	932.34	1864.68	3729.36
B =	30.86	61 73	123.47	246.94	493.88	987.76	1975.52	3951.04



Antenna Design

TWO separate anti-noise antennas are, theoretically, advisable if the best "all-wave" reception is to be obtained:

A—A long antenna for use in the 550-1500 kc. broadcast band.

B—A special antenna for the shortwave region of 1500-15,000 kc.

This is not practical in most locations, nor does the average set user care to bother with a dual system. We must accordingly compromise between the needs of the two ranges.

In shaking down to a practical compromise let us see what noise-reduction depends upon.

Noise can come from several sources and can reach the set by a variety of routes. Let's take them one at a time.

Static can be combated only by listening to strong stations.

Self-generated noises, especially "shush" and irregular buzzing or humming, are present in many cheap "allwave" receivers due to defects of design, sometimes in the set, sometimes in the tubes. Some of the "pentagrid converters" seem to be bad offenders in this regard, though in carefully designed sets they work very acceptably.

If the set is noticeably noisier when switched to short waves, take off the antenna and repeat the test. If the noise persists (especially the "shush") better try another set of the same make before fooling with the antenna.

Man-made electrical noise, apart from that born in the receiver, can reach the set via the antenna, via the power line, or via a badly-placed ground connection. Therefore, noise must be reduced by:

1—An antenna that does not collect noise.

2—A ground lead that does not collect noise.

3—A set designed to keep noise from entering via the power line.

The purchaser is almost helpless as to point 3 and must rely on the set designer's skill. If different sets are compared for noise be sure that a tonally bad set does not get the best of the comparison. Sets sometimes seem quiet because the things have poor high-note reproduction. Noise is largely in the treble area, hence a set deficient in highs sounds quiet. Note whether the "s," "f" and "th" of spoken speech come through well. If not—the alleged noiselessness may be simply a poor audio system. A *good* audio system can always have its top end spoiled at will be means of the "tone control" when the static or the tenors are so severe as to require it.

Quiet Ground Leads—If anyone suggests the installation of an all-electric short-wave receiver without a ground wire, or suggests running a ground wire to an electrical outlet—shoot, or call the police. This man is a menace.

A set so installed has no ground connection *except the main source of our radio noise*. It is irrational to go to the birthplace of noise when we wish to avoid noise. Of course I realize that this sort of thing is usually due to overcrowding by the boss, the poor devil of an installer being required to "get through and get out"—but it's bad.

The best ground connection is probably one buried outside the house, where it is definitely clear of all light wiring. For the small-town dweller 6 to 10 feet of rod or pipe driven down, or 50 feet of wire buried in a shallow trench, settles the grounding business for keeps if he uses a good-sized wire that will not corrode off.

For the city man it's not so simple and he is referred to the waterpipe, the steampipe and the gaspipe in the sequence mentioned. They become noisier as one goes higher up in the building, especially if there be elevator controls aloft.

The Antenna—Having gotten rid of some 50 per cent of the noise sources we now go to the remaining one—the antenna itself. The principles of anti-noise antennas are simple enough. The general idea is:

a. To collect the signal in a noise-free space.

b. To avoid metallic connection to things filled with noise.

c. To take advantage of any "polarization" of the radio waves.

The Simple, Large Antenna—The very great advantage of merely lengthening an ordinary antenna seems to be little appreciated. This is the first thing to try in any case of moderately bad noise. The effect is that of Figure 1. In many instances nothing else is required to convert most annoying reception to very good reception, *especially* at short waves. The obvious lesson taught by the drawings is that noise often starts in the electrical wiring of the house—but *doesn't travel far*.

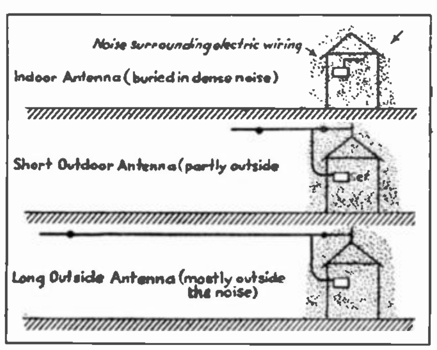


FIGURE 1—*Why a long outside antenna often increases signal-to-noise ratio.*

The Shielded Leadin—Where the noise situation is very severe it no longer suffices to extend the antenna out into a noisefree region; we must also *prevent* collection in the noisy region at the house. Apparently, the obvious way to do this is to shield the antenna when it gets near the house. If this is done in the manner of Figure 2A, reception will be quite poor for reasons that we need not worry about here, but which have a good theoretical explanation.

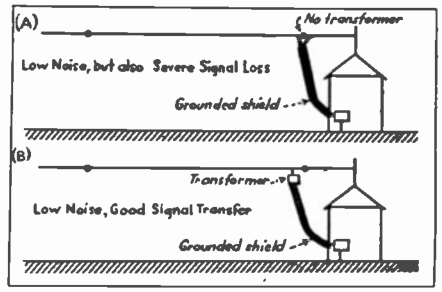


FIGURE 2—*Shielded leadins—poor (A); good (B).*

This can be corrected *for a narrow range of frequencies* by means of a transformer placed at the end of the shielded leadin. (See 2B.) Such a transformer can be made to work over the 550-1500 kc. band very nicely indeed, and a number of good types are on the market. Note, however, that the shielded line is now only a power-transmission line. It is no longer a part of the antenna and collects no signal. The "top" of the antenna should therefore be somewhat longer than would be necessary for an ordinary unshielded antenna.

For Shortwaves—Most unfortunately we have not yet learned to make this sort of shielded antenna very efficient at shortwaves, which is to say, in the frequency-range of 1500 to 15,000 kc. (20 to 200 meters). Our transformers refuse to work well over so tremendous a range of frequencies, and the line losses are severe.

The Hertz Antenna—So far we have talked about antennas which use a ground connection. Marconi first used such antennas; accordingly we call them Marconi antennas. Observe (Figure 3) that there is always more or less "up and down" to them. They start at the earth and go up. Sometimes they go horizontally also, but invariably they go up. In a moment we shall show why that is important.

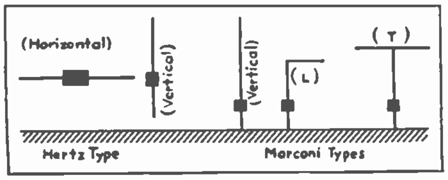


FIGURE 3—*Hertz (ungrounded) antenna types are becoming more and more popular for shortwave work.*

Now the Hertz antenna uses no ground connection whatever. Accordingly it need not run up and down at all; we can make it a straight horizontal antenna if we feel like it. For the best shortwave reception we *do* feel like it, as you shall see.

A Small Dose of Theory—Near the radio transmitting station the waves are departing in the manner of Figure 4A. They are mainly vertical, and are best received by a vertical (or partly vertical) receiving antenna—an antenna that has some height. The Marconi antennas of Figure 3 will work best for such reception, as will the *vertical* Hertz type of Figure 3.

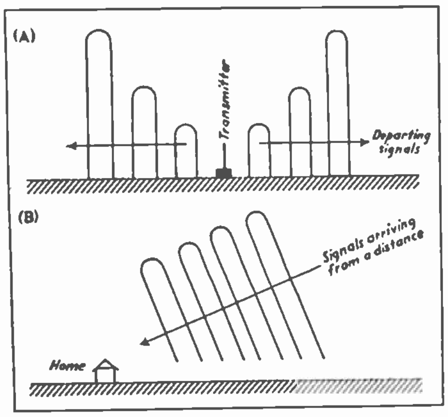


FIGURE 4—*Why vertical receiving antennas are best on locals, horizontal types OK for DX.*

At a great distance we have a different picture. For reasons which would be very dreary and tiresome we find our shortwaves now arriving in the manner of Figure 4B. It is at once apparent that this leaning of the waves ("polarization toward the horizontal") gives the *horizontal* Hertz antenna a chance which it did not have on the nearby reception of 4A. For that reason the horizontal Hertz antenna is very useful in shortwave long-range reception.

But—that isn't all. Our *noise* comes from nearby sources and a good part of it is vertically polarized, hence does not greatly disturb the tranquil meditations of the horizontal Hertzian antenna.

The Practical Form—Getting back to things you can see, and have to pay for, let's see how such a thing looks in practice.

To get it out of the worst noise, and to keep it from being "shadowed" from incoming signals, we must of course put it up in the air as in 5A. Few people care to hang on the middle of an antenna, with a receiver under one arm, hence we must somehow lead the collected signals down to the living

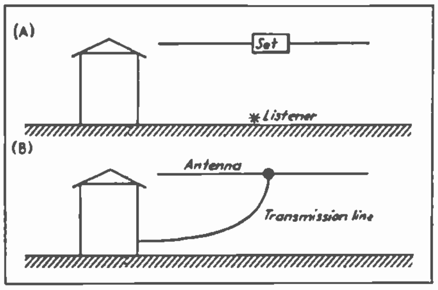


FIGURE 5—*The theoretical ideal (A) and the practical substitute (B).*

room *without* allowing the leadin to collect either signals or noise and *without shielding* to produce the losses we talked about some paragraphs ago, and *without transformers up in the air which are unwilling to work from 550 to 15,000 kc.*

There is not as yet a perfect answer to this rather messy set of requirements, although we can provide very good answers for *one* frequency, such as the 49 meter (6100 kc.) broadcast group. The difficulty in making a system work over a wide range of frequencies lies in the fact that we have no way of tuning the antenna because it is off at the other end of a long power-transmission line. (In the usual receiver the antenna may not appear to be tuned but since the antenna passes through the receiver it is indirectly tuned to some extent by the first tuned circuit.)

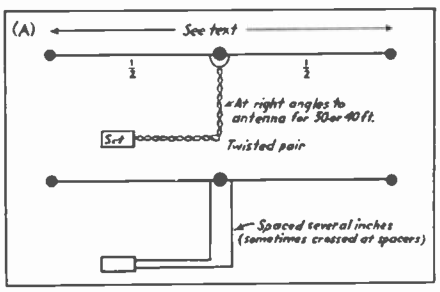


FIGURE 6—*Two efficient transmission line systems using Hertz collectors.*

One practical compromise is to use the form of antenna shown in Figure 6A. If we make the top about 70 or 75 feet long the best performance will appear in the 49 meter band just mentioned, but at other wavelengths the line no longer acts as a pure line; the upper part participates in varying degree in the antenna action, and the losses vary materially with frequency. However, a theoretical shortcoming can often be tolerated commercially, and the extreme simplicity of this arrangement must be evident to all beholders. Its anti-noise action leaves little to be desired, it is easy to erect, the line can be of any convenient length upward of some 40 feet (be sure to use that much and coil up any you don't need inside the set cabinet), and strong wind does little damage.

Of course there are limitations; the rubber covering of the two leads has to be of correct composition to withstand weather, of proper thickness to secure decent transmission down the line, and the braided covering must be of a form not favoring water-retention.

The Fly in the Ointment—The *real* shortcoming of this *or any other* horizontal Hertz type lies in the relative ineffectiveness of such an antenna at 500 kcs., that is "at the upper end of the dial." To make the antenna long enough to get around this difficulty results in preposterous clumsiness. Accordingly one must either accept reduced reception in the ordinary broadcast band for the sake of noiselessness (frequently a good exchange) or else one must use some arrangement for converting this antenna to another type for that band.

The "Folded Hertz" Antenna—In Figure 6B we have an antenna system which is commonly spoken of as having a transmission line. However, one can with greater correctness say that this is simply a long antenna folded up. The fact that the line is actually part of the antenna is demonstrated by the fact that tuning is possible at the lower end of the line with the same effects *in kind and in degree* as if the whole thing were straightened out.

If tuned to the incoming signal such a system will in some cases give better performance than that of Figure 6A. If left at some fixed tune the system shows less advantage over that of Figure 6A. The greater complexity of such an antenna in practice is due to the necessity for using numerous insulators to keep the dual downlead separated by several inches without allowing the two wires to rub together. However, for the ardent "fan," willing to operate an extra control or two this antenna is "something."

Antenna Direction—If we look down at the top of various antennas we see the *ideal* directional effects shown in Figure 7. These are modified materially by surroundings and must not be taken too seriously.

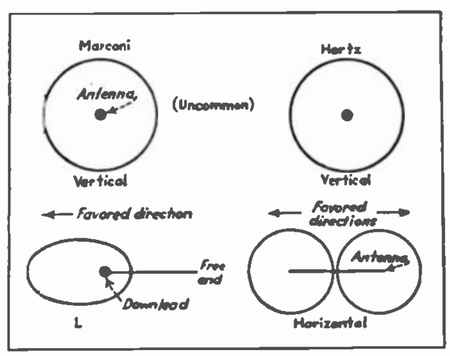


FIGURE 7—*Directional effect is rarely audible but here's the dope for "hair-splitters."*

However, to a New Englander interested in shortwave reception, a Marconi antenna should theoretically point (free end) a little west of north if he is after YV3RC at Caracas, Venezuela, or about west for the best average European reception—but unless the antenna is 4 or 5 times as long as it is high nearly anything between the two will answer.

The Hertz type, for the same man, should run more or less SE to NW, tending toward a East-West rather than a North-South position for Venezuelan reception.

In another part of the country—look at the globe. The flat map is a liar on these things. And don't be too "finicky" about direction.

Height, and Length—As to height . . . get above the noise-making wires if you can. At any cost stay away from elevator penthouses and such like special infernos of noise.

Length has already been indicated for the Hertz 49 meter antenna, but *overall* lengths (tip to tip) of 60 to 75 feet will be found most desirable for shortwave work—the regular broadcast response going down with length unless one uses some conversion method as previously indicated. In an old set not equipped for conversion an external switch can be rigged up to tie the two leads together for ordinary broadcast reception, bringing both to the "Ant." post, and grounding the "Gnd." post as usual.

Where a pure Marconi antenna is to be used as an antenna, 25 or 30 feet is being publicised as a nice compromise—but it is pretty terrible from a noise standpoint, being so short as not to have even its nose out above the surface. (See Figure 1.) If noise is your problem use an antenna about 120 feet long and a receiver with enough tuned circuits so that such an antenna does not cause undue interference between stations.

Grounded Chassis—There is room for argument as to whether the receiver chassis should be *designed for* grounding on the regular groundlead, on a separate one, or not at all. However, that is a design problem. After the receiver is in the warehouse one has to use it as it 's unless one is given to tinkering.

Accordingly one simply has to run the dual downlead systems to the two posts that are provided, and remove the groundlead from one of them. In most cases the results are surprisingly good, though again this is not the ideal method.

Line Filters—A good noise-filter in the 110-volt line which supplies power to the set is worth thinking about, and trying. A special antenna may not be necessary at all—try it and see. However, do not pick a noise filter the size of a walnut when you have a bad noise situation.

Another Small Dose of Theory—In the old vaudeville houses it was customary to use a movie "short" to "run the audience out" before the next performance. Let's use that idea by going back to some theory.

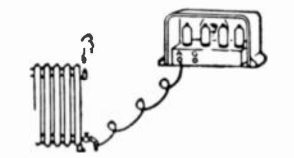
Impedance-matching devices are in order where narrow-band operation suffices. Such a device can be made and certainly does cut down the losses. The theory here is not complex. The antenna as "seen" by the line has a relatively high impedance. The line itself has a low one because it uses solid insulation and has its two conductors (the wire and the external shield) close together. Thus we need a small radio-frequency step-down transformer between the two. It is ordinarily made of a coil wound in either "scramble" or "universal" manner. All of the turns are placed in the antenna circuit, but only a part of them in the down-lead circuit. It therefore acts as a step-down auto-transformer, producing in the line a slightly larger current and lower voltage than otherwise. Since the line losses were mainly in the rubber, these are thereby reduced—altogether aside from reflection losses. Replace this transformer annually.

At the Receiver—So far we have nimbly skipped over the input device at the receiver, that is, the device between the line and the receiver. This is ordinarily built in and hence a problem of the manufacturer. The set having been finished we can only hang on an additional external device, or do some work inside the set. It is perfectly possible to do this, and it is easy enough by simple listening tests to determine whether the change caused an improvement. Not always do we find that an additional external transformer improves matters, since its losses may do as much harm as impedance matching does good.

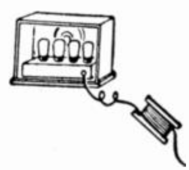
Try it and see—and be sure to try it over the entire frequency range, for the results are not uniform.

Choosing an Antenna

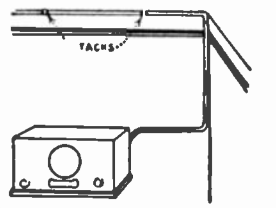
"No Radio Can Be Better Than Its Antenna"



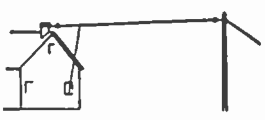
Ground as Antenna—Fair reception on local broadcast stations in some homes. Seldom satisfactory in suburban areas and useless for shortwaves. Use only where other systems cannot readily be installed, or for temporary service.



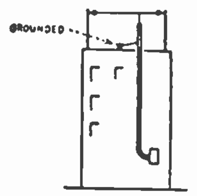
Built-In Wire—Good reception on local broadcast stations in all but extremely noisy buildings. Receives reasonably distant stations when used on upper floors in electrically quiet areas. Rarely effective on shortwaves and invariably noisy in large apartment houses.



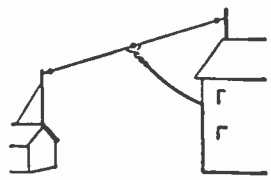
Moulding-Strip—Good reception on local broadcast stations in all but extremely noisy buildings. Receives reasonably distant stations when used on upper floors in electrically quiet areas. Rarely effective on shortwaves and invariably noisy in large apartment houses.



Ordinary Outdoor System—Excellent on both broadcast and shortwave bands when building and vicinity are electrically quiet. Recommended for homes away from trolley-lines, high-tension wires, motors and busy roads.



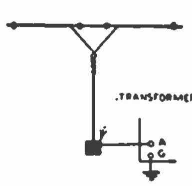
Shielded Lead-In—Reduces noise pickup by downlead where this wire must pass through electrically disturbed areas. Good reception on broadcast band but not recommended for shortwaves. In common with other noise-reducing types, must have antenna proper mounted out of noisy area for maximum benefit.

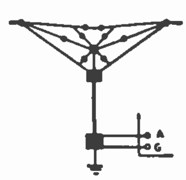


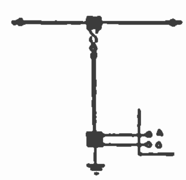
Simple Doublet—Reduces noise pickup by download where it must pass through noisy areas. Good reception on shortwave band and satisfactory for broadcast reception. Expecially efficient at certain frequencies, which may be those most often desired.

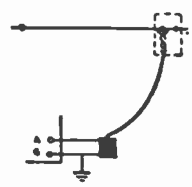
TYPICAL MODERN ALLWAVE MATCHED TYPES

Matched to reduce losses in the transmission line between the antenna proper and the set and designed, also, to give good reception over the entire broadcast and shortwave range, or in those portions of the spectrum in which programs of major interest are found, these modern types and variations of them represent the last word in modern radio design.

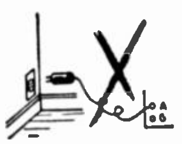




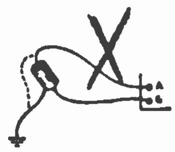




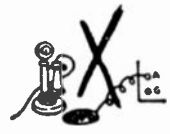
THINGS TO AVOID



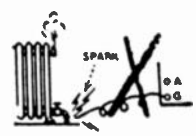
Electric Socket "Adapter"



Aerial "Eliminator"



Telephone Connection

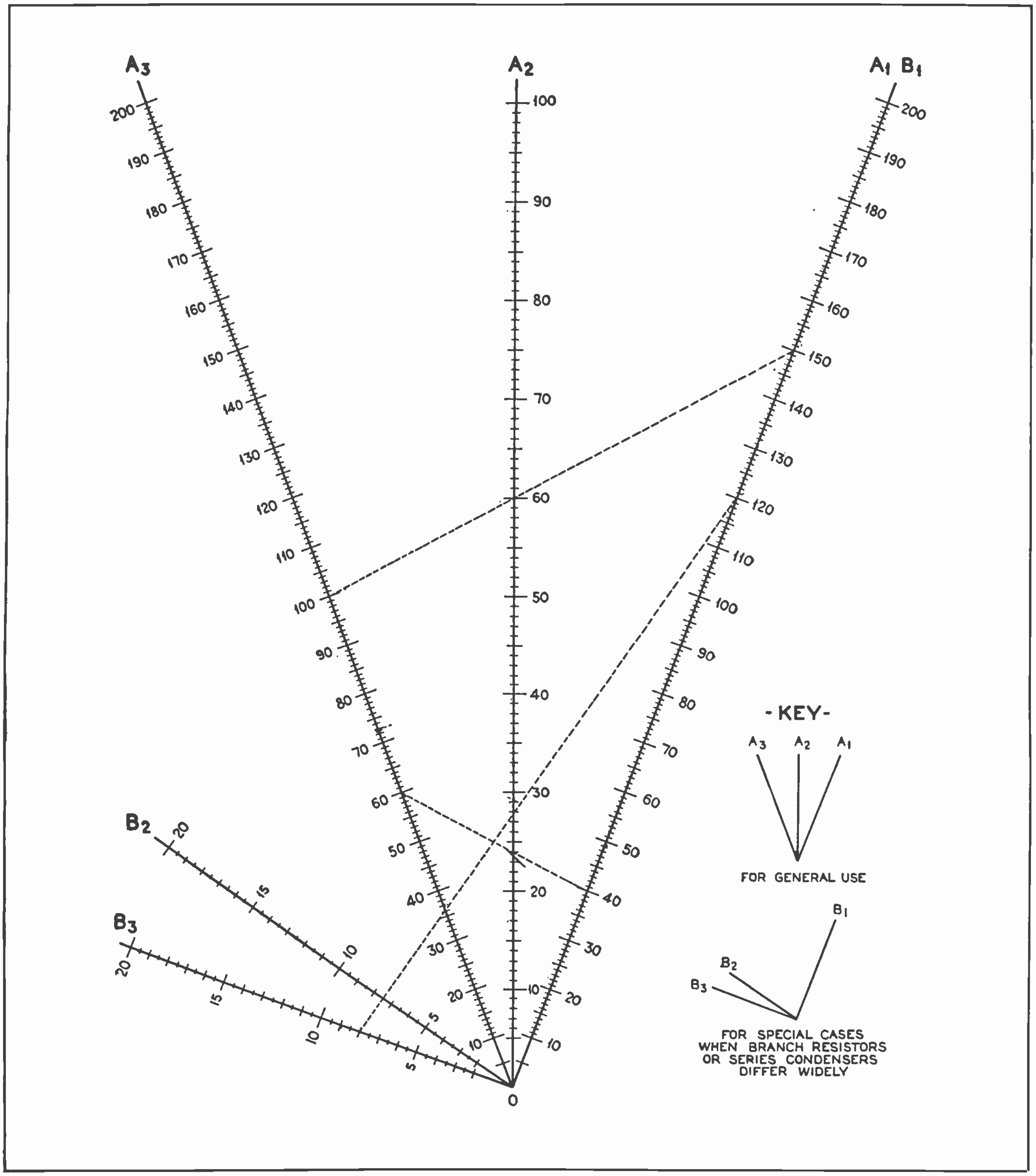


Grounding AC-DC Sets

Show this **to your customer. It will convince him that a *good* antenna is a *good* investment.**

Series Condenser—Parallel Resistors Chart

This chart enables you to find the equivalent resistance of two resistors in parallel and also the capacity of two condensers in series. Draw a straight line through the divisions on scale A_1 and A_2 representing the resistance in the two branches, and you will find the resultant resistance on scale A_3. To find the resistance of one branch when the other branch and the total resistance are known, draw lines through the corresponding points on A_1 and A_2 and find the answer on A_3. When the resistance of the two branches is widely different, use the chart consisting of scales B_1, B_2 and B_3. B_1 and B_3 are for the unequal branches and the result is on B_2.



REACTANCE OR

Always use corresponding scales

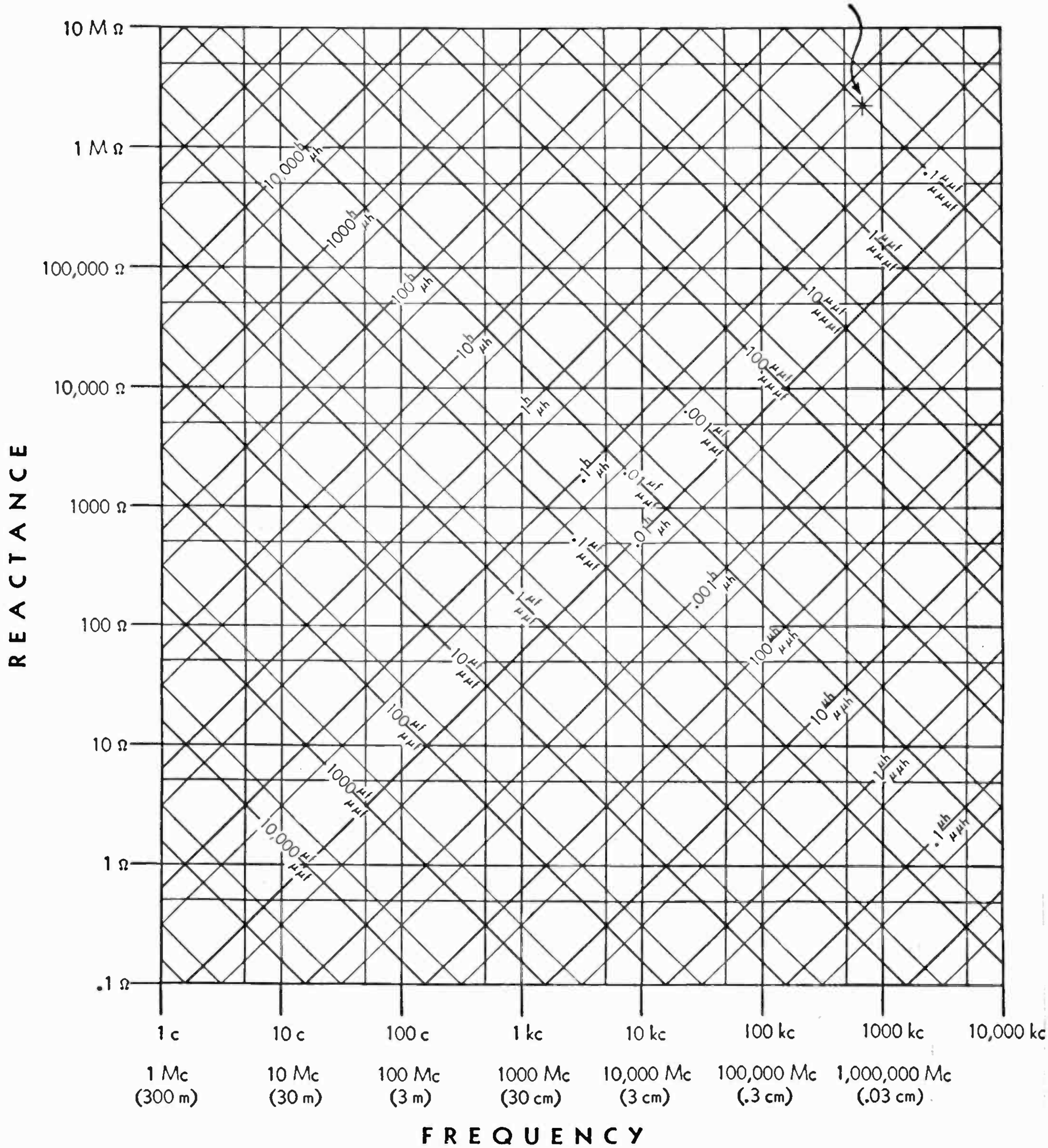


CHART A

Chart A may be used to find:

(1) The reactance of a given inductance at a given frequency.

(2) The reactance of a given capacitance at a given frequency.

(3) The resonant frequency of a given inductance and capacitance.

In order to facilitate the determination of magnitude of the quantities involved to two or three significant figures the chart is divided into two parts. Chart A is to be used for rough calculations. Chart B, which is a single decade of Chart A enlarged approximately 7 times, is to be used where the significant two or three figures are to be determined.

To Find Reactance—Enter the charts vertically from the bottom (frequency) and along the lines slanting upward to the right (inductance) or to the left (capacitance). Corresponding scales (upper or lower) must be used throughout. Project horizontally to the left from the intersection and read reactance.

L. C. CHARTS

Always obtain approximate value from Chart A before using Chart B

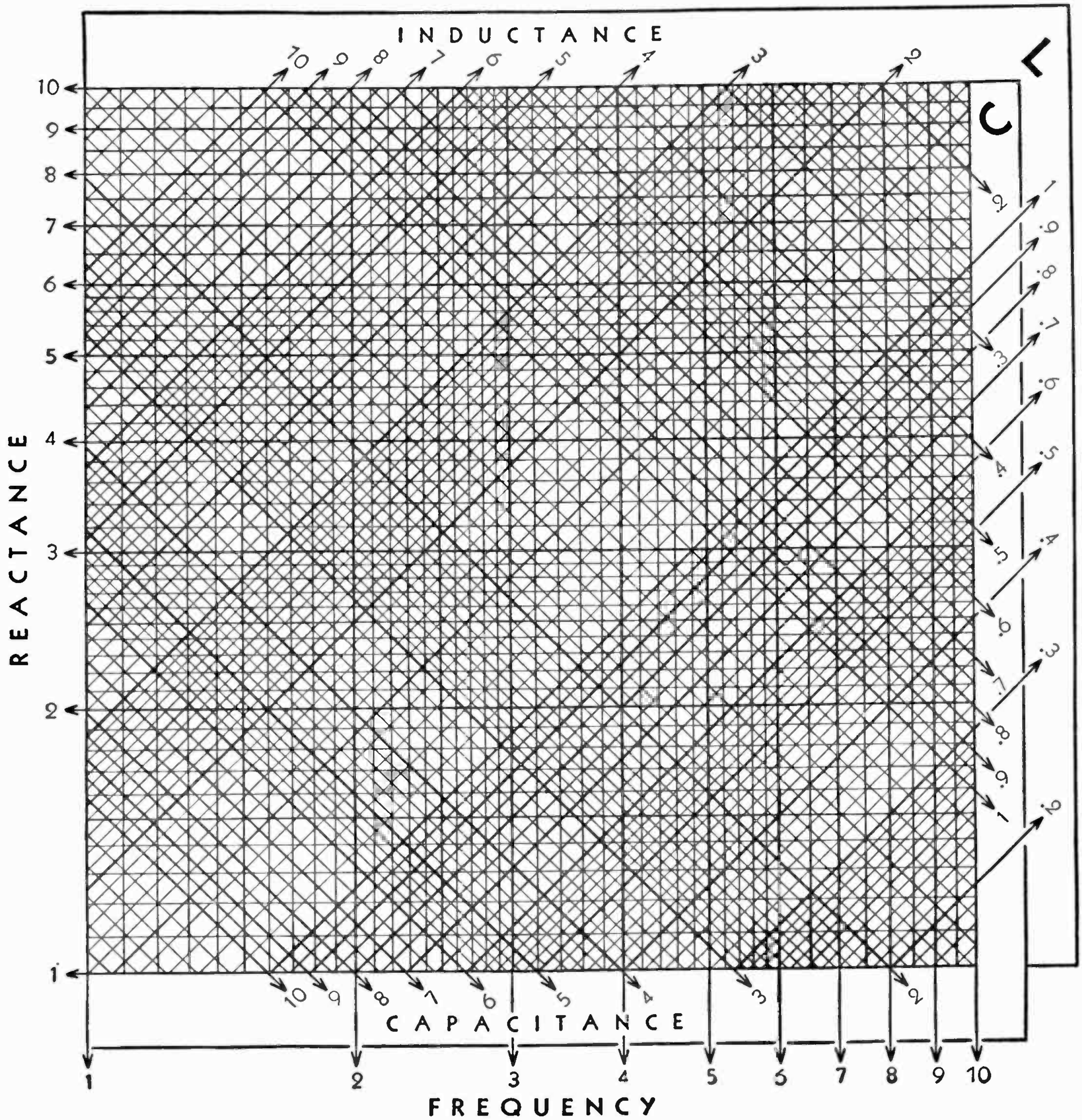


CHART B

To Find Resonant Frequency—Enter the slanting lines for the given inductance and capacitance. Project downward from their intersection and read resonant frequency from the bottom scale. Corresponding scales (upper or lower) must be used throughout.

Example: The sample point indicated (Chart A) corresponds to a frequency of about 700 kc. and an inductance of 0.5 henry, or a capacitance of 0.1 μμf, giving in either case a reactance of about 2,000,000 ohms. The resonant frequency of a circuit containing these values of inductance and capacitance is, 700 kc. approximately.

Chart B is used to obtain additional precision of reading but does not place the decimal point which must be located from a preliminary entry on Chart A. Since the chart necessarily requires two logarithmic decades for inductance and capacitance for every single decade of frequency and reactance, unless the correct decade for L and C is chosen, the calculated values of reactance and frequency will be in error by a factor of 3.16.

Example: (Continued.) The reactance corresponding to 0.5 henry or 0.1 μμf is 2,230,000 ohms at 712 kc., their resonant frequency.

Decibel Conversion Tables

IT IS convenient in measurements and calculations on communications systems to express the ratio between any two amounts of electric or acoustic power in units on a logarithmic scale. The *decibel* (1/10th of the *bel*) on the briggsian or base-10 scale and the *neper* on the napierian or base-*e* scale are in almost universal use for this purpose.

Since voltage and current are related to power by impedance, both the *decibel* and the *neper* can be used to express voltage and current ratios, if care is taken to account for the impedances associated with them. In a similar manner the corresponding acoustical quantities can be compared.

Table I and Table II on the following pages have been prepared to facilitate making conversions in either direction between the number of *decibels* and the corresponding power, voltage, and current ratios. Both tables can also be used for *nepers* and the *mile of standard cable* by applying the conversion factors from the table "A" shown at right.

Decibel—The number of decibels N_{db} corresponding to the ratio between two amounts of power P_1 and P_2 is

$$N_{db} = 10 \log_{10} \frac{P_1}{P_2} \qquad (1)$$

When two voltages E_1 and E_2 or two currents I_1 and I_2 operate in the same or equal impedances,

$$N_{db} = 20 \log_{10} \frac{E_1}{E_2} \qquad (2)$$

and

$$N_{db} = 20 \log_{10} \frac{I_1}{I_2} \qquad (3)$$

If E_1 and E_2 or I_1 and I_2 operate in unequal impedances,

$$N_{db} = 20 \log_{10} \frac{E_1}{E_2} + 10 \log_{10} \frac{Z_2}{Z_1} + 10 \log_{10} \frac{k_2}{k_1} \qquad (4)$$

and

$$N_{db} = 20 \log_{10} \frac{I_1}{I_2} + 10 \log_{10} \frac{Z_1}{Z_2} + 10 \log_{10} \frac{k_1}{k_2} \qquad (5)$$

where Z_1 and Z_2 are the absolute magnitudes of the corresponding impedances and k_1 and k_2 are the values of power factor for the impedances. Note that Table I and Table II can be used to evaluate the impedance and power factor terms, since both are similar to the expression for power ratio, equation (1).

Neper—The number of nepers N_{nep} corresponding to a power ratio $\frac{P_1}{P_2}$ is

$$N_{nep} = \frac{1}{2} \log_e \frac{P_1}{P_2} \qquad (6)$$

For voltage ratios $\frac{E_1}{E_2}$ or current ratios $\frac{I_1}{I_2}$ working in the same or equal impedances,

$$N_{nep} = \log_e \frac{E_1}{E_2} \qquad (7)$$

and

$$N_{nep} = \log_e \frac{I_1}{I_2}$$

When E_1 and E_2 or I_1 and I_2 operate in unequal impedances,

$$N_{nep} = \log_e \frac{E_1}{E_2} + \frac{1}{2} \log_e \frac{Z_2}{Z_1} + \frac{1}{2} \log_e \frac{k_2}{k_1} \qquad (8)$$

and

$$N_{nep} = \log_e \frac{I_1}{I_2} + \frac{1}{2} \log_e \frac{Z_1}{Z_2} + \frac{1}{2} \log_e \frac{k_1}{k_2} \qquad (9)$$

where Z_1 and Z_2 and k_1 and k_2 are as in equations (4) and (5).

TABLE "A"—Relations Between Decibels, Nepers, and Miles of Standard Cable

Multiply	*By*	*To Find*
decibels......	.1151	......nepers
decibels......	1.056	miles of standard cable
miles of standard cable	.947	......decibels
miles of standard cable	.109	......nepers
nepers.......	8.686	......decibels
nepers.......	9.175	miles of standard cable

To Find Values Outside the Range of Conversion Tables

Values outside the range of either Table I or Table II on the following pages can be readily found with the help of the following simple rules.

TABLE I: DECIBELS TO VOLTAGE AND POWER RATIOS

Number of decibels positive (+):

Subtract +20 decibels successively from the given number of decibels until the remainder falls within range of Table I. *To find the voltage ratio,* multiply the corresponding value from the right-hand voltage-ratio column by 10 for each time you subtracted 20 db. *To find the power ratio,* multiply the corresponding value from the right-hand power-ratio column by 100 for each time you subtracted 20 db.

Example—*Given:* 49.2 db

49.2 db − 20 db − 20 db = 9.2 db

Voltage radio: 9.2 db ⟶

2.884 × 10 × 10 = 288.4

Power ratio: 9.2 db ⟶

8.318 × 100 × 100 = 83180

Number of decibels negative (−):

Add +20 decibels successively to the given number of decibels until the sum falls within the range of Table I. *For the voltage ratio,* divide the value from the left-hand voltage-ratio column by 10 for each time you added 20 db. *For the power ratio,* divide the value from the left-hand power-ratio column by 100 for each time you added 20 db.

Example—*Given:* −49.2 db

−49.2 db + 20 db + 20 db = −9.2 db

Voltage ratio: −9.2 db ⟶

.3467 × 1/10 × 1/10 = .003467

Power ratio: −9.2 db ⟶

.1202 × 1/100 × 1/100 = .00001202

TABLE II: VOLTAGE RATIOS TO DECIBELS

For ratios smaller than those in table—Multiply the given ratio by 10 successively until the product can be found in the table. From the number of decibels thus found, subtract +20 decibels for each time you multiplied by 10.

Example—*Given:* Voltage ratio = .0131

.0131 × 10 = .131 × 10 = 1.31

From Table II, 1.31 ⟶

2.345 db − 20 db − 20 db = −37.655 db

For ratios greater than those in table—Divide the given ratio by 10 successively until the remainder can be found in the table. To the number of decibels thus found, add +20 db for each time you divided by 10.

Example—*Given:* Voltage ratio = 712

712 × 1/10 = 71.2 × 1/10 = 7.12

From Table II, 7.12 ⟶

17.050 db + 20 db + 20 db = 57.050 db

TABLE I

Given: Decibels — *To Find:* Power and {Voltage / Current} Ratios

TO ACCOUNT FOR THE SIGN OF THE DECIBEL

For positive (+) values of the decibel—Both voltage and power ratios are greater than unity. Use the two right-hand columns.

For negative (−) values of the decibel—Both voltage and power ratios are less than unity. Use the two left-hand columns.

Example—*Given:* ± 9.1 db. *Find:*

	Voltage Ratio	*Power Ratio*
+9.1 db.	8.128	2.851
−9.1 db.	0.1230	0.3508

← −db+ →

Voltage Ratio	Power Ratio	db	Voltage Ratio	Power Ratio
1.0000	1.0000	0	1.000	1.000
.9886	.9772	.1	1.012	1.023
.9772	.9550	.2	1.023	1.047
.9661	.9333	.3	1.035	1.072
.9550	.9120	.4	1.047	1.096
.9441	.8913	.5	1.059	1.122
.9333	.8710	.6	1.072	1.148
.9226	.8511	.7	1.084	1.175
.9120	.8318	.8	1.096	1.202
.9016	.8128	.9	1.109	1.230
.8913	.7943	1.0	1.122	1.259
.8810	.7762	1.1	1.135	1.288
.8710	.7586	1.2	1.148	1.318
.8610	.7413	1.3	1.161	1.349
.8511	.7244	1.4	1.175	1.380
.8414	.7079	1.5	1.189	1.413
.8318	.6918	1.6	1.202	1.445
.8222	.6761	1.7	1.216	1.479
.8128	.6607	1.8	1.230	1.514
.8035	.6457	1.9	1.245	1.549
.7943	.6310	2.0	1.259	1.585
.7852	.6166	2.1	1.274	1.622
.7762	.6026	2.2	1.288	1.660
.7674	.5888	2.3	1.303	1.698
.7586	.5754	2.4	1.318	1.738
.7499	.5623	2.5	1.334	1.778
.7413	.5495	2.6	1.349	1.820
.7328	.5370	2.7	1.365	1.862
.7244	.5248	2.8	1.380	1.905
.7161	.5129	2.9	1.396	1.950
.7079	.5012	3.0	1.413	1.995
.6998	.4898	3.1	1.429	2.042
.6918	.4786	3.2	1.445	2.089
.6839	.4677	3.3	1.462	2.138
.6761	.4571	3.4	1.479	2.188
.6683	.4467	3.5	1.496	2.239
.6607	.4365	3.6	1.514	2.291
.6531	.4266	3.7	1.531	2.344
.6457	.4169	3.8	1.549	2.399
.6383	.4074	3.9	1.567	2.455
.6310	.3981	4.0	1.585	2.512
.6237	.3890	4.1	1.603	2.570
.6166	.3802	4.2	1.622	2.630
.6095	.3715	4.3	1.641	2.692
.6026	.3631	4.4	1.660	2.754
.5957	.3548	4.5	1.679	2.818
.5888	.3467	4.6	1.698	2.884
.5821	.3388	4.7	1.718	2.951
.5754	.3311	4.8	1.738	3.020
.5689	.3236	4.9	1.758	3.090
.5623	.3162	5.0	1.778	3.162
.5559	.3090	5.1	1.799	3.236
.5495	.3020	5.2	1.820	3.311
.5433	.2951	5.3	1.841	3.388
.5370	.2884	5.4	1.862	3.467
.5309	.2818	5.5	1.884	3.548
.5248	.2754	5.6	1.905	3.631
.5188	.2692	5.7	1.928	3.715
.5129	.2630	5.8	1.950	3.802
.5070	.2570	5.9	1.972	3.890

← −db+ →

Voltage Ratio	Power Ratio	db	Voltage Ratio	Power Ratio
.5012	.2512	6.0	1.995	3.981
.4955	.2455	6.1	2.018	4.074
.4898	.2399	6.2	2.042	4.169
.4842	.2344	6.3	2.065	4.266
.4786	.2291	6.4	2.089	4.365
.4732	.2239	6.5	2.113	4.467
.4677	.2188	6.6	2.138	4.571
.4624	.2138	6.7	2.163	4.677
.4571	.2089	6.8	2.188	4.786
.4519	.2042	6.9	2.213	4.898
.4467	.1995	7.0	2.239	5.012
.4416	.1950	7.1	2.265	5.129
.4365	.1905	7.2	2.291	5.248
.4315	.1862	7.3	2.317	5.370
.4266	.1820	7.4	2.344	5.495
.4217	.1778	7.5	2.371	5.623
.4169	.1738	7.6	2.399	5.754
.4121	.1698	7.7	2.427	5.888
.4074	.1660	7.8	2.455	6.026
.4027	.1622	7.9	2.483	6.166
.3981	.1585	8.0	2.512	6.310
.3936	.1549	8.1	2.541	6.457
.3890	.1514	8.2	2.570	6.607
.3846	.1479	8.3	2.600	6.761
.3802	.1445	8.4	2.630	6.918
.3758	.1413	8.5	2.661	7.079
.3715	.1380	8.6	2.692	7.244
.3673	.1349	8.7	2.723	7.413
.3631	1318	8.8	2.754	7.586
.3589	.1288	8.9	2.786	7.762
.3548	.1259	9.0	2.818	7.943
.3508	.1230	9.1	2.851	8.128
.3467	.1202	9.2	2.884	8.318
.3428	.1175	9.3	2.917	8.511
.3388	.1148	9.4	2.951	8.710
.3350	.1122	9.5	2.985	8.913
.3311	.1096	9.6	3.020	9.120
.3273	.1072	9.7	3.055	9.333
.3236	.1047	9.8	3.090	9.550
.3199	.1023	9.9	3.126	9.772
.3162	.1000	10.0	3.162	10.000
.3126	.09772	10.1	3.199	10.23
.3090	.09550	10.2	3.236	10.47
.3055	.09333	10.3	3.273	10.72
.3020	.09120	10.4	3.311	10.96
.2985	.08913	10.5	3.350	11.22
.2951	.08710	10.6	3.388	11.48
.2917	.08511	10.7	3.428	11.75
.2884	.08318	10.8	3.467	12.02
.2851	.08128	10.9	3.508	12.30
.2818	.07943	11.0	3.548	12.59
.2786	.07762	11.1	3.589	12.88
.2754	.07586	11.2	3.631	13.18
.2723	.07413	11.3	3.673	13.49
.2692	.07244	11.4	3.715	13.80
.2661	.07079	11.5	3.758	14.13
.2630	.06918	11.6	3.802	14.45
.2600	.06761	11.7	3.846	14.79
.2570	.06607	11.8	3.890	15.14
.2541	.06457	11.9	3.936	15.49

← −db+ →

Voltage Ratio	Power Ratio	db	Voltage Ratio	Power Ratio
.2512	.06310	12.0	3.981	15.85
.2483	.06166	12.1	4.027	16.22
.2455	.06026	12.2	4.074	16.60
.2427	.05888	12.3	4.121	16.98
.2399	.05754	12.4	4.169	17.38
.2371	.05623	12.5	4.217	17.78
.2344	.05495	12.6	4.266	18.20
.2317	.05370	12.7	4.315	18.62
.2291	.05248	12.8	4.365	19.05
.2265	.05129	12.9	4.416	19.50
.2239	.05012	13.0	4.467	19.95
.2213	.04898	13.1	4.519	20.42
.2188	.04786	13.2	4.571	20.89
.2163	.04677	13.3	4.624	21.38
.2138	.04571	13.4	4.677	21.88
.2113	.04467	13.5	4.732	22.39
.2089	.04365	13.6	4.786	22.91
.2065	.04266	13.7	4.842	23.44
.2042	.04169	13.8	4.898	23.99
.2018	.04074	13.9	4.955	24.55
.1995	.03981	14.0	5.012	25.12
.1972	.03890	14.1	5.070	25.70
.1950	.03802	14.2	5.129	26.30
.1928	.03715	14.3	5.188	26.92
.1905	.03631	14.4	5.248	27.54
.1884	.03548	14.5	5.309	28.18
.1862	.03467	14.6	5.370	28.84
.1841	.03388	14.7	5.433	29.51
.1820	.03311	14.8	5.495	30.20
.1799	.03236	14.9	5.559	30.90
.1778	.03162	15.0	5.623	31.62
.1758	.03090	15.1	5.689	32.36
.1738	.03020	15.2	5.754	33.11
.1718	.02951	15.3	5.821	33.88
.1698	.02884	15.4	5.888	34.67
.1679	.02818	15.5	5.957	35.48
.1660	.02754	15.6	6.026	36.31
.1641	.02692	15.7	6.095	37.15
.1622	.02630	15.8	6.166	38.02
.1603	.02570	15.9	6.237	38.90
.1585	.02512	16.0	6.310	39.81
.1567	.02455	16.1	6.383	40.74
.1549	.02399	16.2	6.457	41.69
.1531	.02344	16.3	6.531	42.66
.1514	.02291	16.4	6.607	43.65
.1496	.02239	16.5	6.683	44.67
.1479	.02188	16.6	6.761	45.71
.1462	.02138	16.7	6.839	46.77
.1445	.02089	16.8	6.918	47.86
.1429	.02042	16.9	6.998	48.98
.1413	.01995	17.0	7.079	50.12
.1396	.01950	17.1	7.161	51.29
.1380	.01905	17.2	7.244	52.48
.1365	.01862	17.3	7.328	53.70
.1349	.01820	17.4	7.413	54.95
.1334	.01778	17.5	7.499	56.23
.1318	.01738	17.6	7.586	57.54
.1303	.01698	17.7	7.674	58.88
.1288	.01660	17.8	7.762	60.26
.1274	.01622	17.9	7.852	61.66

To find decibel values outside the range of this table, see preceding page

TABLE I—continued

−db+ ←— —→

Voltage Ratio	Power Ratio	db	Voltage Ratio	Power Ratio
.1259	.01585	18.0	7.943	63.10
.1245	.01549	18.1	8.035	64.57
.1230	.01514	18.2	8.128	66.07
.1216	.01479	18.3	8.222	67.61
.1202	.01445	18.4	8.318	69.18
.1189	.01413	18.5	8.414	70.79
.1175	.01380	18.6	8.511	72.44
.1161	.01349	18.7	8.610	74.13
.1148	.01318	18.8	8.710	75.86
.1135	.01288	18.9	8.811	77.62

Voltage Ratio	Power Ratio	db	Voltage Ratio	Power Ratio
.1122	.01259	19.0	8.913	79.43
.1109	.01230	19.1	9.016	81.28
.1096	.01202	19.2	9.120	83.18
.1084	.01175	19.3	9.226	85.11
.1072	.01148	19.4	9.333	87.10
.1059	.01122	19.5	9.441	89.13
.1047	.01096	19.6	9.550	91.20
.1035	.01072	19.7	9.661	93.33
.1023	.01047	19.8	9.772	95.50
.1012	.01023	19.9	9.886	97.72
.1000	.01000	20.0	10.000	100.00

Voltage Ratio	Power Ratio	db	Voltage Ratio	Power Ratio
3.162×10^{-1}	10^{-1}	10	3.162	10
10^{-1}	10^{-2}	20	10	10^{2}
3.162×10^{-2}	10^{-3}	30	3.162×10	10^{3}
10^{-2}	10^{-4}	40	10^{2}	10^{4}
3.162×10^{-3}	10^{-5}	50	3.162×10^{2}	10^{5}
10^{-3}	10^{-6}	60	10^{3}	10^{6}
3.162×10^{-4}	10^{-7}	70	3.162×10^{3}	10^{7}
10^{-4}	10^{-8}	80	10^{4}	10^{8}
3.162×10^{-5}	10^{-9}	90	3.162×10^{4}	10^{9}
10^{-5}	10^{-10}	100	10^{5}	10^{10}

TABLE II

Given: **{Voltage / Current} Radio** ***To Find:*** **Decibels**

POWER RATIOS

To find the number of decibels corresponding to a given power ratio—Assume the given power ratio to be a voltage ratio and find the corresponding number of decibels from the table. The desired result is exactly one-half of the number of decibels thus found.

Example—*Given:* a power ratio of 3.41.
Find: 3.41 in the table:
3.41→10.655 db × ½ = 5.328 db

Voltage Ratio	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
1.0	.000	.086	.172	.257	.341	.424	.506	.588	.668	.749
1.1	.828	.906	.984	1.062	1.138	1.214	1.289	1.364	1.438	1.511
1.2	1.584	1.656	1.727	1.798	1.868	1.938	2.007	2.076	2.144	2.212
1.3	2.279	2.345	2.411	2.477	2.542	2.607	2.671	2.734	2.798	2.860
1.4	2.923	2.984	3.046	3.107	3.167	3.227	3.287	3.346	3.405	3.464
1.5	3.522	3.580	3.637	3.694	3.750	3.807	3.862	3.918	3.973	4.028
1.6	4.082	4.137	4.190	4.244	4.297	4.350	4.402	4.454	4.506	4.558
1.7	4.609	4.660	4.711	4.761	4.811	4.861	4.910	4.959	5.008	5.057
1.8	5.105	5.154	5.201	5.249	5.296	5.343	5.390	5.437	5.483	5.529
1.9	5.575	5.621	5.666	5.711	5.756	5.801	5.845	5.889	5.933	5.977
2.0	6.021	6.064	6.107	6.150	6.193	6.235	6.277	6.319	6.361	6.403
2.1	6.444	6.486	6.527	6.568	6.608	6.649	6.689	6.729	6.769	6.809
2.2	6.848	6.888	6.927	6.966	7.008	7.044	7.082	7.121	7.159	7.197
2.3	7.235	7.272	7.310	7.347	7.384	7.421	7.458	7.495	7.532	7.568
2.4	7.604	7.640	7.676	7.712	7.748	7.783	7.819	7.854	7.889	7.924
2.5	7.959	7.993	8.028	8.062	8.097	8.131	8.165	8.189	8.232	8.266
2.6	8.299	8.333	8.366	8.399	8.432	8.465	8.498	8.530	8.563	8.595
2.7	8.627	8.659	8.691	8.723	8.755	8.787	8.818	8.850	8.881	8.912
2.8	8.943	8.974	9.005	9.036	9.066	9.097	9.127	9.158	9.188	9.218
2.9	9.248	9.278	9.308	9.337	9.367	9.396	9.426	9.455	9.484	9.513
3.0	9.542	9.571	9.600	9.629	9.657	9.686	9.714	9.743	9.771	9.799
3.1	9.827	9.855	9.883	9.911	9.939	9.966	9.994	10.021	10.049	10.076
3.2	10.103	10.130	10.157	10.184	10.211	10.238	10.264	10.291	10.317	10.344
3.3	10.370	10.397	10.423	10.449	10.475	10.501	10.527	10.553	10.578	10.604
3.4	10.630	10.655	10.681	10.706	10.731	10.756	10.782	10.807	10.832	10.857
3.5	10.881	10.906	10.931	10.955	10.980	11.005	11.029	11.053	11.078	11.102
3.6	11.126	11.150	11.174	11.198	11.222	11.246	11.270	11.293	11.317	11.341
3.7	11.364	11.387	11.411	11.434	11.457	11.481	11.504	11.527	11.550	11.573
3.8	11.596	11.618	11.641	11.664	11.687	11.709	11.732	11.754	11.777	11.799
3.9	11.821	11.844	11.866	11.888	11.910	11.932	11.954	11.976	11.998	12.019
4.0	12.041	12.063	12.085	12.106	12.128	12.149	12.171	12.192	12.213	12.234
4.1	12.256	12.277	12.298	12.319	12.340	12.361	12.382	12.403	12.424	12.444
4.2	12.465	12.486	12.506	12.527	12.547	12.568	12.588	12.609	12.629	12.649
4.3	12.669	12.690	12.710	12.730	12.750	12.770	12.790	12.810	12.829	12.849
4.4	12.869	12.889	12.908	12.928	12.948	12.967	12.987	13.006	13.026	13.045
4.5	13.064	13.084	13.103	13.122	13.141	13.160	13.179	13.198	13.217	13.236
4.6	13.255	13.274	13.293	13.312	13.330	13.349	13.368	13.386	13.405	13.423
4.7	13.442	13.460	13.479	13.497	13.516	13.534	13.552	13.570	13.589	13.607
4.8	13.625	13.643	13.661	13.679	13.697	13.715	13.733	13.751	13.768	13.786
4.9	13.804	13.822	13.839	13.857	13.875	13.892	13.910	13.927	13.945	13.962
5.0	13.979	13.997	14.014	14.031	14.049	14.066	14.083	14.100	14.117	14.134
5.1	14.151	14.168	14.185	14.202	14.219	14.236	14.253	14.270	14.287	14.303
5.2	14.320	14.337	14.353	14.370	14.387	14.403	14.420	14.436	14.453	14.469
5.3	14.486	14.502	14.518	14.535	14.551	14.567	14.583	14.599	14.616	14.632
5.4	14.648	14.664	14.680	14.696	14.712	14.728	14.744	14.760	14.776	14.791
5.5	14.807	14.823	14.839	14.855	14.870	14.886	14.902	14.917	14.933	14.948
5.6	14.964	14.979	14.995	15.010	15.026	15.041	15.056	15.072	15.087	15.102
5.7	15.117	15.133	15.148	15.163	15.178	15.193	15.208	15.224	15.239	15.254
5.8	15.269	15.284	15.298	15.313	15.328	15.343	15.358	15.373	15.388	15.402
5.9	15.417	15.432	15.446	15.461	15.476	15.490	15.505	15.519	15.534	15.549

Voltage Ratio	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
6.0	15.563	15.577	15.592	15.606	15.621	15.635	15.649	15.664	15.678	15.692
6.1	15.707	15.721	15.735	15.749	15.763	15.778	15.792	15.806	15.820	15.834
6.2	15.848	15.862	15.876	15.890	15.904	15.918	15.931	15.945	15.959	15.973
6.3	15.987	16.001	16.014	16.028	16.042	16.055	16.069	16.083	16.096	16.110
6.4	16.124	16.137	16.151	16.164	16.178	16.191	16.205	16.218	16.232	16.245
6.5	16.258	16.272	16.285	16.298	16.312	16.325	16.388	16.351	16.365	16.378
6.6	16.391	16.404	16.417	16.430	16.443	16.456	16.469	16.483	16.496	16.509
6.7	16.521	16.534	16.547	16.560	16.573	16.586	16.599	16.612	16.625	16.637
6.8	16.650	16.663	16.676	16.688	16.701	16.714	16.726	16.739	16.752	16.764
6.9	16.777	16.790	16.802	16.815	16.827	16.840	16.852	16.865	16.877	16.890
7.0	16.902	16.914	16.927	16.939	16.951	16.964	16.976	16.988	17.001	17.013
7.1	17.025	17.037	17.050	17.062	17.074	17.086	17.098	17.110	17.122	17.135
7.2	17.147	17.159	17.171	17.183	17.195	17.207	17.219	17.231	17.243	17.255
7.3	17.266	17.278	17.290	17.302	17.314	17.326	17.338	17.349	17.361	17.373
7.4	17.385	17.396	17.408	17.420	17.431	17.443	17.455	17.466	17.478	17.490
7.5	17.501	17.513	17.524	17.536	17.547	17.559	17.570	17.582	17.593	17.605
7.6	17.616	17.628	17.639	17.650	17.662	17.673	17.685	17.696	17.707	17.719
7.7	17.730	17.741	17.752	17.764	17.775	17.786	17.797	17.808	17.820	17.831
7.8	17.842	17.853	17.864	17.875	17.886	17.897	17.908	17.919	17.931	17.942
7.9	17.953	17.964	17.975	17.985	17.996	18.007	18.018	18.029	18.040	18.051
8.0	18.062	18.073	18.083	18.094	18.105	18.116	18.127	18.137	18.148	18.159
8.1	18.170	18.180	18.191	18.202	18.212	28.223	18.234	18.244	18.255	18.266
8.2	18.276	18.287	18.297	18.308	18.319	18.329	18.340	18.350	18.361	18.371
8.3	18.382	18.392	18.402	18.413	18.423	18.434	18.444	18.455	18.465	18.475
8.4	18.486	18.496	18.506	18.517	18.527	18.537	18.547	18.558	18.568	18.578
8.5	18.588	18.599	18.609	18.619	18.629	18.639	18.649	18.660	18.670	18.680
8.6	18.690	18.700	18.710	18.720	18.730	18.740	18.750	18.760	18.770	18.780
8.7	18.790	18.800	18.810	18.820	18.830	18.840	18.850	18.860	18.870	18.880
8.8	18.890	18.900	18.909	18.919	18.929	18.939	18.949	18.958	18.868	18.978
8.9	18.988	18.998	19.007	19.017	19.027	19.036	19.046	19.056	19.066	19.075
9.0	19.085	19.094	19.104	19.114	19.123	19.133	19.143	19.152	19.162	19.171
9.1	19.181	19.190	19.200	19.209	19.219	19.228	19.238	19.247	19.257	19.266
9.2	19.276	19.285	19.295	19.304	19.313	19.323	19.332	19.342	19.351	19.360
9.3	19.370	19.379	19.388	19.398	19.407	19.416	19.426	19.435	19.444	19.453
9.4	19.463	19.472	19.481	19.490	19.499	19.509	19.518	19.527	19.536	19.545
9.5	19.554	19.564	19.573	19.582	19.591	19.600	19.609	19.618	19.627	19.636
9.6	19.645	19.654	19.664	19.673	19.682	19.691	19.700	19.709	19.718	19.726
9.7	19.735	19.744	19.753	19.762	19.771	19.780	19.789	19.798	19.807	19.816
9.8	19.825	19.833	19.842	19.851	19.860	19.869	19.878	19.886	19.895	19.904
9.9	19.913	19.921	19.930	19.939	19.948	19.956	19.965	19.974	19.983	19.991

Voltage Ratio	0	1	2	3	4	5	6	7	8	9
10	20.000	20.828	21.584	22.279	22.923	23.522	24.082	24.609	25.105	25.575
20	26.021	26.444	26.848	27.235	27.604	27.959	28.299	28.627	28.943	29.248
30	29.542	29.827	30.103	30.370	30.630	30.881	31.126	31.364	31.596	31.821
40	32.041	32.256	32.465	32.669	32.869	33.064	33.255	33.442	33.625	33.804
50	33.979	34.151	34.320	34.486	34.648	34.807	34.964	35.117	35.269	35.417
60	35.563	35.707	35.848	35.987	36.124	36.258	36.391	36.521	36.650	36.777
70	36.902	37.025	37.147	37.266	37.385	37.501	37.616	37.730	37.842	37.953
80	38.062	38.170	38.276	28.382	38.486	38.588	38.690	38.790	38.890	38.988
90	39.085	39.181	39.276	39.370	39.463	39.554	39.645	39.735	39.825	39.913
100	40.000	—	—	—	—	—	—	—	—	—

To find ratios outside the range of this table, see page 178.

Useful Servicing Formulas

A KNOWLEDGE of the elementary principles of electricity is necessary so that all the problems encountered in radio receiver servicing can be isolated and solved by the proper application of fundamental truths. Without further preamble, let us consider that statement upon which all forms and branches of electrical engineering is based:

OHMS LAW

Statement of Ohms Law: "Current flowing in a conductor will increase directly with an increase in voltage, and will decrease directly with an increase in resistance." In other words, voltage is the *cause*, while current is the *effect;* and the amount of the effect is directly dependent upon the amount of cause and inversely upon the amount of opposition offered to the effect.

Mechanical Analogy: Suppose that by exerting a certain effort, a man is able to walk a certain distance on a smooth city road. With double the effort, he can walk double the distance on the same road. Assume that on a rough country road, with the same effort, he can walk only half this distance, or with double the effort, he can walk the original distance. Applying this analogy to electricity, a certain voltage causes a certain current to flow. Double the voltage will cause double the current to flow, if the resistance is the same. If the resistance is doubled, however, the same voltage will result in only half the current flow. With double the voltage and double the resistance, the same current will flow.

Ohms Law (Equation):

$$I = \frac{E}{R}; \quad \text{Current} = \frac{\text{Voltage}}{\text{Resistance}}$$

Where I, E, and R are expressed in amperes, volts, and ohms respectively. The terms of voltage, current and resistance are used with the understanding that the reader has some elementary knowledge of electricity. Inasmuch as the limitations of this book prevent a complete review of the fundamentals, reference can be made to books covering the subject of fundamentals in electrical engineering.

The equations below all mean the same thing, and serve to express in various forms the idea set forth above.

$$E = I \times R; \quad \text{Voltage} = \text{Current} \times \text{Resistance}$$

$$R = \frac{E}{I}; \quad \text{Resistance} = \frac{\text{Voltage}}{\text{Current}}$$

The substitution of numerical values in place of names or letters will make the meaning clearer. It will be seen that if any two values are known, the third can be determined from these equations.

Problem: A choke used in the filter system of a "B" supply unit has a resistance of 100 ohms, and the voltage drop across the choke is 50 volts. What is the current flowing through the choke?

Using the first statement of Ohms Law, and substituting values for words: I equals 50 volts divided by 100 ohms. Thus, the current is .5 ampere (Figure 1A).

Figure 1B shows another application of the law that can be solved by the third

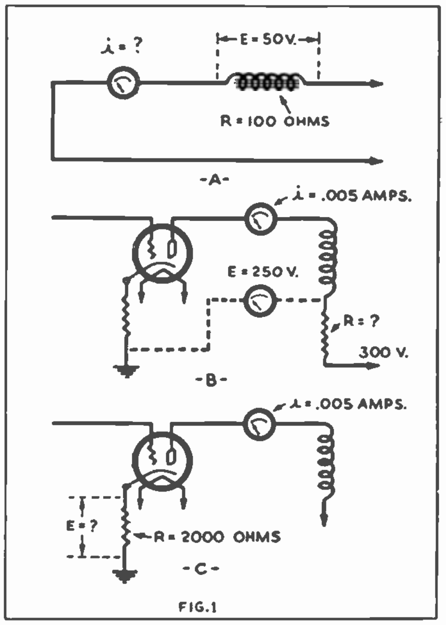


FIGURE 1. *Illustrating fundamental radio circuit calculations which require familiarity with ohms law. (A) Solving for current flowing in a circuit; (B) the resistance required to effect a known voltage drop; (C) the voltage drop across a known value of resistance.*

statement. Note should be taken of the fact that the voltage across the resistor R is not 300 volts, but the difference between the two voltages indicated, or 50 volts. Substituting in the equation:

$$R = \frac{E}{I}; \quad R = \frac{50}{.005} = 10{,}000 \text{ ohms.}$$

In Figure 1C is shown a common calculation necessary in modern service work. Here we must determine the value of the bias resistor for a particular tube. This value is easy to obtain, thus:

$$E = I \times R; \quad E = .005 \times 2{,}000 = 10 \text{ volts.}$$

Ohms Law in a Nutshell

$$\frac{E}{I \times R}$$

E = Voltage I = Current
× = Multiply by R = Resistance

Put your thumb over the unknown—or the symbol designating the value you want to know—thus to find voltage, cover E and the answer is: multiply current by resistance.

Power

Definition. "Power is the rate of doing work." Thus, one man may perform a certain piece of work in a day, while another may do the same thing in an hour. The second man has expended more power. "Electrical power is the product of the voltage times the current," or in symbols:

$W = E \times I$; Power (watts) = Voltage (in volts) × Current (in amperes).

Problem: In Figure 1B, how many watts are dissipated in the resistor? Watts = 50 volts × .005 amperes = .25 Watt.

In many cases it is more convenient to find the electrical power loss in terms of resistance. Thus, the equation W equals E times I can be stated in terms of the circuit resistance and the current flowing through it.

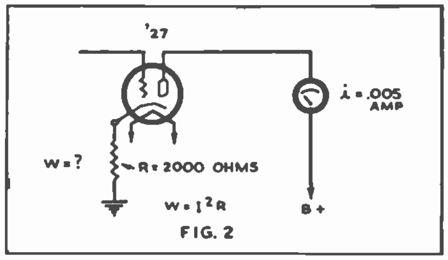


FIGURE 2. *A specific illustration of calculating the wattage rating of a resistor in a radio circuit.*

W = I times I times R; or $W = I^2 \times R$ or, in other words, watts equal current (amperes) times current (amperes) times resistance (ohms).

In Figure 2 there is a circuit with a resistor in series with the cathode and the ground of a '27 type tube. This resistor supplies the bias for the tube. If the resistance has a value of 2,000 ohms, what is the power loss in the resistor?

$W = .005 \times .005 \times 2{,}000 = .05$ watt.

Another form of this equation states the power in terms of voltage and resistance.

$$W = \frac{\text{voltage} \times \text{voltage}}{\text{resistance}} \text{ or } W = \frac{E^2}{R}$$

A tube has a DC plate resistance of 40,000 ohms and the voltage applied between plate and ground is 200 volts. What is the power lost in the plate circuit of the tube? See Figure 3.

$$W = \frac{200 \times 200}{40{,}000} = 1 \text{ Watt.}$$

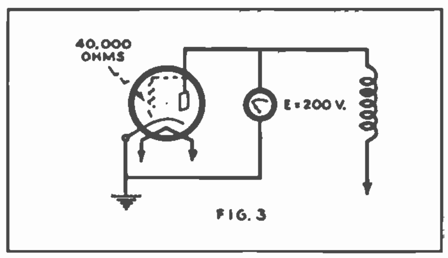


FIGURE 3. *Figuring the power or "watts" dissipated in a radio circuit.*

Kirchhoff's Laws

These laws depend on Ohms Law. They constitute a further application of Ohms Law to more complicated circuits.

In addition to simple electrical circuits, conductors may be connected in various complicated networks, all of which come under the heading of "divided circuits." By means of Kirchhoff's Laws, the current in any part of a divided circuit may be found, if the resistances of the various parts, and the e.m.f.'s (volts) are known.

Kirchhoff's First Law: "Any current flowing to a point in any electrical circuit is equal to the *sum of the currents flowing away from that point.*"

Kirchhoff's Second Law: "In any closed electrical circuit the sum of the impressed electromotive forces will equal the sum of the voltage drops." This statement requires modification, in so far as "addition" of voltages is concerned. Voltages are added, provided that they are in the same direction, but must be subtracted if in opposite directions.

An example of Kirchhoff's first law is seen in Figure 4 where the sum of the currents, 8 amperes and 4 amperes, flowing towards point A, is equal to the current, 12 amperes leaving point A.

Kirchhoff's second law is also numerically illustrated in Figure 4. Assume that the resistances of various parts of the circuit are as marked, and that the total internal resistance of the battery is .06 ohm. Then according to the statement of the second law, if the impressed voltage is 7.12 volts:

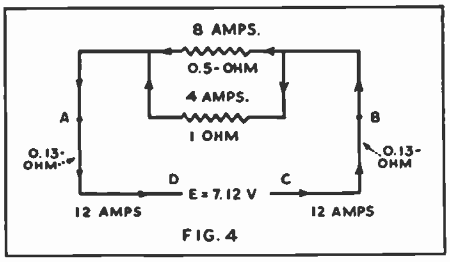


FIGURE 4. *Illustrating Kirchhoff's first law: "a current flowing into a circuit is the equal to the current leaving the circuit."*

Impressed Voltage = 7.12 = total voltage drop through the lower circuit.

Impressed Voltage = 12 × .1 (C to B) plus 4 × 1 (B to A in lower branch) plus 12 × .1 (A to D) plus 12 × .06 (D to C through battery).

Impressed Voltage = total of 7.12 volts.

In a like manner, impressed voltage equals *total voltage drop through the upper circuit.*

7.12 = 12 × .1 (C to B) plus 8 × .5 (B to A through upper circuit) plus 12 × .1 (A to D) plus 12 × .06 (D to C through battery), a total of 7.12 volts.

Conductors and Resistors

Materials are divided into two classes—conductors and non-conductors. Materials which offer a relatively easy path for the flow of electricity are called "conductors." In general, the pure metals are of this class, copper wire being nearly always used as a low-resistance conductor.

In reality there are no materials which are not conductors of electricity, but certain materials are such poor conductors that they may be classed as *non-conductors*. When such non-conductors are used to reduce an electric current to a predetermined small value, they are called "*resistors*."

Determining Resistance
(Excepting Temperature Change)

The material of which a conductor is composed has an important bearing upon its resistance. Thus a unit length and unit cross-section of aluminum has about one and one-half times the resistance of copper having the same dimensions. Platinum has about six times the resistance of copper.

The longer the conductor, the greater the resistance; while the greater the cross-sectional area, the less the resistance. The length of a conductor is usually expressed in feet, while the cross-sectional area is expressed in circular mils (equivalent to its diameter in thousandths of an inch, squared).

It can be conveniently remembered that No. 10 copper wire has a diameter of .1 of an inch (100 mils, or 10,000 circular mils), and that 1,000 feet of such wire will have a resistance of 1 ohm. It is possible to calculate the approximate resistances of copper wire (Brown and Sharpe or American Wire Gauge) from the above. Thus, for wires larger than No. 10, the resistance is *halved* for every *third* number of larger wire. As an example, No. 7 wire has an approximate resistance of 1/2-ohm per 1,000 ft. In a like manner, for wires smaller than No. 10, the resistance is doubled for every third number of smaller wire. The resistance of No. 13 is about 2 ohms per thousand feet; of No. 16, approximately 4 ohms per thousand feet, etc. The two numbers between every third may be calculated from the others, since the next smaller size has about 1.25 greater resistance, while the second smaller size has about 1.6 greater resistance. Thus the resistance of No. 11 wire is approximately 1 × 1.25 equals 1.25 ohms per thousand feet; and that of No. 14, approximately 1.6 ohms per thousand feet.

Effect of Temperature on Resistance: The resistance of practically all electrical conductors increases with increase of temperature. Carbon, practically the only exception, decreases in resistance with any substantial increase in temperature.

Two words synonymous with a resistance are "temperature coefficient." The term "coefficient" refers to a number used as a multiplier. The temperature coefficient is that multiplier which will give the increase in resistance per degree rise in temperature for each ohm of the material. For all pure metals, the temperature coefficient is approximately .0023 (where temperature is measured in degrees Fahrenheit). The figure .0023 is close enough for all ordinary work although the temperature coefficient is not constant for all initial temperatures.

Current Carrying Capacity

The allowable rise in temperature of the conductors or resistors in an electrical circuit is the final factor which determines its current carrying capacity. If the conductors or resistors are covered, the maximum allowable temperature of the insulation will impose the limitation, since the insulation or the enamel covering may crack, char, or even burn at high temperatures.

The temperature rise will be determined by the difference between the heat generated and the heat dissipated, or removed. Thus, a certain amount of electrical energy will be converted into heat and some of this heat will be carried away. The remaining heat will serve to increase the temperature. Of course, a certain amount of heat energy will raise the temperature of some materials a great deal more than others. Hence, the material of the conductor will also have some bearing on the temperature rise, aside from its resistance.

The heat generated in an electrical circuit will depend upon the value of the current flowing and upon the resistance in the circuit. If the current is doubled, the heat generated will be quadrupled. If the resistance is doubled, the heat generated will simply be doubled (if the current is constant). Thus, an increase of current has a much greater effect on the amount of heat generated than proportionate increase of resistance. Any-

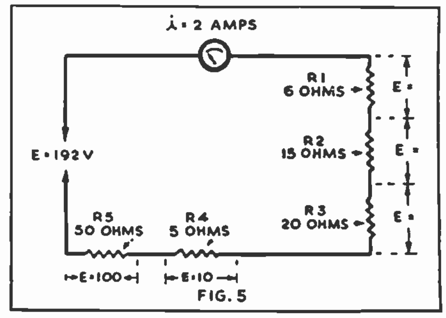


FIGURE 5. *Illustrating the effect of resistances connected in series. The total resistance is equal to the sum of the resistances in the circuit.*

thing that will increase the resistance of a circuit will increase the amount of heat generated.

Safe Current Carrying Capacities: In cases of resistor replacement, it is wise to replace with a resistor that will dissipate at least three times the power to be wasted in the circuit.

Voltage Drop: There is a difference in voltage between any two points in a circuit between which there is resistance, and this difference in voltage is known as the *voltage drop*. The difference in the voltage is determined by the resistance between the two points and the current flowing. If we desire to know the value of the resistance to be placed in series with a 201A type tube in order to operate it from a 6-volt storage battery, we must first determine the voltage drop required between the battery and the filament of the tube, namely 1 volt. Having determined the voltage to be dropped, and knowing the current required by the tube (.25 ampere), we can find the value of the resistance by Ohms Law. R equals E/I. Thus the resistor has a value of 4 ohms.

Circuits: Circuits can be classified into three general groups: Series, parallel, and series parallel. Examples of which will be covered in greater detail.

Circuits with Resistors in Series: If resistances are connected in series, the total resistance is the sum of all of the resistors in the circuit. See Figure 5. Thus the equation may be written R (eff.) equals R1 plus R2 plus R3 plus R4 plus R5, etc.

It will be noted on examination of the diagram that in series circuits the current is the same through all the resistors, but that the voltage drop across the resistors will depend upon the value of the individual resistor.

Circuits with Resistors in Parallel (equal value of resistance): In many circuits there

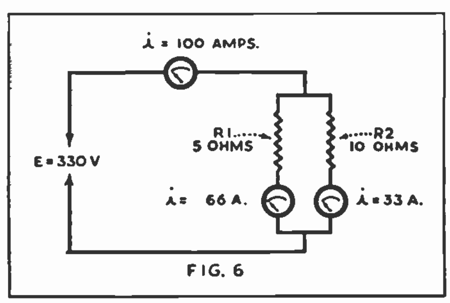


FIGURE 6. *Illustrating the effect of paralleled resistances. The current divides into each resistor so that the sum of the currents flowing in each equal that flowing out of the battery or generator.*

are combinations of resistors in parallel: that is to say, the current path is divided through two or more resistors. If the numerical values of the resistors are equal, then the effective circuit resistance can be obtained from the following equation:

R (eff.) equals R/N,

wherein R is the value of one of the resistors and N is the number of resistors in the circuit.

Example: There are 6 resistors in a circuit and they are in parallel. The resistance of each one is 12 ohms. Then dividing 12 by 6 we have the effective resistance, which is 2 ohms.

The solution of equal values of resistors in parallel is an extremely simple operation, but it must be remembered that the formula is useful only when the resistors are equal in value.

A circuit with resistors in parallel is shown in Figure 6. Note that if the resistors are equal in value, the same current will flow through both resistors, and the same voltage drop will appear across them. The sum of the currents through the resistors will equal the total current flowing out of the battery, E.

Circuits with Resistors in Parallel (unequal values of resistance): Many times we will come across circuits with resistors in parallel which are unequal in value. This is shown in Figure 6. If there are but two resistors in the circuit, as shown, then we can use the following formula:

$$R\ (\text{eff.}) = \frac{R1 \times R2}{R1 + R2}$$

Example: We have two resistors in parallel of 5 and 10 ohms, respectively. What is the effective value of resistance? Now, 5 times 10 is 50; 5 plus 10 is 15; 50 divided by 15 gives the effective value of resistance which is 3.3 ohms.

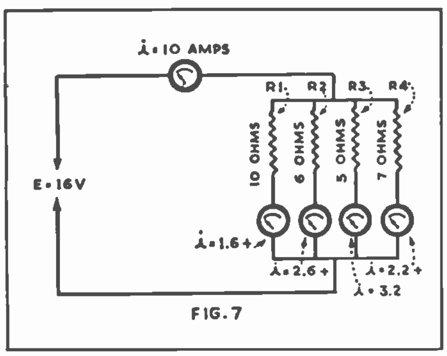


FIGURE 7. *The effect of a multiple number of resistors in parallel in a circuit. See text for full details.*

Note that in circuits with resistors in parallel, the same voltage will appear across the resistors, but that the current through the resistors will vary with the value of the individual resistor.

Circuit with Resistors in Parallel (two or more of unequal value): Figure 7 shows a circuit in which there are four resistors in parallel and unequal in value. In this case we would use the formula commonly known as the "reciprocal of the sum of the reciprocals." Thus:

$$R\ (\text{eff.}) = \frac{1}{\frac{1}{R1}+\frac{1}{R2}+\frac{1}{R3}+\frac{1}{R4}}\ \text{etc.};$$

substituting:

$$R\ (\text{eff.}) = \frac{1}{\frac{1}{10}+\frac{1}{6}+\frac{1}{5}+\frac{1}{7}};$$

solving:

$$\frac{1}{10} = .1;\ \frac{1}{6} = .166;\ \frac{1}{5} = .2;\ \frac{1}{7} = .14;$$

adding:

.1 plus .166 plus .2 plus .14 equals .606;

Finding the reciprocal:

$$\frac{1}{.606} = 1.6 \text{ ohms effective.}$$

The sum of the currents in the branches of a parallel circuit will equal the total current flowing into the circuit. From an examination of the circuit, we find that the sum of the currents is 9.6 + amperes.

The complete solution of the problem of Figure 7 has been carried out so that any one desiring to use these methods of calculation can do so. This solution will serve as a model and aid in studying just how the formula is to be handled. The author has gone to some lengths here in the solution of the problem but his experience indicates that there is never enough said on this subject as far as the average Service Man is concerned. Note that the same voltage appears across all the resistors and that the current through the individual resistors will be dependent on their value.

Resistance Networks (with resistors in series and in parallel): Circuits are encountered with resistors in series and in parallel. The solution of the effective value of resistance is obtained by breaking up the circuit into its local circuits, solving each portion consisting of parallel circuits, and then resolving them into simple series circuits. Figure 8 is an example along these lines.

Solution: The first thing to do is to solve all of the branch circuits. Circuit R1, R2, R3 has an effective resistance of 3 ohms.

Circuit R5, R6, R7 has a resistance of 2.2 ohms.

Circuit R8, R9 has a resistance of 2.2 ohms.

As the above parallel circuits are in series with resistor R4, we find the effective value

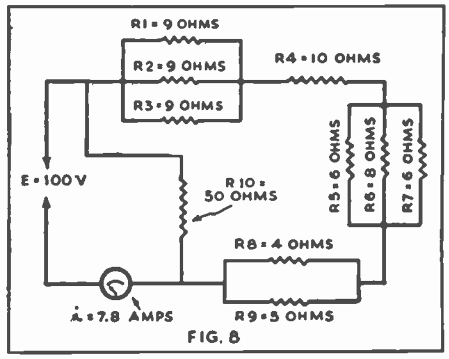


FIGURE 8. *A series circuit arrangement of paralleled resistors and how they affect the current flow. Refer to text for method of calculating.*

of resistance by adding 10, 3, 2.2 and 2.2 together. This totals 17.4 ohms.

Resistor R10 is connected across the voltage supply, and the effective value of the resistance network R1 and R9 is, in turn, connected across R10. Thus, R10 is in parallel to the 17.4 ohm resistance of the network.

Solving for parallel circuits 50 × 17.4 / 50 plus 17.7 we have the effective total circuit resistance of 12.8 ohms.

Knowing that the voltage applied across this network is 100 volts, and that the effective resistance is 12.8 ohms, then 100/12.8 is 7.8 amperes, or the total current flowing in the circuit.

The reader may think that a problem of this type can hardly occur, but if he will study the circuit of Figure 9 he will see the need for some practical knowledge on the solution of similar problems. The circuit of Figure 9 is a receiver breakdown circuit of the RCA Radiola 80. Note that there are many small series circuits and that they are all in parallel across the power supply which takes the place of the battery E in all the problems set out above.

Formulas in Brief

Resistances in Series

$$R_t = R_1 + R_2 + R_3 \ldots R_n$$

Where: R_t is the total value of all resistors connected in series.

R_1, R_2, etc., are the individual resistors.

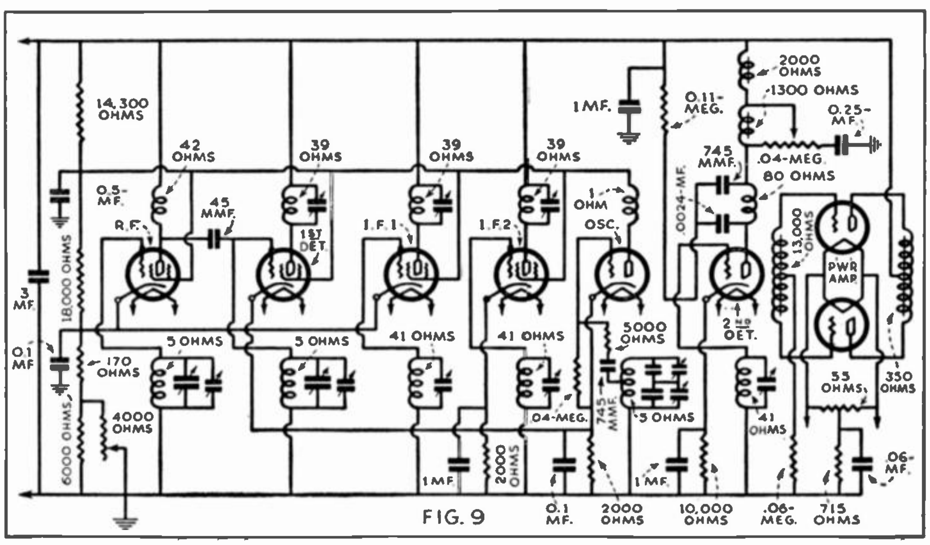


FIGURE 9. *A typical radio receiving circuit, the Radiola 80, and how series and parallel resistors are practically applied.*

Resistances in Parallel

$$R_t = \frac{1}{\frac{1}{R_1}+\frac{1}{R_2}} = \frac{R_1 \times R_2}{R_1+R_2}$$

Where: R_t is the effective value of all the resistors connected in parallel.

R_1, R_2 are the individual resistors.

Example: What is the effective value of resistance of a circuit having resistors of 30,000 and 60,000 ohms connected in parallel?

$$R_t = \frac{30{,}000 \times 60{,}000}{30{,}000 + 60{,}000} = 20{,}000 \text{ ohms}$$

Reactance (Inductive) of a Coil

$2\pi fL$ = Reactance (ohms)

Where: $\pi = 3.14$

f = frequency in cycles per second.

L = inductance in henries.

Example: What is the reactance of a 20-henry choke at 50 cycles?

$6.3 \times 50 \times 20 = 6{,}300$ ohms.

Reactance (Capacitative) of a Condenser

$$\frac{10^6}{2\pi fC} = \text{Reactance (ohms)}$$

Where: $\pi = 3.14$

f = frequency in cycles per second.

C = capacity in microfarads.

Example: What is the reactance of a 2-mf. condenser at 50 cycles?

$$\frac{10^6}{6.3 \times 50 \times 2} = 1{,}590 \text{ ohms}$$

Wavelength

$$\lambda = 1{,}885\sqrt{LC}$$

Where: λ = wavelength in meters.

L = inductance in microhenries.

C = capacity in microfarads (mf.).

Example: To what wavelength will a .0005-mf. (500 mmf.) condenser, in parallel with a 180-microhenry coil, tune?

$1{,}885\sqrt{180 \times 0.0005}$ 565 meters

Frequency

$$f = \frac{10^6}{2\pi\sqrt{LC}}$$

Where: f = frequency in cycles.

$\pi = 3.14$

L = inductance in microhenries.

C = capacity in microfarads (mf.).

Example: To what frequency will a 0.0005-mf. (500 mmf.) condenser, in parallel with a 180-microhenry coil, tune?

$$\frac{10^6}{6.3\sqrt{180 \times 0.0005}} = 530{,}000 \text{ cycles} = 530 \text{ kilocycles} = 565 \text{ meters}$$

Impedance of a Circuit

When an inductance, capacity and a resistance are connected in series, the combined effect is called the impedance of the circuit.

$$Z = \sqrt{R^2 + (X_l - X_c)^2}$$

Where: Z = impedance in ohms.

R = resistance in ohms.

X_l = reactance of inductance in ohms.

X_c = reactance of capacity in ohms.

Ohms Law for A.C. Circuits

$$E = IZ \qquad Z = \frac{E}{I} \qquad I = \frac{E}{Z}$$

Where: Z = impedance of circuit in ohms.

E = potential difference in volts (V).

I = current in amperes (A).

The Decibel

The number of decibels corresponding to a given power ratio is 10 times the common logarithm of the ratio.

$$N = 10 \text{ Log}_{10} \frac{P_2}{P_1}$$

Where: N = decibels.

$$\frac{P_2}{P_1} = \text{power ratio}$$

In the case of voltage or current the number of decibels corresponds to 20 times the common logarithm of the ratio.

Example: What gain in decibels will there be if the voltage in an amplifier rises to 7 times the normal level at a certain frequency?

$N = 20 \log_{10} 7 = 20 \times 0.845 = 17$ decibels.

Color Code Chart for Fixed Condensers

(Total Indicates mmf.)

First Dot	Second Dot	Third Dot
Black........0	Black......0	
Brown.......1	Brown.....1	Brown.........0
Red.........2	Red.......2	Red..........00
Orange......3	Orange.....3	Orange.......000
Yellow.......4	Yellow.....4	Yellow.....0,000
Green.......5	Green......5	Green.....00,000
Blue........6	Blue.......6	Blue....000,000
Purple.......7	Purple.....7	Purple..0,000,000
Gray........8	Gray......8	Gray...00,000,000
White.......9	White......9	White 000,000,000

A. C. Voltage and Power

The *Maximum* Voltage E_m is 1.414 × the *Effective* Voltage E_e.

The *Effective* Voltage E_e is 0.707 × the *Maximum* Voltage E_m.

The *Average* Voltage E_a is 0.636 × the *Maximum* Voltage E_m.

The *Power* in an AC Circuit W =

$$I \times E \times \frac{R}{Z}$$

Where the Angle of Lag or lead, Φ and the

$$\text{Power Factor } \frac{R}{Z} = \textit{Cosine } \Phi,$$

$$\textit{Sine } \Phi = \frac{X}{Z}, \text{ and } \textit{Tangent } \Phi = \frac{X}{R}$$

Oscillatory Circuit Values

Where λ ("lambda") is the WAVELENGTH in Meters, L is the Inductance in MICROHENRIES and C is the Capacity in MICROFARADS.

The RESONANT FREQUENCY in Cycles is:

$$Fr = \frac{159{,}160}{\sqrt{L \times C}}$$

$$(\lambda = 1885\sqrt{L \times C}$$

The DECREMENT of a Circuit is ("Delta")

$$\delta = \frac{R}{2frL} = 3.1416 \times \frac{R}{xL}$$

Where the POWER FACTOR is $\frac{R}{xL}$

Vacuum-Tube Formulas

Amplification constant ("mu") μ equals

$$\frac{\text{Change in Plate Voltage } (E_p)}{\text{Change in Grid Voltage } (E_g)}$$

Plate Impedance (in ohms) r_p equals

$$\frac{\text{Change in Plate Voltage } (E_p)}{\text{Change in Plate Current } (I_p)}$$

Mutual Conductance g_m equals

$$\frac{\text{Change in Plate Current } (I_p)}{\text{Change in Grid Voltage } (E_g)}$$

When the Plate Current is measured in Amperes; the Mutual Conductance

$$\text{gm in MICROMHOS} = \frac{\mu}{r_p} \times 1{,}000{,}000$$

When E_g is the Input Voltage, r_p is the Plate Impedance and R_p is the External Plate Impedance or Load Impedance, the

$$\text{Voltage Amplification} = \frac{\mu \times E_g \times R_p}{r_p + R_p}$$

Power Output

When E_g expresses the RMS (Root-Mean-Square) Effective Value of the AC Input, the

$$\text{POWER OUTPUT} = \frac{\mu^2 \times E_g^2 \times R_p}{(r_p + R_p)^2}$$

The MAXIMUM Power Output is $\frac{\mu^2 \times E_g^2}{4r_p}$

The Maximum UNDISTORTED Power Output is $\frac{2\,\mu^2 \times E_g^2}{9r_p}$

When E_g is the Maxmum (Peak) A. C. Input Value

The Maximum Undistorted Power Output is

$$\frac{\mu^2 \times E_g^2}{9r_p}$$

Transformer Ratios

$$\frac{\text{The Voltage across the Secondary}}{\text{The Voltage across the Primary}} \text{ equals}$$

$$\frac{\text{The Number of Secondary Turns}}{\text{The Number of Primary Turns}}$$

Alternating Current

Where Z is the *Impedance* in Ohms, E is *Effective* Electromotive Force in Volts, and I is Current Intensity in Amperes, then

$$I = \frac{E}{Z} \qquad E = Z \times I \qquad Z = \frac{E}{I}$$

Where L is the *Inductance* in Henries and C the *Capacity* in Farads, *f* is the Frequency in Cycles (per second), then in ohms,

The Inductive Reactance $X_L = 6.283 \times fL$

The Capacitative Reactance $X_C = \frac{1}{6.283 \times fC}$

The Resonant Frequency is $\frac{1}{6.283\sqrt{LC}}$

The Impedance of a circuit consisting of a resistor and capacitor in series is:

$$Z = \sqrt{R^2 + Xc^2}$$

The Impedance of a circuit consisting of a resistor in parallel with a condenser is:

$$Z = \frac{RXc}{\sqrt{R^2 + Xc^2}}$$

,OC/

Measurement of Radio Components

MANY servicemen waste much time and effort in their daily work because they are not adequately equipped to make measurements of the three leading electrical characteristics of receivers or amplifiers. That is, Resistance, Capacity and Inductance. While excellent nationally known and proven test equipment for every practical need is available to all—still there is a need for clear, simple, practical information with which these measurements should be made.

Before going into the subject, let us briefly consider the degree of accuracy which must be observed in making every-day measurements.

During a conversation we were informed that a bridge just purchased "was not accurate." Further questioning brought out the fact that the accuracy of the bridge was 2% plus or minus, and yet the owner thought the bridge was not sufficiently accurate. Such is far from being the case, because a tolerance of plus or minus 2% is insignificant when compared to the usual commercial tolerance, which is usually plus or minus 10%, and in many cases plus or minus 20%.

Because all radio parts are subject to changes caused by humidity and temperature, it is necessary that there be an allowable tolerance from specified values. Such a variation does not introduce any appreciable errors in the operation of the receiver, because there are adjustments or balancing factors present that offset them.

Measuring Instruments

Practically all servicemen possess an ohmmeter and are thoroughly familiar with its use and time saving features. An ohmmeter is not as accurate as even a poor bridge. Very few ohmmeters have an error of less than 10%, because the meter is usually made to a 2% limit and the additional errors of calibration and reading increase the total error. In addition, the ohmmeter is useful only for measuring resistance values, and can not be used to measure inductance or capacity.

Inductance and capacity in large values can be measured at low frequencies by means of alternating current voltmeter and ammeters, or milli-ammeters. Unfortunately, such AC meters are expensive and entirely too limited in their application to be of any real assistance to the serviceman in his daily work. Then, too, they are useless for the measurement of low values of inductance or capacity at the high frequencies employed in radio receivers.

There are two instruments which you can either buy or build that will save you as much time and effort as your ohmmeter. These two instruments are respectively the Alternating Current Bridge, and the Vacuum Tube Voltmeter.

Practical AC Bridge

Too many servicemen struggle along without the aid of an AC bridge, because it is a general opinion that a bridge is useful only where extremely accurate measurements need to be taken, and that a bridge is worthless unless its accuracy is of the "umpteenth" degree.

Where funds are lacking for the immediate purchase of nationally known equipment, **you can easily build a universal AC bridge** which will be accurate within 4% or 5%, at very little cost or expenditure of time. With this bridge, you may accurately measure a wide range of inductance, capacity or resistance at practically any audio frequency. **You will find this device to be a great time saver,** because it will no longer be necessary to "guess" at the inductance of a tuning coil, or of a choke, or the capacity value of any condenser or circuit which you may encounter. In addition, impedance ratios are directly and quickly ascertained, which will assure you of a correct "match" when working on sound systems, multiple speaker installations or other such types of work.

Before entering upon the description of the universal AC bridge, it is well to briefly outline the action which takes place in a bridge circuit.

Figure 1 illustrates the common DC or Wheatstone bridge, consisting of four arms of resistance labeled A, B, C and D. When the ratio of resistance A to that of B is equal to the ratio of C to D, there will be no potential difference across the meter, or, in other words, the current will be divided equally across the arms of the bridge and it is said to be "balanced." For explanation, let us assume that A has the value of 10 ohms, and B a value of 2 ohms. If C is 10 ohms and D is 2 ohms, the bridge will be balanced.

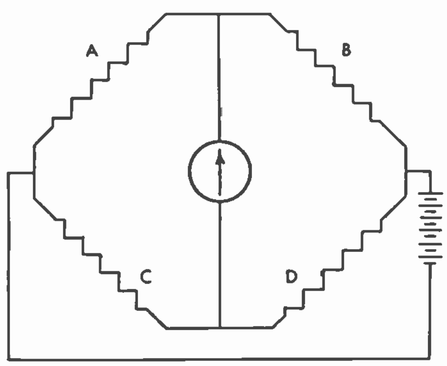


FIGURE 1

To measure an unknown resistance, we can connect it into the bridge in place of arm C. Then by changing the values of the ratio A to B, or by leaving this ratio fixed and changing the value of D until the meter reads zero (or as we say, the bridge is again balanced), it is easy to find the unknown resistance, because the ratio between the unknown resistance and the resistance of D is exactly equal to the ratio of A to B. The important point is that the ratio of A to B may be fixed, and the value of D varied to obtain balance, or, because it is easier to change the ratio of A to B, D may be a fixed value. It has been found convenient to make D a fixed whole number value such as 10 or 100, and to change from one value to another by plugging-in or switching. Then by varying the ratio A B, it is only necessary to consider that the unknown resistance, generally designated by X, bears the same relation to the known value of D as A does to B. This is usually expressed by the formula:

$$X = D\frac{A}{B}$$

In the AC bridge, a resistance must be compared with a resistance, and as a general rule, a capacitance with a capacitance, and similarly an inductance with an inductance. However, there are exceptions to this rule, but for simplicity's sake, it is usually more convenient to use an inductance standard for one arm of the bridge when measuring inductance, and similarly a standard capacitor for one arm of the bridge when measuring capacity. However, the ratio arms A and B may consist of pure resistance, regardless of whether we are measuring resistance, inductance or capacity.

One peculiarity of the AC bridge is that a separate means must be provided for balancing out the effects of stray capacity, which is not directly involved in the measurement, but which will cause erroneous readings if not compensated. The effect of these stray capacity currents is most noticeable in the region of impedance of 50,000 ohms and higher.

The usual form of compensation employed in the AC bridge is a potentiometer connected across the source of energy with the moving arm of the potentiometer connected to ground so that the stray capacities introduced may be balanced out. This system is usually referred to as the Wagner ground, or earth connection.

Another peculiarity of the AC bridge is that it measures capacity or inductance in terms of impedance; i.e., reactance.

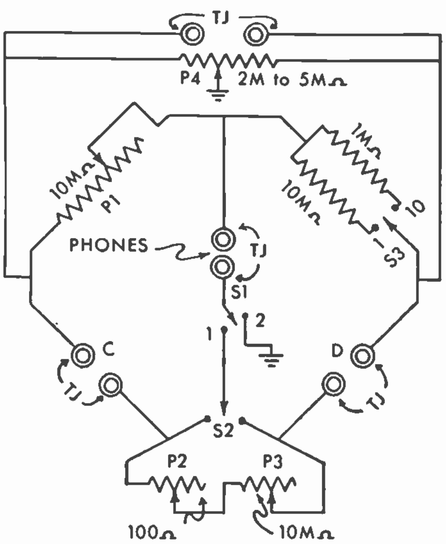
The impedance of a capacitor or inductor is composed principally of capacitive or inductive reactance. Unfortunately, resistance is also present and will give a false reading if not compensated or balanced out. For instance, when measuring the inductance of a choke it is necessary to overcome the effects of the resistance of the winding in order to find the inductive reactance. It is also necessary to compensate for the capacity present in the winding, but this will be considered later.

Both the "standard" and unknown inductors possess resistance. We may balance these resistance values by means of a variable resistance and a switch arranged so that this resistance may be added in series with either the "standard" or unknown inductor. The variable resistor is usually referred to as the "Phasing Control" and is usually provided in a "coarse" and "fine" adjustment. After the resistance or "phase" is equalized the bridge may be balanced for the inductive reactance.

The capacitive reactance present in a choke or inductor and referred to as the "distributed capacity" may be determined in several ways, one of which is to shunt a condenser across the inductor and measure the impedance at a rather high frequency. Then make a second measurement at a frequency twice the first frequency. Then calculate the distributed capacity by means of commonly used formulas.

The "inductive reactance" present in condensers is usually too small to be measured except by means of special and complicated circuits. It is not necessary to consider this component in ordinary work.

Figure 2 illustrates the circuit of an easily built universal AC bridge.



TJ=YAXLEY TIP JACKS P3=YAXLEY C10MP
P1=YAXLEY E10MP P4=YAXLEY C5MP
P2=YAXLEY C100P
S1=YAXLEY 2003 P B. SWITCH
S2, S3=YAXLEY No. 11 MIDGET SW
1-365, 3-366 YAXLEY BAR KNOBS

FIGURE 2

The parts for this bridge should be assembled in a neat manner, preferably, but not necessarily, in a metal box with all the parts insulated from the box, with the exception of potentiometer P4, which may be mounted directly to the metal, and in addition should have the moving arm soldered to the box and connected to a binding post or pin jack for a ground connection.

It is hardly necessary to mention that the box should be of copper, aluminum or brass, as iron is not a good conductor. It is also advisable to enclose the metal box within a wooden box, as there may be times when it will be necessary to use the bridge at a fairly high potential to ground.

Notice—Potentiometer E10MP is made to a commercial tolerance of plus or minus 10%. Check the potentiometer to be certain it is of 10,000 ohms or more, rather than slightly below 10,000 ohms.

In addition to the list of parts given in Figure 2, it is necessary to procure precision resistors, capacitors and inductors.

It is advisable to procure three each of these precision units in the following values:

Of Resistors—10 ohms, 1000 ohms, and 100,000 ohms—all three to be plus or minus 1% or less.

Of Capacitors—.01 mfd., 1 mfd., and 5 mfd.

Of Inductors—1 each of 1 henry, 10 millihenries and 1 millihenry, or 1000 microhenries.

The resistors may be purchased from your distributor. When ordering, do not forget the 1000 and 10,000 ohm 1% resistors for the ratio arm of the bridge.

The precision capacitors and inductors may be ordered from any one of several manufacturers of condensers or coils. The .01 and 1 mfd. standards are sold by RCA as their part numbers 11799 and 11790 respectively. The 1 henry, 10 millihenry, and 1 millihenry standards are RCA part numbers 11787, 11788 and 11789 respectively.

These units should be enclosed in a container equipped with pins so that they may be plugged into the pin tip jacks, or, if you prefer, you may mount them within the bridge and use a switch in place of the plug-in arrangement.

For general use, it may be advisable to use the plug-in system, as the capital investment and time required for building will not be as great as it will be with the switching arrangement, which is quite complicated.

When measuring capacity it is necessary to reverse the position of the unknown and standard arms because the impedance of a condenser varies inversely with the capacity. The reversal of the standard and unknown capacitors allows the use of a linear direct reading scale for all three types of measurements.

Note—Any leads which may be connected to the "standards" should be short and direct so as to avoid the introduction of spurious capacity and resistance.

Construction of the Bridge

A recommended assembly for the bridge circuit illustrated in Figure 2 is given in illustration No. 3.

In this illustration you will notice that the parts are marked. P1 is the main variable resistor. P2 and P3 are "phasing controls" used to establish a balance between the resistance of an unknown capacitor or inductor and that of the standard. P4 is the Wagner ground. The two pin tip jacks on the left are the connections for the C arm of the bridge. The two on the right-hand side are the connections for the D arm of the bridge. The two pin tip jacks at the bottom of the panel are for the head-phones, galvanometer or vacuum tube voltmeter, depending upon which one of the three is to be used for a

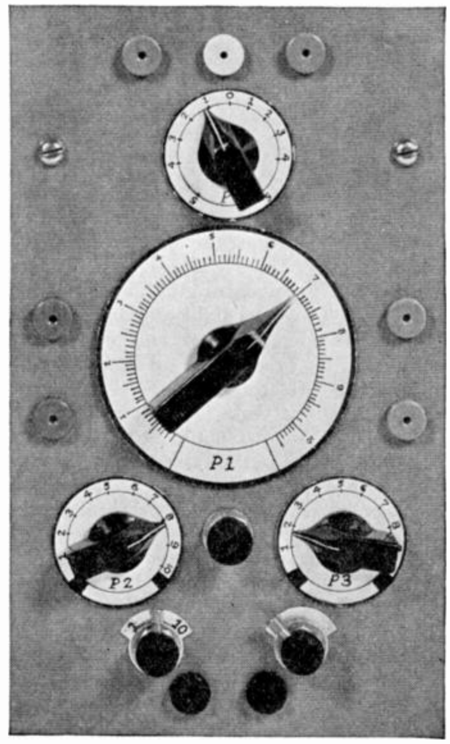


FIGURE 3

resonance indicator. The two outer pin tip jacks at the top of the panel above the potentiometer P4 are for connection to the alternating current supply. The center one is for a ground connection.

Before assembly of the bridge, it is necessary to prepare the scales for use with the various potentiometers. The scale for P1 should be most accurate and is best made and calibrated in the following manner:

A disk 3$\frac{3}{16}$" in diameter should be cut from a piece of drawing or bristol board and a $\frac{3}{8}$" hole carefully cut or punched in its exact center. Then mount the control on the panel with this disk beneath the bar knob. Turn the bar knob to the full counter-clockwise position and mark this point zero. Then lay off the scale in thousand ohm divisions. Later sub-divide these into ten parts, or hundred ohm divisions. This can best be done by measurement; that is, dividing the space between the thousand ohm marks into 10 equal parts. Disregard the additional resistance above 10,000 ohms and be sure to allow for that small part of the rotation, at the counter-clockwise position, which is shorted out for the terminal connection.

This calibration should not be attempted with an ohmmeter, because of the inaccuracies of such a meter. It is far better to use the volt-ammeter method, being sure to use separate meters and not attempt to make one meter do for both the voltage and current readings.

Another method which is fairly accurate is to ascertain the 10,000 ohm point on the rotation of the control. Then divide the total number of degrees rotation between the full counter-clockwise or zero point, and the 10,000 ohm point, into 10 equal divisions, each of which can then be sub-divided into 10 divisions.

The scales for the other three potentiometers should be made in the same manner, except that the scale for P4 should read zero at the center of its rotation.

Your attention is called to the black spaces at the ends of the scales on potentiometers P2 and P3. These black spaces indicate the terminal short-out, or rotation wherein there is no resistance change.

The bridge should be wired with heavy bus bar wire, and all parts rigidly secured against vibration. The leads should be as short and direct as possible. A suggested wiring arrangement is shown in Figure 4.

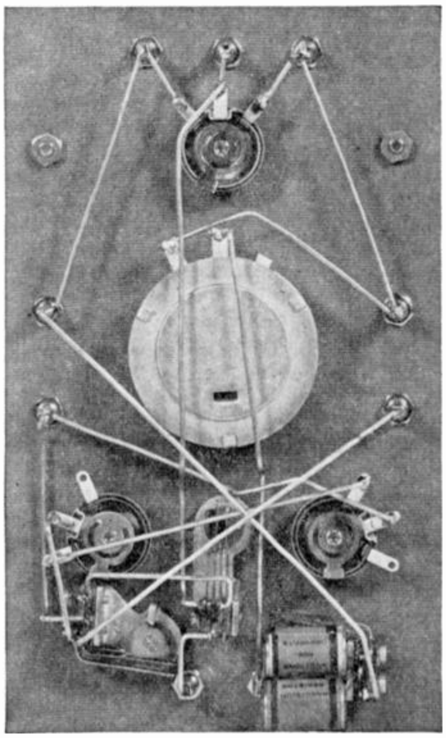


FIGURE 4

Before giving directions for using the bridge, it is necessary to provide both a source of audio frequency power supply, and to consider the means to be used to indicate resonance. We will first consider the current supply.

Current Supply for the Bridge

Inasmuch as we have an AC bridge, it will be necessary to provide an alternating current of suitable frequency with which to operate the bridge.

For measurements in audio work, it is customary to use a frequency of 400 cycles. Thus, when you read a description which contains a reference to the impedance of, say a magnetic loud speaker, it is assumed that the value given is the impedance of the speaker at the usual standard frequency of 400 cycles.

For general measurement work, it would perhaps be best to use 1000 cycles as a frequency of the supply voltage.

Suitable sources of current for the bridge are the audio oscillator, or for temporary use, even a Buzzer or low voltage 60 cycle current may be used.

The audio oscillator should preferably be one that will give a sine wave. However, this is not absolutely necessary.

Any one of the numerous audio oscillators now on the market may be used to supply current for the bridge, or, if such an oscillator is not available, one may be assembled as per Figure 5.

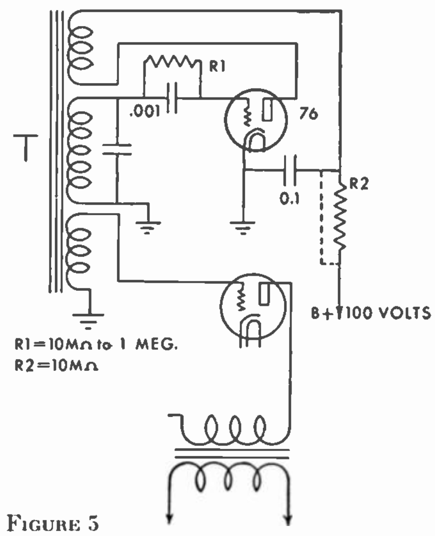


FIGURE 5

TO BRIDGE

One of these oscillators was built in our Laboratory using a type 19 tube and an RCA Transformer No. 11775. One section of the 19 was used as the oscillator and the other section as the amplifier-buffer which was driven by the pick-up coil on the transformer. With the secondary tuned by a capacity of .31 mfd. and with 45 volts (no R2) on both plates and 1.5 volts on the filament, the frequency was 1,000 cycles. With a capacity of .81 mfd. a frequency of 410 cycles was obtained.

Other makes of transformers may be used, but it will be necessary to cut and try to get the correct value of the tuning capacity.

Thordarson gives directions for building an audio oscillator having 8 different frequencies and employing their transformer part No. T6125.

Notice—A coupling transformer should be provided between the oscillator and bridge because the "effective impedance" of the bridge to the oscillator is very low, especially so when using low values of resistance and large values of capacity for "standards."

Some oscillators may stop because of the "short" presented by such a high load if a matching transformer is not used.

To ascertain the approximate transformer ratio, it is necessary to know the output impedance of the oscillator and the impedance of the bridge. If the oscillator shown in Figure 3 is used, the output impedance will be approximately 10,000 ohms, and the bridge impedance with a 10 ohm standard will of course be 10 ohms or more, and for a capacity standard of 1 mfd. the bridge impedance will be approximately 150 ohms if the oscillator is tuned to 1,000 cycles. Therefore, a speaker matching transformer might be just the answer.

Because many constructors will use different parts or oscillators, we regret that it is impossible to give exact details. However, first ascertain the impedance ratio and then select a transformer of the proper turns ratio, remembering that the turns or voltage ratio is equal to the square root of the impedance ratio.

Resonance Indicators

Some means must be employed to secure an indication of balance condition in the bridge. Perhaps the simplest, and for ordinary work the most convenient, would be a pair of sensitive head-phones, especially if they are of the "crystal" variety.

For accurate work where a ratio of "standard" to unknown is greater than about three to one, it is advisable to use at least one stage of audio amplification between the bridge and the head-phones. Two stages will be excellent if they are tuned to resonance with the oscillator frequency to avoid the disturbing second harmonic of the oscillator which may be confusing because it is heard strongly when the bridge is balanced for the fundamental frequency.

A vacuum tube voltmeter, or the "Magic Eye" may be used to indicate resonance. The "Magic Eye" has been described so often that it is not necessary to explain it here. Both the "Magic Eye" and the vacuum tube voltmeter may be used when using the bridge for DC measurement of coil resistance.

Checking the Bridge

Before considering the use of the bridge, it is well to test the bridge to determine the accuracy of calibration. To do this, it is necessary to have two precision resistors, or two resistors whose value is accurately known. Plug them into the C and D arms of the bridge, set the phasing controls P2 and P3 at their full counter-clockwise position, then plug in the head-phones and turn on the oscillator. Set the ratio switch to position 1 and vary the knob of P1 until the oscillator is no longer heard. The reading on the scale of P1 should be No. 10 if the two resistors are exactly alike. However, if it is definitely known that the two resistors are exactly alike, which is rarely the case, and the reading of P1 is not No. 10, it will be necessary to re-check the calibration of the scale of P1 and the wiring or the setting of the arm on P1 until the trouble is located and corrected.

Use of the Bridge

When the ratio switch is on position 1, the scale reads in tenths. Thus, number 1 on the scale of potentiometer P1 is .1, and 2 is likewise, or .2, and so on up to No. 10, which of course is unity, or 1. When the ratio switch is on position No. 10, the reading of the scale for potentiometer P1 is in units, corresponding exactly to the scale, which makes the scale read 1, 2, 3, 4, 5, and so on.

Thus, if the 100 ohm standard is being used and the ratio switch is in position 1 and the potentiometer P1 has a reading of 2, the resistance of the unknown resistor is two-tenths of 100 or twenty ohms. Similarly if the 1 mfd. standard is being used, a dial reading of 2, when the ratio switch is in number 1 position, would indicate .2 mfd. as being the capacity of the condenser under test, whereas, if the ratio switch is on position 10, the capacity would be 2 mfd. for a scale reading of 2.

The phasing controls P2 (Fine) and P3 (Coarse) may be placed in either the C or D arms of the bridge by means of switch S2, and are necessary because otherwise it would be impossible to secure a definite null point when attempting to measure the capacity of a condenser having leakage or high contact resistance, or in the case of inductors, when measuring an inductor which is wound with wire of either more or less resistance than that of the standard inductor.

The Wagner ground adjustment P4 is necessary to secure a null point when measuring capacity or inductance of a component which is a part of a circuit.

If it is impossible to obtain a sharp, definite null point when measuring impedances in the order of 50,000 ohms or more, it will be necessary to adjust the Wagner ground, especially so when the impedance to be measured is part of a receiver circuit. To make the adjustment, first obtain as close a null point as possible in the usual manner by adjusting P1 and the phasing controls. Then press the push button of switch S1 and adjust potentiometer P4 for minimum oscillator sound in the phones. Release the button and again attempt to find the null point on P1 by adjusting it and the phasing controls.

The two positions of the range switch allows the following values to be obtained with the respective standards.

The 10 ohm standard will give a range of from .1 to 10 ohms on the low or No. 1 ratio, and a range of from 10 ohms to 100 ohms on the high or No. 10 ratio. The 1000 ohm standard will give a range on the low point of 100 to 1000 ohms, and on the high point a range of 1000 to 10,000 ohms. The 100,000 ohm standard gives a range on the low point of 10,000 to 100,000, and on the high point a range of 100,000 to 1 megohm.

The capacitor standard of .01 gives a low range of .001 to .01, and a high range of .01 to .1. The 1 mfd. standard gives a low range of .1 to 1 mfd., and a high range of 1 mfd. to 10 mfd. The 5 mfd. standard will give a low range of .5 mfd. to 5 mfd., and a high range of 5 mfd. to 50 mfd.

The inductor standard of 1 millihenry has a range on the low point of 100 microhenries to 1 millihenry, and on the high point a range of 1 millihenry to 10 millihenries. The 10 millihenry standard gives a range on the low point of 1 millihenry to 10 millihenries, and on the high point a range of 10 millihenries to 100 millihenries. The 1 henry standard permits a range of 100 millihenries to 1 henry on the low ratio, and a range of 1 henry to 10 henries on the high ratio. An additional standard of approximately 10 henries would give a useful range up to 100 henries on the high ratio.

Resistance Measurements

Resistance may be measured on the AC bridge provided that it is not the resistance of a coil or other component wherein capacity or inductance is combined with the resistance to be measured.

Resistance is measured by plugging the standard resistor into the D arm, i.e., right hand tip jacks and the unknown resistor into the C arm or left hand tip jacks.

With the headphones and oscillator connected and the phasing controls turned to the full counter-clockwise position, set the ratio switch S3 to the number 1 position and turn the large bar knob of P1 from one end of the dial to the other. If the oscillator signal does not decrease it will be necessary to throw S3 to the number 10 position and again try P1 for a decrease in oscillator signal; should no such point be found, it will be necessary to try another value of standard resistor and repeat the previously described procedure.

When varying P1 a point should be found where the oscillator signal decreases sharply and if P1 is moved further the signal again becomes loud. The point of minimum oscillator signal is the null or balance point and the scale reading multiplied by the ratio setting, gives the ratio of the resistance value of the unknown resistor to the resistance value of the standard resistor.

When the ratio switch is in the number 1 position the scale of P1 reads in tenths, thus if the standard is 10 ohms and the scale reading is 2 the unknown resistance is 2 ohms, whereas if the ratio switch is in the number 10 position the resistance will be 20 ohms.

In order to secure a definite null point when measuring resistor values above approximately 1,000 ohms it is sometimes necessary to connect a small .00025 mfd. variable capacity across the standard resistor. If the null point is indistinct the condenser should be varied until the oscillator signal decreases, then readjust P1 to the best null point, i.e., the point of least signal.

Note: To measure the resistance of coils it is necessary to set up the bridge with a battery in place of the oscillator as described under the heading "DC Resistance Measurements."

Measurement of Paper Capacitors

To measure the unknown capacity of a paper condenser, it is necessary to set up the bridge as shown in Figure 6.

Notice that the unknown condenser is connected in the D arm of the bridge and that the standard is applied to the C arm.

For purposes of illustration we will measure the capacity of a condenser which is marked .1 mfd. Therefore, we will plug in our standard 1 mfd. condenser into the C arm and connect the unknown into the D arm of the bridge. Then connect the head-phones and oscillator and set the ratio switch to position 1 and turn the phasing controls to their full counter-clockwise position. Now by swinging the large bar knob of potentiometer P1 back and forth, you will find a point where the volume of the AC signal drops. Set the arm to the center of this point. If there is a little signal heard at the center of the null point, ground your body by touching the ground connection at the upper center tip jack and in addition try the phasing controls.

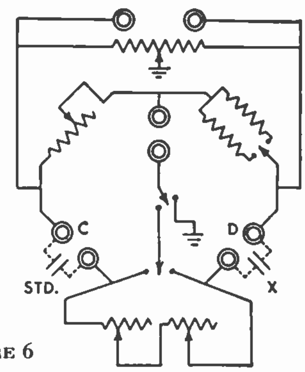


FIGURE 6

With switch S2 thrown to the C or "unknown" arm of the bridge, carefully increase the resistance of the "fine" or P3 potentiometer. If the signal increases, throw the switch S2 to the D or "standard" arm. If this does not cause a slight decrease of the signal, return the knob of P3 to zero and adjust the Wagner ground. Should the increase of P3 with S2 in either arm cause the signal to drop, keep adding resistance in P3 until the lowest signal point is found, or when necessary use P4 if P3 is not enough, and then readjust P1 to the null point. Continue this procedure until you secure the lowest possible amount of signal at one definite point on P1.

We will assume that this point is at 14 on the P1 scale, which means that .14 mfd. is the true value of the condenser which is labeled .1.

We would like to call your attention to the fact that the tolerance of paper condensers such as are used for bypass and filter work, is rather large.

Therefore, do not be surprised if you measure a condenser which is marked .25 and find that it is really much closer to .5, or, you may find that it is slightly less than the marked value. However, by the time you have measured several hundred paper condensers you will no longer be surprised at these discrepancies. Mallory paper condensers are held to strict tolerances and have less variance than those of inferior quality.

The standard capacitors recommended in the earlier part of this article give a range of .001 to 10 mfd. For larger capacity values it will be necessary to employ a larger standard, approximately 5 mfd., which will enable you to read up to 50 mfd. The best way of obtaining the 5 mfd. unit is to purchase a 5 mfd. oil filled motor starting or running condenser such as is used on certain refrigerator motors.

WARNING! Use only mica, oil filled or paper condensers for bridge standards. Make sure that the 5 mfd. unit you purchase is of the oil filled type.

After purchasing the 5 mfd. condenser, measure its capacity using your 1 mfd. standard. It will probably turn out to be something less than a full 5 mfd. However, you may use it as a standard and multiply its exact capacity by the ratio of the bridge. Thus, if the measured capacity of your oil filled condenser is 4.2 mfd., when it is used as a standard, a scale reading of 9 on the potentiometer P1, with the ratio switch in the high or No. 10 position, would indicate that the unknown capacitor has a value of 9 times 4.2, or 37.8 mfd. Such capacities will probably never be encountered except in electrolytic condensers.

Note—The procedure for measurement of electrolytic condensers will be covered in a later chapter.

For measuring capacity values below .001, a standard of .001 or smaller may be used. However, it is best to use the substitution method. The substitution method of measuring capacity value below .001 mfd. is extremely accurate. **The accuracy depends entirely upon the accuracy of the calibration curve of a standard variable condenser, and is independent of any bridge errors,** since the bridge conditions do not change during the actual measurement of the capacity. The circuit for the substitution method of capacity measurement is shown in Figure 7.

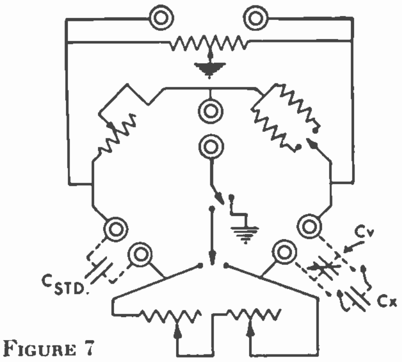


FIGURE 7

In the circuit you will note that condenser CV is variable, and that CX indicates the unknown capacity, arranged to be connected across CV by means of a double pole low capacity switch, such as a small knife switch or other low capacity arrangement.

The capacity of the variable condenser CV can be of any convenient value such as .0005, or .001 mfd., and the capacity standard can be a .001 mica condenser.

Condenser CX is connected across CV and the bridge is brought to balance by variation of P1 and the phasing controls. When the bridge is balanced, CX is disconnected from CV and the dial of CV turned so as to increase the capacity sufficiently to restore the balance of the bridge. The increase of capacity noted on the dial of CV is exactly equal to the unknown capacity.

Condenser CV might well be one of the older "43 plate" straight line capacity condensers, provided that it has good bearings and insulation. You may calibrate the dial of this condenser by placing it in shunt with a fixed capacity of .001 and measure its capacity at several settings in the regular bridge set-up, then draw a curve of the capacity vs. dial reading on graph paper.

To Measure Inductance

To measure inductance, the bridge is set up as shown in Figure 8.

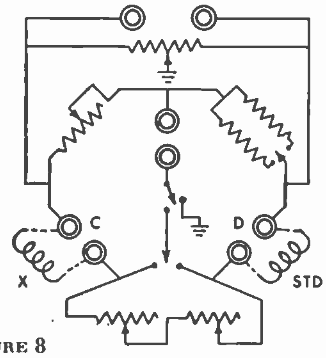


FIGURE 8

Note that the positions of the standard and unknown inductors are reversed from the positions given for the standard and unknown capacities. The unknown is connected in the C arm of the bridge, as is done in resistance measurements.

Sufficient explanation has been given to enable us to avoid details as to the procedure for measuring inductance, as it is carried out in exactly the same manner as the measurements for paper condensers.

The phasing controls will be found to be much more critical when measuring inductance values than when measuring capacity values. It is imperative that the phasing controls be carefully adjusted and in addition do not forget the use of the Wagner ground when making measurements of receiver components.

The largest inductor standard recommended for purchase was that of 1 henry. However, it is often necessary to measure inductance values much greater than the 10 henry range obtainable with this standard. Therefore, we advise that you either make or obtain a small iron cored coil having an inductance of approximately 10 henries. The inductance of this coil can be accurately measured and it can be used as a standard provided that it is of rugged construction and well sealed against the absorption of moisture. Such an inductance standard of 10 henries will allow a measurement of inductance values up to 100 henries.

For measuring small values of inductance, it is best to use a variable inductance along the same manner as outlined for the use of a variable capacity for the measurement of small capacity values. Such a variable inductance may well be one of the older variometers. However, it should be of good quality and of rugged construction with pig-tail connections to the rotor.

To Measure Capacity of Electrolytic Condensers

There are two methods for measuring the capacity of electrolytic condensers. The first method is to form the condenser by placing it on its rated working voltage for 4 or 5 minutes. Then disconnect the condenser, discharge it and proceed in the same manner of measurement as given for paper condensers. This method is particularly advantageous when working upon a receiver, in that the receiver may be turned on for several minutes, then turned off and the condenser, or at least one side of it, disconnected from the receiver circuit, and the bridge connected by means of flexible leads and the capacity measured.

When measuring filter condensers, the phasing controls will probably have to be adjusted to balance the resistance between the standard and the unknown capacitor. This is especially true when measuring old electrolytic condensers. The resistance of an old electrolytic condenser may run to a fairly high value, and the phasing controls will give a rather close check as to the resistance of the condenser, because their dials are calibrated and the standard condenser will probably have an insignificant amount of resistance. The lower the resistance of an electrolytic condenser, the better its condition.

The second method of measuring electrolytic capacitors requires the use of the application of a polarizing voltage during the measurement. This calls for a special set-up for providing the polarizing voltage.

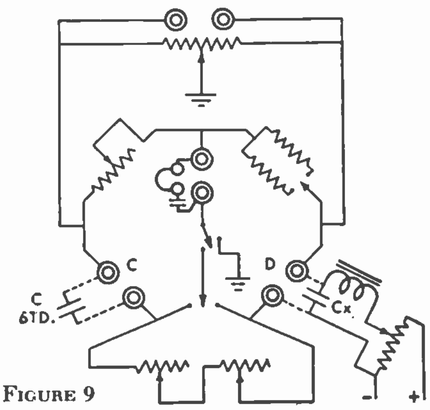


FIGURE 9

WARNING! Be careful when using the arrangement shown in Figure 9. Make sure before turning on the high polarizing voltage that there can be no short to damage the equipment or to give you a shock.

Note the blocking condenser in series with the head-phones. This condenser is for the purpose of preventing the flow of the direct "polarizing" voltage through the headphones. The 1000 henry choke shown may be obtained from any one of the leading transformer manufacturers. It should be of such construction as to maintain a large value of inductance even when carrying a leakage current of as much as 10 or 20 milliamperes.

The procedure to be followed is to first connect the standard condenser, and then connect in the unknown capacitor and to gradually raise the polarizing voltage, keeping an eye on the leakage current which is indicated on the milliammeter.

Do not raise the polarizing voltage too fast, as the condenser may have a very high leakage which is especially true if the condenser has been on the shelf; i.e., not connected to a polarizing voltage for some time. If such is the case, it will require a minute or two for the condenser to age down, and as the leakage current drops, the voltage may be increased until the full working voltage of the condenser is reached.

Be very careful, as a shorted condenser, or one with too high a leakage might ruin your milliammeter. It is hardly necessary to point out that a high scale range should be chosen for the milliammeter until after the condenser has been aged down, or found to be in good condition at which time the milliammeter may be shifted to a lower range to ascertain the exact leakage current.

The procedure for measuring the capacity is the same as that outlined for paper condensers, except that the phasing controls may require careful adjustment.

Miscellaneous Bridge Measurements

To ascertain the "impedance ratio" of a transformer, connect a known resistance across either the primary or secondary. Then connect the other winding to the C arm of the bridge and use a resistor, of the same value as that across the transformer, in the D arm of the bridge and adjust the bridge to the null point. The ratio which is shown on the bridge will be the impedance ratio of the transformer for the frequency at which the measurement was made. The voltage ratio of the transformer is the square root of the impedance ratio.

Another use of the bridge is to ascertain the match of an output transformer to a line or speaker, and in addition the impedance of various lines or speakers may be measured at different frequencies provided that a variable and calibrated oscillator is used with the bridge.

DC Resistance Measurement

The AC bridge cannot be used to measure the pure or DC resistance of coils. It is necessary to use a battery in place of the oscillator and a galvanometer or vacuum tube voltmeter in place of the head-phones when using the bridge to measure pure resistance values of coils. The connections of the standard and unknown resistors is the same as for the AC resistance measurements, i.e., the standard in the D arm and the unknown in the C arm. The ratio and P1 scale readings remain the same as for the AC procedure.

Frequency Measurement

One of the most unusual measurements that can be made on the AC bridge is that of frequency measurement.

The universal bridge may be used over a range of approximately 20 to 20,000 cycles. The set-up for the measurement is shown in Figure 10.

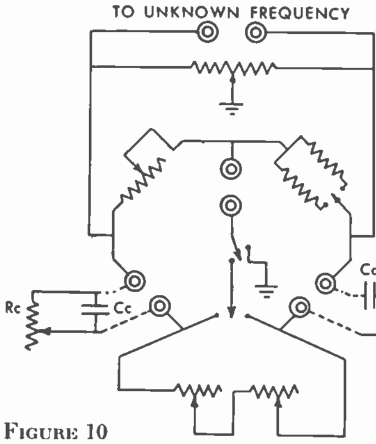


FIGURE 10

The formula for balance of this bridge circuit is: when arm B is twice A the frequency is

$$F = \frac{1}{6.28\ Rd\ Cd}$$

wherein Rd is resistance in ohms and Cd is expressed in farads. The two condensers must be of the same value and the two resistors must also be of the same value, thus the resistance of both Rc and Rd must be increased or decreased the same amount until balance or the null point is found. A single value of condenser capacity will allow a frequency range of ten to one to be covered with a suitable resistance change. It is not advisable to use a resistance value below 100 ohms. This circuit and formula is given for the advanced experimenter who can work out the required values of R and C for different ranges and carefully adjust and balance the bridge. An accuracy of 1% may be attained without extraordinary precision of parts. One should remember that it is difficult to distinguish between the fundamental frequency for which the bridge is balanced and the harmonics for which it is not balanced.

Vacuum Tube Voltmeter

The vacuum tube voltmeter is another very versatile and useful piece of equipment which is something every serviceman can well use to save time and lighten his work. A vacuum tube voltmeter may be purchased from well known test equipment manufac-

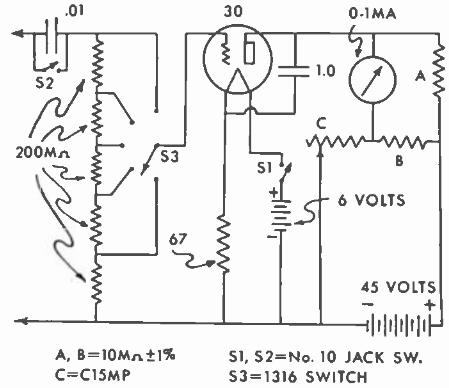


FIGURE 11

turers, or one may be assembled that is quite accurate. Such a simple yet accurate vacuum tube voltmeter is shown in Figure 11.

The vacuum tube voltmeter illustrated is a useful and handy device for measuring DC or audio frequencies. It has a range of three to four volts which is easily multiplied by means of the voltage divider and therefore the useful range will extend up to twenty volts.

When measuring DC the switch S2 should be closed and the positive side of the circuit applied to the grid. An extra tap on the voltage divider switch will allow the reading of bias cell voltages which of course should never be undertaken with the voltage divider in the circuit.

This meter may not be sensitive enough for use with the bridge when reading DC resistance values.

Voltage gain and AVC voltages are easily checked with this meter. In addition, it may be hooked across the AVC circuit for use as an indicator when aligning the receiver.

The assembly should be placed in a neat box. If meters are scarce, we suggest that two 500 type pin tip jacks be used so that you may plug in your analyzer meter and avoid the expense of a separate meter. After assembly, turn on the switches and with the input shorted, the 15,000 ohm potentiometer adjusted until the meter reads zero. Then by applying known measured voltages across the input and plotting the reading of the meter against the applied voltage, a curve may be established so that the true applied voltage may be read at any time. This meter will hold its calibration for long periods of time and is not affected by falling of the battery voltage, because this is compensated by adjusting the 15,000 ohm potentiometer.

Auto Radio Interference

ELIMINATING interference from auto receivers is a tedious and exasperating job. Quite often it is necessary to "hunt" for the trouble. When the noise or interference is noticed with the car standing still, it is a good stunt to use a noise locator consisting of a small metal ball or disc attached to an insulating rod and having a shielded lead attached to the ball or disc and plugged-in or attached to the antenna lead-in of the receiver. With this device one may ascertain the point on the car where the noise is loudest and in addition locate the various rods, wires and tubes which carry the noise to the antenna or to the receiver.

There is no "cure-all" for auto radio interference because each car, although of the same make, presents different problems. We suggest that you consult the following tabulated sources of troubles and cure.

CHASSIS AND ANTENNA PICK-UP

Two classes of interference exist in auto radio, chassis (lead) pick-up and antenna pick-up. To determine which one exists, ground the antenna lead close to the receiver. If the interference is eliminated, it is antenna pick-up. If interference continues, it is chassis or lead pick-up.

CHASSIS PICK-UP

If interference is found to be chassis pick-up, be sure that all ground connections are clean and tight, all cables, tubes and pipes are grounded and are not rubbing against metal body parts or the receiver itself. If receiver has been properly installed according to the manufacturer's specifications, as to suppressors, condensers, filters, and the receiver wires have been kept out of the motor compartment or have been properly shielded, there should be no chassis noise.

ANTENNA PICK-UP

If interference is antenna pick-up, be sure that the antenna lead is properly shielded from the receiver to the antenna and that it is well grounded. The antenna lead should be brought down the post nearest the receiver. It should never be brought down the same post with the dome light wires. If an under car aerial is used, a .5 mfd. condenser should be put on the tail light and stop light wires to ground. In extremely bad cases, insert an R.F. choke in series. This choke consists of about fifty turns of No. 16 insulated wire on ¾-inch form. Keep antenna lead as far away from generator and starter as possible. If interference continues, then systematically check all parts and conditions that sometime cause noise.

ROTOR ARM OF DISTRIBUTOR

The rotor arm of the distributor should be peened to reduce the gap between it and the contacts in the distributor head. The gap between the arm and contacts should be about .004 inches maximum. **Care must be taken that the rotor does not touch any of the contacts.** After peening dress the rotor down with a file to its original shape. If the rotor is double ended, both ends should be treated in the same manner. One end should be completed before doing the other. It is better to peen the rotor than to build it up with solder, as solder soon burns away. It is now possible to purchase longer rotors. These are usually the same part number but with a suffix such as the letter A. Sometimes connecting a .002 to .006 mica condenser directly across the primary breaker points of the distributor helps eliminate stubborn cases of interference. Adjust spark plug points to a gap of approximately .028 inches.

IGNITION NOISE—LOW TENSION

Remove the high tension wire between the coil and distributor, turn the ignition switch on and crank the car. If a click is heard in the speaker, it is an indication that at least part of the noise is from the distributor breaker points or the low tension circuit. In this case, replace the primary lead running from the ignition coil to the breaker points of the distributor with No. 14 shielded low tension cable. Ground this cable in two places with connections as short as possible. In some cases, it may be necessary to replace the switch to ignition coil lead with No. 14 shielded low tension cable, making a good ground on the shielding. Be careful of the shielded leads so that the coil, switch or distributor connections are not grounded. In some cases of persistent interference a small R.F. choke—about 25 turns of No. 14 wire—in series with the primary distributor lead may be necessary.

IGNITION NOISE—HIGH TENSION

If, when making the click test, no clicking is heard in the speaker, then the interference is caused by the high tension secondary circuit of the ignition system. Low tension wires that are parallel or in the field of the high tension circuits act as carriers and should be moved at least 3 inches from them. Where the high and low tension wires are housed in the same manifold, removing the low tension wire is usually sufficient.

If the ignition coil is on the dash or under the cowl, one of two things must be done:

First, shield the high tension coil to distributor lead. This can be done by covering the lead first with flexible loom and then with copper shielded loom, grounding one end to the coil frame and the other to the motor block or manifold. This lead should run as direct as possible from the coil to motor compartment even if it is necessary to drill a new hole in the dash. In some cases, it may be necessary to shield the entire coil. This can be done by shielding the coil with a copper can and grounding it to the coil mounting. Second, it may be necessary in some cases to move the coil into the motor compartment because of the effect of the electro-magnetic field of the coil on the receiver. Mount the coil on the motor block as closely as possible to the distributor, making sure that you have a good ground connection. The new primary wire should be No. 14 shielded low tension cable. Do not run this wire close to the high tension leads and be sure the shield is well grounded.

DOME LIGHTS

The dome light is usually the greatest source of antenna pick-up interference. First check the dome light by disconnecting the dome light connection back of dash and grounding the wire. This should eliminate the interference. If so, put a 1 mfd. condenser from the dome light wire to ground at the corner post. It may also be necessary to place a small R.F. choke in series with the dome light wire. The condenser should be connected on the ammeter side of the choke coil. This choke coil consists of about 50 turns of No. 16 wire wound on about a ½-inch wooden form.

LOOSE CONNECTIONS

Loose connections are a frequent cause of interference. Be sure light bulbs are tight in their sockets, that all battery cable connections are tight and well grounded, that secondary leads at distributor and spark coil leads are making good tight contact. Ground all control cables and metal tubing that pass through the dash with a good short ground lead. Be sure that the generator brushes and commutator are clean and in good condition. Otherwise filtering will be a waste of time. Sometimes it is necessary to use a .5 mfd. condenser on the generator at the battery side in addition to the usual condenser.

ACCESSORIES

Accessories, such as lighters, electric motor heaters, horns, and light switches are often a source of interference. In these cases the procedure is to try a condenser from ground to the various accessories until the interference is eliminated, then install the condenser in those places permanently. **Spark intensifiers should not be used.**

PASSENGER BODY PICK-UP

In some cars a person's body acts as a carrier of noise from the floor boards to the roof antenna. When this happens, shield the floor boards of the front seat by covering them with a copper screen and grounding it at several places to the frame.

OVERCOMING SOME NOISES

Radio spark plugs with built-in suppressors have been found very satisfactory, from both appearance and service standpoints. A .5 mfd. condenser from the low tension lead on the coil to ground has in some cases improved noisy reception and in others it has increased the noise. Only by experimenting on each installation can you determine whether to use this or not. **Never attach any condenser to the low voltage lead running from the coil to the distributor.**

Dirty and improperly spaced spark plug and distributor points are sure to cause noise. Clean and check them for proper gap and also check distributor condenser.

LOCAL INTERFERENCE

Interference picked up from powerlines and electrical equipment should not be confused with ignition noise. Electrical or outside interference will be heard whether car is running or not. Ignition noise should be checked in a location that is free of outside disturbances.

BODY NOISE

Noise heard in the receiver when the car is in motion with the motor shut off may be body or wheel noise. It is heard most often when traveling over rough streets or roads. These noises are caused by loose parts and connections. To eliminate this form of interference, tighten all chassis bolts and loose parts, ground all "floating" parts and parts that are poorly grounded. Also check all cables, tubes and shafts that might be coming in contact with some other metal part of the car or receiver.

WHEEL OR BRAKE NOISE

The front brakes sometimes accumulate static and cause interference due to a poor ground in the front wheels and a peculiarly constructed lining. If this condition is suspected, set the car in motion, then with the motor shut off and the clutch disengaged, apply the brakes. If the interference is eliminated then the front wheels are the cause. To overcome this condition, use graphite grease or insert grounding springs in the internal hub caps. In the case of external brakes, it is necessary to ground the brake bands to the chassis.

STATIC NOISE

Tail light, stop light, head light or horn wires sometimes pick up static charges from the tires and cause interference. To determine if these are at fault, drive the car from a dry pavement onto a wet one. If the wet pavement eliminates the noise, then the light wire should be shielded and the shield grounded. Noise is sometimes caused by the antenna being too close to body metal of car. Antenna should be checked for this condition, regardless of whether the car manufacturer or an individual has installed it.

CHOKES

It is necessary in a number of cases to use R.F. chokes in addition to bypass condensers in order to eliminate bad cases of noise. It may be necessary to use these chokes in any of the light wires, the "A" battery lead, or even the voice coil or field leads of the speaker, if the speaker is a separate unit. In some cases, it is necessary to ground the windshield wiper and the rain troughs. The hood of the car should be well grounded. This can best be done by looping the hood tape at several points with metal braid and then soldering the braid to the bulkhead or to the inside of the radiator shell. The hood should be scraped free of paint where it contacts the braid.

Storage batteries that test less than 5 volts with the set and all lights on should be inspected thoroughly. The battery acts as a large condenser that by-passes a lot of interference and if the battery is in poor condition interference will be increased.

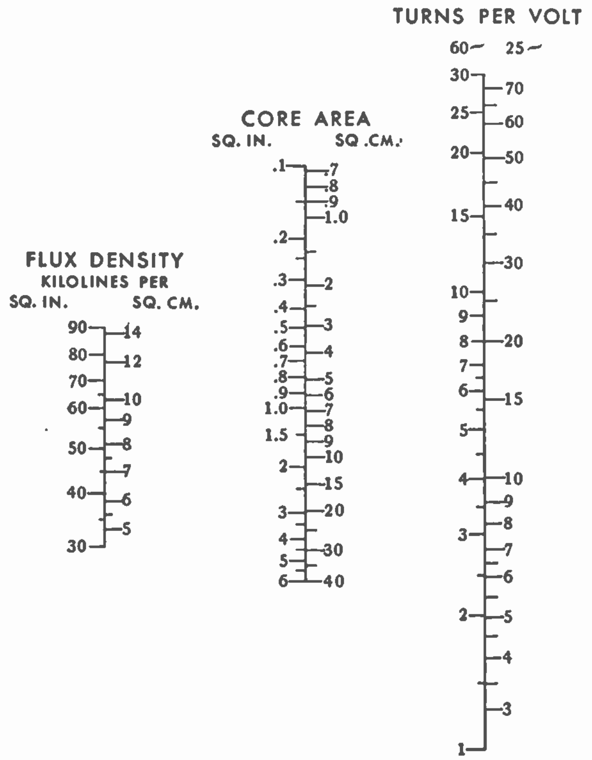
STATIC DISCHARGE

Parts of a car that are poorly grounded or not grounded at all sometimes accumulate charges of static electricity which, from time to time, is discharged to grounded parts and causes interference. Friction between tire and road may cause this. To overcome this static, attach a commercial brass wiper under the retaining nut on the spindle so that it contacts the wheel hub or cap. In cases of wooden wheels, it is necessary to ground the rim to the hub. On cars having floating power, free wheeling, etc., a static discharge occurs whenever the motor is not delivering power to the drive shaft, because of the emergency brake being on the drive shaft. This interference may be eliminated by mounting a small carbon brush and holder so that the brush makes contact with the emergency brake drum between the ends of the brake bands. Then ground the brush holder.

SUMMARY

The Galvin Mfg. Co. give the following suggestions in their "Motorola Service Manual" for the suppression of ignition interference. These hints are given in the order of their importance.

1. Apply suppressors to spark plugs and distributor.
2. Apply generator condenser.
3. Reroute primary wire from coil to distributor, keeping it as far as possible away from high tension wire.
4. Connect dome-light filter to dome-light wire at point where it enters front corner post.
5. Shield high tension wire if coil is mounted on instrument panel.
6. Shield antenna lead-in wire from radio set to top of front corner post. Ground shield at both ends.
7. Shield primary wire from coil to distributor.
8. Connect a .002 to .006 high grade mica condenser directly across the primary breaker points of the distributor.
9. Bond the upper metal parts of the car body to one another and return a heavy copper bond from these points down to the bulkhead of the car. (This is usually necessary in cars using composite wood and metal body construction.)
10. Bond where necessary all control rods and pipes passing through the bulkhead.
11. Shield head of coil when mounted on instrument panel.
12. Cover floor boards of car with copper screening.
13. Adjust spark plug points to approximately .028 of an inch.
14. Clean and adjust primary distributor breaker points.
15. In cars having rubber motor mountings, connect heavy bond from grounded side of battery directly to frame of car.
16. Connect a .5 to 1 mfd. condenser from hot primary side of ignition coil to ground.
17. If ignition coil is mounted on driver's side of bulkhead, move it to the motor compartment side, using the same holes for mounting.
18. Clean ignition system wiring. Clean and brighten all connections. Replace any high tension wiring having imperfect insulation.
19. Ground metal sun visor and rain troughs if necessary.
20. Make sure hood of car is well grounded. Clean hold-down hasps on both sides.
21. Ground instrument panel and steering column to bulkhead.
22. When under-car aerial is used, connect a .5 mfd. condenser to tail and stop light wires.

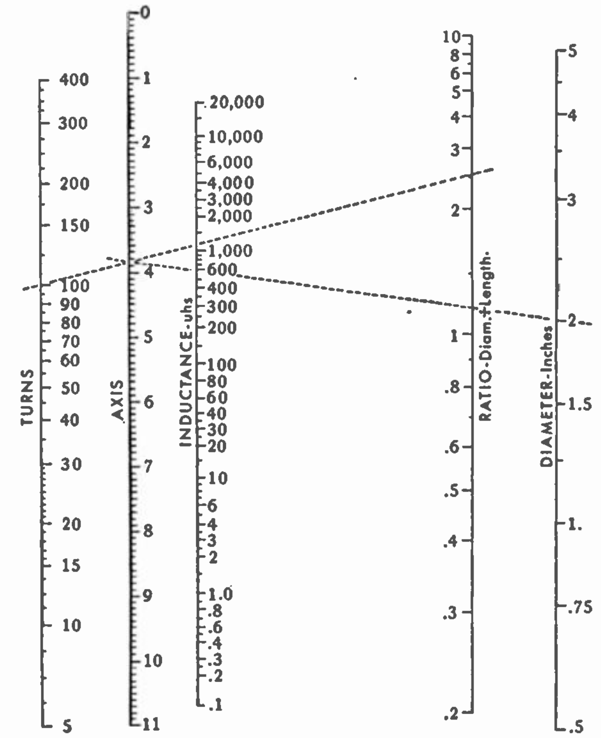


Transformer Turns-Per-Volt Chart

Knowing the flux density of the core area, the turns per volt for either a primary or secondary may be determined by merely drawing a straight line from the flux density column through the core area column the extension of the line terminating in the turns per volt column.

Flux density is a quality of the kind of iron used. The flux density of different types of core material may be found by referring to any of the standard works on electricity.

For convenience, the flux density column is divided into kilolines per square inch and kilolines per square centimeter. The core area is also divided into square inches and square centimeters. The turns per volt column gives values for sixty cycle on the left of the column and for twenty-five cycle on the right.



Coil Turns, Inductance and Diameter

Knowing the turns of a coil, its length of winding, and the diameter, the inductance may be found by using a straight-edge from the turns column to the ratio (length of winding) column, intersecting the axis column; then a second line from the intersection of the axis column to the diameter column. The inductance in microhenrys will be the point where the second line intersects the inductance column. In the above chart the first line is laid from 100 turns to 2.5 ratio (which is length of winding), this first line intersecting the axis at 3.8 on the scale. The second line is from 3.8 on the axis scale to the 2 inch diameter, intersecting the inductance column at 600 microhenrys.

Knowing the diameter, ratio and the inductance, the number of turns may be found by reversing the process. As shown in the chart, draw a line from 2 inch diameter through the 600 microhenrys intersecting axis at 3.8 on the scale; then run line from 3.8 on axis scale to 2.5 on ratio (length of winding), the extension of this line cutting the turns scale at 100 which is the number of turns.

After finding number of turns, consult wire table to determine size of wire which will permit given number of turns in a given length of winding.

Conversion

Factors for conversion—alphabetically arranged.

Multiply	By	To Get
Amperes	× 1,000,000,000,000	micromicroamperes
Amperes	× 1,000,000	microamperes
Amperes	× 1,000	milliamperes
Cycles	× .000,001	megacycles
Cycles	× .001	kilocycles
Farads	× 1,000,000,000,000	micromicrofarads
Farads	× 1,000,000	microfarads
Farads	× 1,000	millifarads
Henrys	× 1,000,000	microhenrys
Henrys	× 1,000	millihenrys
Kilocycles	× 1,000	cycles
Kilovolts	× 1,000	volts
Kilowatts	× 1,000	watts
Megacycles	× 1,000,000	cycles
Mhos	× 1,000,000	micromhos
Mhos	× 1,000	millimhos
Microamperes	× .000,001	amperes
Microfarads	× .000,001	farads
Microhenrys	× .000,001	henrys
Micromhos	× .000,001	mhos
Micro-ohms	× .000,001	ohms
Microvolts	× .000,001	volts
Microwatts	× .000,001	watts
Micromicrofarads	× .000,000,000,001	farads
Micromicro-ohms	× .000,000,000,001	ohms
Milliamperes	× .001	amperes
Millihenrys	× .001	henrys
Millimhos	× .001	mhos
Milliohms	× .001	ohms
Millivolts	× .001	volts
Milliwatts	× .001	watts
Ohms	× 1,000,000,000,000	micromicro-ohms
Ohms	× 1,000,000	micro-ohms
Ohms	× 1,000	milliohms
Volts	× 1,000,000	microvolts
Volts	× 1,000	millivolts
Watts	× 1,000,000	microwatts
Watts	× 1,000	milliwatts
Watts	× .001	kilowatts

Conversion Table Frequency to Wavelength

$$\text{Wavelength in Meters} = \frac{300{,}000}{\text{Frequency in Kilocycles}} \text{ or } \frac{300}{\text{Frequency in Megacycles}}$$

Long-Wave Broadcast Band		Short Waves	
Frequency Kilocycles	Wavelength Meters	Frequency Megacycles	Wavelength Meters
550	545	1.5	200
600	500	2	150
650	461	3	100
700	429	4	75.0
750	400	5	60.0
800	375	6	50.0
850	353	7	42.9
900	333	8	37.5
950	316	9	33.3
1000	300	10	30.0
1050	286	11	27.3
1100	273	12	25.0
1150	261	13	23.1
1200	250	14	21.4
1250	240	15	20.0
1300	231	16	18.8
1350	222	17	17.6
1400	214	18	16.7
1450	207	19	15.8
1500	200	20	15.0

Characteristics of Receiving Tubes

THE time has long since passed when a serviceman, an amateur or an engineer could quote from memory the "basing" and all the "characteristics" of the available vacuum tubes. From a modest beginning, the number of types has increased to a total so great that not even the type designations can be memorized with assurance. The purpose of the consolidated tube charts shown on following pages, is to group the essential data on each type so that information may be had in a minimum of time.

Glass Octal Base Tubes

In studying the vacuum tubes available today, two groups can be formed. The first includes tubes of the conventional glass type manufactured prior to the introduction of the metal tube in April, 1935. The second group includes all-metal tubes and several classes of glass tubes designed to be interchangeable with metal tubes.

Glass tubes designed to be interchangeable with the all-metal types can be subdivided into two general classifications. First of these is the "G" classification (or group) in which the tubes are glass but are equipped with the octal base first introduced on metal tubes. These "G" tubes, except for the base, appear to be exactly like certain of the conventional glass tubes and indeed they are. For example, type 6K7G is a 78 with an octal base and type 6A8G is type 6A7 with an octal base. When fitted with a "glove" shield, these tubes are practically interchangeable with the all-metal 6K7 and 6A8 types.

Metal-Glass Tubes

The second group includes the "metal-glass" tubes. These MG tubes are the conventional glass types which correspond in characteristics to the all-metal tubes but they are equipped with the octal-type base and are covered with a close-fitting sleeve cover of shield metal. In general they are designated with the same number used for the all-metal tubes followed by the suffix MG. In receivers of modern design, the MG tubes like those in the G classification can be substituted for all-metal tubes with small realignment adjustments. The smallest of the metal-glass tubes are the "Coronet" type. These, except for height, correspond to the regular MG tubes, although they are designated with the same type numbers which apply to the all-metal tubes.

Present Numbering System

The application of type designations to vacuum tubes was a haphazard process until the Radio Manufacturers Association set up a committee of engineers from the radio tube industry to handle the numbering of tubes and associated problems connected with the new types. From this committee came the present numbering system of: a numeral to indicate approximate filament or heater operating voltage; a letter to show the function of the tube, and a numeral to indicate the number of elements. Thus the 25Z5 tells by its first numeral group that the filament or heater operates at approximately 25 volts, by the letter Z; that the tube is a rectifier, and by the final numeral that the tube has five connected elements: i.e., two plates, two cathodes and one common heater. Reference to the charts will show that more than seventy-five tubes appear under the old numbering system of an arbitrary numeral. No doubt there are many more tubes in this class which for some reason (usually poor adaptability to circuits) were dropped by the manufacturer who introduced them.

Special Tubes

Among the special tubes listed in the charts are several of the "spray shield" type introduced by Majestic. The replacement tubes now furnished for them are no longer sprayed with metal in most cases, but are fitted with a "glove shield" soldered at the joints.

Socket Connections

The basing views shown with the tube charts are for the bottom of the tube base or the bottom of the socket. This arrangement provides the clearest picture of connections, since construction (or service) involves the bottom of the base in all cases. The pin numbering, looking at the bottom of the base or socket, runs clockwise. In the conventional base glass tubes, with the filament or heater pins toward the observer, the left-hand pin is number one. In the octal base tubes, looking at the bottom of the base, the first pin in a clockwise direction from the key is the No. 1 pin. While this explanation is unnecessary in reference to the base diagrams shown, it is useful in checking the basing of new types where the pin numbers and their corresponding internal connections may be published without a diagram.

Plate Supply Voltage

The data given in the tube charts covers essential points of interest for each type. It should be noted that the plate *supply* voltage is indicated. In resistance-coupled amplifiers, the *actual* plate voltage will be considerably lower due to the drop in the plate resistor. In adjusting bias to the proper value, this lower plate voltage should be taken into account.

Internal Capacitance

The values of internal capacitance are useful in the design of radio-frequency circuits and in figuring shunt effect on high audio frequencies in high-gain, resistance-coupled amplifiers.

Filament voltages should be held within a few percent for the older thoriated, tungsten-filament tubes such as the 01A, V99 and X99. Oxide-coated filaments and the heaters for oxide-coated cathode tubes should be maintained within 10 percent of the rated values.

COMPLETE TUBE CHART

See Supplementary Chart on page 203

Type No.	DESCRIPTION: Type	DESCRIPTION: Cathode	Basing See Socket Connection Chart on Page 202	Fil. Current Amps.	CAPACITANCES Micro-Microfarads: Grid Plate	CAPACITANCES: Input	CAPACITANCES: Output	OPERATING CONDITIONS AND CHARACTERISTICS: When Used As	Plate Supply Volts	Screen Grid Volts	Grid Bias Volts (Neg.)	Plate Current MA.	Ampl. Factor	Plate Resis. Ohms	Mut. Cond. μMhos.	Max. Undist. Output Watts	Recomm. Load Resis. Ohms	Cut-Off Bias Volts
1.1 VOLT D.C. DETECTOR AND AMPLIFIER TUBES																		
WD-11	Triode	Fil.	4F Spec. 4 Pin	0.25	3.3	2.5	2.5	Grid Leak Detector	45		+A							
WX-12			4D Med. 4 Pin					Amplifier	90		4.5	2.5	6.6	15500	425	0.007	15000	
									135		10.5	3.0	6.6	15000	440	0.040	15000	
864	Triode	Fil.	4E Sm. 4 Pin	.25				Non-Microphonic Amplifier	90		4.5	2.9	8.2	13500	610		15000	
									135		9.0	3.5	8.2	12700	645		15000	
2.0 VOLT D.C. DETECTOR AND AMPLIFIER TUBES																		
15	Pentode	Heater	5F Sm. 5 Pin	.22				Detector-Oscillator	135	67.5	15	1.85	500	800000	750			
30	Triode	Fil.	4D Sm. 4 Pin	0.060	6.0	3.7	2.1	Bias Detector	180		18							
								Amplifier	135		9	3	9.3	10300	900	.07	20000	
									180		13.5	3.1	9.3	10300	900	0.13	20000	
31	Triode	Fil.	4D Sm. 4 Pin	0.130				Amplifier	135		22.5	8	3.8	4100	925	0.185	7000	
									180		30	12.3	3.8	3600	1050	0.375	5700	
32	Tetrode	Fil.	4K Med. 4 Pin	0.060	0.015 Max.	6.0	11.7	Detector	180	67.5	6						150000	
								Amplifier	135	67.5	3	1.7	610	.95M Ω	640			9
									180	67.5	3	1.7	780	1.2M Ω	650			9
33	Pentode	Fil.	5K Med. 5 Pin	0.260				Amplifier	100	100	8	10.5	60	50000	1200	0.30	7000	
									135	135	13.5	14.5	70	50000	1450	0.70	7000	
34	Remote Cut-Off Pentode	Fil.	4M Med. 4 Pin	0.060	0.015 Max.	6.0	12.6	1st Detector	67.5 to 180	67.5	5							
								Amplifier	135	67.5	3	2.8	360	0.6M Ω	600			27
									180	67.5	3	2.8	620	1.0M Ω	620			27
49	Double Grid Triode	Fil.	5C Med. 5 Pin	0.120				Class A	135		20	5.7	4.5	4000	1125	0.17	11000	
								Cl. B (Avg. 2 tubes)	180		0	4 to 30				3.0	9000 Min.	
19	Twin Triode	Fil.	6C Sm. 6 Pin	0.260				Complete Cl. B (Both Sections)	135		0	10 to 35				2.1	10000	
									135		3	4 to 35				1.9	10000	
1A4	Tetrode	Fil.	4K Sm. 4 Pin	0.060	0.007 Max.	4.6	11	Amplifier	180	67.5	3	2.3	720	0.90M Ω	750			20
1A6	Heptode	Fil.	6L Sm. 6 Pin	0.060	0.8	5	6	Oscillator Section	135		a50000 Ω b20000 Ω	2.3						
					0.25	10.5	9	Mixer Section	(a) 180	67.5	3	1.3		0.5M Ω	300	Conversion Conductance	Rc0.02M Ω	22.5
									(b) 180	45	−F	1.2		0.6M Ω	250			11
1B4	Tetrode	Fil.	4K Sm. 4 Pin	0.060	0.007 Max.	4.6	11	1st Detector	180	67.5	6							
951								Amplifier	180	67.5	3	1.7	780	1.0M Ω	650			9
1B5 25S	Duplex Diode Triode	Fil.	6M Sm. 6 Pin	0.060	3.6	2	3	Diode Detect. Triode Amplifier	135		3	0.8	20.0	35000	575			

1C6	Heptode	Fil.	6L Sm. 6 Pin	0.120	1.5	6	6	Oscillator Section	180		0.05M Ω	3.3				Conversion Conduc-tance	Rc 0.02M Ω	
					0.3	10	10	Mixer Section	180	67.5	3	1.5		0.75M Ω	325			14
1F4	Pentode	Fil.	5K Med. 5 Pin	0.120				Amplifier	135	135	4.5	8.0	340	0.2M Ω	1700	0.34	16000	
1F6	Duo Diode Pentode	Fil.	6T Sm. 6 Pin	.060	.007	4	9	R. F. Det.-Ampli.	180	67.5	1.5	2.0	650	1 Meg.	650			12.0
								A. F. Det.-Ampli.	135	135 Supply	2.0	Plate Resistor .25 Meg.; Screen Resistor .8 Meg.						

2.5 VOLT A.C. DETECTOR AND AMPLIFIER TUBES

24A	Tetrode	Heater	5E Med. 5 Pin	1.75	0.007 Max.	5.0	10.5	Detector	250	45	5						0.25M Ω	
								A. F. Amplifier	250	25	1	0.5	1000	2.0M Ω	500		0.1M Ω	
								R. F. Amplifier	180	90	3	4.0	600	0.4M Ω	1000			15
									250	90	3	4.0	630	0.6M Ω	1050			15
26	Triode	1.5V A.C. Fil.	4D Med. 4 Pin	1.5 V 1.05a	8.1	3.5	2.2	Amplifier	135		10	5.5	8.3	7600	1100	0.08	8800	
									180		14.5	6.2	8.3	7300	1150	0.18	10500	
27	Triode	Heater	5A Sm. 5 Pin	1.75	3.3	3.5	3.0	Bias Detector	250		30							
								Amplifier	135		9	4.5	9	9000	1000	0.08	13000	
									180		13.5	5.0	9	9000	1000	0.165	19000	
									250		21	5.2	9	9250	975	0.30	34000	
35 51	Remote Cut-Off Tetrode	Heater	5E Med. 5 Pin	1.75	0.007 Max.	5.0	10.5	1st Detector	250	90	7 App.							
								Amplifier	180	90	3	6.3	305	0.3M Ω	1020			50
									250	90	3	6.5	420	0.4M Ω	1050			50
45	Triode	Fil.	4D Med. 4 Pin	1.50				Single Amplifier	180		31.5	31	3.5	1650	2125	0.82	2700	
									275		56	36	3.5	1700	2050	2.0	4600	
								Push-Pull (Avg. 2 Tubes)	300		70	44 to 70				10	9000	
46	Double Grid Triode	Fil.	5C Med. 5 Pin	1.75				Class A	250		33	22	5.6	2400	2350	1.25	6400	
								Cl. B (Avg. 2 tubes)	300		0	8 to 70				16	5000 Min.	
									400		0	12 to 75				20	5500 Min.	
47	Pentode	Fil.	5B Med. 5 Pin	1.75				Amplifier	250	250	16.5	31	150	60000	2500	2.7	7000	
53	Twin Triode	Heater	7B Med. 7 Pin Lg. Pin Circle	2.0				Cl. A (Parallel Conn.)	294		6	7	35	11000	3200	0.37	35000	
								Complete Cl. B (Both Sections)	250		0	28 to 50				8	8000	
									300		0	35 to 50				10	10000	
55	Duplex Diode Triode	Heater	6G Sm. 6 Pin	1.0	2.0	2.0	4.0	Diode Detector	180		13.5	6	8.3	8500	975	0.16	20000	
								Triode Amplifier	250		20	8	8.3	7500	1100	0.35	20000	
56	Triode	Heater	5A Sm. 5 Pin	1.0	3.2	3.2	2.2	Bias Detector	250		20							
								Amplifier	250		13.5	5.0	13.8	9500	1450	0.26	47000	
57	Pentode	Heater	6F Sm. 6 Pin	1.0	0.007 Max.	5.0	6.5	Detector	250	100	3.8						0.25M Ω	
								Amplifier	250	100	3	2.0	2000	2.0M Ω	1225			7
58	Remote Cut-Off Pentode	Heater	6F Sm. 6 Pin	1.0	0.007 Max.	5.0	6.5	1st Detector	250	100	10							
								Amplifier	250	100	3	8.2	1280	0.8M Ω	1600			50
59	Triple Grid	Heater	7A Med. 7 Pin Lg. Pin Circle	2.0				Class A Triode	250		28	26	6	2400	2600	1.25	5000	
								Class A Pentode	250	250	18	35	100	40000	2500	3	6000	
								Cl. B Triode (Avg. 2 tubes)	400		0	25 to 75				20	6000 Min.	

Type No.	DESCRIPTION Type	Cathode	Basing See Socket Connection Chart on page 202	Fil. Current Amps.	CAPACITANCES Micro-Microfarads Grid Plate	Input	Output	OPERATING CONDITIONS AND CHARACTERISTICS When Used As	Plate Supply Volts	Screen Grid Volts	Grid Bias Volts (Neg.)	Plate Current MA.	Ampl. Factor	Plate Resis. Ohms	Mut. Cond. µMhos.	Max. Undist. Output Watts	Recomm. Load Resis. Ohms	Cut-Off Bias Volts
2.5 VOLT A.C. DETECTOR AND AMPLIFIER TUBES *(continued)*																		
2A3	Triode	Fil.	4D Med. 4 Pin	2.5				Single Amplifier	250		45	60	4.2	800	5250	3.5	2500	
2A3H		Heater	4Q	2.8				Cl. AB (2 tubes)	300	Self Bias	62	80 to 100				10	5000	
									300	Self Bias	62	80 to 150				15	3000	
2A5	Pentode	Heater	6B Med. 6 Pin	1.75				Pentode	250	250	16.5	34	220	0.1M Ω	2300	3	7000	
								No. 2 Gr. to Pl. Class AB Triode 2 tubes	350		38	42 to 90				18	8000	
2A6	Duplex Diode Triode	Heater	6G Sm. 6 Pin	0.8	2.0	2.0	4.0	Diode Detector	250		2	0.8	100	91000	1100			
								Triode Amplifier	250		2	0.1					0.25M Ω	
2A7	Heptode	Heater	7C Sm. 7 Pin	0.8	1.0	7	5.5	Oscillator Section	250		50000 Ω	4					Rc 0.02M Ω	
					0.3	8.5	9	Mixer Section	250	100	3	4		0.36M Ω	520	Conversion Conductance		45
2B7	Duplex Diode Pentode	Heater	7D Sm. 7 Pin	0.8	0.010 Max.	3.3	10	Diode Detector	100	100	3	5.8	285	0.3M Ω	950			17
								R. F. Amplifier	250	100	3	6.0	800	0.8M Ω	1000			17
								Dio. Det. & A. F. Amp.	250	50	4.5	0.65					0.20M Ω	
3.3 VOLT D.C. DETECTOR AND AMPLIFIER TUBES																		
20	Triode	Fil.	4D Sm. 4 Pin	0.132				Amplifier	135		22.5	6.5	3.3	6300	525	0.110	6500	
V-99	Triode	Fil.	4E Spec. 4 Pin	0.063	3.3	2.5	2.5	Grid Leak Detector	45		+A	1.5	6.6	17000	370			
X99			4D Sm. 4 Pin					Amplifier	90		4.5	2.5	6.6	15500	425	0.007	15500	
22	Screen Grid	Fil.	4K Med. 4 Pin	0.132	0.020 Max.	3.3	12	R. F. Amplifier	135	67.5	1.5	3.7	160	0.32M Ω	500			7.5
								Audio Amplifier	180	22.5	0.75	0.3	350	2.0M Ω	175		0.25M Ω	
5.0 VOLT D.C. DETECTOR AND AMPLIFIER TUBES																		
12A	Triode	Fil.	4D Med. 4 Pin	0.25	8.0	4.0	2.0	Amplifier	135		D. C. 9.0 / A. C.	6.2	8.5	5100	1650	0.13	9000	
									180		13.5	7.7	8.5	4700	1800	0.85	10700	
71A	Triode	Fil.	4D Med. 4 Pin	0.25				Amplifier	135		27.0 / 29.5	17.3	3.0	1820	1650	0.40	3000	
									180		40.5 / 43.0	20	3.0	1750	1700	0.79	4800	
200A	Cs. Vapor Triode	Fil.	4D Med. 4 Pin	0.25	8.5	3.2	2.0	Grid Leak Detector	45		−A	1.5	20	30000	670			
01A	Triode	Fil.	4D Med. 4 Pin	0.25	8.1	3.1	2.2	Grid Leak Detector	45		+A	1.8	8.0	12000	670			
								Amplifier	90		4.5	2.5	8.0	11000	725	0.015	25000	
									135		9	3.0	8.0	10000	800	0.055	20000	
40	Triode	Fil.	4D Med. 4 Pin	0.25	8.8	3.4	1.5	Bias Detector	180		4.5	0.1					0.25M Ω	
								Audio Amplifier	180		3	0.2	30	0.15M Ω	200		0.25M Ω	

6.3 VOLT A.C. OR D.C. DETECTOR AND AMPLIFIER TUBES

36	Tetrode	Heater	5E Sm. 5 Pin	0.30	0.007 Max.	3.7	9.2	Detector	180	67.5	6						0.25M Ω	
								Amplifier	100	55	1.5	1.8	470	0.55M Ω	850			7
									250	90	3	3.2	595	0.55M Ω	1080			7
37	Triode	Heater	5A Sm. 5 Pin	0.30	2.0	3.5	2.2	Bias Detector	180		20							
								Amplifier	90		6	2.5	9.2	11500	800	0.03	17500	
									250		18	7.5	9.2	8400	1100	0.34	20000	
38	Pentode	Heater	5F Sm. 5 Pin	0.30				Amplifier	100	100	9	7	80	85000	950	0.27	13500	
									135	135	13.5	9	100	0.1M Ω	1000	0.525	13500	
									250	250	25	22	120	0.1M Ω	1200	2.5	10000	
39 / 44	Remote Cut-Off Pentode	Heater	5F Sm. 5 Pin	0.30	0.007 Max.	3.5	10	1st Detector	90 to 250	90	7 App.							
								Amplifier	90	90	3	5.6	360	0.375M Ω	960			42
									250	90	3	5.8	1050	1.0M Ω	1050			42
41	Pentode	Heater	6B Sm. 6 Pin	0.40				Amplifier	180	180	13.5	18.5	150	81000	1850	1.5	9000	
									250	250	18	32	150	68000	2200	3.4	7600	
42	Pentode	Heater	6B Med. 6 Pin	0.70				Pentode	250	250	16.5	34	185	79000	2350	3	7000	
								Amplifier	315	315	22	42	230	0.1M Ω	2300	5	7000	
								No. 2 Gr. to Pl. Class A B Triode (2 tubes)	350		38	42 to 90				18	8000	
52	Double Grid Triode	Fil.	5C Med. 5 Pin	0.30				Class A	110		0	43	5.2	1750	3000	1.5	2000	
								Cl. B. (Avg. 2 tubes)	180		0	6 to 40				6	9000 Min.	
75	Duplex Diode Triode	Heater	6G Sm. 5 Pin	0.30	2.0	2.0	4.0	Diode Detector	250		2	0.8	100	91000	1100			
								Triode Amplifier	250		2	0.1					0.25M Ω	
76	Triode	Heater	5G Sm. 6 Pin	0.30	2.8	3.5	2.5	Oscillator	90		0							
								Amplifier	250		13.5	5.0	13.8	9500	1450	0.25	50000	
77	Pentode	Heater	6F Sm. 6 Pin	0.30	0.007 Max.	4.0	11	Detector	250	100	4.3							
								Amplifier	250	100	3	2.3	1500	1.5M Ω	1250			7.5
78	Remote Cut-Off Pentode	Heater	6F Sm. 6 Pin	0.30	0.007 Max.	4.0	11	1st Detector	250	100	10							
								Amplifier	250	100	3	7.0	1160	0.8M Ω	1450			42
79	Twin Triode	Heater	6H Sm. 6 Pin	0.60				Complete Cl. B Both Sections	250		0	20 to 60				8	14000	
85	Duplex Diode Triode	Heater	6G Sm. 6 Pin	0.30	2.0	2.0	4.0	Diode Detector	180		13.5	6	8.3	8500	975	0.16	20000	
								Triode Amplifier	250		20	8	8.3	7500	1100	0.35	20000	
89	Triple Grid	Heater	6F Sm. 6 Pin	0.40				Cl. A Triode	250		31	32	4.7	2600	1800	0.9	5500	
								Cl. A Pentode	250	250	25	32	125	70000	1800	3.4	6750	
								Cl. B. Triode (Avg. 2 tubes)	250		0	6 to 50				5	10000Min.	
6A3	Triode	Fil.	4D Med. 4 Pin	1.0				Single Amplifier	250		45	60	4.2	800	5250	3.3	2500	
								Class AB (2 tubes)	325	Self Bias	63	130 to 150				10	5000	
									325	Fixed Bias	63	140 to 200				15	3000	
6A4LA	Pentode	Fil.	5B Med. 5 Pin	0.30				Amplifier	180	180	12	22	100	4500	2200	1.4	8000	
								Class AB (2 tubes)	230	230	22	32	Self Bias R_{C1} = 700 Ω			4.2	16000	
12A5	Pentode	Heater	7F Sm. 7 Pin	6.3 V 0.6A 12.6 V 0.3A	8.5	4	2	Amplifier	100	100	15	17			1700	0.65	4500	
									180	180	27	38			2300	2.6	3800	

Type No.	DESCRIPTION Type	Cathode	Basing See Socket Connection Chart on page 202	Fil. Current Amps.	CAPACITANCES Micro-Microfarads Grid Plate	Input	Output	OPERATING CONDITIONS AND CHARACTERISTICS When Used As	Plate Supply Volts	Screen Grid Volts	Grid Bias Volts (Neg.)	Plate Current MA.	Ampl. Factor	Plate Resis. Ohms	Mut. Cond. µMhos.	Max. Undist. Output Watts	Recomm. Load Resis. Ohms	Cut-Off Bias Volts
6.3 VOLT A.C. OR D.C. DETECTOR AND AMPLIFIER TUBES *(continued)*																		
6A6	Twin Triode	Heater	7B Med. 7 Pin Lg. Pin Circle	0.8				Cl. A Parallel Conn.	294		6	7	35	11000	3200	0.37	35000	
								Complete Cl. B	250		0	28 to 50				8	8000	
								Both Sections	300		0	35 to 50				10	10000	
6A7	Heptode	Heater	7C Sm. 7 Pin	0.30	1.0	7	5.5	Oscillator Section	250		50000 Ω	4					Rc 0.02M Ω	
					0.3	8.5	9	Mixer Section	250	100	3	4		0.36M Ω	520	Conversion Conductance		45
6B5	Dual Triode	Heater	6D Med. 6 Pin	0.80				Single Tube	Each 300		0	Out-Put 45 In-Put 8	58	24000	2400	4	7000	Volts RMS 15
									Each 325		0	51 9				5.2	7000	17
								Two Tubes	Each 250		0	33 6.5				8.5	10000	38
									Each 325		0	51 9				13.5	10000	42
6B7	Duplex Diode Pentode	Heater	7D Sm. 7 Pin	0.30	.010 Max.	3.3	10	Diode Detector	100	100	3	5.8	285	0.3M Ω	950			17
								R. F. Amplifier	250	100	3	6.0	800	0.8M Ω	1000			17
								Dio. Det. & A. F. Ampl.	250	50	4.5	0.65					0.2M Ω	
6C6	Pentode	Heater	6F Sm. 6 Pin	0.30	0.007 Max.	5.2	6.8	Detector	250	100	3.8						0.25M Ω	
								Amplifier	250	100	3	2.0	2500	2.0M Ω	1225			7
6D6	Remote Cut-Off Pentode	Heater	6F Sm. 6 Pin	0.30	0.007 Max.	5.2	6.8	1st Detector	250	100	10							
								Amplifier	250	100	3	8.2	1280	0.8M Ω	1600			50
6E5	Cathode Ray	Heater	6R Sm. 6 Pin	0.30				Tuning Indicator	With Plate 250V. (Thru 1M Ω) Target 250V. Ib = 0.25 m.a. And Shadow Angle is 90° at Ec = Ov., Angle is Zero At Ec = −8V. Approx.									
6E6	Twin Triode	Heater	7B Med. 7 Pin.	0.60				Complete Cl. A	180		20	23	6.0	2150	2800	0.75	15000	
								Both Sections	250		27.5	36	6.0	1750	3400	1.6	14000	
6F7	Triode Pentode	Heater	7E Sm. 7 Pin	0.30	2.0	2.5	3.0	Triode Amplifier	100		3	3.5	8	18000	500			
					0.008 Max.	3.2	12	Pentode 1st Detect.	250	100	10							
								Pentode Amplifier	250	100	3	6.5	900	.85M Ω	1100			50
6G5	Cathode Ray	Heater	6R Sm. 6 Pin	0.30				Tuning Indicator	With Plate 250V. (Thru 1M Ω) Target 250V. Ib = 0.25 m.a. and Shadow Angle is 90° at Ec = Ov., Angle is Zero at Ec = −22V. Approx.									
6N7G	Twin Triode	Heater	8B Octal Med. Shell 8 Pin	0.80				Same as 6A6										
7.5 VOLT A.C. POWER AMPLIFIER TUBES																		
10	Triode	Fil.	4D Med. 4 Pin	1.25				Amplifier	350		31	16	8.0	5150	1550	0.9	11000	
									425		39	18	8.0	5000	1600	1.6	10000	
50	Triode	Fil.	4D Med. 4 Pin	1.25				Amplifier	350		63	45	3.8	1900	2000	2.4	4100	
									450		84	55	3.8	1800	2100	4.6	4350	

SERIES FILAMENT POWER AMPLIFIER TUBES

43	Pentode	Heater	6B Med. 6 Pin	0.3a				Amplifier	95	95	15	20	90	45000	2000	0.9	4500	
				25V.					180	135	20	38	100	40000	2500	2.75	5000	
48	Pentode	Heater	6B Med. 6 Pin	0.4a				Amplifier	96	96	1.9	52			3800	2.0	1500	
				30V.					125	100	22.5	56			3900	2.5	1500	
12A7	Pentode and Diode	Heater	7K Sm. 7 Pin	0.3a				Amplifier	135	135	13.5	9	100	0.1M Ω	975	0.55	13500	
				12.6V.				Rectifier	125 RMS			30 Max.						

METAL DETECTOR AND AMPLIFIER TUBES

6A8	Heptode	Heater	8A Octal 8 Pin	0.3	1	7	4.5	Oscillator Section	250		50000 Ω	4						
					0.05	13	13.0	Mixer Section	250	100	3	4		0.36M Ω	520	Conversion Conductance		
6C5	Triode	Heater	6Q Octal 6 Pin	0.30	2.0	4.5	14	Oscillator	90		0							
								Amplifier	250		8	8	20	10000	2000			
6F5	Triode	Heater	5M Octal 5 Pin	0.30				Amplifier	250		2	0.9	100	66000	1500			
									250		2	0.1					0.25M Ω	
6F6	Pentode	Heater	7S Octal 7 Pin	0.70				Pentode Amplifier	250	250	16.5	34	185	79000	2350	3	7000	
								Triode (G_2 to P)	250		20	31	6.2	2700	2300	0.85	4000	
								Cl. AB Pentode	375	250	340 Ω Self	54				19	10000	
								Amplifier (2 tubes)	375	250	26 Fixed	34				19	10000	
6H6	Twin Diode	Heater	7Q Octal 7 Pin	0.30				Diode Detector	100 Max. AC			2 Max. Ea. Diode						
6J7	Pentode	Heater	7R Octal 7 Pin	0.30	0.002	8	12	Detector	250	100	3.8						0.25M Ω	
								Amplifier	250	125	3	4			1550			9
									250	100	3	2	2500	2.0M Ω	1225			7
6K7	Pentode	Heater	7R Octal 7 Pin	0.30	0.002	8	12	1st Detector	250	100	10							
								Amplifier	250	125	3	10.5	990	0.6M Ω	1650			52
									250	100	3	7	1160	0.8M Ω	1450			42
6L6	Tetrode	Heater	7V Sm. Oct. 7 Pin	0.9				Pwr. Amplifier	250	250	14V	72	135	22500	6000	Scr. G. Current 5MA		
								Pwr. Amp. Fixed Bias	375	125	9	24				4.2	14000	
								Pwr. Amp. Self Bias	375	125	9	24				4.0	14000	
								Fixed Bias	375	250	17.5	57				11.5	4000	
								2 tubes Class AB Fix. Bias	400	250	20.0	88 to 168				40	6000	
								2 tubes Class AB Fix. Bias	400	300	25.0	102 to 230				60	38000	
6L7	Heptode	Heater	7T Octal 7 Pin	0.30	G_1 0.001	G_1 8.5 G_3 11.5	13	Mixer	250	150	G1 6 G3 15	3.3	I_{G2-4}=8.3	2.0M Ω	350	Conversion Conductance		G1 45
								Amplifier	250	100	G1 G3 3	5.3	880	0.8M Ω	1100			G1 23 G3 12
6Q7	Duplex Diode Triode	Heater	7V Octal 7 Pin	0.30	1.2	6	4.5	Diode Detector	100		1.5	0.35	70	0.87M Ω	800			
								Triode Amplifier	250		3	1.1	70	0.58M Ω	1200		0.25M Ω	
6R7	Duplex Diode Triode	Heater	7V Octal 7 Pin	0.30	2.0	6	4.5	Diode Detector Triode Amplifier	250		90	9.5	16	8500	1900	0.28	15000	
25A6	Pentode	Heater	7S Octal 7 Pin	0.3a				Amplifier	95	95	15	20	90	45000	2000	0.9	4500	
				25.0V.					180	135	20	38	100	40000	2500	2.75	5000	

RECTIFIER TUBES

Type and Description					Fil. Amps.	Fil. Volts	Max. A.C. Volts Per Anode	Max. D.C. Out. Curr. (Amps.)	Max. Peak Inverse Volts	Max. Peak Plate Current	Min. Choke Before Filter Cond.	Max. Heater Cathode Bias	Max. D.C. Volts Del. to Filter (Nom.) Cond. Input	Max. D.C. Volts Del. to Filter (Nom.) Choke Input
BA	Full Wave	Gas	Cold	4J M. 4 P.			350	0.350	1000	1.00				300
BH	Full Wave	Gas	Cold	4J M. 4 P.			350	0.125	1000	0.40				300
BR	Half Wave	Gas	Cold	4H M. 4 P.			300	0.050	850	0.20			300	
1V	Half Wave	High Vacuum	Heater	4G Sm. 4 Pin	0.3	6.3	350	0.050	1000	0.20		500	400	
80	Full Wave	High Vacuum	Fil.	4C Med. 4 Pin	2.0	5.0	350	0.125	1000	0.40			300	225
							400	0.110	1100	0.35			370	275
							550	0.135	1500	0.30	20 Henries			425
81	Half Wave	High Vacuum	Fil.	4B Med. 4 Pin	1.25	7.5	700	0.085	2000	0.60 Full Wave			750	550
82	Full Wave	Mercury Vapor	Fil.	4C Med. 4 Pin	3.0	2.5	500	0.125	1400	0.40			590	425
83	Full Wave	Mercury Vapor	Fil.	4C Med. 4 Pin	3.0	2.5	500	0.250	1400	0.80			530	400
83V	Full Wave	High Vacuum	Heater	4L Med. 4 Pin	2.0	5.0	500	0.250	1400	0.80			510	385
0Z3	Full Wave	Gas	Cold	5N Sm. 5 Pin			350	0.075 Max. 0.030 Min.	1250	0.20			425	300
0Z4	Full Wave	Gas	Cold	4R Octal 4 Pin			350	0.075 Max. 0.030 Min.	1250	0.20			425	300
5Y3	Full Wave	High Vacuum	Fil.	5L Octal Med. Shell 5 Pin	2.0	5.0	Same as Type 80							
5Z3	Full Wave	High Vacuum	Fil.	4C Med. 4 Pin	3.0	5.0	500	0.250	1400	0.70			480	360
6Z4 / 84	Full Wave	High Vacuum	Heater	5D Sm. 5 Pin	0.5	6.3	350	0.060	1000	0.20		500	425	300
12Z3	Half Wave	High Vacuum	Heater	4G Sm. 4 Pin	0.3	12.6	250	0.060	700	0.30		350	310	
25Z5	Rectifier Doubler	High Vacuum	Heater Heater	6E Sm. 6 Pin	0.3	25.0	125	0.200	700	0.40	Rectifier	350	120	
								0.100	700	0.20	Doubler	350	200	

METAL RECTIFIER TUBES

Type and Description					Fil. Amps.	Fil. Volts	Max. A.C. Volts Per Anode	Max. D.C. Out. Curr. (Amps.)	Max. Peak Inverse Volts	Max. Peak Plate Current	Min. Choke Before Filter Cond.	Max. Heater Cathode Bias	Max. D.C. Volts Del. to Filter (Nom.) Cond. Input	Max. D.C. Volts Del. to Filter (Nom.) Choke Input
5W4	Full Wave	High Vacuum	Fil.	5H Sm. Oct. 5 Pin	1.5	5.0	350	0.110					370	
5Z4	Full Wave	High Vacuum	Heater	5L Octal 5 Pin	2.0	5.0	400	0.125	1100	0.50			425	275
6X5	Full Wave	High Vacuum	Heater	6S Octal 6 Pin	0.6	6.3	350	0.075	1250	0.25		500	400	
25Z6	Rectifier Doubler	High Vacuum	Heater	7Q Octal 7 Pin	0.3	25.0	125	0.170	700	0.35	Rectifier	350	115	
								0.085	700	0.17	Doubler		225	

SPECIAL TUBES

Type No.	Filament Volts	Filament Amps.	Basing View	Basing Shield Conn. to	Characteristics Use and Dimensions
2S/4S	2.5	1.35	5D	Cathode Pin	Approximately 40 Ma. on each Diode Plate at 50 volts D.C.; Duplex Diode Detector.
24S	2.5	1.75	5E	Cathode Pin	Same as 24A
27S	2.5	1.75	5E	Cathode Pin	Same as 27
35/51S	2.5	1.75	5E	Cathode Pin	Same as 35
55S	2.5	1.0	6G	Cathode Pin	Same as 55
56S	2.5	1.0	5A	Cathode Pin	Same as 56
57S	2.5	1.0	6F	Cathode Pin	Same as 57
57AS	6.3	0.4	6F	Cathode Pin	Same as 6C6 except Heater Amps.
58S	2.5	1.0	6F	Cathode Pin	Same as 58
58AS	6.3	0.4	6F	Cathode Pin	Same as 6D6 except Heater Amps.
75S	6.3	0.3	6G	Cathode Pin	Same as 75
85AS	6.3	0.3	6G	Heater pin Adjacent to Cathode Pin	Similar to 85 except Amp. Factor = 20; Mutual Cond. = 1250; Plate Curr. = 5.5 Ma.; Plate Volts = 250 V; Grid Bias = −9V.
182B	5.0	1.25	4D	No Shield	Similar to 45 except Fil. Volts, Amp. Fact. = 5.0; Mutual Cond. = 1500; Plate Curr. = 18 Ma.; Pl. Volts = 250V; Gr. Bias = −35V.
183	5.0	1.25	4D	No Shield	Similar to 45 except Fil. Volts; Amp. Fact. = 3.0 Mut. Cond. = 1500; Pl. Curr. = 20 Ma.; Pl. Volts = 250V; Gr. Bias = −58V.
485	3.0	1.25	5A	No Shield	Similar to 27 except Heater Volts; Amp. Fact. = 12.8; Mut. Cond. = 1300; Pl. Curr. = 5.2 Ma.; Pl. Volts = 180V; Gr. Bias = −10V.
950	2.0	0.12	5K	No Shield	Similar to 33 except Fil. Amps; Pl. Curr. = 7 Ma.; Power Output = 0.45 Watts; Pl. & Scr. volts = 135V; Max. Cont. Gr. Bias = −16.5V.
2A7S	2.5	1.0	7C	Cathode Pin	Same as 2A7
2Z2 / G84	2.5	1.5	4B	No Shield	Similar to 1V
6A7S	6.3	0.3	7C	Cathode Pin	Same as 6A7
6B7S	6.3	0.3	7D	Cathode Pin	Same as 6B7
6C7	6.3	0.3	7G	Separate Pin	Same as 85A-S
6D7	6.3	0.3	7H	Separate Pin	Same as 6C6
6E7	6.3	0.3	7H	Same as 6D6	Same as 6D6
6F7S	6.3	0.3	7E	Cathode Pin	Same as 6F7
6Y5	6.3	0.8	6J	Separate Pin	Similar to 6Z4/84
6Z5	12.6 / 6.3	0.4 / 0.8	6K	No Shield	Similar to 6Z4/84

COMPARISON CHART—Similar Characteristics

Octal Base Glass	Metal Glass	Metal	Glass
5Y3	5Z4MG		80
6A8G	6A8MG	6A8	6A7
6C5G	6C5MG	6C5	
6F5G	6F5MG	6F5	75 Triode
6F6G	6F6MG	6F6	42
6H6G	6H6MG	6H6	
6J7G	6J7MG	6J7	77
6K7G	6K7MG	6K7	78
6L7G	6L7MG	6L7	
6N7G	6N7MG		6A6
	6N6MG		6B5
6Q7G	6Q7MG	6Q7	
6R7G	6R7MG	6R7	
6X5G	6X5MG	6X5	
6B6	6B6		75
6P7	6P7		6F7
25A6G	25A6MG	25A6	43
25Z6G	25Z6MG	25Z6	25Z5

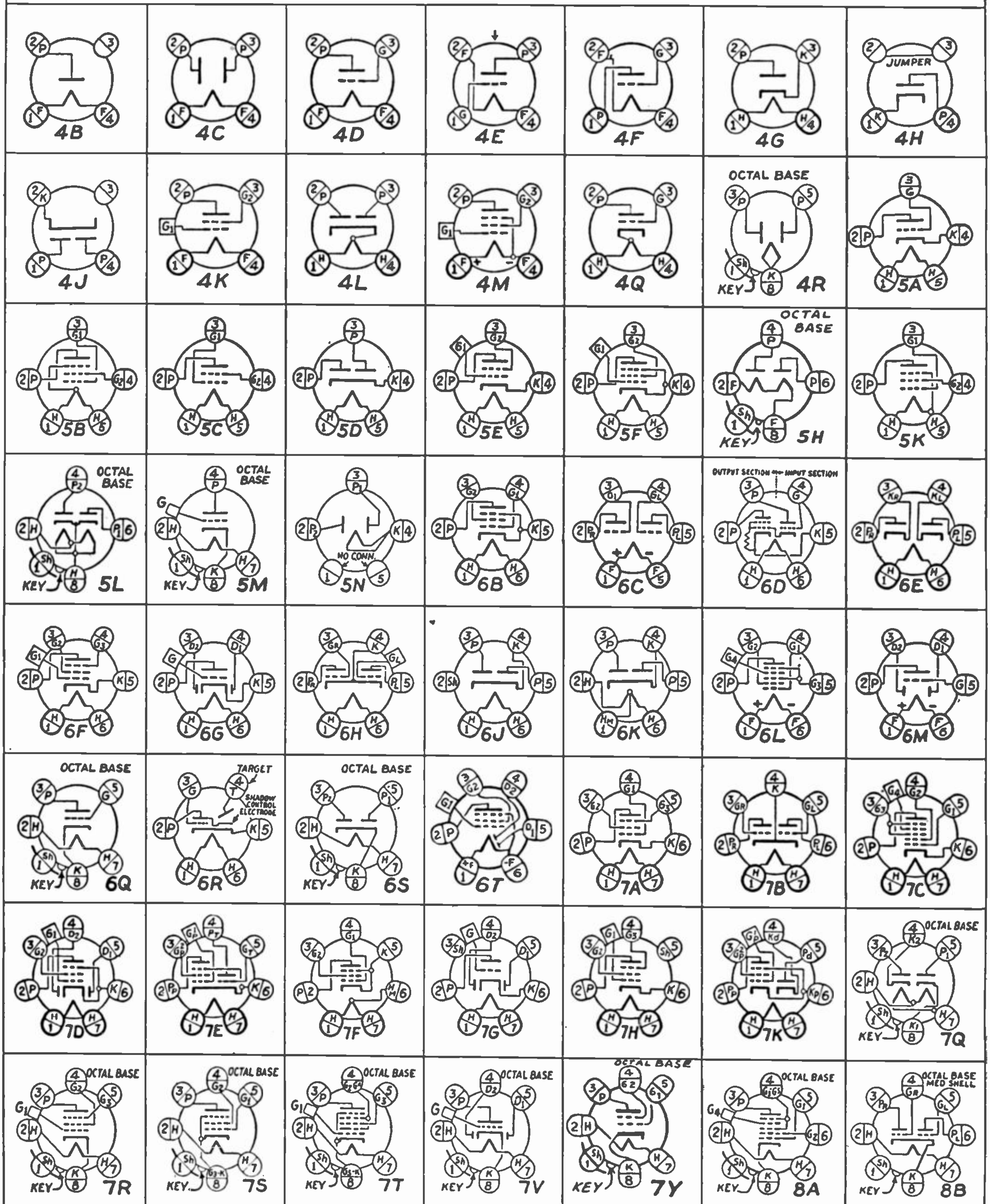
BASE CONNECTIONS—Octal Base 2-Volt Glass Tubes

Octal Base "G" Types	Equiv. Types	1	2	3	4	5	6	7	8	Top Cap
1C7G	1C6	NC	+F	P	G_3G_5	G_1	G_2	−F	NC	G_4
1D5G	1A4	NC	+F	P	G_2	NC	—	−F	NC	G_1
1D7G	1A6	NC	+F	P	G_3G_5	G_1	G_2	−F	NC	G_4
1E5G	1B4	NC	+F	P	G_2	NC	—	−F	NC	G_1
1F5G	1F4	NC	+F	P	G_2	G_1	—	−F	NC	—
1H4G	30	NC	+F	P	NC	G_1	—	−F	NC	—
1H6G	1B5/25S	NC	+F	P	D(+)	D(−)	G	−F	NC	—
1J6G	19	NC	+F	P_1	G_1	G_2	P_2	−F	NC	—

TABLE OF COMPARATIVE TYPES

Octal Base Glass	Metal Glass	Metal	Glass
5V4			83V
6L6G		6L6	
1C7G			1C6
1D5G			1A4
1D7G			1A6
1E5G			1B4
1F5G			1F4
1H4G			30
1H6G			1B5/25S
1J6G			19

SOCKET CONNECTIONS—BOTTOM VIEW



See pages 206, 207 and 208 for additional Socket Connections.

SUPPLEMENTARY TUBE CHART

See Complete Chart on Page 194

2.0 VOLT D.C. DETECTOR AND AMPLIFIER TUBES

Type No.	Description: Type	Description: Cathode	Basing See Socket Conn. Chart on page 206	Fil. Current Amps.	Capacitances Micro-Microfarads: Grid-Plate	Input	Output	When Used As	Plate Supply Volts	Screen Grid Volts	Grid Bias Volts (Neg.)	Plate Curr. Ma.	Screen Curr. Ma.	Ampl. Factor	Plate Resist. Ohms	Mut. Cond. µMhos	Max. Undist. Power Output Watts	Recomm. Load Resist. Ohms	Cut-Off Bias Volts
1C7G	Heptode	Fil.	8A Octal 8 Pin	0.120	0.3	6	6	Oscillator Section	180		0.5 Meg.	3.3						Rc2 = 0.02 Meg.	
						10	9	Mixer Section	135	67.5	3.0	1.3	2		0.55 Meg.	300	Conversion		
									180	67.5	3.0	1.5	2		0.75 Meg.	325	Conductance		
1D5G	Tetrode Var. Mu.	Fil.	8B Octal 7 Pin	0.060	0.007 Max.	4.8	11.5	Amplifier	180	67.5	3.0	2.3	0.8	705	1.05 Meg.	750			20
1D7G	Heptode	Fil.	8A Octal 8 Pin	0.060	0.8	5	6	Oscillator Section	135		0.5 Meg.	2.3							
					0.25	10.5	9	Mixer Section	135	67.5	3.0	1.2	2.5		0.4 Meg.	275	Conversion		
									180	67.5	3.0	1.3	2.4		0.5 Meg.	300	Conductance		
1E5G	Tetrode	Fil.	8B Octal 7 Pin	0.060	0.007 Max.	4.6	11	First Detector	180	67.5	6.0								
								Amplifier	180	67.5	3.0	1.7	0.6	780	1.2 Meg.	650			8
1E7G	Dbl. Pent.	Fil.	8C Octal 8 Pin	0.240				Amp. Push-Pull Both Sections	135	135	7.5	6.5	2.0				0.65	24000	
								Amp. Each Section	135	135	4.5	7.5	2.1	350	.22 Meg.	1600			
1F5G	Pentode	Fil.	8D Octal 7 Pin	0.120				Amplifier (Cl. A Pentode)	135	135	4.5	8.0	2.6	340	.2 Meg.	1700	.34	16000	
1F7G	Duo Diode Pentode	Fil.	8E Octal 8 Pin	0.060	0.007	4	9	R. F. Amplifier	180	67.5	1.5	2.0	0.6	650	1 Meg.	650			12
								A. F. Amplifier	135	135	2.0	0.42	0.34	41	Gain		25.2 V.	.25 Meg. Pl. Res.	
								(Resis. Coupled)		Supply	0.8 Meg. Screen Resistor						Peak	0.5 Meg. Grid. Res.	
1H4G	Triode	Fil.	8F Octal 7 Pin	0.060				Amplifier	135		9.0	3.0		9.3	10300	900			
									180		13.5	3.1		9.3	10300	900			
1H6G	Duo Diode Triode	Fil.	8G Octal 8 Pin	0.060	3.6	2	3	Triode Amplifier	135		3.0	0.8		20	35000	575			
1J6G	Twin Triode	Fil.	8H Octal 8 Pin	0.240				Complete Cl. B (Both Sections)	135		6.0	1.0	Static Plate Current for Two tubes. Max. peak plate current per plate, 50 Ma.				1.6	10000	
									136		3.0	4.0					1.9	10000	
									135		0	10.0					2.1	10000	

6.3 VOLT A.C. OR D.C. DETECTOR AND AMPLIFIER TUBES

Type No.	Description: Type	Description: Cathode	Basing See Socket Conn. Chart on page 206	Fil. Current Amps.	Capacitances Micro-Microfarads: Grid-Plate	Input	Output	When Used As	Plate Supply Volts	Screen Grid Volts	Grid Bias Volts (Neg.)	Plate Curr. Ma.	Screen Curr. Ma.	Ampl. Factor	Plate Resist. Ohms	Mut. Cond. µMhos	Max. Undist. Power Output Watts	Recomm. Load Resist. Ohms	Cut-Off Bias Volts
6B8	Duo Diode Pentode	Heater	8V Octal 8 Pin	0.300	0.007	3.3	9.5	R. F. or I. F. Ampl. and Detector	250	125	3.0	10.0	2.3	800	0.6 Meg.	1325			21
6D8G	Heptode	Heater	8W Octal 8 Pin	0.150	1.0	6.0	5.5	Oscillator Section	135		0.05 Meg.	Grid Leak							
									250 Thru 20000 Ohms		0.05 Meg.								
					0.3	8.0	11.0	Mixer Section	135	67.5	3.0	8.0	Total Cathode		0.4	325	Conversion		25
									250	100	3.0	13.0	Current		0.32 Meg.	500	Conductance		38.5
6J5G	Triode	Heater	8I Octal 7 Pin	0.300	3.4	3.8	3.3	Amplifier	250		8.0	9.0		20	7700	2600			
6K5G	Triode	Heater	8J Octal 7 Pin	0.300	2.0	2.4	3.6	Amplifier	250		3.0	1.1		70	0.05 Meg.	1400			

Type No.	DESCRIPTION Type	Cathode	Basing See Socket Conn. Chart on page 206	Fil. Current Amps.	CAPACITANCES Micro-Microfarads Grid-Plate	Input	Output	OPERATING CONDITIONS AND CHARACTERISTICS When Used As	Plate Supply Volts	Screen Grid Volts	Grid Bias Volts (Neg.)	Plate Curr. Ma.	Screen Curr. Ma.	Ampl. Factor	Plate Resist. Ohms	Mut. Cond. μMhos	Max. Undist. Power Output Watts	Recomm. Load Resist. Ohms	Cut-Off Bias Volts
6.3 VOLT A.C. OR D.C. DETECTOR AND AMPLIFIER TUBES *(continued)*																			
6L5G	Triode	Heater	8K Octal 6 Pin	0.150	2.7	3.0	5.0	Amplifier	135		5.0	3.5		17	11300	1500			11
									250		9.0	8.0		17	9000	1900			20
6N5	Cath. Ray	Heater	6A Sm. 6 Pin	0.150				Tuning Indicator	Plate Supply 135 Volts Thru 0.25 Meg. Target 135 Volts Ib = 0.5Ma. & Shadow 90° For Ec = 0. Shadow 0° for Ec = −12 V.										
6P7	Triode Pentode	Heater	8L Octal 8 Pin	0.300				Triode	100		3.0	3.5		8	18000	450			
								Pentode	250	100	3.0	6.5	1.5	900	.85 Meg.	1100			50
6Q6G	Sing. Diode Triode	Heater	8M Octal 6 Pin	0.150	1.8	2.5	5.2	Amplifier	135		1.5	0.9		65	.65 Meg.	1000			
									250		3.0	1.2		65	.62 Meg.	1050			
6S7G	Var. Mu. Pentode	Heater	8N Octal 7 Pin	0.150	.007 Max.	4.6	7.8	R.F. or I.F. Ampl.	135	67.5	3.0	3.7	0.9	850	.68 Meg.	1250			25
									250	100	3.0	8.5	2.0	1100	.63 Meg.	1750			38.5
954	Acorn Pentode	Heater	Special	0.150	0.007	3.0	3.0	R.F. or I.F. Ampl.	90	90	3.0	1.2	0.5	1100	1 Meg.	1160			
									250	100	3.0	2.0	0.7	2000	1.5 Meg.	1400			
								Detector	250	100	6.0							0.25 Meg.	
955	Acorn Triode	Heater	Special	0.160	1.4	1.0	0.6	Cl. A Amplifier R.F. or A.F.	90		2.5	2.5		25	14700	1700			
									135		3.75	3.5		25	13200	1900			
									180		5.0	4.5		25	12500	2000	.135	20000	
								Cl. C R.F. Power Amplifier or Osc.	180		35.0	7.0					0.5		
1603	Low Microphonic Pentode	Heater	6B Sm. 6 Pin	0.300	0.010	5.5	7.0	Pent. Ampl. Cl. A	100	100	3.0	2.0	0.5	1185	1 Meg.	1185			
									250	100	3.0	2.0	0.5	1500	1.5 Meg.	1225			
					2.8	3.0	11.5	Triode Conn.	180		5.3	5.3		20	11000	1800			
								Cl. A Amplifier	250		8.0	6.5		20	10500	1900			
2.5 VOLT A.C. OR D.C. POWER AMPLIFIER TUBES																			
2B6	Dual Triode	Heater	7A Med. 7 Pin	2.25				Input Section	250		24	4		7.2		600		8000	
								Output Section	250		+2.5	40		18		3500	4.0	5000	
6.3 VOLT A.C. OR D.C. POWER AMPLIFIER TUBES																			
6B4G	Triode	Fil.	8O Octal 8 Pin	1.0	16	7	5	Sing. Cl. A Ampl.	250		45	60		4.2	800	5250	3.2	2500	
								Push-Pull Class A — Fixed Bias	325		68	40 Per Tube					15 Two Tubes	3000 P to P	
								Push-Pull Class A — Self Bias	325	Bias Resist. 750 Ohms		40 Per Tube					10 Two Tubes	5000 P to P	
6D5	Triode	Heater	8P Octal 6 Pin	0.7				Single Cl. A	275		40	31		4.7	2250	2100	1.4	7200	
								Push-Pull Cl. AB	300		50	23 Per Tube					5	5300 P to P	
6K6G	Pentode	Heater	8Q Octal 7 Pin	0.4				Amplifier	180	180	13.5	18.5	3.0	150	81000	1850	1.5	9000	
									250	250	18.0	32	5.5	150	68000	2200	3.4	7600	

6.3 VOLT A.C. OR D.C. POWER AMPLIFIER TUBES *(continued)*

6N6	Dual Triode	Heater	8R Octal 7 Pin	0.8				Single Tube	Ea. 300		0	Output 45	Input 8	58	24100	2400	4.0	7000	
									Ea. 325		0	Output 51	Input 9.0	58	24100	2400	5.2	7000	
								Push-Pull	Ea. 300		0	45	8				10.0	10000	
									Ea. 300		0	51	9.0				13.5	10000	
6N7	Twin Triode	Heater	8S Octal 8 Pin	0.8				Cl. A Parallel Connection	250		5	6		35	11300	3100		20000 to	
									294		6	7		35	11000	3200		40000	
								Complete Cl. B Both Sections	250		0	14 Per Plate					8.0	8000 P to P	
									300		0	17.5 Per Plate					10.0	10000 P to P	

7.5 VOLT A.C. OR D.C. POWER AMPLIFIER TUBES

1602	Low Micro-phonic Triode	Fil.	Med. 4 Pin Bayonet	1.25	7	4	3	Cl. A Amplifier	350		32	16		8	5150	1550	0.9	11000	Bias Resist. 1950 Ohms
									425		40	18		8	5000	1600	1.6	10200	2150 Ohms
					Formerly Designated as —10 Special														

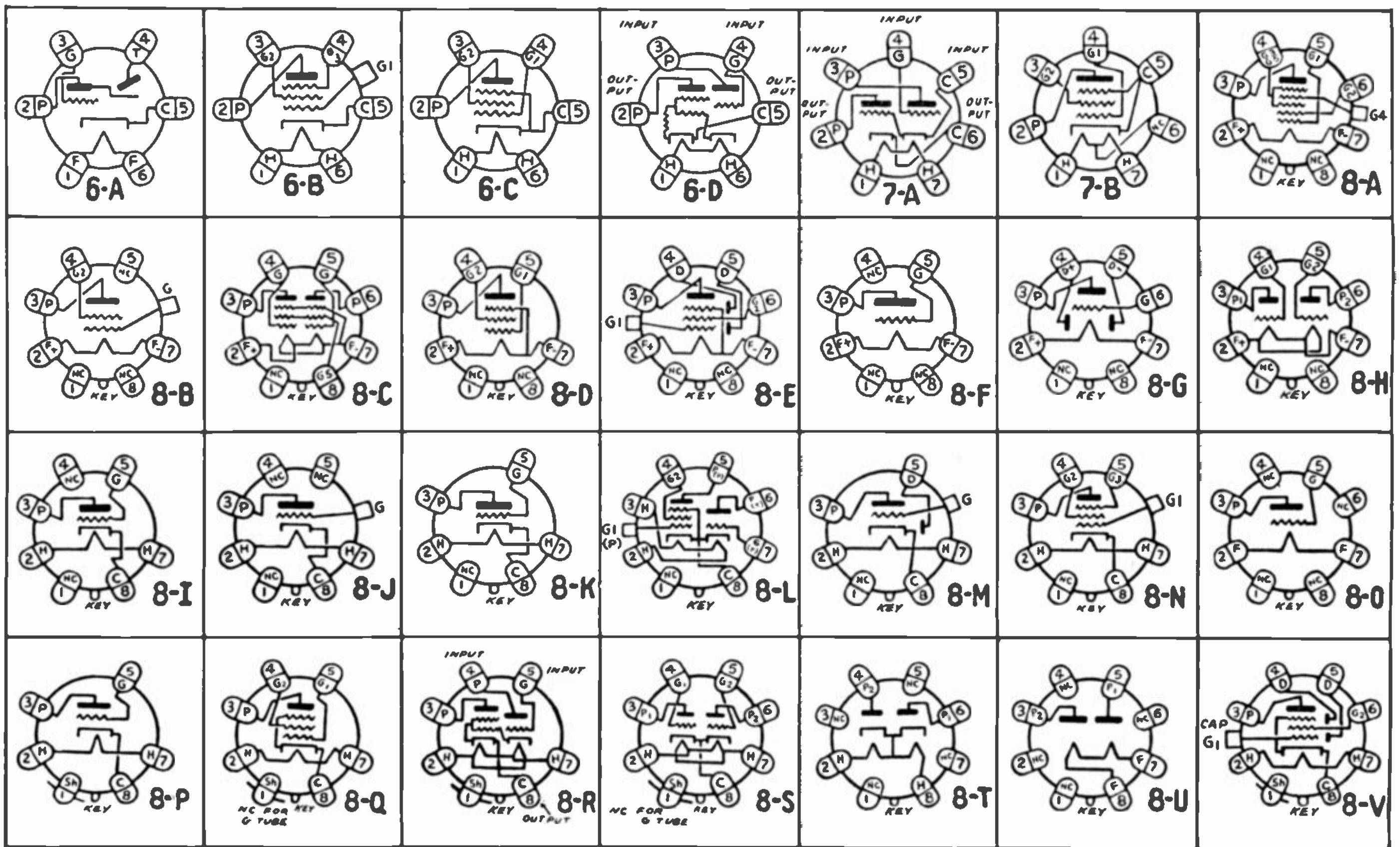
SERIES FILAMENT POWER AMPLIFIER TUBES

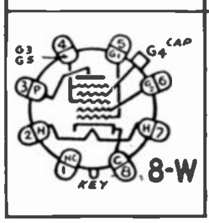
12A5	Pentode	Heater	7B Sm. 7 Pin	0.3a 12.6V. or 0.6a 6.3V.				Amplifier Cl. A Pentode	100	100	15	17	3	70	35000	1900	0.85	4500	
									180	180	27	36	6	80	32000	2500	3.5	3800	
18	Pentode	Heater	6C Sm. 6 Pin	0.3a 14V.				Amplifier Cl. A Pentode	250	250	16.5	34	7.5	185	79000	2350	3.0	7000	Note: Characteristics Similar to 42, 2A5
25A6	Pentode	Heater	8Q Octal 7 Pin	0.3a 25V.				Amplifier Cl. A Pentode	95	95	15	20	4	90	45000	2000	0.9	4500	
									135	135	20	39	8.5	99	42000	2350	2.0	4000	
									180	135	20	40	8	96	40000	2400	2.75	5000	
25B5 25N6G	Dual Triode	Heater	6D Med. 6 Pin 8S Oct. 7 Pin	0.3a 25V.				Dynamic Coupled Amplifier	110	Input 110 Plate	0	45	Input 7 Plate	25	11400	2200	2.0	2000	
									180	100	0	46	5.8	35	15200	2300	3.8	4000	
25B6G	Pentode	Heater	8Q Octal 7 Pin	0.3a 25V.				Amplifier Cl. A Pentode	95	95	15	45	4–12			4000	1.75	2000	

RECTIFIER TUBES

Type	DESCRIPTION			Base	Fil. Amps.	Fil. Volts	Max. A.C. Volts Per Anode	Max. D.C. Output Curr. Ma.	Max. Peak Inverse Volts	Max. Peak Pl. Curr. Ma.	Max. Volts Delivered to Filter (Nom.) Condenser Input	Choke Input
			Cathode									
5V4G	Full Wave	High Vacuum	Heater	8T Octal 8 Pin	2.0	5.0	400	200	1100	700		
5X4G	Full Wave	High Vacuum	Fil.	8U Octal 8 Pin	3.0	5.0	500	250	1400	700	480	360
5Y4G	Full Wave	High Vacuum	Fil.	8U Octal 8 Pin	2.0	5.0	350	125	1000	400	300	225
							400	110	1100	350	370	275
							550	135	1500	300	For Choke Input only; Use 20h. min.	425

SUPPLEMENTARY SOCKET CONNECTIONS BOTTOM VIEW





See pages 202, 207 and 208 for additional Socket Connections.

BIAS RESISTOR CALCULATIONS and GAIN-FORMULA

THE service man often finds it necessary to replace the grid bias resistor in receivers employing a self-biasing arrangement for obtaining the proper grid voltage. When the resistance value is not known, it may be calculated by dividing the grid voltage required (at the plate voltage at which the tube is operating), by the plate current in amperes, plus the screen current in amperes, times the number of tubes passing current through the resistor.

Under this rule, the grid bias resistor value is given by the following formula:

$$R = \frac{E_{c_1} \times 1{,}000}{(I_B + I_{c_2})n}$$

where: R = Grid bias resistor value in ohms.

E_{c_1} = The grid bias required in volts.

I_B = The plate current of a single tube in milliamperes.

I_{c_2} = The screen grid current of a single tube in milliamperes.

n = The number of tubes passing current through the resistor.

Example—It is desired to determine the value of bias resistor used to obtain the proper value of grid bias on three type '35 tubes working in the radio frequency stages of a receiver. First, determine the plate and screen voltages employed in this set. Suppose, in this case, it is found that the plate supply voltage is 250 and the screen voltage is 90. Looking in the characteristics chart on page 195, it is found that the proper grid bias for the '35 under these conditions is —3.0 volts. In addition, the plate current is 6.5 milliamperes. The screen current is 2.5 milliamperes. Substituting in the formula,

$$R = \frac{3.0 \times 1{,}000}{(6.5 + 2.5)3} = 111 \text{ ohms}$$

The value of grid bias resistors can be calculated in this manner for any type and any number of tubes. In the case of triodes, the screen current term drops out entirely.

Be sure to determine the plate voltage at which the tubes are working, the number of tubes being supplied from the bias resistor, the screen voltage (if a tetrode or pentode), the correct value of grid bias voltage required (whether the tube cathode is operated from A.C. or D.C. will affect the value of bias voltage), and the plate and screen current for the given plate voltage.

In the case of resistance-coupled amplifiers which employ high resistance in the plate circuit, it must be remembered that the plate voltage is equal to the plate supply voltage minus the voltage drop in the plate load resistance caused by the plate current. The net plate voltage alone determines the correct value of grid bias.

The foregoing methods of calculations apply to self bias only.

Size of Bias Resistors—In addition to having the proper resistance, a resistor should have sufficient size and heat dissipating ability to carry the current. The actual wattage dissipated in a resistor can easily be calculated from the following application of Ohms law:

$$\text{Watts} = \frac{E^2}{R} \text{ where } \begin{array}{l} E = \text{voltage across resistors} \\ R = \text{resistance in ohms} \end{array}$$

When selecting the proper resistor for a given application, the actual wattage given by the formula should be multiplied from two to ten times, depending upon such factors as air circulation, mounting position, and amount of heat which may be developed without injury to other parts. For a given dissipation, the larger the resistor, the lower the operating temperature per unit of area.

Cut-Off Bias—Every serviceman should be familiar with the formula for calculating "cut-off." This is the point where plate current ceases to flow as the grid voltage is made increasingly negative. In volume control circuits, the control range should never be extended into the "cut-off" region, otherwise serious distortion will result. The formula *for triodes* is:

$$\text{"Cut-off" voltage} = \frac{\text{Plate voltage}}{\text{Mu}}$$

"The cut-off" voltage for tetrodes, pentodes and variable mu tubes cannot be calculated from this simple formula, and should be obtained from the tube manufacturers tables.

The Gain or voltage amplification of resistance coupled audio stages can easily be calculated from the following formula:

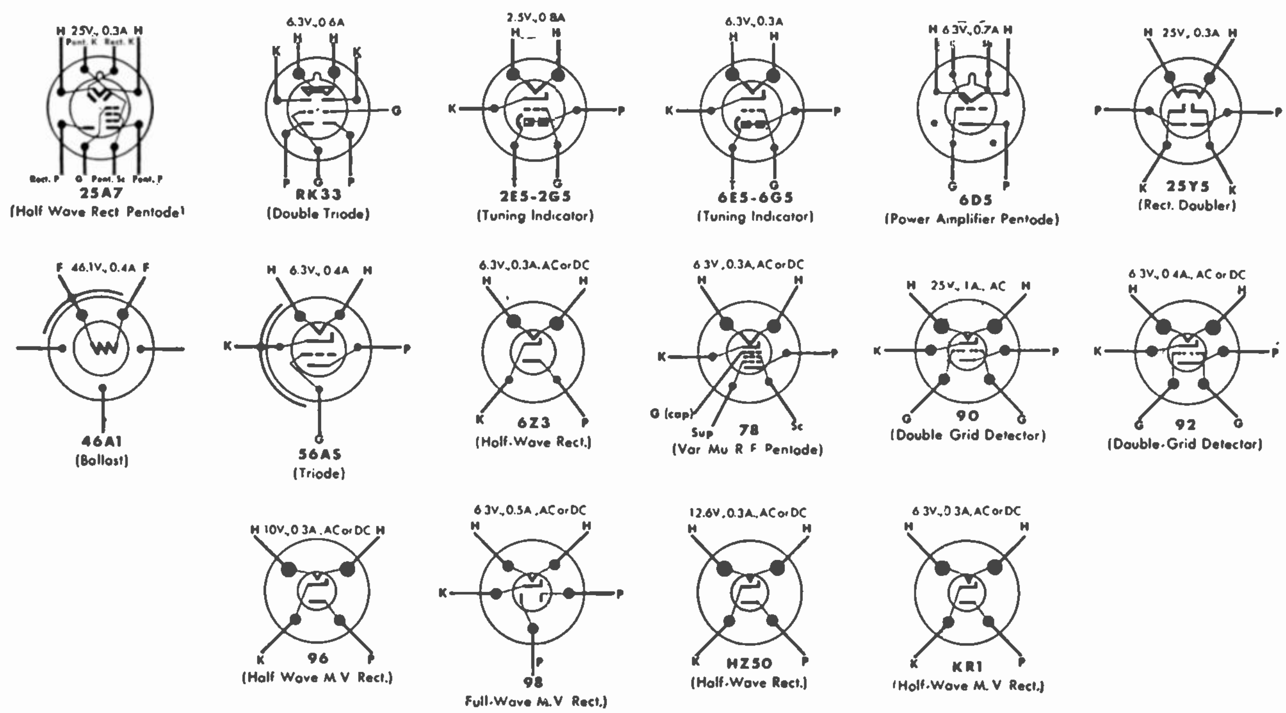
$$\text{Voltage Ampiification} = \frac{\text{Mu} \times \text{Rl}}{\text{Rl} + \text{Rp}}$$

where Mu = Amplification constant of tube
Rl = Load resistance
Rp = Plate resistance

(*See pages 202, 206 and 208 for other Socket Connections*)

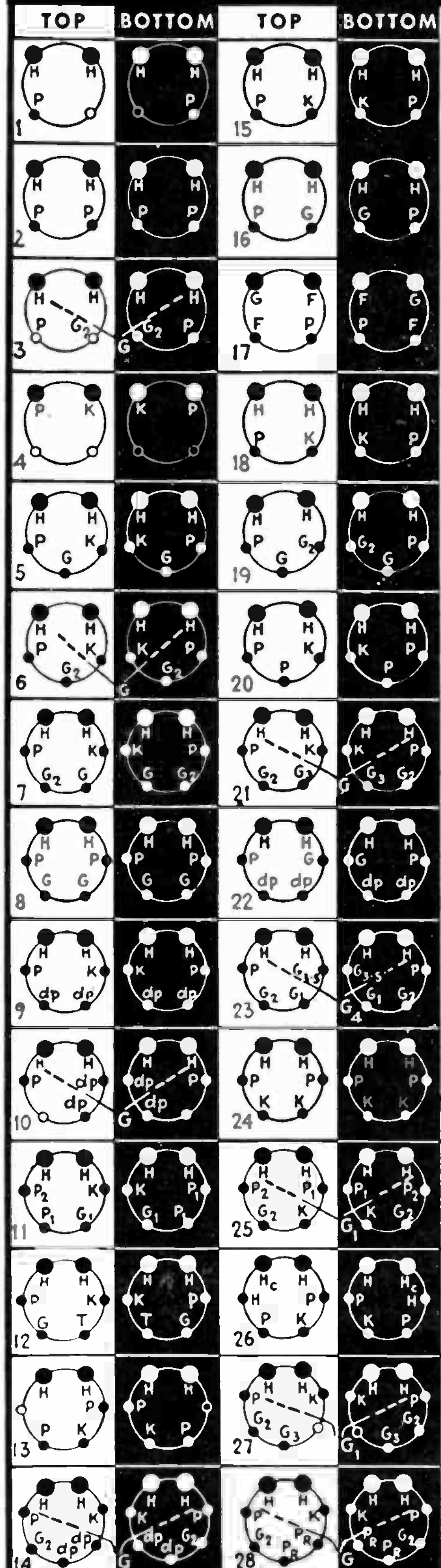
ADDITIONAL TUBE SOCKET CONNECTIONS
(Bottom View)

Not shown on preceding pages

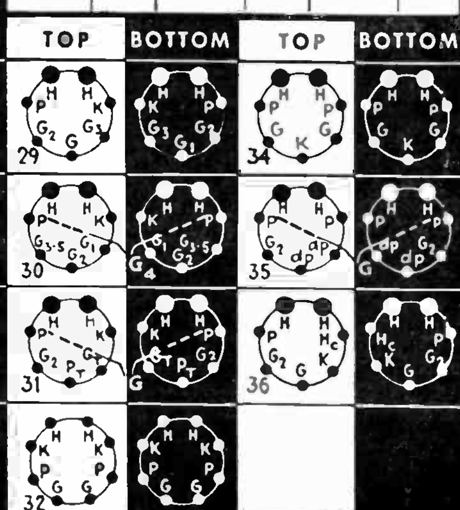


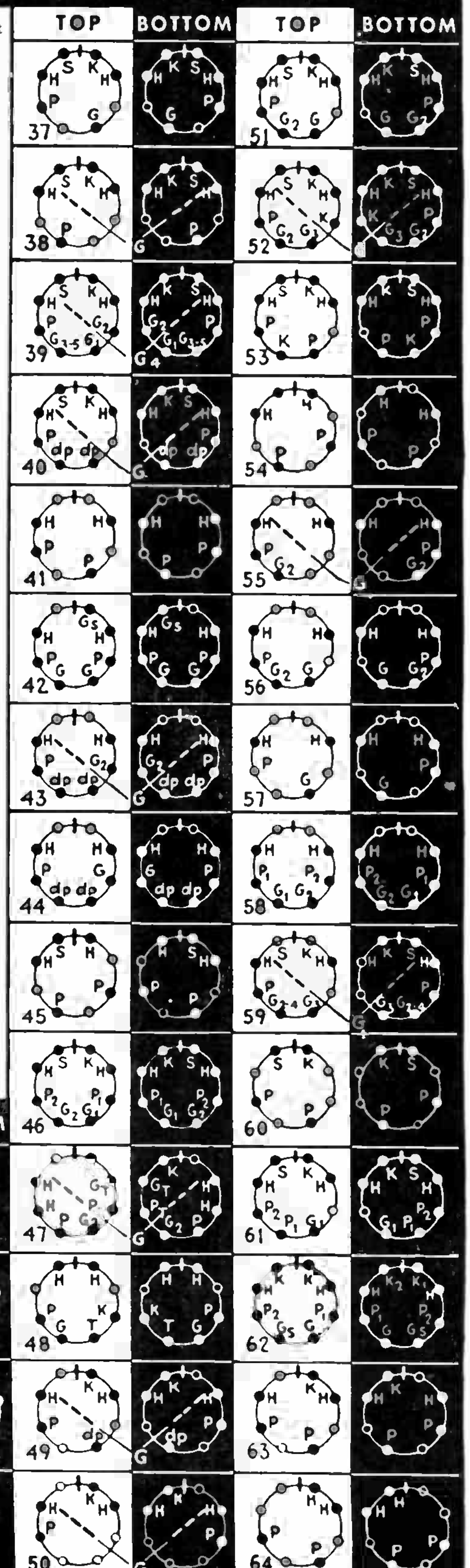
QUICK REFERENCE CHART

Showing Tube Socket Connections—Both Tops and Bottoms



Type	Socket	Type	Socket	Type	Socket
00A	16	6D6	21	30	16
01A	16	6D7	27	31	16
0Z4	60	6D8G	39	32	3
1A4	3	6E5	12	33	19
1A6	23	6E6	34	34	3
1B4	3	6E7	62	35	6
1B5	22	6F5	38	36	6
1C6	23	6F6	51	37	5
1C7G	39	6F7	31	38	6
1D5G	55	6G5	12	39	6
1D7G	39	6H6	53	40	16
1E5G	55	6J5G	37	41	7
1E7G	42	6J7	52	42	7
1F4	19	6K5G	50	43	7
1F5G	56	6K6G	51	44	6
1F6	10	6K7	52	45	16
1F7G	43	6L5G	37	46	19
1H4G	57	6L6	51	47	19
1H6G	44	6L7	59	48	7
1J6G	58	6N5	48	49	19
1V	15	6N6	61	50	15
2A3	16	6N7	46	53	34
2A5	7	6P7	47	55	9
2A6	9	6Q6G	63	56	5
2A7	30	6Q7	40	57	21
2B6	40	6R7	40	58	21
2B7	35	6S7G	52	59	29
2E5	12	6X5	52	71	16
2F7	31	6X5G	63	75	9
2G5	12	6Y5	13	76	5
2S-4S	20	6Z5	26	77	21
2Z2-G84	1	10	16	78	21
5V4G	45	11	17	79	25
5W4	45	12	16	80	2
5X4G	64	12A5	36	81	1
5Y3	45	12A7	28	82	2
5Y4G	64	12Z3	15	83	2
5Z3	2	15	8	83V	2
5Z4	54	18	7	84	20
6A3	16	19	8	85	9
6A4	19	20	16	89	21
6A6	34	22	3	V99	17
6A7	30	24A	6	X99	16
6A8	39	25S	22	182B	16
6B4G	37	25A6	51	183	16
6B5	11	25A7	62	485	5
6B6	40	25B5	11	950	19
6B7	35	25N6	61	BA	18
6B8	43	25Y5	24	BH	18
6C5	37	25Z5	24	BR	4
6C6	21	25Z6	53	LA	19
6C7	14	26	16	RK33	32
6D5	37	27	5		





Some Servicemen Read TUBE SOCKET CONNECTIONS One Way, Some the Other. This New Chart Shows Both.

Other Socket Connections shown on pages 202, 206 and 207.

ACTUAL SOCKET VOLTAGES

Measured to Chassis with 1000-ohms-per-volt D. C. Instrument

6J7 Oscillator

A.C. Sets	A.C.-D.C. Sets
150 to 220	75 to 90
0	0
150 to 200	70 to 90
-15 to -18	-5 to -9
0	0

6K7 I. F. Amplifier

A.C. Sets	A.C.-D.C. Sets
230 to 255	90 to 107
0 to 7	0
100 to 125	90 to 107
0 to -3	0
0 to 8	3 to 7

6L6 Output

A.C. Sets	A.C.-D.C. Sets
255 to 280	90 to 107
250 to 268	90 to 107
0 to 16	0 to 11
0 to 15.7	0 to 10

6R7 Detector-Amplifier

A.C. Sets	A.C.-D.C. Sets
130 to 175	55 to 75
Small	Small
3 to 5	1 to 2

6Q7 Detector-Amplifier

A.C. Sets	A.C.-D.C. Sets
80 to 130	55 to 75
Small	Small
2 to 6.5	1 to 2

6N6 Output

A.C. Sets	A.C.-D.C. Sets
220 to 285	90 to 105
230 to 290	90 to 105
0 to 4	0 to 2
0	0

6A8 Mixer

A.C. Sets	A.C.-D.C. Sets
245 to 260	82 to 107
95 to 130	50 to 65
0 to -0.2	
130 to 165	82 to 100
-5 to -20	
0 to 4.5	0 to 2

6C5 Amplifier

A.C. Sets (Trans.)	A.C. Sets (Res.)	A.C.-D.C. Sets
245-270	90-100	62 to 95
0	0	0
7 - 9	5	1.5 to 3

6F5 Amplifier

A.C. Sets (Trans.)	A.C. Sets (Res.)	A.C.-D.C. Sets
125 150	75 90	55 to 75
0.2	0.2	0
0 1.5	0 1.5	0 to 1

6F6 Output

A.C. Sets	A.C.-D.C. Sets
225 to 245	90 to 107
250 to 260	90 to 107
-0.2 to -0.5	-0.1 to -0.2
0	0

6H6 Detector-A. V. C.

A.C. Sets (Signal Volt.)	A.C.-D.C. Sets (Signal Volt.)
-0.4 to -3	-0.1 to -1
-0.3 to -3	-0.1 to -1
0 to -3	0 to -1
0 to -3	0 to -3

6L7 Mixer

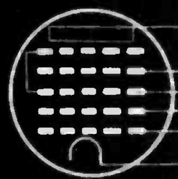
A.C. Sets	A.C.-D.C. Sets
250 to 270	85 to 105
75 to 100 -0.4	50 to 65 -0.2
-2 to -7	
0	0

Here's a new service chart idea designed to speed up location of set trouble. 95% of all receivers using the tubes illustrated apply voltages within the limits shown.

ACTUAL SOCKET VOLTAGES

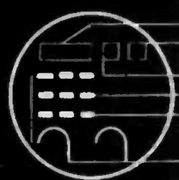
Measured to Chassis with 1000-ohms-per-volt D. C. Instrument

6A7 Mixer



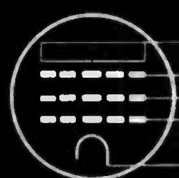
A.C.	A.C.-D.C.
230 to 265	97 to 134
0	0
90 to 110	63 to 80
137 to 180	80 to 112
-3 to -7.5	-2.6 to -8
2.5 to 5	2 to 2.6

6B7 Detector-Amplifier



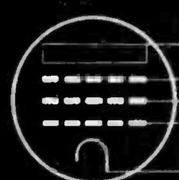
A.C.	A.C.-D.C.
115 to 135	25 to 45
0	0
0	0
75 to 105	20 to 35
0	0
1 to 2	1 to 1.5

6C6 Detector



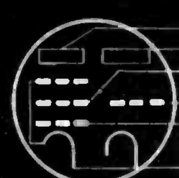
A.C.	A.C.-D.C.
0 to 30	0 to 22
0 to 2.6	0 to 2
25 to 75	18 to 45
0	0
0 to 2.6	0 to 2

6D6 I. F. Amplifier



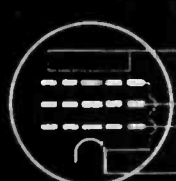
A.C.	A.C.-D.C.
225 to 265	97 to 105
2.8 to 6.6	3 to 3.5
90 to 120	97 to 105
0	0
2.5 to 6.6	3 to 3.5

6F7 Detector I. F. Amplifier



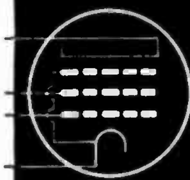
A.C.	A.C.-D.C.
110 to 135	83 to 105
118 to 140	20 to 35
45 to 60	70 to 105
0	0
0	0
0 to 1.5	0

41 Output



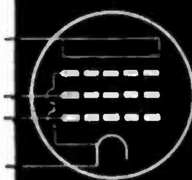
A.C.	A.C.-D.C.
220 to 245	75 to 105
225 to 255	93 to 110
-1 to -6	-0.3 to -1.5
0	0

42 Output



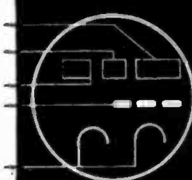
A.C.	A.C.-D.C.
225 to 247	75 to 105
240 to 260	80 to 110
-1 to -7	-0.3 to -1.5
0	0

43 Output



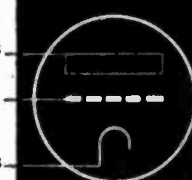
A.C.	A.C.-D.C.
	75 to 105
	95 to 120
	-0.3 to -1.7
	0

75 Detector-Amplifier



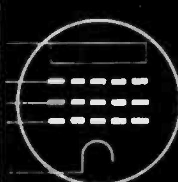
A.C.	A.C.-D.C.
80 to 95	30 to 35
-0.1 to -0.2	0
-0.1 to -0.2	0 to -0.1
0	0
0	0 to 1

76 Audio



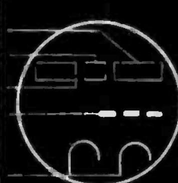
A.C.	A.C.-D.C.
115 to 140	35 to 48
0	0
7.2 to 10	3.5 to 4.8

78 I. F.



A.C.	A.C.-D.C.
225 to 250	107 to 120
2.7 to 6.5	2 to 2.6
90 to 115	80 to 107
0	0
2.5 to 6.5	2 to 2.6

85 Detector-Amplifier



A.C.	A.C.-D.C.
118 to 135	40 to 48
0	0
2 to 2.5	0 to -0.1
-0.01	0
15 to 17.5	0 to 1

Here's a new service chart idea designed to speed up location of set trouble. 95% of all receivers using the tubes illustrated apply voltages within the limits shown.

ACTUAL SOCKET VOLTAGES

Measured to Chassis with 1000-ohms-per-volt D. C. Instrument

Tube	A.C.	A.C.-D.C.
38 Audio	145 to 170	105 to 115
	150 to 185	95 to 105
	0	0
	11 to 14.5	9 to 11
77 Mixer	240 to 277	80 to 115
	0 to 7	0
	100 to 110	105 to 115
	0	0
	7 to 20	17.5 to 22
78 R. F. Amplifier	245 to 275	105 to 120
	0	2 to 2.5
	160 to 170	85 to 95
	0	0
	0 to 3.1	2 to 2.5
6B5 Audio	225 to 285	90 to 105
	215 to 265	90 to 105
	0	0
	0 to 4	0 to 2
6C6 Detector	35 to 40	18 to 22
	0	0.1 to 0.5
	20 to 26	12 to 15
	0	0
	3 to 5	17.5 to 22
6D6 R. F. Amplifier	240 to 265	105 to 118
	4 to 7	2.5 to 3.5
	80 to 110	90 to 118
	0	0
	2.5 to 7	2 to 5

Tube	A.C.	A.C.-D.C.
6J7 Detector	0 to 1	0 to 1
	2.6 to 4	2 to 3
	65 to 75	65 to 85
	0	0
	2.6 to 4	2 to 3.5
6K7 R. F. Amplifier	232 to 265	99 to 110
	0 to 2.5	0 to 3
	90 to 110	105 to 115
	0	0
	0 to 3.5	0 to 3
25A6 Audio	Not used	93 to 102
		102 to 111
		0 to −0.6
		10 to 12.5
25B5 Audio	Not used	105 to 115
		90 to 115
		0
		0
6E5 Tuning Indicator	240 to 265	105 to 118
	0	0
	0	0
	−1 to −2.5	−1 to −2
6G5 Tuning Indicator	245 to 265	105 to 118
	0	0
	0	0
	−1 to 3	−1 to 2.8

Here's a new service chart idea designed to speed up location of set trouble. 95% of all receivers using the tubes illustrated apply voltages within the limits shown.

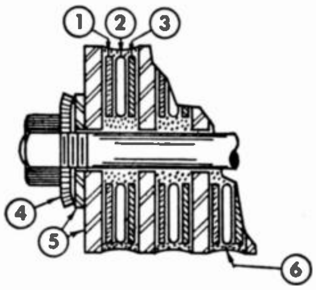
Mallory Replacement Rectifiers

Mallory Replacement Rectifiers for Chargers, Boosters, Eliminators and Speakers

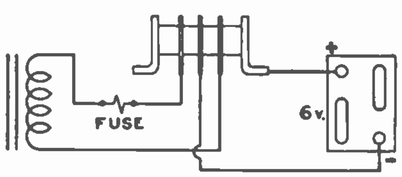
Catalog Number	Replaces Old Types Number
41AB	XB4
W8A3	4A3
12A1BY	XP12, UP8
12C1	X112, X12, U12
16C3	X116, X16, ME16
16C3B	XB16, M16
16CD3	
W16A1	
20A1	X20
W20A1	
W24A1	
65-10	

SECTION THROUGH SINGLE JUNCTION of Mallory Dry Disc Rectifier

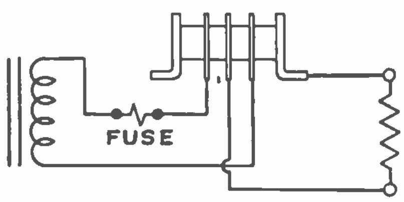
1. Magnesium
2. Copper Sulphide
3. Non-Polarizing Backing
4. Alloy Steel Spring Washer
5. Steel Washers
6. Protective Covering



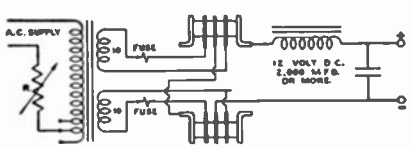
TYPICAL APPLICATIONS OF MALLORY DRY DISC RECTIFIER



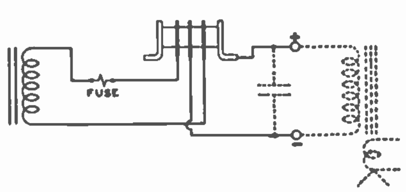
6-Volt Battery Charger



Resistance Load



Filtered Power Supply



Power Supply

● The increasing use of Mallory Dry Disc Rectifiers by manufacturers of battery chargers, boosters, eliminators, public address systems, pin game power packs and other DC apparatus operated from AC lines, opens up a new and profitable field for the serviceman. The same high quality and precision design has been built into a line of Mallory Replacement Rectifiers for this field as listed below.

The replacement reference contains the more popular applications for which Mallory Rectifiers are carried in stock. Mallory can supply replacement rectifiers made to order for many other applications not listed here at slightly higher prices. When ordering supply name and make of unit giving all information on name plate and send in old rectifier if possible.

Mallory engineers are always anxious to work with servicemen on any rectifier application. Upon receipt of complete circuit specifications and load requirements, they will be pleased to advise the proper use of Mallory Rectifiers together with the proper transformer and other circuit components. Mallory engineers will welcome hearing from any serviceman concerning any unusual rectifier applications.

General Replacement Reference

Make	Application	Model	Use Mallory Rectifier Cat. No.
Acme	Charger		4A1B
Amervox	Speaker		16C3B
Arvin	Charger	400	W8A3
Arvin	Charger	500	16C3
Arvin	Charger	600	16C3
Bernard	A Eliminator		16C3B
Bernard	Charger		4A1B
Bosch	Charger	250H	16C3
Bosch	Charger	250J	16C3
Brach	A Eliminator		16C3B
Briggs-Stratton	Charger		16C3B
Cadillac	Bat. Booster	A1109	16CD3
Cadillac	Charger	A1180	16CD3
Chevrolet	Charger	250B	16C3
Elkon	A Eliminator		16C3B
Elkon	Charger	B	4A1B
Elkon	Charger	E	12C1
Elkon	Charger	T	4A1B
Elkon	Charger	3 Amp	16C3B
Elkon	Charger	310	16C3
Elkon	Rectifier	M16	16C3B
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RADIO DEFINITIONS*

"A" Power Supply. A power supply device providing heating current for the cathode of a vacuum tube.

Alternating Current. A current, the direction of which reverses at regularly recurring intervals, the algebraic average value being zero.

Amplification Factor. A measure of the effectiveness of the grid voltage relative to that of the plate voltage in affecting the plate current.

Amplifier. A device for increasing the amplitude of electric current, voltages or power, through the control by the input power of a larger amount of power supplied by a local source to the output circuit.

Anode. An electrode to which an electron stream flows.

Antenna. A conductor or a system of conductors for radiating or receiving radio waves.

Atmospherics. Strays produced by atmospheric conditions.

Attenuation. The reduction in power of a wave or a current with increasing distance from the source of transmission.

Audio Frequency. A frequency corresponding to a normally audible sound wave. The upper limit ordinarily lies between 10,000 and 20,000 cycles.

Audio-Frequency Transformer. A transformer for use with audio-frequency currents.

Autodyne Reception. A system of heterodyne reception through the use of a device which is both an oscillator and a detector.

Automatic Volume Control. A self-acting device which maintains the output constant within relatively narrow limits while the input voltage varies over a wide range.

"B" Power Supply. A power supply device connected in the plate circuit of a vacuum tube.

Baffle. A partition which may be used with an acoustic radiator to impede circulation between front and back.

Band-Pass Filter. A filter designed to pass currents of frequencies within a continuous band limited by an upper and a lower critical or cut-off frequency and substantially reduce the amplitude of currents of all frequencies outside of that band.

Beat. A complete cycle of pulsations in the phenomenon of beating.

Beat Frequency. The number of beats per second. This frequency is equal to the difference between the frequencies of the combining waves.

Beating. A phenomenon in which two or more periodic quantities of different frequencies react to produce a resultant having pulsations of amplitude.

Broadcasting. Radio transmission intended for general reception.

By-Pass Condenser. A condenser used to provide an alternating-current path of comparatively low impedance around some circuit element.

"C" Power Supply. A power supply device connected in the circuit between the cathode and grid of a vacuum tube so as to apply a grid bias.

Capacitive Coupling. The association of one circuit with another by means of capacity common or mutual to both.

Carbon Microphone. A microphone which depends for its operation upon the variation in resistance of carbon contacts.

Carrier. A term broadly used to designate carrier wave, carrier current, or carrier voltage.

Carrier Frequency. The frequency of a carrier wave.

Carrier Suppression. That method of operation in which the carrier wave is not transmitted.

Carrier Wave. A wave which is modulated by a signal and which enables the signal to be transmitted through a specific physical system.

Cathode. The electrode from which the electron stream flows. (See Filament.)

Choke Coil. An inductor inserted in a circuit to offer relatively large impedance to alternating current.

Class A Amplifier. A class A amplifier is an amplifier in which the grid bias and alternating grid voltages are such that plate current in a specific tube flows at all times.

Class AB Amplifier. A class AB amplifier is an amplifier in which the grid bias and alternating grid voltages are such that plate current in a specific tube flows for appreciably more than half but less than the entire electrical cycle.

*Most of these definitions are based on I. R. E. standards.

Class B Amplifier. A class B amplifier is an amplifier in which the grid bias is approximately equal to the cut-off value so that the plate current is approximately zero when no exciting grid voltage is applied, and so that plate current in a specific tube flows for approximately one-half of each cycle when an alternating grid voltage is applied.

Class C Amplifier. A class C amplifier is an amplifier in which the grid bias is appreciably greater than the cut-off value so that the plate current in each tube is zero when no alternating grid voltage is applied, and so that plate current flows in a specific tube for appreciably less than one-half of each cycle when an alternating grid voltage is applied.
Note: To denote that grid current does not flow during any part of the input cycle, the suffix 1 may be added to the letter or letters of the class identification. The suffix 2 may be used to denote that grid current flows during some part of the cycle.

Condenser Loud Speaker. A loud speaker in which the mechanical forces result from electrostatic reactions.

Condenser Microphone. A microphone which depends for its operation upon variations in capacitance.

Continuous Waves. Continuous waves are waves in which successive cycles are identical under steady state conditions.

Conversion Transconductance is the ratio of the magnitude of a single beat-frequency component ($f_1 + f_2$) or ($f_1 - f_2$) of the output current to the magnitude of the input voltage of frequency f_1 under the conditions that all direct voltages and the magnitude of the second input alternating voltage f_2 must remain constant. As most precisely used, it refers to an infinitesimal magnitude of the voltage of frequency f_1.

Converter (generally in superheterodyne receivers). A converter is a vacuum-tube which performs simultaneously the functions of oscillation and mixing (first detection) in a radio receiver.

Coupling. The association of two circuits in such a way that energy may be transferred from one to the other.

Cross Modulation. A type of intermodulation due to modulation of the carrier of the desired signal in a radio apparatus by an undesired signal.

Current Amplification. The ratio of the alternating current produced in the output circuit of an amplifier to the alternating current supplied to the input circuit for specific circuit conditions.

Cycle. One complete set of the recurrent values of a periodic phenomenon.

Damped Waves. Waves of which the amplitude of successive cycles, at the source, progressively diminishes.

Decibel. The common transmission unit of the decimal system, equal to 1/10 bel.

$$1 \text{ bel} = 2 \log_{10} \frac{E_1}{E_2} = 2 \log_{10} \frac{I_1}{I_2}$$

(See Transmission Unit.)

Detection is any process of operation or a modulated signal wave to obtain the signal imparted to it in the modulation process.

Detector. A detector is a device which is used for operation on a signal wave to obtain the signal imparted to it in the modulation process.

Diaphragm. A diaphragm is a vibrating surface which produces sound vibrations.

Diode. A type of thermionic tube containing two electrodes which passes current wholly or predominantly in one direction.

Direct Capitance (C) between two conductors—The ratio of the charge produced on one conductor by the voltage between it and the other conductor, divided by this voltage, all other conductors in the neighborhood being at the potential of the first conductor.

Direct Coupling. The association of two circuits by having an inductor, a condenser, or a resistor common to both circuits.

Direct Current. A unidirectional current. As ordinarily used, the term designates a practically non-pulsating current.

Distortion. A change in wave form occurring in a transducer or transmission medium when the output wave form is not a faithful reproduction of the input wave form.

Double Modulation. The process of modulation in which a carrier wave of one frequency is first modulated by the signal wave and is then made to modulate a second carrier wave of another frequency.

Dynamic Amplifier. The RCA Dynamic Amplifier is a variable gain audio amplifier, the gain of which is proportional to the average intensity of the audio signal. Such an amplifier compensates for the contraction of volume range required because of recording or transmission line limitations.

Dynamic Sensitivity of a Phototube. The alternating-current response of a phototube to a pulsating light flux at specified values of mean light flux, frequency of pulsation, degree of pulsation, and steady tube voltage.

Electro-Acoustic Transducer. A transducer which is actuated by power from an electrical system and supplies power to an acoustic system or vice versa.

Electron Emission. The liberation of electrons from an electrode into the surrounding space. In a vacuum tube it is the rate at which the electrons are emitted from a cathode. This is ordinarily measured as the current carried by the electrons under the influence of a voltage sufficient to draw away all the electrons.

Electron Tube. A vacuum tube evacuated to such a degree that its electrical characteristics are due essentially to electron emission.

Emission Characteristic. A graph plotted between a factor controlling the emission (such as the temperature, voltage, or current of the cathode) as abscissas, and the emission from the cathode as ordinates.

Facsimile Transmission. The electrical transmission of a copy or reproduction of a picture, drawing or document. (This is also called picture transmission.)

Fading. The variation of the signal intensity received at a given location from a radio transmitting station as a result of changes occurring in the transmission path (see Distortion.)

Fidelity. The degree to which a system, or a portion of a system, accurately reproduces at its output the signal which is impressed upon it.

Filament. A cathode in which the heat is supplied by current passing through the cathode.

Filter. A selective circuit network, designed to pass current within a continuous band or bands of frequencies or direct current, and substantially reduce the amplitude of currents of undesired frequencies.

Frequency. The number of cycles per second.

Full-Wave Rectifier. A double element rectifier arranged so that current is allowed to pass in the same direction to the load circuit during each half cycle of the alternating-current supply, one element functioning during one-half cycle and the other during the next half cycle, and so on.

Fundamental Frequency. The lowest component frequency of a periodic wave or quantity.

Fundamental or Natural Frequency (of an antenna). The lowest resonant frequency of an antenna, without added inductance or capacity.

Gas Phototube. A type of phototube in which a quantity of gas has been introduced, usually for the purpose of increasing its sensitivity.

Grid. An electrode having openings through which electrons or ions may pass.

Grid Bias. The direct component of the grid voltage.

Grid Condenser. A series condenser in the grid or control circuit of a vacuum tube.

Grid Leak. A resistor in a grid circuit, through which the grid current flows, to affect or determine a grid bias.

Grid-Plate Transconductance. The name for the plate current to grid voltage transconductance. (This has also been called mutual conductance.)

Ground System (of an antenna). That portion of the antenna system below the antenna loading devices or generating apparatus most closely associated with the ground and including the ground itself.

Ground Wire. A conductive connection to the earth.

Half-Wave Rectifier. A rectifier which changes alternating current into pulsating current, utilizing only one-half of each cycle.

Harmonic. A component of a periodic quantity having a frequency which is an integral multiple of the fundamental frequency. For example, a component the frequency of which is twice the fundamental frequency is called the second harmonic.

Heater. An electrical heating element for supplying heat to an indirectly heated cathode.

Heterodyne Reception. The process of receiving radio waves by combining in a detector a received voltage with a locally generated alternating voltage. The frequency of the locally generated voltage is commonly different from that of the received voltage. (Heterodyne reception is sometimes called beat reception.)

Homodyne Reception. A system of reception by the aid of a locally generated voltage of carrier frequency. (Homodyne reception is sometimes called zero-beat reception.)

Hot-Wire Ammeter, Expansion Type. An ammeter dependent for its indications on a change in dimensions of an element which is heated by the current to be measured.

Indirectly Heated Cathode. A cathode of a thermionic tube, in which heat is supplied from a source other than the cathode itself.

Induction Loud Speaker is a moving coil loud speaker in which the current which reacts with the polarizing field is induced in the moving member.

Inductive Coupling. The association of one circuit with another by means of inductance common or mutual to both.

Interelectrode Capacitance. The direct capacitance between two electrodes.

Interference. Disturbance of reception due to strays, undesired signals, or other causes; also, that which produces the disturbance.

Intermediate Frequency in Superheterodyne Reception. A frequency between that of the carrier and the signal, which results from the combination of the carrier frequency and the locally generated frequency.

Intermodulation. The production, in a non-linear circuit element, of frequencies corresponding to the sums and differences of the fundamentals and harmonics of two or more frequencies which are transmitted to that element.

Interrupted Continuous Waves. Interrupted continuous waves are waves obtained by interruption at audio frequency in a substantially periodic manner of otherwise continuous waves.

Kilocycle. When used as a unit of frequency, is a thousand cycles per second.

Lead-In. That portion of an antenna system which completes the electrical connection between the elevated outdoor portion and the instruments or disconnecting switches inside the building.

Linear Detection. That form of detection in which the audio output voltage under consideration is substantially proportional to the modulation envelope throughout the useful range of the detecting device.

Loading Coil. An inductor inserted in a circuit to increase its inductance but not to provide coupling with any other circuit.

Loud Speaker. A telephone receiver designed to radiate acoustic power into a room or open air.

Magnetic Loud Speaker. One in which the mechanical forces result from magnetic reactions.

Magnetic Microphone. A microphone whose electrical output results from the motion of a coil or conductor in a magnetic field.

Master Oscillator. An oscillator of comparatively low power so arranged as to establish the carrier frequency of the output of an amplifier.

Megacycle. When used as a unit of frequency, is a million cycles per second.

Mercury-Vapor Rectifier. A mercury-vapor rectifier is a two-electrode, vacuum-tube rectifier which contains a small amount of mercury. During operation, the mercury is vaporized. A characteristic of mercury-vapor rectifiers is the low-voltage drop in the tube.

Mircophone. A microphone is an electro-acoustic transducer actuated by power in an acoustic system and delivering power to an electric system, the wave form in the electric system corresponding to the wave form in the acoustic system. This is also called a telephone transmitter.

Mixer Tube (generally in superheterodyne receivers.) A mixer tube is one in which a locally generated frequency is combined with the carrier-signal frequency to obtain a desired beat frequency.

Modulated Wave. A modulated wave is a wave of which either the amplitude, frequency, or phase is varied in accordance with a signal.

Modulation is the process in which the amplitude, frequency, or phase of a wave is varied in accordance with a signal, or the result of that process.

Modulator. A device which performs the process of modulation.

Monochromatic Sensitivity. The response of a phototube to light of a given color, or narrow frequency range.

Moving-Armature Speaker. A magnetic speaker whose operation involves the vibration of a portion of the ferromagnetic circuit. (This is sometimes called an electromagnetic or a magnetic speaker.)

Moving Coil Loud Speaker. A moving coil loud speaker is a magnetic loud speaker in which the mechanical forces are developed by the interaction of currents in a conductor and the polarizing field in which it is located. This is sometimes called an Electro-Dynamic or a Dynamic Loud Speaker.

Mu-Factor. A measure of the relative effect of the voltages on two electrodes upon the current in the circuit of any specified electrode. It is the ratio of the change in one electrode voltage to a change in the other electrode voltage, under the condition that a specified current remains unchanged.

Mutual Conductance. (See Grid-Plate Transconductance.)

Oscillator. A non-rotating device for producing alternating current, the output frequency of which is determined by the characteristics of the device.

Oscillatory Circuit. A circuit containing inductance and capacitance, such that a voltage impulse will produce a current which periodically reverses.

Pentode. A type of thermionic tube containing a plate, a cathode, and three additional electrodes. (Ordinarily the three additional electrodes are of the nature of grids.)

Percentage Modulation. The ratio of half the difference between the maximum and minimum amplitudes of a modulated wave to the average amplitude, expressed in per cent.

Phonograph Pickup. An electromechanical transducer actuated by a phonograph record and delivering power to an electrical system, the wave form in the electrical system corresponding to the wave form in the phonograph record.

Phototube. A vacuum tube in which electron emission is produced by the illumination of an electrode. (This has also been called photo-electric tube.)

Plate. A common name for the principal anode in a vacuum tube.

Power Amplification (of an amplifier). The ratio of the alternating-current power produced in the output circuit to the alternating-current power supplied to the input circuit.

Power Detection. That form of detection in which the power output of the detecting device is used to supply a substantial amount of power directly to a device such as a loud speaker or recorder.

Pulsating Current. A periodic current; that is, current passing through successive cycles, the algebraic average value of which is not zero. A pulsating current is equivalent to the sum of an alternating and a direct current.

Push-Pull Microphone. One which makes use of two functioning elements 180 degrees out of phase.

Radio Channel. A band of frequencies or wavelengths of a width sufficient to permit of its use for radio communication. The width of a channel depends upon the type of transmission. (See Band of Frequencies.)

Radio Compass. A direction finder used for navigational purposes.

Radio Frequency. A frequency higher than those corresponding to normally audible sound waves. (See Audio Frequency.)

Radio-Frequency Transformer. A transformer for use with radio-frequency currents.

Radio Receiver. A device for converting radio waves into perceptible signals.

Radio Transmission. The transmission of signals by means of radiated electromagnetic waves originating in a constructed circuit.

Radio Transmitter. A device for producing radio-frequency power, with means for producing a signal.

Rectifier. A device having an asymmetrical conduction characteristic which is used for the conversion of an alternating current into a pulsating current. Such devices include vacuum-tube rectifiers, gas rectifiers, oxide rectifiers, electrolytic rectifiers, etc.

Reflex Circuit Arrangement. A circuit arrangement in which the signal is amplified, both before and after detection, in the same amplifier tube or tubes.

Regeneration. The process by which a part of the output power of an amplifying device reacts upon the input circuit in such a manner as to reinforce the initial power, thereby increasing the amplification. (Sometimes called "feedback" or "reaction.")

Resistance Coupling. The association of one circuit with another by means of resistance common to both.

Resonance Frequency (of a reactive circuit). The frequency at which the supply current and supply voltage of the circuit are in phase.

Rheostat. A resistor which is provided with means for readily adjusting its resistance.

Screen Grid. A screen grid is a grid placed between a control grid and an anode, and maintained at a fixed positive potential, for the purpose of reducing the electrostatic influence of the anode in the space between the screen grid and the cathode.

Secondary Emission. Electron emission under the influence of electron or ion bombardment.

Selectivity. The degree to which a radio receiver is capable of differentiating between signals of different carrier frequencies.

Sensitivity. The degree to which a radio receiver responds to signals of the frequency to which it is tuned.

Sensitivity of a Phototube. The electrical current response of a phototube, with no impedance in its external circuit, to a specified amount and kind of light. It is usually expressed in terms of the current for a given radiant flux, or for a given luminous flux. In general the sensitivity depends upon the tube voltage, flux intensity, and spectral distribution of the flux.

Service Band. A band of frequencies allocated to a given class of radio communication service.

Side Bands. The bands of frequencies, one on either side of the carrier frequency, produced by the process of modulation.

Signal. The intelligence, message or effect conveyed in communication.

Single Side-Band Transmission. That method of operation in which one side band is transmitted, and the other side band is suppressed. The carrier wave may be either transmitted or suppressed.

Static. Strays produced by atmospheric conditions.

Static Sensitivity of a Phototube. The direct current response of a phototube to a light flux of specified value.

Stopping Condenser. A condenser used to introduce a comparatively high impedance in some branch of a circuit for the purpose of limiting the flow of low-frequency alternating current or direct current without materially affecting the flow of high frequency alternating current.

Strays. Electromagnetic disturbances in radio reception other than those produced by radio transmitting systems.

Superheterodyne Reception. Superheterodyne reception is a method of reception in which the received voltage is combined with the voltage from a local oscillator and converted into voltage of an intermediate frequency which is usually amplified and then detected to reproduce the original signal wave. (This is sometimes called double detection or supersonic reception.)

Swinging. The momentary variation in frequency of a received wave.

Telephone Receiver. An electro-acoustic transducer actuated by power from an electrical system and supplying power to an acoustic system, the wave form in the acoustic system corresponding to the wave form in the electrical system.

Television. The electrical transmission of a succession of images and their reception in such a way as to give a substantially continuous reproduction of the object or scene before the eye of a distant observer.

Tetrode. A type of thermionic tube containing a plate, a cathode, and two additional electrodes. (Ordinarily the two additional electrodes are of the nature of grids.)

Thermionic. Relating to electron emission under the influence of heat.

Thermionic Emission. Electron or ion emission under the influence of heat.

Thermionic Tube. An electron tube in which the electron emission is produced by the heating of an electrode.

Thermocouple Ammeter. An ammeter dependent for its indications on the change in thermo-electromotive force set up in a thermo-electric couple which is heated by the current to be measured.

Total Emission. The value of the current carried by electrons emitted from a cathode under the influence of a voltage such as will draw away all the electrons emitted.

Transconductance. The ratio of the change in the current in the circuit of an electrode to the change in the voltage on another electrode, under the condition that all other voltages remain unchanged.

Transducer. A device actuated by power from one system and supplying power to another system. These systems may be electrical, mechanical, or acoustic.

Transmission Unit. A unit expressing the logarithmic ratios of powers, voltages, or currents in a transmission system. (See Decibel.)

Triode. A type of thermionic tube containing an anode, a cathode, and a third electrode, in which the current flowing between the anode and the cathode may be controlled by the voltage between the third electrode and the cathode.

Tuned Transformer. A transformer whose associated circuit elements are adjusted as a whole to be resonant at the frequency of the alternating current supplied to the primary, thereby causing the secondary voltage to build up to higher values than would otherwise be obtained.

Tuning. The adjustment of a circuit or system to secure optimum performance in relation to a frequency; commonly, the adjustment of a circuit or circuits to resonance.

Vacuum Phototube. A type of phototube which is evacuated to such a degree that the residual gas plays a negligible part in its operation.

Vacuum Tube. A device consisting of a number of electrodes contained within an evacuated enclosure.

Vacuum Tube Transmitter. A radio transmitter in which vacuum tubes are utilized to convert the applied electric power into radio-frequency power.

Vacuum Tube Voltmeter. A device utilizing the characteristics of a vacuum tube for measuring alternating voltages.

Voltage Amplification. The ratio of the alternating voltage produced at the output terminals of an amplifier to the alternating voltage impressed at the input terminals.

Voltage Divider. A resistor provided with fixed or movable contacts and with two fixed terminal contacts; current is passed between the terminal contacts, and a desired voltage is obtained across a portion of the resistor. (The term potentiometer is often erroneously used for this device.)

Wave a. A propagated disturbance, usually periodic, as an electric wave or sound wave,
b. A single cycle of such a disturbance, or,
c. A periodic variation as represented by a graph.

Wavelength. The distance traveled in one period or cycle by a periodic disturbance.

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