

Howard W. Sams

PF
PHOTOFACT

INDEX

AND TECHNICAL DIGEST

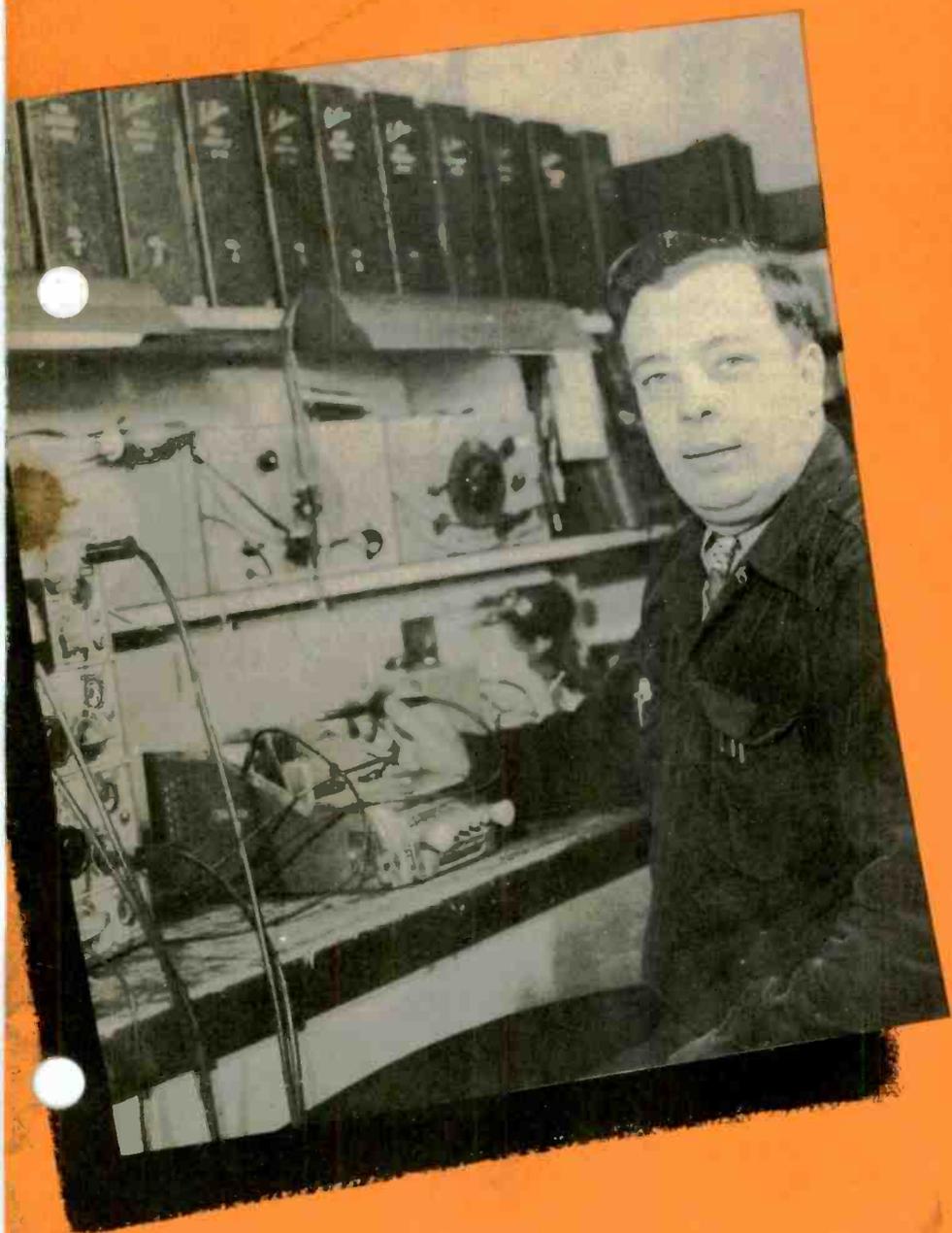
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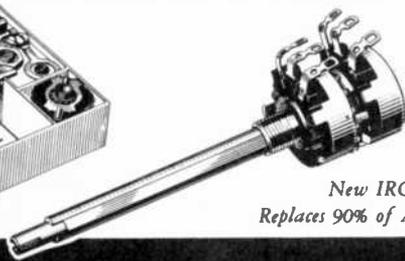
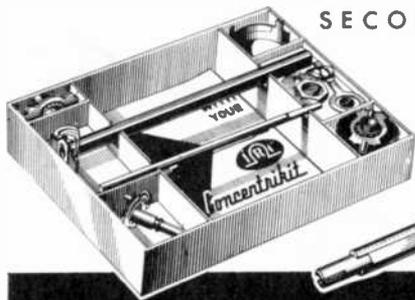
COVERING PHOTOFACT
FOLDER SETS 1 THRU 127



CONTENTS

Shop Talk	
<i>Milton S. Kiver</i>	4
High, Wide, and Handsome	
<i>Merle E. Chaney</i>	5
Dollar and Sense Servicing	
<i>John Markus</i>	11
Television Tuning Units (Part 2)	
<i>W. William Hensler</i>	13
As I See It	
<i>Walter R. Jones</i>	19
Keyed AGC Operation	
<i>W. W. Hensler and R. B. Dunham</i>	26
PHOTOFACT CUMULATIVE INDEX	
No. 25 Covering PHOTOFACT Folder Sets Nos. 1-127 Inclusive	29
The "Thing"	54

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New IRC CONCENTRIKIT
Replaces 90% of All Concentric Duals

HOW TO ASSEMBLE MOST CONCENTRIC DUAL CONTROLS FOR TV OR RADIO WITH ONLY A FEW BASIC PARTS

Actually, you can duplicate almost any concentric dual carbon control shown in Photofacts Index—with IRC's new CONCENTRIKIT. And you can do it in just a few minutes! This kit of specially designed parts—plus a wide selection of shaft ends and base assemblies—gives you a full range of concentric duals for auto radios, home receivers, TV sets.

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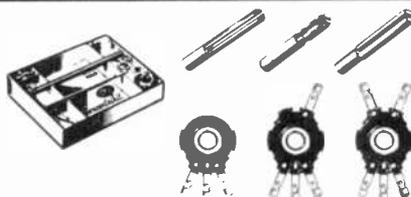


From Pre-war Concentrics to the Latest TV Specials
LOW-COST, UNIVERSAL INVENTORY
— NO OBSOLESCENCE

With TV sets constantly being improved, and using more and more concentrics, the problem of obsolescence is almost as bad as that of finding exact duplicates. CONCENTRIKIT is your insurance against being "stuck" with specials that are out of date. Yet, at the same time, CONCENTRIKIT lets you service out-moded sets without looking all over the landscape for suitable concentric duals.

Only 11 Universal Parts—plus Shaft Ends and Base Elements
SAVE BY BUYING ONLY WHAT YOU NEED

Each CONCENTRIKIT contains 11 IRC *universal* parts—common to all IRC Type Q Concentric Duals. It does *not* include inner shaft ends, control Base-Element assemblies, switches or sleeve



bushings. These are purchased separately—as you need them. But because they all are *standard* with IRC, there's no difficulty in getting what you want when you want it. And because they are so adaptable, you save by buying only what you need.

The parts of CONCENTRIKIT have been made as universal as possible. The control coupler permits positioning of terminals in 16 different positions to duplicate the terminal location of original controls. The outer shaft is channeled to the right depth for most flats so you can apply them with a minimum of filing. Width of channel has been selected to give you proper guide for slotting. Inner shaft employs the well-known IRC Tap-in Shaft attachment to provide easier assembly for universal use.

A Wide Variety of Shaft Ends and Base Elements

The majority of inner knobs on concentric duals require a special fitting known as a shaft end. IRC makes three available to cover a wide range of needs. Also, two base elements are required for each concentric dual. These are available in a wide assortment of resistance values, tapers and tapped units. Select the proper shaft end and base-elements when you purchase CONCENTRIKIT.



For many concentric duals, you'll need a switch—and for some (such as auto replacements) you'll need sleeve bushings. IRC provides both single and double-pole switches (Type 76-1 and 76-2) to give you substantial coverage of all your switch requirements. Sleeve bushings come in three adaptable types.

CONCENTRIKIT ASSEMBLY IDENTIFICATION OF PARTS

A Control Cover

B Inner Shaft (and Contactor)

C Rear Base-Element (not included in CONCENTRIKIT)

D Coupler

E Resilient Retainer Ring (Stock No. R-2)

F Spring Thrust Washer

G Disc Washer

H Outer Shaft (and Contactor)

I Panel Base-Element (not included in CONCENTRIKIT)

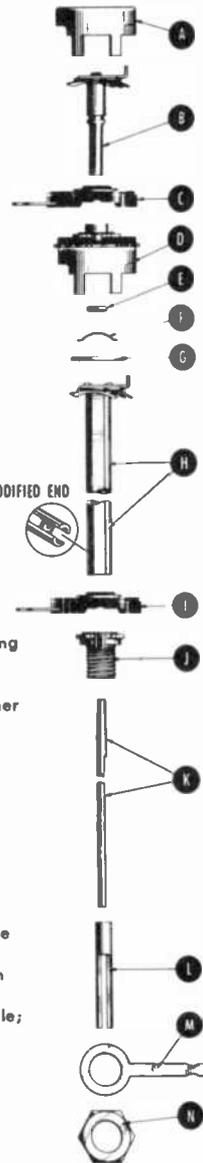
J Bushing-Ground Plate

K Inner Shaft Extension

L Shaft End (3 available; not included in CONCENTRIKIT)

M Grounding Lug

N Mounting Nut



NEW TV CONTROL MANUAL

IRC's new up-to-date TV Control Manual is scheduled for release in April. Includes comprehensive listing of replacements for vast majority of TV sets. Also lists complete replacement detail on concentric dual controls—including not only TV but also home radio and auto sets as far back as they have been used. Features complete section on use of Concentrikit, providing many tips and short cuts on its use. Order this valuable IRC TV Control Manual (Form SO86A) from your IRC Distributor.



Wherever the Circuit Says 

INTERNATIONAL RESISTANCE CO.

423 N. Broad Street, Philadelphia 8, Pa.

MILTON S. KIVER

President, Television Communications Institute

Shop Talk

WHAT DO WE DO NOW? To the seasoned TV serviceman, what to do when he is given a TV set to repair is second nature. But there are unquestionably more novices than experienced veterans in the field and to them "What Do You Do Now?" is a frightening question. While it is not possible to set down a strict step-by-step procedure in this limited space, a general approach can be outlined.

When a TV set is first taken to the bench for repair, read the customer's complaints carefully. (If you are inspecting the set in the home, determine all you can concerning set behavior before even touching the set. This not only helps you, but gives the customer a chance to tell what he knows. And it makes for wonderful customer relations.)

The next step is to turn the set on and permit it to warm up. (If the set fuse is blown or does blow when the power is turned on, a short circuit is indicated and this should be located before the power is once more applied to the set.) With an antenna connected to the set, observe what indications are obtained. Examine the screen, listen to the sound, and then check the operation of the various front panel controls. Do this carefully because it will tell you much concerning set operation. Does the picture remain in sync over the normal rotation range of the horizontal and vertical hold controls? If both controls are critical, then the trouble normally exists in some circuit leading to the vertical and horizontal sweep systems and not in the sweep systems themselves. If only one system appears to be affected, then the trouble can be assumed to be situated here.

How effective is the contrast control? Is there sufficient leeway in the fine-tuning control to permit a station to be properly tuned in? Does the sound and the picture come in at the same setting of this control? Does the set display the same defect on all stations?

This line of self-questioning, while done consciously at first, becomes, with repetition, second nature. Learn to observe and you've taken a long stride toward becoming an experienced serviceman.

From the symptoms demonstrated by the set through its sound and picture, plus what you have learned from rotating the various controls, you should have some inkling of the approximate location of the trouble. (This information is given in standard television texts.) Let us say that it is the horizontal sweep system. Locate the tubes in this section of the receiver and substitute in their place tubes known to be good. Substitute one tube at a time. (A set of special testing tubes kept specifically for this purpose is a great time saver.) Checking each suspected tube individually in a tube tester is time-consuming and may not always reveal the defective tube.

It is only after it has been determined that the tubes are okay that the circuits themselves are

checked. In the amplifier stages following the video second detector, in the sync separator stages, and in the deflection systems, the writer likes to check waveform first. In all other stages, voltage checks are made at the start. This procedure is admittedly a matter of preference, but it seems to work out quite well.

Determine from the service manual, or from an experienced serviceman, whether the wave patterns or the voltage values obtained are normal. 10 to 15 per cent variations in voltage (and resistance) readings can be accepted; discrepancies greater than this should be checked carefully. Test condensers by bridging across them other units of equal (or closely similar) value. Look for the obvious and don't take too much for granted.

Here, then, in outline form is a time-tested and proven method of approach. It is simple, direct, and works with the percentages. After you have gained experience and service poise you will undoubtedly modify it to suit yourself. But it will get you started in the beginning.

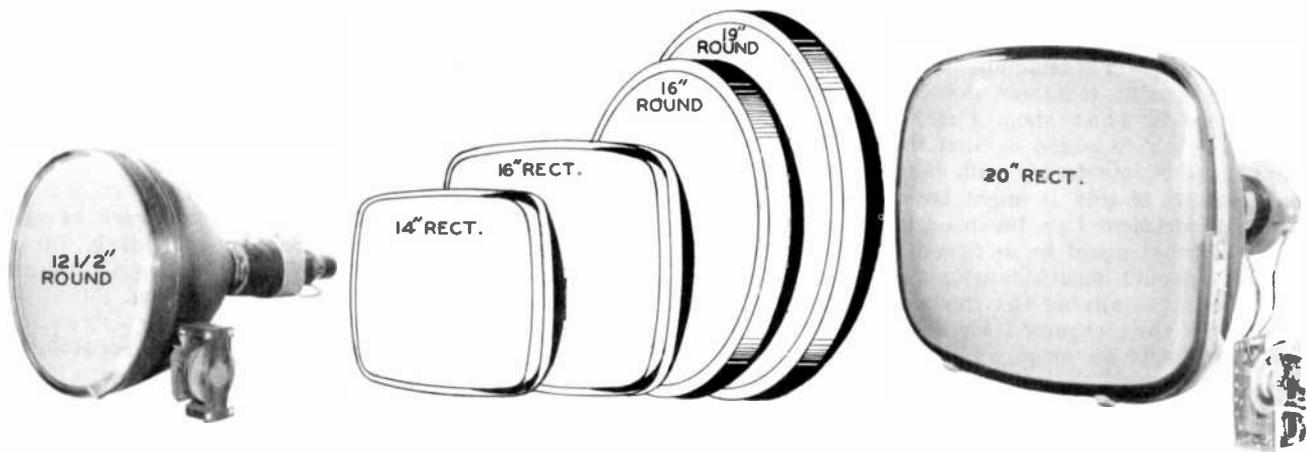
For any TV receiver servicing in the home, a small pocket-size tube manual and a booklet showing tube layouts for various TV sets will prove of immense value. The tube layout book (such as Sams' "Television Tube Location Guide") will help you trace the signal path through the receiver while the tube manual will, if nothing else, identify the various pins of the socket and give you a rough idea of the voltages that should be present. Surprisingly enough, it is generally the so-called "old timer" who forgets (either purposely or unconsciously) these two booklets and then finds himself stumped by a new set or a new tube.

In this rapidly changing field of television, new tubes and new chassis are appearing constantly and the service technician cannot afford to adopt the "I know it" attitude. There is just too much to keep abreast of.

A NOTE ON SERVICE STUMPERS. Every television receiver is a well-ordered, carefully-designed mechanism that operates according to a certain set of rules. From a knowledge of these rules, we can, with a fair degree of accuracy, generally trace a defect to a certain section of the receiver from a study of the symptoms. This is the familiar pattern of approach for all TV servicemen.

There are times, however, when the serviceman encounters troubles which appear to bear little or no relationship to the symptoms they produce. Thus, for example, in the Capehart CX-33 receiver, failure of a video amplifier tube causes the high voltage on the C. R. T. to disappear. Your first impulse, upon receiving such a set, is to note the absence of high-voltage and thereafter to confine your attention to the

◆ ◆ Please turn to page 44 ◆ ◆



High, Wide and Handsome

by MERLE E. CHANEY

The conversion of television receivers using 10" or 12" picture tubes to those employing 14", 16", or larger, represents a new field in which the television technician can supplement his income. The trend toward larger picture tube sizes does not antique the 10" or 12" set by any means, but there is a desire on the part of the television viewer to own a set with a larger screen. A television set represents a good-sized investment and most people cannot afford to sacrifice their initial investment by purchasing a new receiver. The answer to this is the conversion of the older set so that a larger picture tube can be used. This places the service technician in a position to perform additional services for the customer, creating good will and, at the same time, broadening his sources of income.

Obviously, all conversion work must be profitable and several items should be taken into consideration before entering into this field. First, it must be remembered that a conversion job takes much more time than a regular service job. In almost every case several parts must be removed from the chassis and new parts must be installed. This may require some metal work to fabricate mounting brackets for the new parts, which is a time consuming job. Considerable work will be required on the cabinet to accommodate the new tube. Even under the best conditions it is estimated that a satisfactory conversion will take a service technician a day to complete the job, and in some cases a little longer. In other words, in a one-man service shop, the regular service work would be stopped for at least a day, or perhaps longer, which in most cases could not be tolerated. Remember, the repair and maintenance of radio and television sets is the real backbone of your business and to insure its future, this work should not be slighted in any way.

When a customer's set fails he brings it to your shop for repair and, when you accept the job, he expects you to complete it as soon as possible. This necessitates the repair of the sets in proper sequence. It would be economically unsound to refuse any repair jobs which can be done by your shop. Also it would be unsound to accept conversion jobs if they were to interfere with your regular repair work.

This does not mean, however, that there is no place in the one-man shop for conversion work. Past experience has shown that there may be certain periods when there will be fewer sets brought into the shop for repair. It is during these periods that it would be possible to complete a conversion job.

The time when a conversion job is to be done, in most cases, can be controlled. Since the customer's set is operating he is more willing to wait a few days, if necessary, for the conversion job, than he would be if his set had failed and required service. Thus the set could be scheduled to be picked up at a time when the work would fit into the schedule of the service shop. In every case it is recommended that the set not be picked up until you are ready to start the conversion work. This means that the set will be in your shop for a minimum of time, with greater satisfaction to the customer.

Service shops employing two or more technicians should be in a better position to handle conversion work than in the case of the smaller shop. The



Fig. 1. 630-Type TV Chassis with Deflection Yoke and Focus Coil Removed.

very fact that several technicians are required to do the service work, indicates that considerable work is being done by that shop. Caution must be exercised here too, to guard against the acceptance of conversion jobs interfering with the regular service work. Because of this it might be wise to set up a separate department for the handling of conversion work. Personnel could be assigned to do this work and after a period should develop methods and techniques for streamlining the operation. By cutting down on the time required for doing the job, more conversions could be made, resulting in more profit for the shop.

So far our discussion has dealt with the time element of doing this type of work. It is of great importance and is the first obstacle that must be hurdled. If you feel that you are getting maximum output from your shop now, and that the acceptance of additional work would place a burden on your organization, no conversion work should be accepted. If you decide to enter into the field, on a limited basis, keep it on a limited basis. It is awfully hard to turn down jobs, but if you do not have the time to complete them, accepting them would be the same as selling merchandise which you do not have. It is much easier to explain to the would-be customer that you simply do not have the time to do the job at the moment, than to have him on your neck for not turning out the job on schedule. Your frankness may make him a potential customer for future repair work or you might even find that he will be willing to wait for the conversion job until such a time as you can handle it.

Assuming that you have decided to do conversion work, either on a large or small scale, the next step is to decide what receivers are going to be accepted. From the cabinet standpoint, there are three distinct groups. The first would be the case where the customer is going to mount his receiver in a custom installation or in a new cabinet, with this work being done by someone other than yourself. Obviously, this is the most desirable course since it does not place the responsibility of the cabinet work on you.

The second group would be those receivers that are to be mounted in the original cabinet. The cabinet in this case is the limiting factor as to how large a tube can be used. Be sure that sufficient data is available or that past experience has shown that the tube which the customer wants will fit into the cabinet before you contract to do the job. It is suggested, when doing a conversion job for the first time on any model, that no alterations be made on the cabinet until the chassis is converted and that it is definitely established that the new tube will fit into the cabinet. Also, notes should be listed to be used as a guide for any future work on that same model. After the work on the cabinet is completed, a template should be made to make the next job easier.

The third group can be classified as those sets which are to be mounted in custom installations or in new cabinets with the responsibility of the installation given to you. This obviously requires more work than in either of the preceding groups. Since the average service shop is not set up to do cabinet work of this caliber, it might be possible in some cases

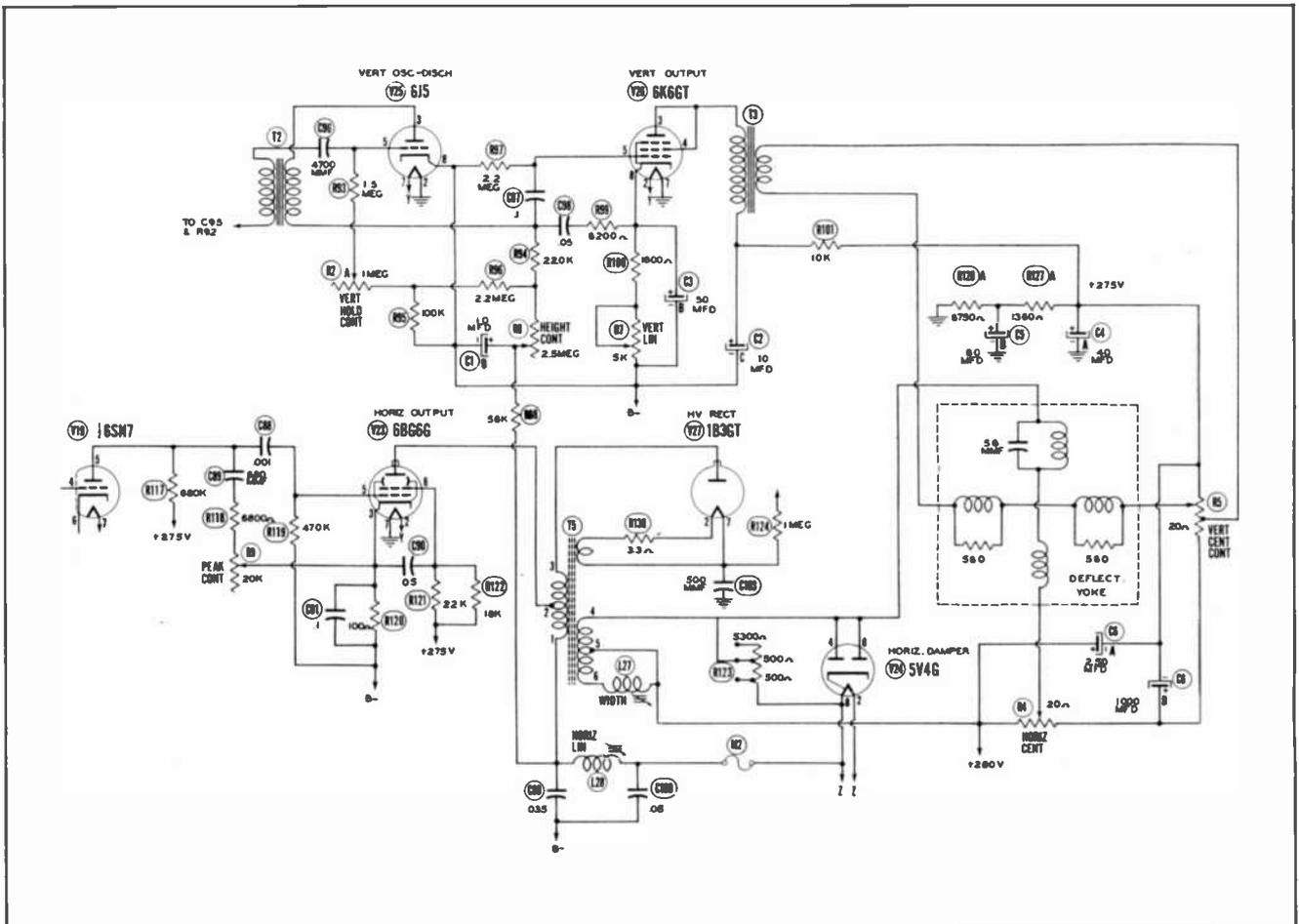


Fig. 2. Schematic of Horizontal and Vertical Sweep Circuits before Conversion.

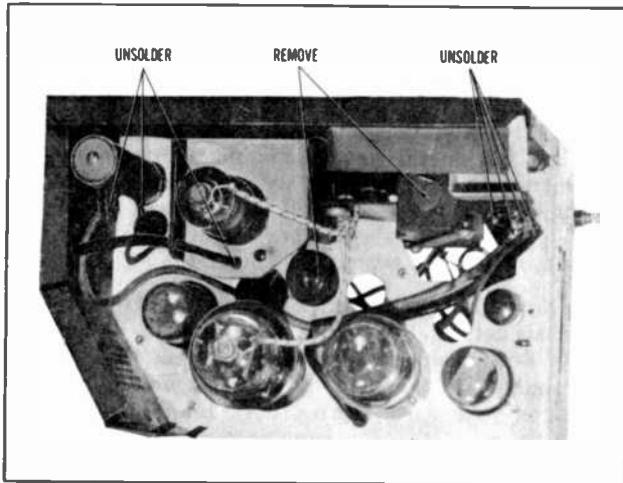


Fig. 3. Original Wiring in HV Compartment.

to contact a local cabinet maker and engage him to do this work for you. This would also apply to group two listed above. Any arrangement of this type should be entered into cautiously, however, making sure that both parties will benefit.

The three groups listed should serve as a guide to help you select what receivers you are going to accept as far as the cabinet work is concerned.

The next thing to consider is which chassis can be converted from an electrical standpoint. First of all, the series filament type sets can present several problems in making a conversion and therefore it might be wise to not accept them for conversion. This does not mean that they cannot be converted, but unless specific data is available outlining the correct procedure, several problems might arise during the conversion which could result in a loss instead of a profit.

Usually a little more power will be required to sweep the larger tube. Consequently those sets having power supplies that are already working at maximum capacity may cause trouble after the conversion is made. This information can be obtained from service data which gives the current drain on the power transformer. The next factor is the general layout of the chassis. If the affected parts are crowded, making the work difficult, the set should not be accepted for conversion. Again this does not mean that a set of this type cannot be converted, but it might be economically sound not to attempt it. It is hard to draw the line where sets will or will not be accepted, but usually a careful study of the circuit and photographs of the chassis layout, will aid in making a decision. If, after a job is accepted, it is found that the conversion is more difficult than anticipated, with resulting higher costs, any future requests for conversion of the model should not be accepted.

The maintenance of an adequate supply of parts for carrying on this work is very important. By having the parts on hand before the job is started, much time will be saved and you will have the assurance that the job can be completed. This is especially true since the supply of parts is rather uncertain at this time. The maintenance of a parts supply includes not only the electrical components but also the mechanical parts such as stock for making brackets, tube escutcheons and bezels. If any one of the re-

quired items are not on hand when the job is started, it may hold up its completion for some time - much to the dissatisfaction of the customer.

Whenever possible it is an aid in selling conversion jobs to establish a set price for the conversion of any specific model. This price can then be quoted to the customer and he knows exactly what it is going to cost him. The established price also gives the customers added confidence, helping in selling the job. If, after quoting a price on a certain model, it is found that the price is too low or too high, it may be revised before accepting another job on the same model.

There are times when it would be logical to suggest a conversion job to the customer from a financial standpoint. If a set with a small-size picture tube is in the shop for repair, and it is found that the picture tube or a major component in the deflection circuit is defective, the customer might be interested in having the set converted. Since one of the costlier components, such as picture tube, horizontal output transformer, or deflection yoke, needs replacement, the net cost to the customer for the conversion job would be less.

It is suggested that an explanation be made to the customer as to the extent of the guarantee of the receiver after the conversion has been made. This may avoid misunderstanding in the future in the event of failure of components not associated with the deflection circuits.

Following is an account of the work done on one of the models converted in our laboratory. It should provide an idea of the extent of work required to do the job. Keep in mind too, that this particular model is very well suited for conversion and that there are many sets in the field which would require additional work.

CONVERTING THE 630-TYPE TV CHASSIS

In this conversion a 630-type TV chassis, illustrated in Figure 1, was used. This chassis is used in many models which have cabinets too small to accommodate a larger tube, and if it is not desired to use a new cabinet, a conversion cannot be made.

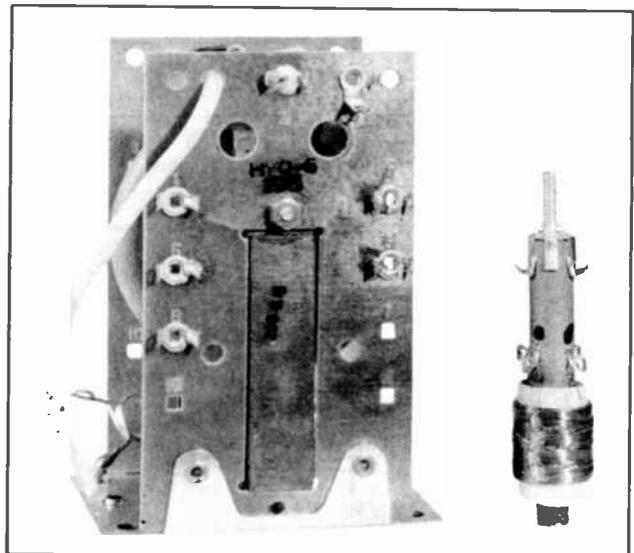


Fig. 4. New HV Transformer and Width Coil.

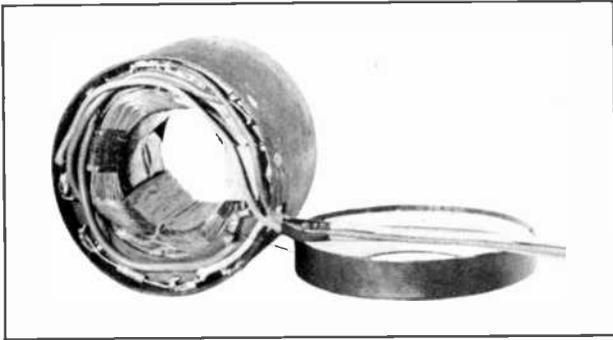


Fig. 5. New Deflection Yoke.

If, however, the chassis is to be mounted in a new cabinet or in a custom installation, a conversion to a larger tube is practical.

Conversion to 14", 16", or 17" Picture Tube

A partial schematic, showing the horizontal and vertical deflection circuits as they are wired in the original circuit, is given in Figure 2. This may be referred to when removing the old parts.

The first step was the removal of the deflection yoke and focus coil. The leads to the deflection yoke and focus coil were unsoldered, at the chassis end, and these units and their brackets removed. An octal socket was then installed on the chassis and leads from the horizontal and vertical circuits were connected to the socket. These leads were connected to the same terminals on the chassis from which the deflection coil leads were removed. They may be terminated at the octal socket at any of the terminals but it is suggested that a sketch be made of the connections so that it can serve as a guide for connecting the leads from the deflection yoke to the plug, which

will be made later. In this particular conversion the deflection yoke socket was positioned near the back of the chassis as shown in Figure 7. With this socket on the top of the chassis it is easily accessible even though the chassis may be mounted in close quarters. All four leads, two from the vertical circuit and two from the horizontal circuit, should be dressed close to the chassis to prevent pulses from being fed to the synchronizing circuits, which might result in erratic sync. By carefully dressing the leads near the chassis, no trouble was experienced.

Next, the two focus coil leads were terminated at the socket, again making a notation of which terminals were used. We then had all six leads which are required to feed the signals and voltages to the deflection yoke and focus coil, terminated at the socket.

The use of this socket is optional. In those cases where the picture tube is to be mounted directly on the chassis it would not be required. When the tube is to be mounted separately from the chassis the socket should be employed.

The next step was the removal of the old components from the high voltage compartment. After taking off the removable section of the HV compartment, terminals 1, 4, 5, and 6, as shown in Figure 3, were unsoldered. The screws mounting the horizontal transformer to the side of the HV compartment were removed, as well as all the screws holding the HV compartment to the chassis. The HV compartment was then removed, which gave access to the HV rectifier filament leads which were then unsoldered. By disconnecting the leads from the top caps of the 1B3 and 6BG6G tubes, the horizontal transformer could then be removed.

Since the original HV filter capacitor is only a 10 KV unit, it was removed so that a unit with a

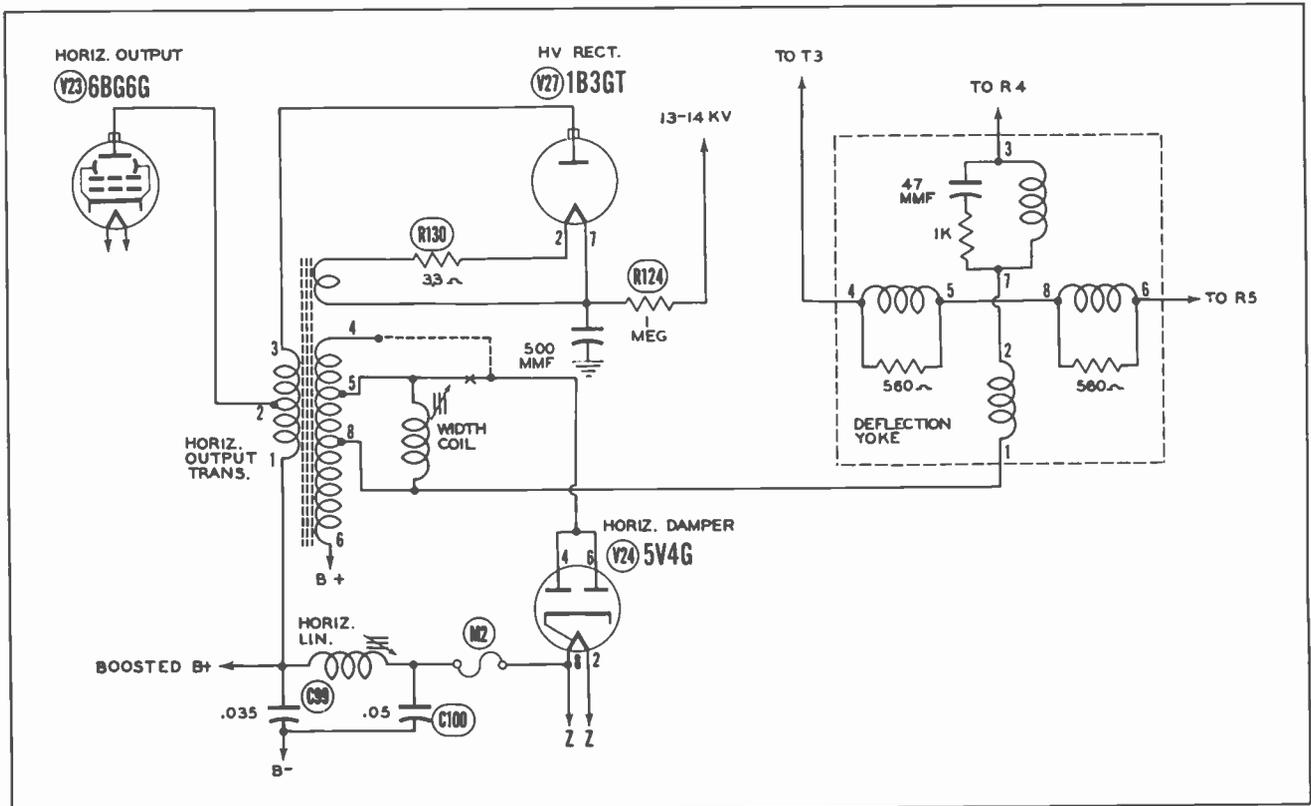


Fig. 6. Schematic of Horizontal Sweep Circuit after Conversion.

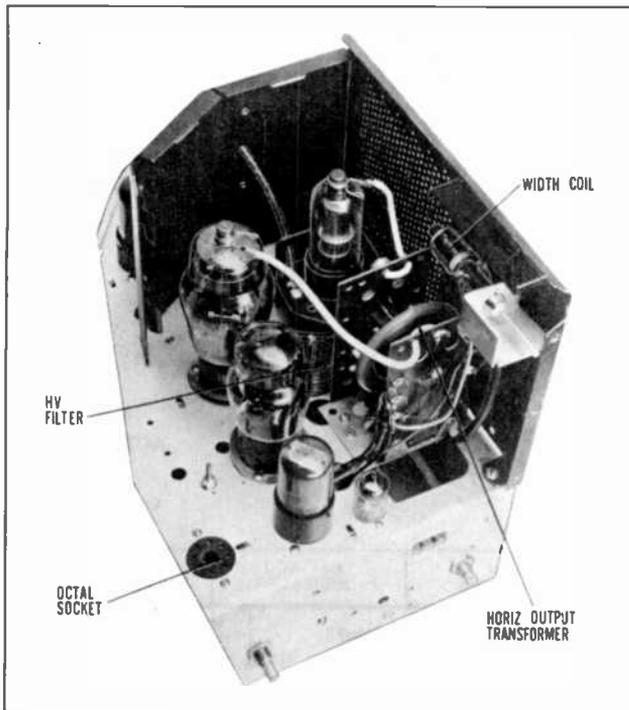


Fig. 7. HV Compartment Showing New Components.

higher rating could be employed. The leads to the damping resistor (See Figure 3) were then unsoldered, as this unit is not required in the new deflection circuit. The high voltage lead was also unsoldered and removed. The old width coil was then removed from its bracket which completed the removal of the parts which were not to be used in the new circuit. The chassis was then ready for the mounting of the new components. A complete parts list of all components required for this conversion is provided, following the step by step procedure given later.

First, the new 15 or 20KV filter capacitor was mounted in the same hole as was the original. It may be necessary to enlarge the hole slightly to accommodate the new unit. If the terminal on the new unit is not threaded, the hole should be enlarged only enough to permit a tight fit of the terminal in the hole. After seating the capacitor in the hole, it may be soldered to the chassis on the underneath side.

The next step was the mounting of the new horizontal output transformer and width coil, which are shown in Figure 4. The Merit type HVO-6 horizontal transformer was mounted on the chassis by first drilling three new mounting holes. The transformer was positioned close to the HV rectifier tube mounting bracket as shown in Figure 7. This is very important since mounting of the transformer too far from the bracket will make it impossible to connect the HV rectifier filament leads to the proper terminals. After the transformer is mounted, the filament leads were connected to the same terminals of the rectifier socket as were the original, again taking care that no sharp points are left after the solder operation.

The next operation was the mounting of the new width coil. The original width coil has an inductance of approximately .035 to .12 MH which cannot be used with the HVO-6 transformer. Any attempt to use the original width coil will result in the effective shorting of one-fourth of the secondary of the HVO-6 transformer which will prevent operation. The Merit type

MWC-1, which has an inductance of 3 to 27 MH, was used. It was mounted on the same bracket as the original width coil, but due to its larger diameter, the hole required a little reaming. Do not attempt to mount this coil any other place than in the HV compartment, as the strong field radiated by it may affect the operation of the set. After the width coil was mounted, the side and front section of the HV compartment was put back in place. The width coil was then connected to the proper terminals as shown in the schematic of the new circuit given in Figure 6.

The Merit type HVO-6 horizontal transformer is a universal type. It will provide sufficient sweep for the large picture tubes and can be used with standard type horizontal output tubes. In this particular circuit it was found that the original 6BG6G provided adequate sweep for a 14", 16", or 17" picture tube. The primary of the HVO-6 was connected the same as the original transformer. Terminal 1 was connected to B+ boost; terminal 2 to the top cap of the 6BG6G and terminal 3 to the top cap of the 1B3. These connections are shown in the schematic of Figure 6. With the exception of the new HV filter capacitor, the HV circuit remains the same as the original circuit. The leads which were disconnected from the secondary terminals of the old horizontal transformer were then connected to the proper terminals of the new transformer per the schematic of Figure 6. The damper tube plates should be connected to terminal 5 of the transformer. Normally this will provide proper damping and sufficient boost voltage. If, after putting the set in operation, however, it is found that insufficient sweep is obtained, the damper plates may be connected to terminal 4 of the horizontal transformer.

This completed all the connections on the chassis and the rest of the HV compartment was put in place. The next step was the connection of the deflection yoke and focus coil to the plug. A Merit type MD70-F, which is a 70 degree unit, was used. Three resistors and one capacitor must be added to the yoke. The values and the connections of these components are given in the schematic of Figure 6 and instructions for mounting them are given in an instruction sheet packed with the new yoke. Figure 5 illustrates this yoke after the components and leads are wired in. Connect whatever length leads are required to extend from the deflection yoke to the socket on the chassis. Allow plenty of length for the leads. If they are tight when the installation is made, the yoke may be held in a cocked position. Terminate these leads in an octal plug at the proper terminals which can be determined from the sketch made earlier when the deflection socket was wired. The focus coil leads were then extended and terminated at the proper terminals in the plug. In many cases the original focus coil may be used on the 14", 16",

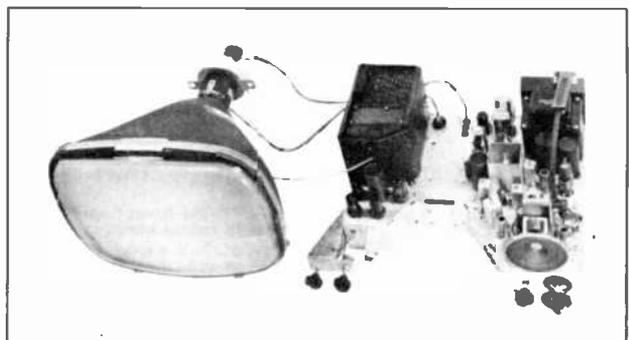


Fig. 8. Complete Unit after Conversion.

BOOS

PICK

MICRO

PHONOGRAPH CARTRIDGES

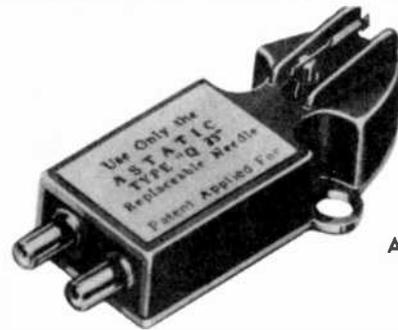
Astatic

PRODUCTS

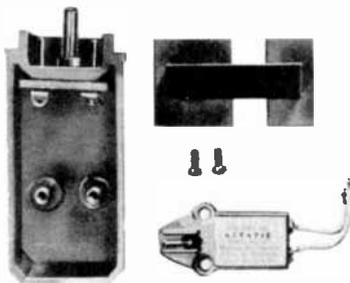
DATA

"CAC" SERIES CRYSTAL CARTRIDGES

The Model CAC-J is the cartridge which Astatic developed in conjunction with the Engineering Research and Development Department of CBS to match precisely the recording characteristics of LP records. It is internally equalized to follow Columbia Records, Inc., ideal frequency response for the recording characteristics of LP records. Aluminum housing with standard 1/2" mounting holes. Will fit most tone arms. Includes adapter plate to mount in RCA and similar 45 RPM record changers. Performance quality . . . with equal fidelity on either 33 1/3 or 45 RPM records . . . truly sets today's standard of perfection, and has been so acclaimed by an increasing number of impartial experts. Other models available (see table) with All-Groove or three-mil styli tips to modernize a broad variety of phonographs, to meet the demands of the quality market of perfectionists and serious music-lovers, where the CAC Series found its first ready acceptance. All models except the CAC-AG-J are available with diamond styli (those which have the letter "X" in the model designations).

TWICE
ACTUAL SIZE

CAC-J REPLACES ★	CAC-AG-J REPLACES	CAC-78-J REPLACES
SHURE P73 P93MG P73A P95MG P73AR W21A P73R W21AR W53MG	SHURE P71 P81AD P71A P81C P71B P81CA P71C P81D P71CA P81E P81 W26A P81A W26B	SHURE P70 W23A P70A W23B P85
ELECTRO-VOICE 14 34 14S 34S	ELECTRO-VOICE 33 33S	ELECTRO-VOICE 32 32S
WEBSTER A2 F12 A2M F13M	WEBSTER A91 A9M1	WEBSTER A3 A3M
RCA 74067 74625 75476		

MODELS FOR
PLUG-IN HEADS

Shown beside a typical plug-in type tone arm head are the special terminals and fittings which adapt the models CAC-W-J and CAC-78W-J for speedy replacement in such equipment.

★ FITS RCA 45 RPM CHANGERS AND IS STANDARD FOR COLUMBIA 102 AND 103 PLAYERS



Model	List Price	Minimum Needle Pressure	Output Voltage 1000 c.p.s. 0.5 Meg. Load	Frequency Range c.p.s.	Needle Type*	For Record	Approx. Net Wt. in Grams	Code
CAC-J	\$ 7.50	6 gr.	1.0†	30-11,000	Q-33 (J) (1-mil tip)	33 1/3 and 45 RPM	5	ASWZZ
CAC-X	31.00	6 gr.	1.0†	30-11,000	Q-33 (X) (1-mil tip)	33 1/3 and 45 RPM	5	ASXDN
CAC-W-J	7.50	(Same as CAC-J) except equipped with special terminals and fittings for easy installation in record changer tone arms with plug-in heads.)					5	ASWYB
CAC-W-X	31.00	(Same as CAC-X) except equipped with special terminals and fittings for easy installation in record changer tone arms with plug-in heads.)					5	ASXDM
CAC-78-J	7.50	15 gr.	1.35††	30-11,000	Q (J) (3-mil tip)	78 RPM	5	ASWZY
CAC-78-X	31.00	15 gr.	1.35††	30-11,000	Q (X) (3-mil tip)	78 RPM	5	ASXDL
CAC-78W-J	7.50	(Same as CAC-78-J) except equipped with special terminals and fittings for easy installation in record changer tone arms with plug-in heads.)					5	ASWYA
CAC-78W-X	31.00	(Same as CAC-78-X) except equipped with special terminals and fittings for easy installation in record changer tone arms with plug-in heads.)					5	ASXDK
CAC-AG-J	7.50	10 gr.	1.35††	30-11,000	Q-AG (J)**	33 1/3, 45 and 78 RPM	5	ASWZX

†RCA 12-5-31-V Test Record or equivalent.
††Audio-tone 78-1 Test Record.

**"J" stands for Sapphire Tip, "X" for Diamond Tip.

**All-Groove Needle Tip of special design and size to play 33 1/3, 45 and 78 RPM Records.

Dollar and Sense Servicing

TRENDS IN TV SERVICING. Shorter service contracts are coming, particularly for renewals, because of the unknown future costs of labor and parts. Many eastern contractors are favoring the 90-day contract for this reason.

Downward drop in percentage of contracts bought by purchasers of sets may be stopped, even turned upward by fear of parts shortages. Set-owners hope that a contract will give them priority on scarce, allocated tubes and parts. If you can handle a few more contracts, this is a legitimate and effective argument. An individual desperately in need of one scarce part is going to find it pretty tough going without a contract.

Stretching of strategic cobalt, nickel, copper, aluminum and steel is the order of the day among manufacturers, to make as many sets as possible with what they've got. This means taking off metal gadgets, decorations and nonfunctioning parts or changing to plastics.

Boosters of FM radio are going to find the going still tougher in the months ahead, because the FM tuner is one thing that can be left off on TV sets and consoles with little or no complaints from purchasers. Making FM optional is the first step in this direction by some manufacturers.

Circuit design trends to be looked for: Fewer tubes per set, with reduced sensitivity and hence reduced usefulness in fringe areas; selenium rectifiers in voltage-doubler circuits replacing power transformers, to save copper and silicon steel; smaller Alnico magnets in speakers; no more built-in antennas, since they're rarely used anyway; electrostatoc picture tubes (not for many months, though), to save deflecting-coil copper.

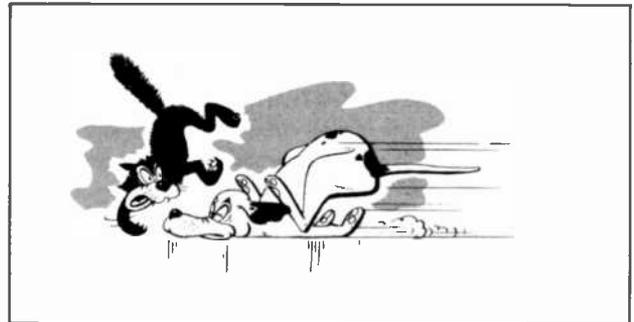
GRAY MARKET PARADOX. In the New York metropolitan area, large service organizations are being besieged with phone calls offering needed 300-ohm twin-lead, tubes and other scarce parts in quantities at prices actually lower than from regular distributors. It's high quality merchandise, too - not distress junk. One possible explanation is that the boys who borrow cash to buy and hoard for a rise in the market can't hang on and pay their interest for long, hence have to dump when servicemen refuse to pay their inflated prices.

Some of the scarcest replacement receiving and picture tubes are being peddled at fantastically high prices by speculators. Generally these tubes are in bulk packages normally used only for set manufacturers. This indicates either that tubes are getting side-tracked out of normal channels or that smaller set-makers are quietly going out of business and releasing their stocks of parts through the usual radio-row channels of New York City.

Though older almost-obsolete picture tubes are scarce here and there, the most-needed large modern tubes are generally plentiful and even coming down in price. Two years ago, a tube engineer predicted that picture tubes would someday cost little more than a sealed-beam auto headlight bulb; maybe he wasn't pipe-dreaming, after all. Such is this business we're in - now, yesterday and forever screwy.

SMALL TV SETS. During the first three post-war years (1946-48) some 1,200,000 TV sets with 12-inch and smaller screens were sold. DuMont sales chief Walter Stickel estimates that almost a million of these will be replaced in 1951 because their screens are now considered to be too small for good viewing. These sets will have to be reconditioned for resale, rental or conversion to bigger picture tubes. Since the work can be done during slack periods, it's one way of keeping down the idle-time overhead expense. At resale, the table model 10-inchers are bringing from \$50 to \$100 in the New York area. At rental, one service organization is getting \$12 a month including use of an indoor antenna. As-is sets available at around \$25 may well be worth picking up to rob for tubes and parts, as many servicemen are already doing.

COLOR. Looks now as if it's black and white for the duration. Even the public has forgotten.



CATS AND DOGS. In this true story, an 80-pound German short-haired pointer stepped on an empty box on the stairs while chasing the cat down-stairs at full speed. The mutt slid down the rest of the way on his nose, hit the polished living room floor, and crashed into the leg of the card table that was temporarily supporting a newly acquired DuMont metal-cabinet TV set. The table leg broke, the card table fell on the dog, and the TV set crashed end-over to the floor. The cat got away. The dog limped away. There was no implosion. Our heart finally got back into sync. The set? It worked perfectly after being turned right-side-up, and has only a few hairline scratches to show for the incident. But there's a quarter-inch-deep gouge in the oak floor, there's a chunk of plaster out of the wall, there's a card table waiting for fixing that never gets done, and we're in the doghouse because it was our idea to get that cute little puppy!

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 The new 1951 MERIT CATALOG #5111 shows complete up-to-date specifications on the entire Merit line of TV, Radio, Amateur and Industrial Transformers. The Merit TV line is as complete as current and advance information will permit.

You'll need the DEC. 1950 MERIT TV REPL GUIDE & CATALOG for saving time in selecting the correct replacements for all popular television receivers. This handy, easy-to-use popular guide lists model and part numbers of 70 manufacturers, covering 800 models and chassis. First two pages list all TV Transformers and Specs.

DEALER PRICE SHEET-FORM No. 2, dated DEC. 30, 1950 shows the part No., Net price and List price of over 280 parts.

AUTO VIBRATOR TRANSFORMER SHEET-FORM No. 3, dated DEC. 30, 1950, shows model No., Net, List prices and Specs. of VIBRATOR TRANSFORMERS for FORD-GM-MOTOROLA and MOPAR car radios. Also simple easy-to-read replacement guide covering 30 manufacturers.

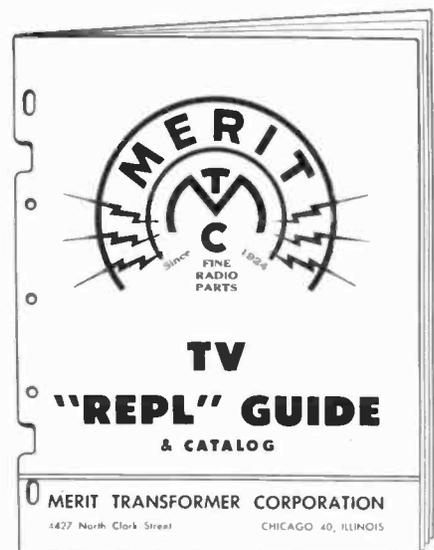
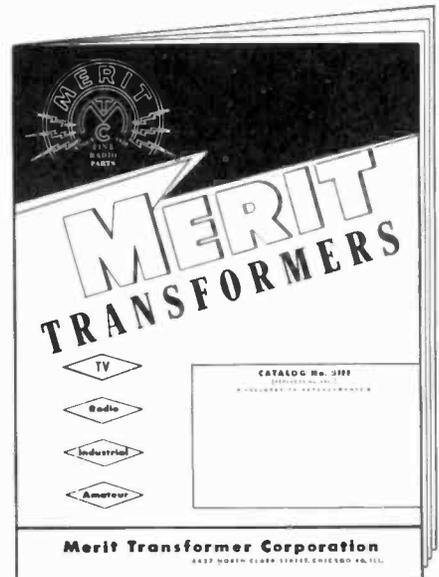
MERIT OUTPUT TRANSFORMER CHART-FORM No. 4, single sheet shows proper Merit output transformer for use with all popular output tubes. Both MERIT specific and universal types are shown. Mounting style is included for further convenience.

MERIT TV COMPONENTS-FORM No. 5, dated JULY 1950—illustrated descriptive sheet on MERIT "FLYBACKS" "DEFLECTION YOKES," "FOCUS COILS" and WIDTH LINEARITY COIL WITH AGC.

MERIT comparative part number sheet for TV & RADIO FORM No. 10—shows numerical listing of MERIT part Nos. to competitive Nos. on TV—on Radio, competitive Nos. to MERIT, for easy conversion.

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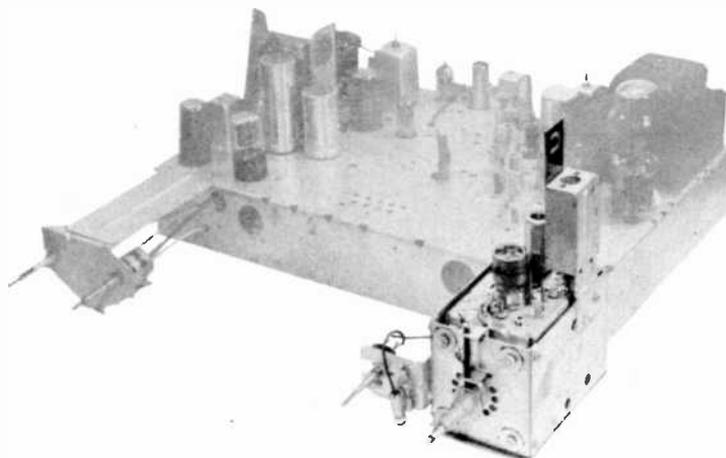


Television Tuning Units

by W. William Hensler

Research material contributed by: Wayne R. Ayers • Eugene L. Bowden • Merle E. Chaney • Garland Mowry • William D. Renner

A description of Circuits, Characteristics, Servicing Methods, and Alignment Procedures for commercially employed television tuners.



PART II

THE GENERAL INSTRUMENT TUNER MODEL 44

The General Instrument Model 44 TV Tuner is a capacitively tuned unit providing continuous tuning over two ranges. One range covers the low band TV channels, 2 through 6, and the other range covers the high band channels, 7 through 13. Switching between bands is achieved through the use of a slide switch which extends the full length of the tuner. The use of the long switch permits the mounting of the tuned circuit coils directly on the slide switch near the proper tube sockets and associated components. With this arrangement the lead lengths can be kept at a minimum and components are accessible for checking or replacement.

Figure 1-11A illustrates the General Instrument Model 44 TV Tuner.

The slide switch is actuated by a cam mounted at the end of a shaft concentric to the tuning shaft. A 5 to 1 reduction is provided from the tuning shaft to the tuning capacitor. A second concentric shaft, for mounting the channel indicator, is linked to the tuning capacitor shaft by a dial string which is cemented to the pulleys on both shafts to prevent slippage. A spring loaded pulley takes up the slack to minimize backlash.

The tuner is so designed that the slide switch is near the center of the unit with the tubes and most of the components on one side of the switch and the tuning capacitor on the other. A terminal strip is located at the rear of the unit for making connections to the rest of the receiver. A shield is provided for the oscillator tube and an external shield slides over the bottom of the unit, shielding the bottom and two sides. The top and ends are shielded by the frame of the tuner, thus providing complete shielding of the tuner.

Two RF stages are employed. Type 6AG5 or 6BC5 tubes are used in these stages and a 6J6 serves as the mixer and oscillator. All replacements of the RF amplifier tubes should be made with type 6BC5 rather than the 6AG5 tubes. Higher transconductance

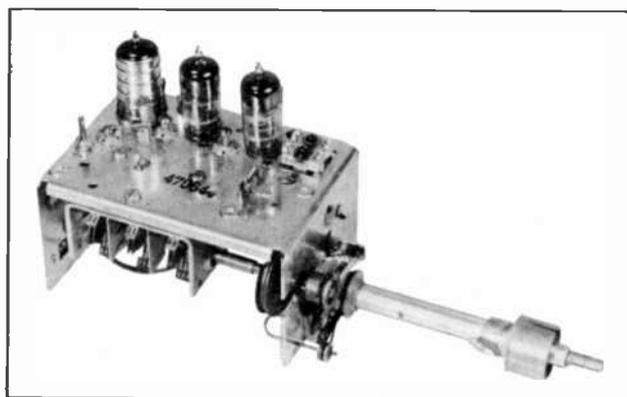


Fig. 1-11A. General Instrument Model 44 TV Tuner.

is provided in the 6BC5, which is interchangeable with the 6AG5, and no wiring change is required.

Proper bandpass is achieved in the General Instrument Model 44 by stagger tuning the two RF stages. In both high and low channel ranges the plate circuit of the first RF amplifier is tuned to the low side of the band, while the plate circuit of the second RF amplifier is tuned to the high side of the band.

The input circuit consists of two double tuned bandpass circuits. The low range circuit has sufficient bandpass to cover channels 2 through 6 while the high range circuit covers channels 7 through 13. The proper circuit is selected by the range switch. The primaries of L1 and L2 (see Figure 1-11K) are center-tapped to ground and designed to match a 300 ohm balanced input. The primaries are trimmed by capacitors mounted on top of the tuner. The secondaries are tuned by the distributed capacity of the circuit and the input capacity of the RF tube. C1 couples the signal to the RF amplifier grid and R1 serves as the grid load, which is returned to the AGC line to control the gain of the stage.

The tuned plate circuit of the 1st RF amplifier, in the high range, consists of L4, A3, the output cap-



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acity of V1, and one section of the variable capacitor in series with C8. In the low range position L4 and C8 are shorted out by the range switch and L5 is placed in the circuit. R3 is connected across L5 to reduce the "Q" of the circuit to broaden the bandpass on the low channels. R4 and C5 make up a decoupling network for the first RF stage. In order to reduce the loading effect of the input resistance of the second RF amplifier upon the 1st RF tuned plate circuit, during high channel operation, the coupling capacitor, C6, is connected to a tap on L4. On some units C6 was connected to the junction of L4 and L5, and C7 was connected as shown dotted on the schematic. When connected in this manner C6 and C7 form a capacitive voltage divider which accomplished the same purpose as the tapped coil. R5 is the grid load for the second RF amplifier and R6 is the cathode resistor which permits self biasing of the second RF amplifier. C9 bypasses the cathode resistor to prevent degeneration in the stage.

The tuned plate circuit of the second RF amplifier is identical to that of the first RF amplifier except for the value of the low band coil shunt. R7, which is 1500 ohms. The coupling capacitor, C12, is always connected to a tap on L6 instead of to a capacitive divider network as used in some units in the first RF amplifier circuit.

C13 and R8 form a decoupling network for the second RF stage. Note that an additional capacitor, C11, parallels C13. Physically C13 is connected to the switch terminal to which L7 is mounted and C11 is connected directly to terminal 6 of the second RF amplifier tube socket. There is a possibility that the inductance in the lead connecting these two points may cause degeneration if only one bypass capacitor were used. The leads on both C11 and C13 are very short, further decreasing the lead inductance. Two capacitors are also used on the first RF stage for the same reason.

C12 couples the RF signal to the triode mixer, one section of a 6J6 dual triode. R9 and R10 make up the grid load for the mixer. The junction of resistors R9 and R10 is terminated at the top of the tuner, point A, for scope connection during alignment. R9 isolates the mixer grid from the scope input.

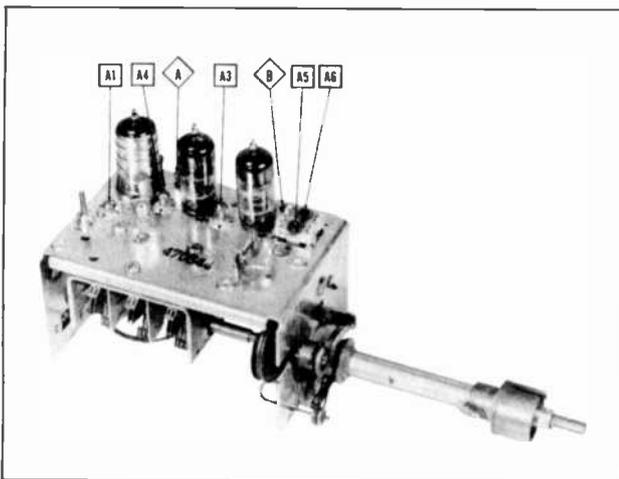


Fig. 1-11B. General Instrument Model 44 Tuner Alignment Points.

The schematic shows a series-tuned mixer plate circuit. L10 is trimmed by the output capacity of the mixer, C19, and the input capacity of the first IF stage. This circuit will vary according to the requirements of the receiver in which it is used. The mixer plate coil may be left off the tuner entirely. When a double tuned IF system is employed, two coils may be mounted on the tuner, usually one on top and one inside the unit. A sound trap, located on top of the tuner, may be added on non-intercarrier receivers. The mixer plate circuit is actually the first IF coil and for its adjustment the IF alignment instructions of the receiver should be consulted.

The second half of the 6J6 is connected in a modified Colpitts oscillator circuit. The third section of the tuning capacitor connects to the plate circuit for tuning. The slide switch is shown in the high range position on the schematic and the tracing out of the oscillator circuit in this position, shows that L8, the high range oscillator coil, has one end connected to the plate of the oscillator tube and the other end returned to the grid. C16, the tuning capacitor, and C18 are in series; and placed across L8. The circuit is trimmed by A1. C18 and the rotor of the tuning capacitor are returned to ground. This ground point governs the amount of feedback voltage applied to the oscillator. Note that in this circuit the value of capacity added from plate to ground, and from grid to ground is large as compared to the interelectrode capacity of the oscillator tube. This minimizes oscillator drift during warmup and also allows replacement tubes to have a greater tolerance in interelectrode capacities without necessitating oscillator realignment. L11 isolates the tuned circuit from the B+ line. C15 and R19 make up the grid leak network and C20 couples the oscillator signal to the mixer grid.

In the low range position C16 and L8 are shorted out and L9 is placed in the circuit. Also the parallel combination of C17 and A2 is connected in parallel with C18 to provide a variable padder on the low range. In some units a 13 mmf. capacitor is used instead of C17 and A2. The operation of the low range oscillator is exactly the same as in the high range position. The tuning capacitor, trimmed by A1, and the parallel network of C18, C17 and A2 are in

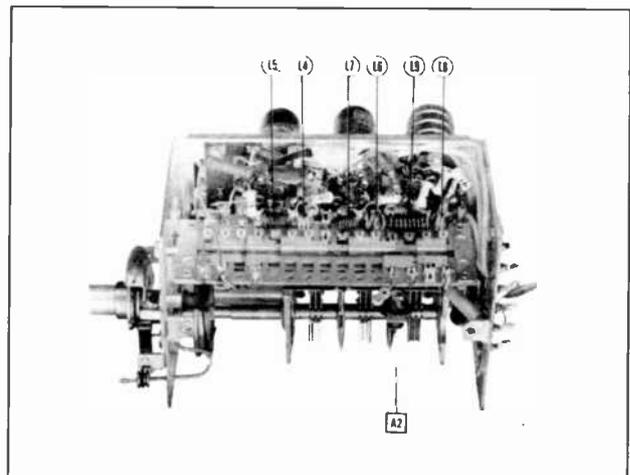


Fig. 1-11C. General Instrument Model 44 Tuned Circuit Coils.

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That's your \$70 (Million) question, Mr. Service-Dealer!

Right now . . . 10,000,000 old style, heavy, stiff-acting phono-cartridges in existing record players are *obsolete*. They limit reproduction. They rapidly wear out valuable records. They should be replaced immediately with *modern, lightweight, compliant* cartridges that guarantee greater record enjoyment, longer record and needle life. Current cartridges that operate inefficiently should be replaced, too.

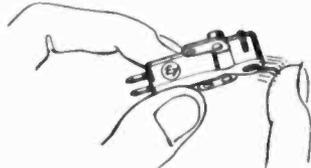
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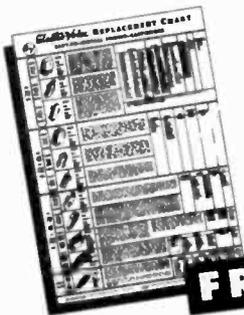
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Model 33 for 78, 45 and 33½ rpm



Model 12 for 78 rpm
Model 14 for 45 and 33½ rpm



Model 34 for 45 and 33½ rpm



Model 16-TT for 78, 45 and 33½ rpm



Model 42 for 78 rpm
Model 44 for 45 and 33½ rpm
Model 43 for 78, 45 and 33½ rpm



Model 96-T for 78, 45 and 33½ rpm



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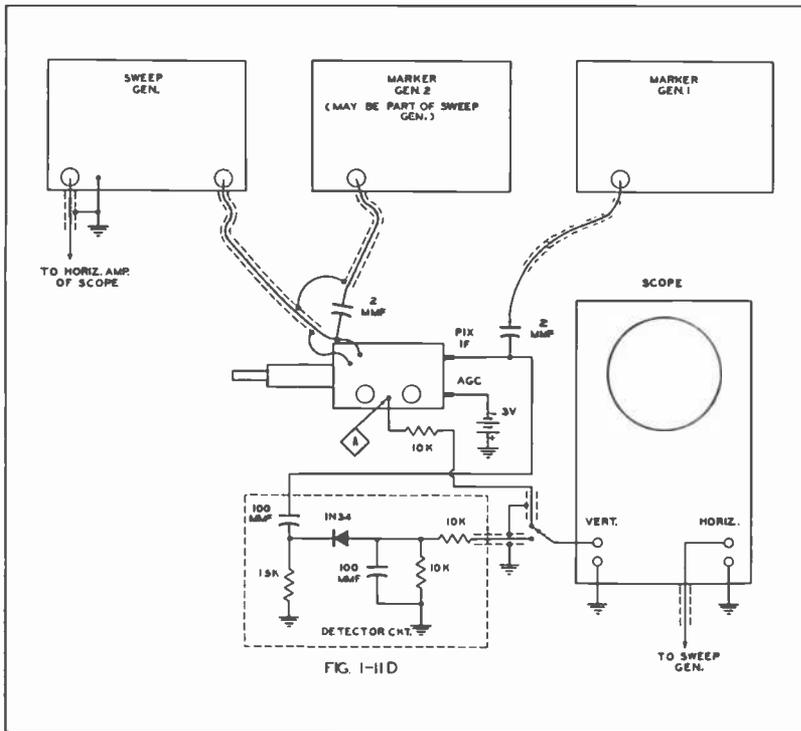


FIG. 1-11D

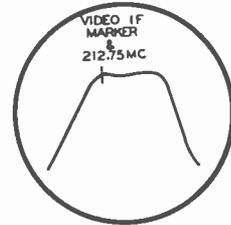


FIG. 1-11E

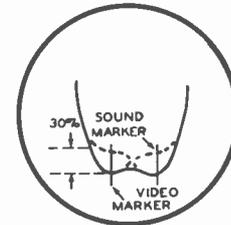


FIG. 1-11F

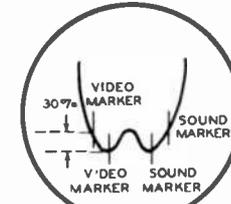


FIG. 1-11G

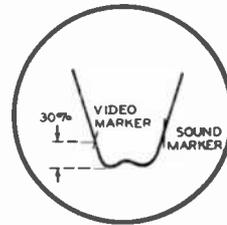


FIG. 1-11H

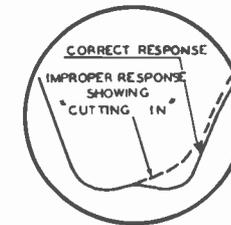


FIG. 1-11I

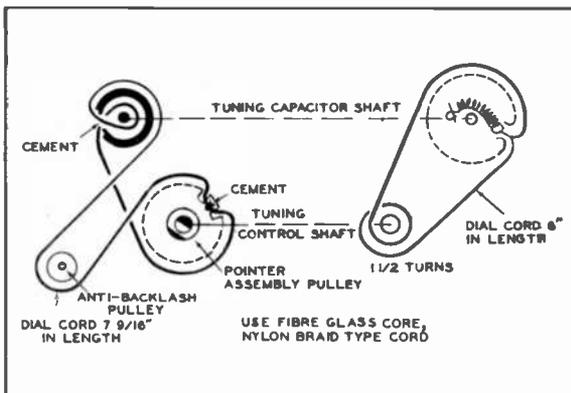


Fig. 1-11J. Dial Drive Stringing.

series and are placed across L9, the low range oscillator coil. The high and low ranges of the oscillator circuits, as well as the RF stages, have a certain amount of overtravel to assure coverage of all channels. The amount of overtravel is given in the alignment instructions for this tuner.

In addition to the alignment point \blacklozenge A, another test point (the junction of R1 and R2) is brought out to the top of the tuner. It may be used to check the AGC voltage applied to the tuner. This point is designated as Point B on the schematic and on the tuner photograph (Figure 1-11B).

The recommended supply voltage for the tuner is 135 to 150 volts. AGC or some form of bias is applied to the AGC terminal at the rear of the unit. With 1.5 volts on the AGC line normal current drain for the tuner is 35 to 40 ma.

If the sensitivity of the receiver is low, the oscillator injection voltage should be checked at point \blacklozenge A. Normal reading is a minimum of -2 volts, meas-

ured with a VTVM having a 10K ohm isolating resistor in series with the DC probe. If the reading is less than -2 volts, replace the 6J6 and recheck the voltage. In the event of oscillator tube replacement, a slight adjustment of the oscillator trimmer, A1, may be required to compensate for a variation of inter-electrode capacity in the replacement tube. The procedure for adjusting the oscillator is given in the accompanying alignment instructions.

Erratic operation is usually caused by faulty switch contacts or tube sockets. The tube pins should be checked for dirt or corrosion, or bent pins which might prevent proper contact to the socket terminals. A slight pressure on the switch contacts may disclose a faulty connection due to a dirty or bent contact. If noise is experienced when the tuning capacitor is rotated, check for dirt or foreign material on the plates, or on the clips which ground the tuning capacitor shaft. They should exert considerable tension on the shaft and should be clean. Five clips are used and the end of each of them is soldered to the frame of the capacitor as well as to a grounding strap which

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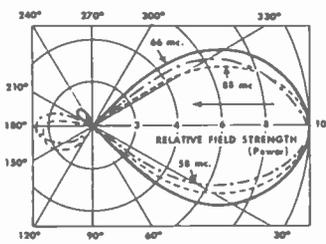
TV ANTENNAS

OUTSTANDING MECHANICAL SPECIFICATIONS

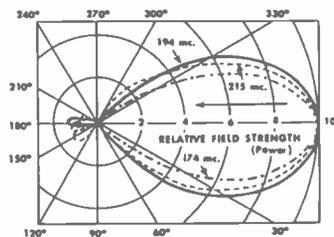
Part	Material	Yield Strength	Size	
		psi	o.d.	Wall
Mast (galv.)	1/2" Thinwall Steel Conduit	32,000	0.922"	.049"
Large Folded Dipole	35 1/2 H Al.	19,000	.500"	.049"
Small Folded Dipole	35 1/2 H Al.	19,000	.375"	.049"
Reflector	35 1/2 H Al.	19,000	.500"	.049"
Crossarm	35 H Al.	26,000	.875"	.065"
Center Support & T Coating	Al. Alloy 45,000 psi tensile strength			

EXCELLENT RADIATION PATTERNS

These are the radiation patterns of the AMPHENOL Inline antenna at 58 mc., 66 mc., and 88 mc., in the low band, and 174 mc., 194 mc., and 215 mc. in the high band. Notice the uniformity of these lobes at all frequencies. The lack of lobes off the sides and negligible ones off the back maintains high front-to-back and front-to-side ratios necessary for the rejection of various interferences. The



Horizontal radiation pattern of Amphenol TV Antenna Model No. 114-005.



Horizontal radiation pattern of Amphenol TV Antenna Model No. 114-005.

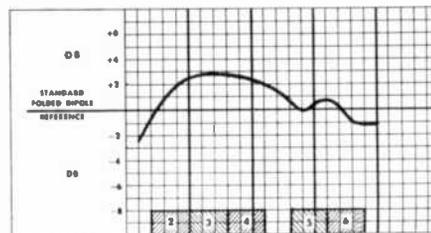
presence of a single forward lobe is usually a very desirable feature, especially when it is wide enough to provide adequate interception area for some differences in transmitter location, changes in the wave front's direction of travel, or physical movement of the antenna in high winds. Furthermore, it is not too critical of orientation. It is necessary only to aim it and forget it.

HIGHER GAIN

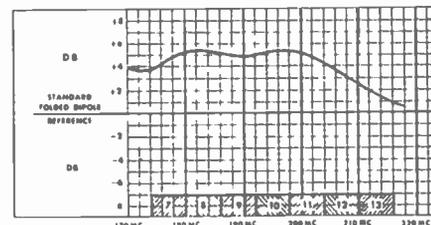
These gain curves of the AMPHENOL Inline antenna represent the intercepted voltage of the AMPHENOL Inline Antenna as plotted against the intercepted voltage of a reference folded dipole cut to the frequency being compared. There is no channel in either the low band or high band where there is more than a three decibel change within the channel that can cause picture modulation or "fuzziness." Gain of the AMPHENOL Inline antenna is quite flat over all channels.

You will find more gain designed into the high band because of greater need for it, due to higher losses at these frequencies. Also, notice the drop-off on channel six. This is at the edge of the FM band and is subject to FM interference, so the Inline's gain is purposely held down at that frequency.

The excellent broadband characteristics, impedance match, single forward lobe radiation patterns on all channels, maximum gain, lightning protection, and superior mechanical features of the AMPHENOL Inline Antenna make it the antenna for greatest TV picture quality!



Gain of Amphenol Model No. 114-005 Antenna over a reference folded dipole, 54 to 88 mc.



Gain of Amphenol Model No. 114-005 Antenna over a reference folded dipole, 174 to 216 mc.

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As I See It

AC-DC RECTIFIER PROBLEMS

It is common practice to find that the rectifier tube in an AC-DC receiver is the tube which most frequently needs replacing. The defect usually indicated is that of an open heater. If the tube types involved are 35Z5GT or 35W4, the open heater generally occurs at the tap. When this represents the total trouble, the substitution of a new tube remedies the situation and the receiver is back in service.

There are situations which can and do arise in a receiver of this type where an analysis of the rectifier tube will indicate that an open heater exists, but actually there are also other defects present. In such cases, the substitution of a new rectifier tube will result in the complete destruction of the tube within the first few minutes of operation. In these days of tube shortages this might become a very serious situation. Let us examine these possibilities in greater detail.

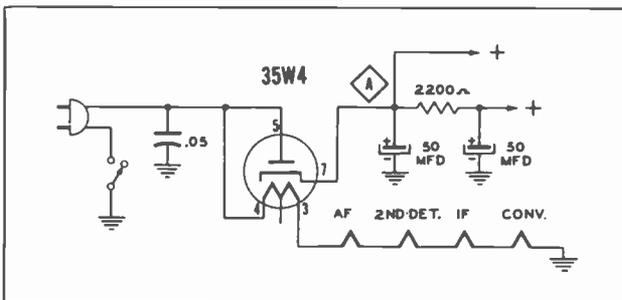


Figure 1

Examination of Figure 1, shows a circuit diagram of the rectifier circuit of an AC-DC receiver shown in Photofact Set No. 117, Folder No. 5. The rectifier tube used is type 35W4. The most serious problem facing a rectifier tube involves a shorted filter capacitor. Let us assume that in some manner a short circuit develops between point ♦A and ground. The plate of the rectifier is tied directly to the power line and thus the tube has the entire line voltage impressed across it. An enormous current will flow through the tube since the only limitation will be the spacing of the tube itself. All data sheets for this type of rectifier indicate that the minimum value of effective plate supply impedance should be 15 ohms. This schematic indicates that this requirement has not been met, with the result that the short circuit current will be high enough to cause serious damage to the rectifier tube itself and probably to the electrolytic capacitor as well. The capacitor may then appear as a short circuit to the next rectifier tube which is used as a replacement, and consequently the tube will fail as soon as the cathode has been heated sufficiently to pass current.

An analysis of a rectifier tube which has failed because of a short circuit may lead to erroneous conclusions unless it is checked for shorts as well as

for an open heater. The effects of the short circuit will usually lead to a short between the heater and cathode, an open heater, and possibly a short between plate and cathode. When the circuit is similar to that in Figure 1, the following steps should be taken before inserting a new rectifier tube in the receiver:

1. Check point ♦A for a short circuit.
2. Check electrolytic capacitor at ♦A.
3. Insert resistor of at least 15 ohms between point ♦A and the cathode terminal of the rectifier socket to limit current in case of another short in the filter circuit. The physical location of the resistor in the receiver must be carefully selected, because it will operate at a fairly high temperature. The wattage rating may be one-half watt.

Figure 2 shows a circuit diagram of the rectifier circuit of an AC-DC receiver shown in Photofact Set No. 117, Folder No. 9. This receiver employs the same type of rectifier, the 35W4, but the circuit shown is already provided with a 27 ohm resistor located between the filter circuit and the cathode of the rectifier, where it was suggested that a 15 ohm resistor be added in Figure 1. The effect of the additional resistance over the minimum value recommended by the tube manufacturer will serve to limit the current to a slightly lower value, thus reducing the probability of the electrolytic capacitor or other components in the receiver being damaged. When replacing a rectifier tube in a receiver having a circuit wired as indicated in Figure 2, it will be wise to check the tube for an open heater, and for

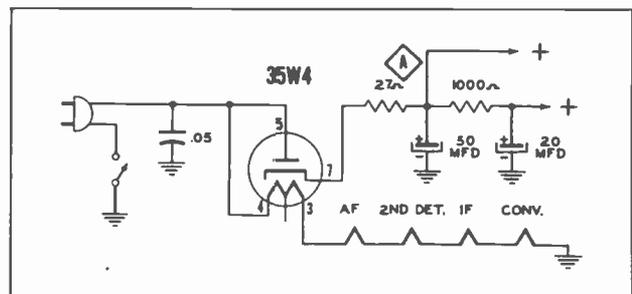


Figure 2

short circuits between heater and cathode and also between plate and cathode. If a short circuit appears at either point then the "surge limiter" as the 27 ohm resistor is called, should be checked to see if there is any indication of an overload having occurred. If the slightest doubt exists the resistor should be replaced. Should any indication of overloading appear, point ♦A should then be checked for a short.

There is another method which is often employed to provide the safety factor afforded by the "surge limiter," and that is the use of a circuit

◆ ◆ Continued from page 17 ◆ ◆

is returned to the chassis. Since the tuner is well shielded, very little dirt or dust will get into the unit under normal operating conditions. If the receiver is located in a spot where considerable dust or dirt is in the air, however, erratic operation may result after a long period of time. The obvious remedy in such a case would be the cleaning of the affected parts.

In the event either dial string comes unwound, it should be restrung according to the instructions which follow in Figure 1-11J. Improper stringing will result in excessive wear, slippage and excessive torque. If the pointer cord has broken, make up a new one of the fibre glass core, nylon braid variety, to the length specified. Set the tuning capacitor fully meshed, and with the tuning shaft at the position indicated, loop the cable around the pointer sleeve pulley. Lift the knot forward over the rim of the pulley, dropping the cord in the cord locking slots. Bring the cord on the right side of the pulley up to the tuning capacitor shaft pulley. Feed the cord through the slot and loop it around the shaft and back through the slot. Continue in a clockwise direction around the pulley, then pull the slack cord down over the anti-backlash pulley. The cord should then be cemented at the points indicated.

The drive cord is strung in a conventional manner, having the cord wound around the drive pulley 1-1/2 turns with the knot in the cord hooked in a spring inside the pulley to take up the slack. Refer to Figure 1-11J which shows the stringing in detail.

If, after replacing the pointer cord the pointer is improperly positioned, it will be necessary to unsolder the pointer ferrule from the shaft and rotate it to its proper position. It should then be tack-soldered to the pointer shaft. The pointer is correct when it is pointing to the number 13 when the receiver is tuned to that channel (air check or by signal generator).

The alignment instructions, schematic diagram and dial stringing information for the General Instrument Model 44 TV Tuner appear in Figures 1-11B through 1-11J and the tabular alignment charts.

* * *

We wish to acknowledge the cooperation of the General Instrument Corporation in supplying us with technical data and samples which were used in this presentation.

ALIGNMENT INSTRUCTIONS GENERAL INSTRUMENT MODEL 44 TV TUNER

ALIGNMENT INSTRUCTIONS—READ CAREFULLY BEFORE ATTEMPTING ALIGNMENT

Two marker generators are required to align the circuits of this tuner. Marker No. 1 is coupled through a 2 or 3 MMFD capacitor to the grid of the first video IF amplifier. The frequency to which marker No. 1 is tuned will be indicated in the table by an asterisk (*). Marker generator No. 2 is connected across the sweep generator at the antenna terminals. If the sweep generator has a built in marker, it may be used for marker No. 2. The frequency to which marker No. 2 is tuned will be indicated in the table by a dagger (†). During alignment it is necessary to switch the scope between alignment point A and the detector circuit connected to the tuner output. It is recommended that a single pole, double throw switch be used for switching the oscilloscope input, connected as shown in figure 1-11D. All connecting leads should be shielded and kept as short as possible.

The sound and video IF frequencies are used as reference points to align the oscillator and for tracking adjustments, therefore it is necessary to determine these frequencies used in the receiver employing this tuner.

Connect the negative lead of a 3 volt battery to the AGC terminal on the tuner, connect the positive lead to chassis or common negative in transformer-less receivers.

Remove the second video IF amplifier tube from its socket to prevent feedback from the video IF amplifier.

The sweep generator output lead should be terminated with its characteristic impedance, usually 50 ohms.

HIGH BAND OSCILLATOR ALIGNMENT

Turn the band switch to "high band" (counter-clockwise).
Leave bottom cover in place while performing step 1.

DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
1. Direct	High side to either antenna terminal. Low side to chassis.	215MC (10MC SWP)	* Video IF Frequency † 212.75MC	Tuning gang fully open.	Vert. amp. thru detector to 1st video IF grid. Low side to chassis.	A1	Adjust A1 to make the two markers coincide as shown in figure 1-11E.
2. "	"	175MC (10MC SWP)	* Video IF Frequency † 172.75MC	Tuning gang fully closed.	"	L8	Use a non-metallic tool to adjust L8. Turn spacing so that markers coincide. Replace bottom cover. If markers separate, make slight readjustment of L8 so that marker will coincide with cover in place. Repeat steps 1 and 2 until High Band oscillator covers the proper range.

LOW BAND OSCILLATOR ALIGNMENT

Turn the band switch to "low band" (clockwise).
Remove the bottom cover of the tuner.

DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
3. Direct	High side to either antenna terminal. Low side to chassis.	87MC (10MC SWP)	* Video IF Frequency † 84.75MC	Tuning gang fully open	Vert. amp. thru detector to 1st video IF grid. Low side to chassis.	L9	Use a non-metallic tool to adjust L9. Turn spacing until markers coincide.
4. "	"	56MC (10MC SWP)	* Video IF Frequency † 54.25MC	Tuning gang fully closed	"	A2	Adjust A2 so that markers coincide. Repeat steps 3 and 4 until no further improvement can be made.

HIGH BAND RF ALIGNMENT

Before attempting the RF Alignment the oscillator should first be aligned as outlined in steps 1 thru 4. Replace tuner shield and turn the band switch to "high band" (counter-clockwise). Feed the channel 13 video carrier frequency (211.25MC) into the antenna terminals, and the video IF frequency into the first video IF amp. grid. With the oscilloscope connected through the detector circuit to the video IF amp. grid, adjust the tuning gang until the markers coincide (see figure 1-IIJ equipment set up). Leave at this setting throughout step 5. For step 6 adjust the tuning gang in a similar manner, except that frequencies used are the channel 7 video carrier (83.25MC) and the video IF frequency. Leave at this setting throughout step 6.

DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
5. Direct	High side to either antenna terminal. Low side to chassis.	213MC (10MC SWP)	↑211.25MC ↑215.75MC	13 (See notes above)	Vert. amp. thru 10KΩ to point A. Low side to chassis.	A3, A4	Adjust A3 for maximum amplitude at the 211.25MC marker. Adjust A4 for maximum amplitude at the 215.75MC marker. Repeat adjustments until satisfactory band pass is achieved. Figures 1-II F, G, and H give acceptable response waveforms.
6. "	"	177MC (10MC SWP)	↑175.25MC ↑179.75MC	7 (See notes above)	"	L4, L6	Using non-metallic tool, adjust spacing of turn of L4 for maximum amplitude at the 175.25MC marker. Adjust L6 for maximum amplitude at the 179.75MC marker. Repeat adjustments until satisfactory band pass is achieved. See figures 1-II F, G or H. Repeat steps 5 and 6 until no further improvement can be made.

LOW BAND RF ALIGNMENT

Turn the band switch to "low band" (clockwise). Remove tuner shield. Set the tuning gang to channel 6 in the manner outlined under high band RF alignment, using channel 6 video carrier frequency (83.25MC) and the video IF frequency of the receiver. Leave at this setting for step 7. For step 8 set the tuning control to channel 2 using the channel 2 video carrier frequency (55.25MC) and the video IF frequency. Leave at this setting for step 8.

DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
7. Direct	High side to either antenna terminal. Low side to chassis.	85MC (10MC SWP)	↑83.25MC ↑87.75MC	6 (See notes above)	Vert. amp. thru 10KΩ to point A. Low side to chassis.	L5, L7	Adjust spacing of turns of L5 of maximum amplitude at the 83.25MC marker. Adjust L7 for maximum amplitude at the 87.75MC. Repeat these adjustments until proper band pass is obtained.
8. "	"	57MC (10MC SWP)	↑55.25MC ↑59.75MC	2 (See notes above)	"	L5, L7	Adjust spacing turns of L5 for maximum amplitude at the 55.25MC marker. Adjust L7 for maximum amplitude at the 59.75MC marker. Repeat steps 7 and 8. A compromise adjustment of L5 and L7 may be necessary to satisfy both steps 7 and 8.

ANTENNA PASS BAND ALIGNMENT

The antenna primary trimmers are adjusted at the factory with a wide range sweep oscillator and a delay line. The coupling is also carefully adjusted and should not be disturbed. Only in cases where these adjustments have been accidentally or otherwise changed alignment be attempted.

HIGH BAND ANTENNA PRIMARY ALIGNMENT

Replace tuner shield and turn band switch to High Band (counter-clockwise). Set tuning capacitor to channel 13 position as outlined in notes under High Band RF Alignment.

DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
9. Direct	High side to either antenna terminal. Low side to chassis.	213MC (10MC SWP)	Not used	13	Vert. amp. thru 10KΩ to point A. Low side to chassis.	A5	Turn A5 counter-clockwise to a reduced capacity setting. Then turn A5 clockwise observing the wave form. The amplitude will increase to a certain point and then the wave shape will start to change shown in figure 1-IIJ. Back off A5 to a maximum amplitude and minimum "cutting in" point.

LOW BAND ANTENNA PRIMARY ALIGNMENT

Turn band switch to Low Band (clockwise). Set tuning capacitor to channel 6 position as outlined in notes under Low Band RF Alignment.

DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
10. Direct	High side to either antenna terminal. Low side to chassis.	85MC (10MC SWP)	Not used	6	Vert. amp. thru 10KΩ to point A. Low side to chassis.	A6	Turn A6 counter-clockwise to a reduced capacity setting. Then turn A6 clockwise observing the wave form. The amplitude will increase to a certain point and then the wave shape will start to change as shown in figure 1-II I. Back off A6 to a maximum amplitude and minimum "cutting in" point.

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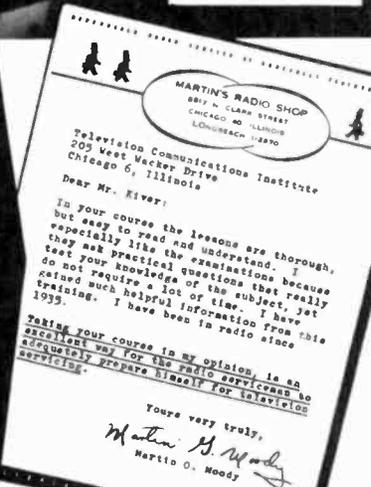
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◆ ◆ Continued from page 9 ◆ ◆

if proper focus cannot be obtained, a new 470 ohm, thin type unit will be required.

The leads to the picture tube socket were then extended to the proper length. These leads should be long enough so that no strain is placed on the neck of the tube when the installation is made. If these leads are quite long, they may be taped at regular intervals to form a sort of cable. If the leads are taped, however, the grid lead should be left free, as taping it close to the rest of the leads will increase the distributed capacity and may degrade the picture.

When the deflection yoke and focus coil are mounted in a bracket which is not connected to the chassis, a ground lead should be connected between the chassis and the bracket. This is especially true when a glass tube with an outside aquadag coating is used.

This completed the conversion and the new tube was installed. A new single type ion trap was used instead of the old double type. The set was then turned on and was carefully watched for any symptoms of shorts or over-heated parts, which might have been caused by improper wiring. After warm up, the service controls were adjusted for proper width, height and linearity. In the event that proper height and vertical linearity cannot be obtained, the method for correcting height and vertical linearity for 19" and 20" tubes, which follows, should be tried.

Conversion to a 19" or 20" Picture Tube

The 630-type chassis may be converted to use 19" or 20" tubes by following the same procedure as given for 14", 16", or 17" tubes, with some additional changes to get adequate sweep and improve vertical linearity.

To gain additional sweep, the plates of the damper tube were connected to terminal 4 of the horizontal output transformer, which provides additional B+ boost voltage.

To improve vertical linearity R98, 56K ohms (see Figure 2), was disconnected from the B+ boost voltage and connected to the junction of C4A and the vertical centering control. R179 was changed to 2.2K ohms. The 6K6GT vertical output tube was changed to a type 6V6GT tube. The focus coil was changed from the original, which measured 250 ohms, to a thin type, which is especially designed for use on short-neck tubes. The new unit has a DC resistance of 470 ohms. This gives additional flux density for proper focusing within the range of the original focus control.

STEP-BY-STEP INSTRUCTIONS FOR MAKING PICTURE TUBE CONVERSION

1. Unsolder deflection yoke and focus coil leads.
2. Remove yoke, focus coil, and mounting brackets.
3. Install octal socket and solder connecting leads to deflection output and focus circuits (see text).
4. Remove side and rear of HV compartment shield. Unsolder leads 1, 4, 5, and 6 on horizontal output transformer. Remove screws holding horizon-

tal output transformer to HV compartment shield. Remove this portion of HV shield.

5. Unsolder filament leads from HV rectifier and remove horizontal output transformer.

6. Remove HV filter capacitor and install new unit (see text).

7. Mount new horizontal output transformer as shown in Figure 7 (see text).

8. Solder HV rectifier leads, and connect new HV filter capacitor.

9. Replace side and front portion of HV shield.

10. Ream out width coil mounting hole and mount new coil.

11. Connect new HV lead (see text).

12. Make necessary connections to horizontal output transformer, per text and Figure 6, and replace side and back HV shield.

13. Install necessary components in deflection yoke, as recommended by the manufacturer, and connect leads of required length to yoke and focus coil. Solder these leads to a plug, if an octal socket is used, or directly to the appropriate circuits.

14. Change vertical deflection circuit as given for 19" or 20" tubes, if vertical linearity cannot be obtained.

15. Turn set on and adjust size and linearity control for the best picture.

PARTS LIST

1 - Horiz. Output Trans.	Merit HVO-6
1 - Width Coil	Merit MWC-1
1 - Deflection Yoke	(Merit MD70 or MD70-F (Stancor DY-7
1 - 15KV or 20KV Filter Capacitor	(Aerovox HV20C (CRL TV2-502
2 - 560 ohm @ 1/2 w Resistors	IRC BTS-560
1 - 1000 ohm @ 1/2 w Resistor	IRC BTS-1000
1 - 47 mmf. Capacitor	Aerovox 1469 - HV-00005
1 - Octal Socket & Plug and HV Lead	

ADDITIONAL PARTS REQUIRED IN SOME APPLICATIONS

1 - 6VGT Tube	Sylvania or Equivalent
1 - 2.2K ohm @ 1 w Resistor	IRC BTA-2200
1 - Focus Coil for Short Neck Tubes	Merit MF-2
1 - Single Magnet Ion Trap	

Any methods or techniques that are offered here should be considered as suggestions rather than recommendations, since they may not necessarily be the easiest way to effect the conversion. However, our experiments on various models of receivers have enabled us to present data which should be helpful.

Keyed AGC Operation

by ROBERT B. DUNHAM and W. WILLIAM HENSLER

One of the most significant features which has been employed in TV receivers is a keyed automatic gain control circuit. Not only is the performance of the set improved with this circuit, but the operation is greatly simplified. In a large percentage of the first post-war receivers, the contrast control varied the gain of the video IF amplifier. This was accomplished by varying the bias applied to the IF stage, or by increasing or decreasing the resistance in the cathode circuit of the video IF amplifiers. The setting of the control was quite critical and its misadjustment might result in overload of the video IF or the video amplifiers. This not only caused poor picture reproduction, but in many instances resulted in clipping of the sync pulses and loss of synchronization. In weak signal areas this type of contrast circuit is especially objectionable since the signal level may vary constantly, requiring frequent adjustment of the contrast control. If some circuit could be added to provide bias to the video IF strip which is proportional to the signal strength, automatic control of the gain would be accomplished.

The first attempts at accomplishing this were patterned after the automatic volume control (AVC) circuits used for many years in radio applications. Several advantages were afforded by this system over that of the manual operation, but it still presented several problems peculiar to TV reception. In sampling the DC voltage across the detector diode load, as is done in radio, the time constant of the AGC filter must be long enough to filter out the lowest frequency present. The nature of the video signal is such that considerable 60 cycle signal is present, due to the blanking signal during vertical retrace time. An efficient filter at this frequency must necessarily have a long time constant, which results in a slow acting AGC system. A fast fading signal, such as that experienced from airplane reflections, causes the receiver to "breathe," sometimes so rapidly that it approaches a flutter. In order to overcome this fading, a fast AGC system is required.

Another disadvantage of the conventional type AGC is the fact that all signals, including noise, that are rectified by the video detector, are filtered and fed to the AGC line. This is objectionable since these noise pulses will decrease the sensitivity of the receiver. Figure 1 illustrates an AGC circuit of this type. The rectified video signal is filtered by R4 and C2, and then applied to the proper circuits. The time constant of this filter is 112,500 micro-seconds, or approximately one-ninth of a second. This is too long a time constant to properly react to airplane "flutter." The obvious thing to do to make the filtering of the AGC signal easier would be to increase the sampling rate. Also, if some means were employed to sample the signal level for only a short period of time, the effect of noise bursts on the AGC level would be lessened.

Through the use of a keyed AGC system, the above requirements are fulfilled. The horizontal scanning frequency is used as the sampling rate which makes possible the use of a much shorter time constant in the AGC filter. Also by sampling the signal level during the horizontal sync pulse only, much greater noise immunity is achieved. The keying tube can conduct only during the sync pulse, which represents slightly less than one-twelfth of the horizontal line time. Thus it can be said that this type system should be twelve times more immune to noise bursts or pulses than the conventional AGC system.

The most universally used keyed AGC system is the type which employs a 6AU6 tube having a positive going video signal applied to the grid and pulses from the horizontal output being fed to the plate. Such a circuit is given in Figure 2. The only plate voltage which is available for the AGC tube is that which is derived from the horizontal output circuit during retrace time. Thus the tube could conduct only at this time. In addition, the positive going video signal, which is direct coupled to the grid of the tube, holds the tube near cutoff except during horizontal retrace time.

Various methods have been employed to obtain the pulse voltage to be applied to the plate circuit of the keyed AGC tube. One is by capacitively coupling the pulse voltage present on the plate of the horizontal output tube to the AGC tube. Since the peak amplitude of these pulses is quite high, the capacitor used in this application must have a rather high voltage rating. Also there is a possibility that un-

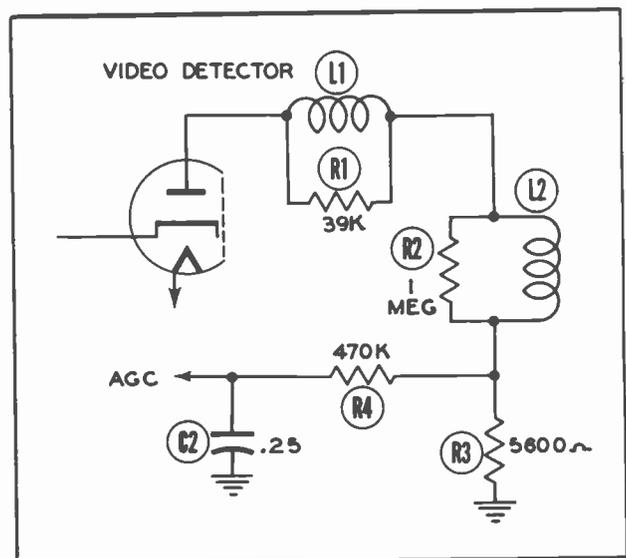


Figure 1. Conventional AGC Circuit.

desirable radiation may be experienced, especially if the AGC tube is located at a distance from the horizontal output tube. Consequently the most often used method is that of inductively coupling the pulse voltage by adding an additional winding on the width coil. A shielded cable is used to couple the pulses to the AGC tube, as shown in Figure 2. Note that the cable shield is bypassed to chassis by C10A, thus preventing radiation which might cause erratic operation.

Another means of obtaining the pulse voltage is through the use of an additional winding on the horizontal transformer. This requires the use of a special transformer, therefore the use of the AGC winding on the width coil is more frequently employed.

For the AGC tube to conduct, the horizontal sweep circuit must be synchronized with the received signal. By referring to Figure 2 it can be seen that the AGC tube is directly coupled to the resistive load of the video IF amplifier tube. R135 is placed in the circuit to prevent loading of the AGC tube on the video signal. The plate current of the video amplifier tube, flowing down through R50, holds the AGC tube cutoff, except during sync pulse time. The amplitude of the sync pulse, therefore, controls the conduction of the AGC tube. The greater the signal amplitude, the greater the conduction of the AGC tube, and vice versa. The AGC voltage is developed across R139 and R140, with C104 serving as the filter capacitor. All of this voltage may be applied as AGC voltage or

only a portion of it, depending upon the requirements of the receiver. Note that the discharge path of C104 is through R139 and R140. This circuit has a time constant of 50,000 micro-seconds, which is considerably less than that of the circuit of Figure 1. The time constant of the charge path of C104 is even less, since the only resistance in series with it is the plate resistance of the tube. With this circuit arrangement the potential on the AGC line can vary at a rapid rate, reducing fading or flutter, which is characteristic of the older type contrast circuit.

Several methods are employed for controlling the contrast of the receiver when an AGC circuit is used. The contrast control, as connected in the circuit of Figure 2, varies the screen potential of the video amplifier to control the contrast. In some receivers the contrast control may be placed in the cathode circuit of the video amplifier which also varies the gain of the video amplifier.

When operating a receiver employing a keyed AGC system, it is seldom necessary to adjust the contrast control when changing from one station to another. Nor is it necessary to readjust the controls even though the signal strength may be continuously varying, providing, of course, the signal does not drop below the useable level.

The keyed AGC circuit shown in Figure 2 is directly adaptable to the 630-type chassis and instructions for incorporating it in this chassis will be included in a subsequent issue of the Technical Digest.

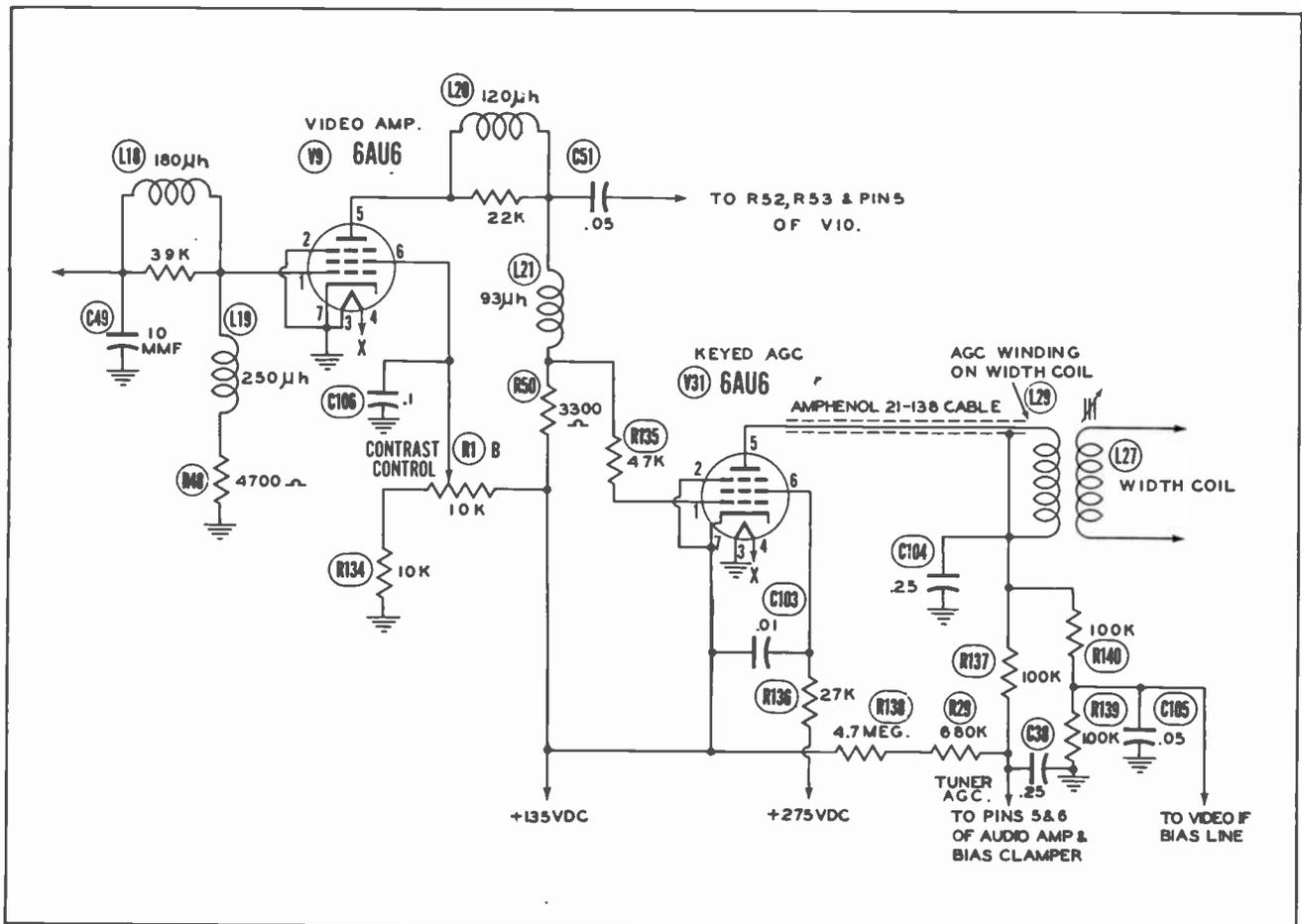


Figure 2. Keyed AGC Circuit.

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INDEX to PHOTOFAC

RADIO AND TELEVISION SERVICE DATA FOLDERS

No. 25

Covering Folder Sets Nos. 1 thru 127

HOW TO USE THIS INDEX: To find the PHOTOFAC Folder you need, look for the name of the receiver in the alphabetical listing below. Then find the required model number under the receiver name. Opposite the model you will find the number of the Set in which it appears and the Folder number. For example, under *ADMIRAL*, Chassis 3A1, the reference is 2—24. The bold 2 identifies the PHOTOFAC Set number in which the Folder appears. The light face number, 24, identifies the individual Folder. It's easy to find the set you need.

IMPORTANT: The suffix letter "A" following the Set or Folder Number in the index listing below indicates a "Preliminary Data Folder." These Folders are designed to provide the service technician *immediately* with preliminary basic data on Television Receivers—pending their complete coverage in the standard, uniform PHOTOFAC Folder Set presentation.

Set Folder No. No.	Set Folder No. No.	Set Folder No. No.	Set Folder No. No.	Set Folder No. No.	Set Folder No. No.																																																																
ADAPTOL	ADMIRAL—Cont.	ADMIRAL—Cont.	ADMIRAL—Cont.	ADMIRAL—Cont.	ADMIRAL—Cont.																																																																
CT-1 48-1	Chassis 20VI Tel. Rec. (See Ch. 20TI)..... 117	Models 4H165, 4H167 (C or CN) Tel. Rec. (See Ch. 20AI)..... 77	Model 7T06, 7T12 (See Ch. 48I)..... 24	Model 7T10, 7T14, 7T15 (See Ch. 5K1)..... 30	Models 26R25A, 26R26A Tel. Rec. (See Ch. 21B1)..... 118																																																																
ADMIRAL	Chassis 20VI Tel. Rec. Prod. Chge. Bul. 15... 126-1	Models 4H165, 4H166, 4H167 (S or SN) Tel. Rec. (See Chassis 30B1). 71	Model 7T10, 7T14, 7T15 (See Ch. 5K1)..... 30	Models 8C11, 8C12, 8C13 (See Chassis 30A1 (Set 37) and 8D1 (Set 47)) Tel. Rec. (See Ch. 21B1)..... 118	Models 26R35, 26R36, 26R37 Tel. Rec. (See Ch. 24D1)..... 103																																																																
Chassis UL5K1 (See Chassis 5K1)..... 30	Chassis 20X1, 20Y1, 20Z1 Tel. Rec. (See Ch. 21F1)..... 100-1	Models 4R11, 4R12 (See Ch. 48I)..... 108	Models 8C14, 8C15, 8C16, 8C17 (See Ch. 8D1).... 67	Models 8D15, 8D16 (See Ch. 8D1)..... 67	Models 26R35A, 26R36A, 26R37A Tel. Rec. (See Ch. 21B1)..... 118																																																																
Chassis UL7C1 (See Chassis 7C1)..... 25	Chassis 20Z1 Tel. Rec. Prod. Chge. Bul. 7... 110-1	Models 5F1, 5F12..... 57	Models 8D15, 8D16 (See Ch. 8D1)..... 67	Model 8RP46 (See Chassis 3A1).... 2	Models 26X55, 26X56, 26X57 Tel. Rec. (See Ch. 24D1)..... 103																																																																
Chassis 3A1 (See Ch. 20TI)..... 117	Chassis 21A1 Tel. Rec. (See Ch. 21F1)..... 127-1A	Models 5R11, 5R12, 5R13, 5R14 (See Ch. 5R1).... 59	Model 9B14, 9B15, 9B16 (See Ch. 9B1)..... 49	Models 9E15, 9E16, 9E17 (See Ch. 9E1).... 68	Models 26X65A, 26X66A, 26X67A Tel. Rec. (See Ch. 21B1)..... 118																																																																
Chassis 3C1 (See Ch. 20TI)..... 117	Chassis 21B1, 21C1, 21D1 Tel. Rec. (See Ch. 21F1)..... 118-2	Model 5T12 (Ch. 5T1).... 68	Model 9A155, 9A155N (See Ch. 19A1) Tel. Rec. (See Ch. 20X1).... 59	Models 12X11, 12X12 Tel. Rec. (See Ch. 20X1).... 100	Models 26X65, 26X66, 26X67 Tel. Rec. (See Ch. 24D1).... 103																																																																
Chassis 3C1 Prod. Chge. Bul. 15 126-1	Chassis 21E1, 21G1 Tel. Rec. (See Ch. 21F1)..... 127-1A	Models 5W11, 5W12 (See Ch. 5W1)..... 79	Models 14R11, 14R12 Tel. Rec. (See Ch. 20T1).... 117	Models 16R11, 16R12 Tel. Rec. (See Ch. 21B1).... 118	Models 26X65A, 26X66A, 26X67A Tel. Rec. (See Ch. 21B1).... 118																																																																
Chassis 4A1 3-31	Chassis 21H1, 21J1 Tel. Rec. (See Ch. 21B1).... 118	Models 5X11, 5X12, 5X13, 5X14 (See Ch. 5X1).... 76	Models 16R11, 16R12 Tel. Rec. (See Ch. 21B1).... 118	Models 17K*1, 17K12 Tel. Rec. (See Ch. 21F1).... 127-1A	Models 26X75, 26X76 Tel. Rec. (See Ch. 24D1).... 103																																																																
Chassis 4B1 24-1	Chassis 21K1, 21L1 Tel. Rec. (See Model 21F1).... 127-1A	Models 6A21, 6A22, 6A23 (See Ch. 6A2)..... 103	Models 17K*1, 17K12 Tel. Rec. (See Ch. 21F1).... 127-1A	Models 19A125, 19A125N, 19A135, 19A135N (See Ch. 19A1) Tel. Rec. (See Ch. 20X1).... 100	Models 26X75A, 26X76A Tel. Rec. (See Ch. 21B1).... 118																																																																
Chassis 4D1 49-1	Chassis 21P1, 21Q1 Tel. Rec. (See Model 21F1).... 127-1A	Model 6C11 (See Ch. 6C1) 53	Models 19A125, 19A125N, 19A135, 19A135N (See Ch. 19A1) Tel. Rec. (See Ch. 20X1).... 100	Models 20X11, 20X12 Tel. Rec. (See Ch. 20X1).... 100	Models 26X75A, 26X76A Tel. Rec. (See Ch. 21B1).... 118																																																																
Chassis 4H1 (See Chassis 30B1).... 71	Chassis 24D1, 24E1, 24F1, 24G1, 24H1 Tel. Rec. (See Ch. 24D1, 24E1, 24F1, 24G1, 24H1 Tel. Rec. Prod. Chge. Bul. 9... 114-1	Model 6C71 (See Ch. 10A1) 3	Models 20X11, 20X12 Tel. Rec. (See Ch. 20X1).... 100	Models 20X145, 20X146, 20X147 Tel. Rec. (See Ch. 20X1).... 100	Models 26X75A, 26X76A Tel. Rec. (See Ch. 21B1).... 118																																																																
Chassis 4J1, 4K1 (See Ch. 20A1)..... 77	Chassis 30A1 Tel. Receiver 30D1 Tel. Rec. (See Ch. 30D1 Tel. Rec. (See Ch. 21B1).... 118	Models 6F10, 6F11, 6F12, 6F32 (See Ch. 6E1, 6E1N)..... 6	Models 20X145, 20X146, 20X147 Tel. Rec. (See Ch. 20X1).... 100	Models 20X122 Tel. Rec. (See Ch. 20X1).... 100	Models 26X75A, 26X76A Tel. Rec. (See Ch. 21B1).... 118																																																																
Chassis 4L1, 4S1..... 100-1	Chassis 30B1, 30C1, 30D1 Tel. Rec. (See Ch. 21B1).... 118	Models 6Q11, 6Q12, 6Q13, 6Q14 (See Ch. 6Q1).... 78	Models 20X122 Tel. Rec. (See Ch. 20X1).... 100	Models 20X136 Tel. Rec. (See Ch. 20X1).... 100	Models 26X75A, 26X76A Tel. Rec. (See Ch. 21B1).... 118																																																																
Chassis 4R1..... 108-3	Chassis 30E1, 30F1, 30G1, 30H1, 30I1, 30J1, 30K1, 30L1, 30M1, 30N1, 30O1, 30P1, 30Q1, 30R1, 30S1, 30T1, 30U1, 30V1, 30W1, 30X1, 30Y1, 30Z1, 30AA1, 30AB1, 30AC1, 30AD1, 30AE1, 30AF1, 30AG1, 30AH1, 30AI1, 30AJ1, 30AK1, 30AL1, 30AM1, 30AN1, 30AO1, 30AP1, 30AQ1, 30AR1, 30AS1, 30AT1, 30AU1, 30AV1, 30AW1, 30AX1, 30AY1, 30AZ1, 30BA1, 30BB1, 30BC1, 30BD1, 30BE1, 30BF1, 30BG1, 30BH1, 30BI1, 30BJ1, 30BK1, 30BL1, 30BM1, 30BN1, 30BO1, 30BP1, 30BQ1, 30BR1, 30BS1, 30BT1, 30BU1, 30BV1, 30BW1, 30BX1, 30BY1, 30BZ1, 30CA1, 30CB1, 30CC1, 30CD1, 30CE1, 30CF1, 30CG1, 30CH1, 30CI1, 30CJ1, 30CK1, 30CL1, 30CM1, 30CN1, 30CO1, 30CP1, 30CQ1, 30CR1, 30CS1, 30CT1, 30CU1, 30CV1, 30CW1, 30CX1, 30CY1, 30CZ1, 30DA1, 30DB1, 30DC1, 30DD1, 30DE1, 30DF1, 30DG1, 30DH1, 30DI1, 30DJ1, 30DK1, 30DL1, 30DM1, 30DN1, 30DO1, 30DP1, 30DQ1, 30DR1, 30DS1, 30DT1, 30DU1, 30DV1, 30DW1, 30DX1, 30DY1, 30DZ1, 30EA1, 30EB1, 30EC1, 30ED1, 30EE1, 30EF1, 30EG1, 30EH1, 30EI1, 30EJ1, 30EK1, 30EL1, 30EM1, 30EN1, 30EO1, 30EP1, 30EQ1, 30ER1, 30ES1, 30ET1, 30EU1, 30EV1, 30EW1, 30EX1, 30EY1, 30EZ1, 30FA1, 30FB1, 30FC1, 30FD1, 30FE1, 30FF1, 30FG1, 30FH1, 30FI1, 30FJ1, 30FK1, 30FL1, 30FM1, 30FN1, 30FO1, 30FP1, 30FQ1, 30FR1, 30FS1, 30FT1, 30FU1, 30FV1, 30FW1, 30FX1, 30FY1, 30FZ1, 30GA1, 30GB1, 30GC1, 30GD1, 30GE1, 30GF1, 30GG1, 30GH1, 30GI1, 30GJ1, 30GK1, 30GL1, 30GM1, 30GN1, 30GO1, 30GP1, 30GQ1, 30GR1, 30GS1, 30GT1, 30GU1, 30GV1, 30GW1, 30GX1, 30GY1, 30GZ1, 30HA1, 30HB1, 30HC1, 30HD1, 30HE1, 30HF1, 30HG1, 30HH1, 30HI1, 30HJ1, 30HK1, 30HL1, 30HM1, 30HN1, 30HO1, 30HP1, 30HQ1, 30HR1, 30HS1, 30HT1, 30HU1, 30HV1, 30HW1, 30HX1, 30HY1, 30HZ1, 30IA1, 30IB1, 30IC1, 30ID1, 30IE1, 30IF1, 30IG1, 30IH1, 30II1, 30IJ1, 30IK1, 30IL1, 30IM1, 30IN1, 30IO1, 30IP1, 30IQ1, 30IR1, 30IS1, 30IT1, 30IU1, 30IV1, 30IW1, 30IX1, 30IY1, 30IZ1, 30JA1, 30JB1, 30JC1, 30JD1, 30JE1, 30JF1, 30JG1, 30JH1, 30JI1, 30JJ1, 30JK1, 30JL1, 30JM1, 30JN1, 30JO1, 30JP1, 30JQ1, 30JR1, 30JS1, 30JT1, 30JU1, 30JV1, 30JW1, 30JX1, 30JY1, 30JZ1, 30KA1, 30KB1, 30KC1, 30KD1, 30KE1, 30KF1, 30KG1, 30KH1, 30KI1, 30KJ1, 30KK1, 30KL1, 30KM1, 30KN1, 30KO1, 30KP1, 30KQ1, 30KR1, 30KS1, 30KT1, 30KU1, 30KV1, 30KW1, 30KX1, 30KY1, 30KZ1, 30LA1, 30LB1, 30LC1, 30LD1, 30LE1, 30LF1, 30LG1, 30LH1, 30LI1, 30LJ1, 30LK1, 30LL1, 30LM1, 30LN1, 30LO1, 30LP1, 30LQ1, 30LR1, 30LS1, 30LT1, 30LU1, 30LV1, 30LW1, 30LX1, 30LY1, 30LZ1, 30MA1, 30MB1, 30MC1, 30MD1, 30ME1, 30MF1, 30MG1, 30MH1, 30MI1, 30MJ1, 30MK1, 30ML1, 30MN1, 30MO1, 30MP1, 30MQ1, 30MR1, 30MS1, 30MT1, 30MU1, 30MV1, 30MW1, 30MX1, 30MY1, 30MZ1, 30NA1, 30NB1, 30NC1, 30ND1, 30NE1, 30NF1, 30NG1, 30NH1, 30NI1, 30NJ1, 30NK1, 30NL1, 30NM1, 30NO1, 30NP1, 30NQ1, 30NR1, 30NS1, 30NT1, 30NU1, 30NV1, 30NW1, 30NX1, 30NY1, 30NZ1, 30OA1, 30OB1, 30OC1, 30OD1, 30OE1, 30OF1, 30OG1, 30OH1, 30OI1, 30OJ1, 30OK1, 30OL1, 30OM1, 30ON1, 30OO1, 30OP1, 30OQ1, 30OR1, 30OS1, 30OT1, 30OU1, 30OV1, 30OW1, 30OX1, 30OY1, 30OZ1, 30PA1, 30PB1, 30PC1, 30PD1, 30PE1, 30PF1, 30PG1, 30PH1, 30PI1, 30PJ1, 30PK1, 30PL1, 30PM1, 30PN1, 30PO1, 30PP1, 30PQ1, 30PR1, 30PS1, 30PT1, 30PU1, 30PV1, 30PW1, 30PX1, 30PY1, 30PZ1, 30QA1, 30QB1, 30QC1, 30QD1, 30QE1, 30QF1, 30QG1, 30QH1, 30QI1, 30QJ1, 30QK1, 30QL1, 30QM1, 30QN1, 30QO1, 30QP1, 30QQ1, 30QR1, 30QS1, 30QT1, 30QU1, 30QV1, 30QW1, 30QX1, 30QY1, 30QZ1, 30RA1, 30RB1, 30RC1, 30RD1, 30RE1, 30RF1, 30RG1, 30RH1, 30RI1, 30RJ1, 30RK1, 30RL1, 30RM1, 30RN1, 30RO1, 30RP1, 30RQ1, 30RR1, 30RS1, 30RT1, 30RU1, 30RV1, 30RW1, 30RX1, 30RY1, 30RZ1, 30SA1, 30SB1, 30SC1, 30SD1, 30SE1, 30SF1, 30SG1, 30SH1, 30SI1, 30SJ1, 30SK1, 30SL1, 30SM1, 30SN1, 30SO1, 30SP1, 30SQ1, 30SR1, 30SS1, 30ST1, 30SU1, 30SV1, 30SW1, 30SX1, 30SY1, 30SZ1, 30TA1, 30TB1, 30TC1, 30TD1, 30TE1, 30TF1, 30TG1, 30TH1, 30TI1, 30TJ1, 30TK1, 30TL1, 30TM1, 30TN1, 30TO1, 30TP1, 30TQ1, 30TR1, 30TS1, 30TT1, 30TU1, 30TV1, 30TW1, 30TX1, 30TY1, 30TZ1, 30UA1, 30UB1, 30UC1, 30UD1, 30UE1, 30UF1, 30UG1, 30UH1, 30UI1, 30UJ1, 30UK1, 30UL1, 30UM1, 30UN1, 30UO1, 30UP1, 30UQ1, 30UR1, 30US1, 30UT1, 30UU1, 30UV1, 30UW1, 30UX1, 30UY1, 30UZ1, 30VA1, 30VB1, 30VC1, 30VD1, 30VE1, 30VF1, 30VG1, 30VH1, 30VI1, 30VJ1, 30VK1, 30VL1, 30VM1, 30VN1, 30VO1, 30VP1, 30VQ1, 30VR1, 30VS1, 30VT1, 30VU1, 30VV1, 30VW1, 30VX1, 30VY1, 30VZ1, 30WA1, 30WB1, 30WC1, 30WD1, 30WE1, 30WF1, 30WG1, 30WH1, 30WI1, 30WJ1, 30WK1, 30WL1, 30WM1, 30WN1, 30WO1, 30WP1, 30WQ1, 30WR1, 30WS1, 30WT1, 30WU1, 30WV1, 30WW1, 30WX1, 30WY1, 30WZ1, 30XA1, 30XB1, 30XC1, 30XD1, 30XE1, 30XF1, 30XG1, 30XH1, 30XI1, 30XJ1, 30XK1, 30XL1, 30XM1, 30XN1, 30XO1, 30XP1, 30XQ1, 30XR1, 30XS1, 30XT1, 30XU1, 30XV1, 30XW1, 30XX1, 30XY1, 30XZ1, 30YA1, 30YB1, 30YC1, 30YD1, 30YE1, 30YF1, 30YG1, 30YH1, 30YI1, 30YJ1, 30YK1, 30YL1, 30YM1, 30YN1, 30YO1, 30YP1, 30YQ1, 30YR1, 30YS1, 30YT1, 30YU1, 30YV1, 30YW1, 30YX1, 30YY1, 30YZ1, 30ZA1, 30ZB1, 30ZC1, 30ZD1, 30ZE1, 30ZF1, 30ZG1, 30ZH1, 30ZI1, 30ZJ1, 30ZK1, 30ZL1, 30ZM1, 30ZN1, 30ZO1, 30ZP1, 30ZQ1, 30ZR1, 30ZS1, 30ZT1, 30ZU1, 30ZV1, 30ZW1, 30ZX1, 30ZY1, 30ZZ1	Model 6T01 1-19	Model 6T02, 6T04..... 1-20	Model 6T05 (See Ch. 6A1) 1	Model 6T06, 6T07 (See Ch. 4A1)..... 3	Model 6T11 (See Model 6T02).... 1	Model 6T12 (See Ch. 4A1) 3	Models 6V11, 6V12 (See Ch. 6V1)..... 62	Models 6W11, 6W12 (See Chassis 6W1)..... 71	Models 6Y18, 6Y19 (See Chassis 6Y1)..... 75	Model 7C60B, 7C60M, 7C60W (See Ch. 6B1).... 48	Model 7C61, 7C62, 7C62UL (See Ch. 6M1)..... 25	Model 7C63, 7C63-UL (See Ch. 7C1)..... 25	Model 7C64 (See Ch. 6B1).... 36	Model 7C73 (See Ch. 9A1) 32	Models 7G11, 7G12, 7G14, 7G15, 7G16 (See Ch. 7G1)..... 54	Model 7P32, 7P33, 7P34, 7P35 (See Ch. 5H1).... 26	Model 7R14, 7R14Z, 7R143 (See Ch. 6L1).... 26	Models 7T01, 7T01M-UL, 7T04, 7T04-UL (See Ch. 5N1)..... 31	Model 7T06, 7T12 (See Ch. 48I)..... 24	Model 7T10, 7T14, 7T15 (See Ch. 5K1)..... 30	Models 8C11, 8C12, 8C13 (See Chassis 30A1 (Set 37) and 8D1 (Set 47)) Tel. Rec. (See Ch. 21B1)..... 118	Models 8C14, 8C15, 8C16, 8C17 (See Ch. 8D1).... 67	Models 8D15, 8D16 (See Ch. 8D1)..... 67	Model 8RP46 (See Chassis 3A1).... 2	Model 9B14, 9B15, 9B16 (See Ch. 9B1)..... 49	Models 9E15, 9E16, 9E17 (See Ch. 9E1).... 68	Models 12X11, 12X12 Tel. Rec. (See Ch. 20X1).... 100	Models 14R11, 14R12 Tel. Rec. (See Ch. 20T1).... 117	Models 16R11, 16R12 Tel. Rec. (See Ch. 21B1).... 118	Models 17K*1, 17K12 Tel. Rec. (See Ch. 21F1).... 127-1A	Models 19A125, 19A125N, 19A135, 19A135N (See Ch. 19A1) Tel. Rec. (See Ch. 20X1).... 100	Models 20X11, 20X12 Tel. Rec. (See Ch. 20X1).... 100	Models 20X145, 20X146, 20X147 Tel. Rec. (See Ch. 20X1).... 100	Model 22X12 Tel. Rec. (See Ch. 20X1).... 100	Models 22X25, 22X26, 22X27 Tel. Rec. (See Ch. 20X1).... 100	Models 24A11, 24A12 Tel. Rec. (See Ch. 20A1).... 77	Model 24A125 Tel. Rec. (See Ch. 20A1).... 77	Model 24A125AN Tel. Rec. (See Ch. 20X1).... 100	Models 24A126, 24A127 (See Ch. 20A1)..... 77	Models 24C15, 24C16, 24C17 Tel. Rec. (See Ch. 20A1).... 77	Models 24R11, 24R12 Tel. Rec. (See Ch. 20T1).... 117	Models 24X15, 24X15S, 24X16, 24X16S, 24X17S Tel. Rec. (See Ch. 20X1 and 4L1)..... 100	Models 25A15, 25A16, 25A17 Tel. Rec. (See Ch. 20A1).... 77	Models 26R11, 26R12 Tel. Rec. (See Ch. 21B1).... 118	Models 26R25, 26R26 Tel. Rec. (See Ch. 24D1).... 103	Models 26R25A, 26R26A Tel. Rec. (See Ch. 21B1)..... 118	Models 26R35, 26R36, 26R37 Tel. Rec. (See Ch. 24D1)..... 103	Models 26R35A, 26R36A, 26R37A Tel. Rec. (See Ch. 21B1)..... 118	Models 26X35, 26X36, 26X37 Tel. Rec. (See Ch. 24D1).... 103	Models 26X45, 26X46 Tel. Rec. (See Ch. 24D1).... 103	Models 26X55, 26X56, 26X57 Tel. Rec. (See Ch. 24D1).... 103	Models 26X65A, 26X66A, 26X67A Tel. Rec. (See Ch. 21B1).... 118	Models 26X75, 26X76 Tel. Rec. (See Ch. 24D1).... 103	Models 26X75A, 26X76A Tel. Rec. (See Ch. 21B1).... 118	Models 27K12 Tel. Rec. (See Ch. 21F1).... 127-1A	Models 27K15, 27K16, 27K17 Tel. Rec. (See Ch. 21F1).... 127-1A	Models 27K25, 27K26, 27K27 Tel. Rec. (See Ch. 21F1).... 127-1A	Models 27K35, 27K36 Tel. Rec. (See Ch. 21F1).... 127-1A	Models 27K46 Tel. Rec. (See Ch. 21F1).... 127-1A	Models 29X15, 29X16, 29X17 Tel. Rec. (See Ch. 24D1).... 103	Models 29X25, 29X26, 29X27 Tel. Rec. (See Ch. 24D1).... 103	Model 29X25A Tel. Rec. (See Ch. 21B1).... 118	Models 30A12, 30A13 (S or SN) Tel. Rec. (See Ch. 30A1).... 57	Models 30A14, 30A15, 30A16, Television Receivers (See Ch. 30A1). 57	Models 30B15, 30B16, 30B17 (S or SN) Tel. Rec. (See Ch. 30B1) 71	Models 30C15, 30C16, 30C17 (S or SN) Tel. Rec. (See Ch. 30B1) 71	Models 30F15, A, 30F16, A, 30F17, A Tel. Rec. (See Ch. 20A1).... 77	Models 32X15, 32X16 Tel. Rec. (See Ch. 20X1 and 4S1)..... 100

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ADMIRAL-ARTHUR ANSLEY

ADMIRAL-Cont.

Models 32X26, 32X27 Tel. Rec. (See Ch. 20X1 and 5B2).....	100
Models 32X35, 32X36 Tel. Rec. (See Ch. 20X1 and 5B2).....	100
Models 34R15, A, 34R16, A Tel. Rec. (See Ch. 20T1).....	117
Model 36R37 Tel. Rec. (See Ch. 21B1).....	118
Models 36R45, 36R46 Tel. Rec. (See Ch. 21B1).....	118
Models 36X35, A, 36X36, A, 36X37, A Tel. Rec. (See Ch. 24D1 (Set 103) and Radio Ch. 5B2 (Set 100)).....	118
Models 37K15, 37K16 Tel. Rec. (See Ch. 21F1).....	127-1A
Models 37K27, 37K28 Tel. Rec. (See Ch. 21F1).....	127-1A
Models 37K35, 37K36 Tel. Rec. (See Ch. 21F1).....	127-1A
Models 39X16, 39X16A, B, 39X17A, B Tel. Rec. (See Ch. 24D1 (Set 103) and Radio Ch. 5B2 (Set 100)).....	118
Model 39X17C Tel. Rec. (See Ch. 21B1).....	118
Models 39X25A, 39X26A Tel. Rec. (See Ch. 21B1).....	118
Models 39X35, 39X36, 39X37 Tel. Rec. (See Ch. 21B1).....	118
Models 221K16, 221K16A Tel. Rec. (See Ch. 21F1).....	127-1A
Models 221K26, 221K28 Tel. Rec. (See Ch. 21F1).....	127-1A
Models 221K35, 221K36 Tel. Rec. (See Ch. 21F1).....	127-1A
Models 321K15, 321K16, 321K18 Tel. Rec. (See Ch. 21F1).....	127-1A
Models 321K27 Tel. Rec. (See Ch. 21F1).....	127-1A
Models 321K35, 321K36 Tel. Rec. (See Ch. 21F1).....	127-1A
Models 321K46, 321K47, 32K49 Tel. Rec. (See Ch. 21F1).....	127-1A

AERMOTIVE

181-AD.....	12-1
-------------	------

AIRADIO

SU-41D.....	11-1
SU-52A, B, C (Receiver).....	13-2
TRA-1A, B, C (Transmitter).....	13-1
3100.....	37-1

AIRCASLE

DM-700 (See Model DM-700).....	85-1
G-516, G-518.....	48-3
G-521.....	54-3
G-724.....	52-25
G-725.....	50-1
K1.....	93-1
P-20.....	71-3
P-22.....	87-1
PAM-A.....	10-1
PC-B, PC-35B.....	99-1
PM-78.....	100-2
PM-358.....	98-1
PX.....	13-35
REY248.....	127-2
SC-448.....	62-2
TD-6.....	103-3
WEU-262.....	91-1
WRA1-A.....	47-1
WRA-A.....	40-1
XB702, XB703 Tel. Rec. 93A-1.....	93A-1
XL750, XP775 Tel. Rec. 93A-1.....	93A-1
7B.....	52-1
9.....	50-2
10T Tel. Rec.....	67-2
12C, 12T Tel. Rec.....	67-2
15.....	86-1
16C, 16T Tel. Rec.....	98-2
101.....	102B
102B.....	106B
150, 153.....	126-2
171, 172.....	96-1
198.....	83-1
201.....	81-1
211.....	65-1
212.....	68-3
213.....	63-1
2271, 227W.....	84-1
312 Tel. Rec.....	312
316 Tel. Rec.....	316
358VM.....	127-3
412 Tel. Rec.....	412
416 Tel. Rec.....	416
56B.....	56B
572.....	572
602-182144.....	114-2
604.....	53-2
606-400WB.....	119-2
607-314, 607-315.....	122-2
621 (Ch. FJ-91).....	14-2
626.....	18-3
641.....	17-1
651.....	15-1
5000, 5001.....	16-2
5002.....	19-1
5003, 5004, 5005, 5006.....	20-1
5008, 5009.....	46-1
5010, 5011, 5012.....	13-4

(Ch. 5101)

13-4

AIRCASLE-Cont.

5015.1.....	118-3
5020.....	16-3
5022.....	123-2
5024.....	45-1
5025.....	24-2
5027.....	49-3
5028.....	44-1
5029.....	51-1
5035.....	46-2
5036.....	72-2
5044.....	121-2
5050.....	48-4
5052.....	45-2
5056-A.....	120-2
6042.....	61-1
6050.....	74-1
6053.....	97-1
6541.....	18-4
6544, 6547 (See Model 6541).....	17
6611, 6612, 6613, 6630, 6631, 6632, 6634, 6635.....	15-2
7000, 7001.....	14-3
7004.....	19-2
7014, 7015.....	57-3
7015 Early.....	47-2
7553.....	45-3
90081, 9008W.....	99-2
90091, 9009W.....	97-2
90121, 9012W.....	94-1
10002.....	56-1
10003-1.....	56-2
10005.....	62-3
10021-1, 10022-1.....	59-3
10023.....	58-1
10024-1.....	58-2
18014, 10850A.....	57-4
12110A.....	73-1
12112A.....	61-2
12708A.....	55-2
13150A.....	60-2
13256A.....	69-1
13810A.....	54-3
13812A.....	64-1
13914A.....	59-4
14711A.....	56-3
14965A, 15008A.....	71-4
15914A (See Model 13914A).....	59

AIR CHIEF (See Firestone)

AIR KING

A-400 (Ch. 470).....	23-1
A-403.....	20-2
A-410.....	34-1
A-410 (Revised).....	40-1
A-426.....	43-1
A-450.....	43-1
A-501, A-502 (Ch. 465-4).....	31-3
A-510.....	24-3
A-511, A-512.....	30-2
A-520.....	49-4
A-600.....	26-3
A-604.....	81-2
A-625.....	50-3
A-650.....	45-4
800.....	66-1
A-1000, A-1001 Tel. Receiver.....	58-3
A1001A Tel. Rec.....	75-2
A1016 Tel. Rec.....	91-2
A2000, A2001, A2002 Tel. Rec. (See Model A1001A).....	75
A2010 Tel. Rec. (See Model A1001A).....	75
A-2012 Tel. Rec. (See Model A1001A).....	75
16C1, 16C2, 16C3 Tel. Rec.....	121-3
16M1 Tel. Rec. (See Model 16C1).....	121
16T1 Tel. Rec. (See Model 16C1).....	121
19C1 Tel. Rec. (See Model 16C1).....	121
718R Tel. Rec. (See Model 16C1).....	121
2017R Tel. Rec.....	117-2
4601 (See Model 4609).....	11
4603.....	3-36
4604.....	4-25
4604D (See Model 4604).....	4
4607, 4608.....	3-1
4609, 4610 Early.....	3
(See Model 4607).....	3
4609, 4610.....	11-2
4625.....	13-8
4700.....	39-1
4704.....	12-2
4705, 4706.....	9-1
4708 (See Model 4704).....	12

AIR KNIGHT (SKY KNIGHT)

CA-500.....	17-4
CB-500P.....	17-31
NS-5D291.....	17-3

AIRLINE

05BR-3021B Tel. Rec.....	109-1
05BR-3024B Tel. Rec.....	109-1
05BR-3027A Tel. Rec.....	109-1
05CG-992A Tel. Rec.....	116-2
05CG-3019A Tel. Rec.....	116-2
05CG-3020A Tel. Rec.....	117-3
05CG-3037A Tel. Rec.....	117-3
05WG-1811B (See Model 94WG-1811A).....	99
05WG-1813A.....	127-4
05WG-2748C, D, E (See Model 94WG-2748A).....	90
05WG-2752.....	100-3
05WG-3016A, B Tel. Rec. (See Model 94WG-3006A Set 72 and Set 110 Folder 2).....	119-3
05WG-3030A Tel. Rec.....	119-3

AIRLINE-Cont.

05WG-3031A Tel. Rec.....	109-1
05WG-3031B Tel. Rec.....	109-1
05WG-3036A, B Tel. Rec.....	109-1
05WG-3038A, B Tel. Rec.....	109-1
05WG-3039A, B Tel. Rec.....	109-1
05WG-3040 Tel. Rec.....	109-1
05WG-3042A Tel. Rec.....	109-1
05WG-3044 Tel. Rec.....	109-1
54BR-1501A, 54R-1502A.....	2-26
54BR-1503A, B, C.....	3-4
54BR-1504A, B, C.....	3-4
54BR-1505A, B, 54BR-1506A, B.....	2-34
54KP-1209A.....	8-1
54WG-1801A, 54WG-1801B.....	4-33
54WG-2500A, 54WG-2700A.....	4-15
64BR-916A.....	3-34
64BR-916B (See Model 74BR-916B).....	17
64BR-917A.....	10-1
64BR917A (See Model 64BR1051A).....	10
64BR-1051A.....	2-32
64BR1051B (See Model 64BR1051A).....	2
64BR-1205A, 64BR-1206A.....	10-3
64BR-1208A.....	16-4
64BR-1503B, 64BR-1504B (See Models 54BR-1503A, B, C, 54BR-1504A, B, C).....	3
64BR-1513A, B.....	24-4
64BR-1514A, B.....	16-5
64BR-1808A.....	16-5
64BR-2200A (See Model 64BR-1208A).....	16
64BR-7000A.....	51-2
64BR-7100A, 64BR-7110A, 64BR-7120A.....	57-5
64BR-7300A, 64BR-7310A, 64BR-7320A.....	54-4
64BR-7810A, 64BR-7820A.....	53-3
64WG-1050A.....	10-2
64WG-1050B, 64WG-1050C, 64WG-1050D.....	10
64WG-1050A.....	10
64WG-1052A.....	9-2
64WG-1052B (See Model 64WG-1052A).....	9
64WG-1207B.....	18-5
64WG-1511A, 64WG-1511B, 64WG-1512A, 64WG-1512B.....	5-5
64WG-1801C (See Models 54WG-1801A, B).....	4
64WG-1804A, B.....	4-27
64WG-1804C (See Model 64WG-1804A).....	4
64WG-1807A.....	4
64WG-1807B.....	5-4
64WG-1809A, 64WG-1809B (See Models 64WG-1511A, B; 64WG-1512A, B).....	5
64WG-2007A.....	5-6
64WG-2007B.....	5-6
64WG-2009A.....	6-2
64WG-2009B.....	6-2
64WG-2010B.....	18-6
64WG-2500A (See Model 54WG-2500A).....	4
64WG-2700A.....	4
64WG-2700B (See Models 54WG-2500A; 54WG-2700A).....	4
74BR-916B.....	17-5
74BR-1053A.....	17-5
74BR-1055A.....	17-5
74BR-1501B, 74BR-1502B, 74BR-1507, 74BR-1508A, 74BR-1513B, 74BR-1514B (See Models 64BR-1513A, B; 64BR-1514A, B).....	24
74BR-1812A (See Model 74BR-1812B).....	22
74BR-1812B.....	22-2
74BR-2001A (See Model 74BR-2001B).....	23-2
74BR-2001B.....	23-2
74BR-2002A.....	23-2
74BR-2701A.....	24-5
74BR-2702A (See Model 74BR-2702B).....	25
74BR-2702B.....	25-3
74BR-2707A.....	25-3
74BR-2708A.....	25-3
74BR-2715A.....	25-3
74BR-2715B.....	25-3
74CSG-8400A.....	24-6
74CSG-8700A.....	60-3
74CSG-8810A.....	60-3
74CSG-8820A.....	52-2
74HA-8200A.....	58-4
74KR-1210A.....	41-1
74KR-2706B.....	41-1
74KR-2713A.....	43-2
74WG-925A.....	43-2
74WG-1050C, D (See Model 64WG-1050A).....	10
74WG-1052B (See Models 64WG-1052A, B).....	9
74WG-1054A.....	22-1
74WG-1054B (See Model 74WG-1054A).....	22
74WG-1056A.....	29-1
74WG-1057A (See Model 74WG-1207B).....	32-2
74WG-1207B (See Model 74WG-1207B).....	18
74WG-1509A.....	27-1
74WG-1510A.....	27-1
74WG-1511B, 74WG-1512B (See Models 64WG-1511A, B; 64WG-1512A, B).....	5
74WG-1802A.....	25-4

AIRLINE-Cont.

74WG-1803A (See Model 74WG-1802A).....	25
74WG-1804C (See Models 64WG-1804A, B).....	4
74WG-1807A, 74WG-1807B (See Models 64WG-1807A, B).....	5
74WG-2002A.....	26-4
74WG-2004A.....	27-2
74WG-2007B, 74WG-2007C (See Models 64WG-2007A, B).....	5
74WG-2009B (See Models 64WG-2009A, B).....	6
74WG-2010A (See Model 64WG-2010B).....	18
74WG-2010B.....	18-6
74WG-2500A (See Model 54WG-2500A).....	4
74WG-2504A.....	28-1
74WG-2504B, 74WG-2504C (See Model 74WG-2504A).....	28
74WG-2505A.....	18-7
74WG-2700A, 74WG-2700B (See Model 54WG-2700A).....	4
74WG-2702A, 74WG-2704C (See Model 74WG-2504A).....	28
74WG-2705A, 74WG-2705B (See Model 74WG-2505A).....	18
74WG-2709A.....	26-5
74WG-2711A (See Model 74WG-2505A).....	18
84BR-1065A.....	46
84BR-1503D, 84BR-1504D, 84BR-1515A, 84BR-1516A, 84BR-1517A, 84BR-1518A, 84BR-1815B, 84BR-1816B, 84BR-2005A, 84BR-2715B, 84BR-2719A, 84BR-2726B, 84BR-3004 Tel. Rec. (See Model 94WG-3006B).....	91-3
84GAA-396A.....	52-26
84GDC-963B.....	51-3
84GDC-987A.....	53-4
84GDM-926B.....	55-4
84GSE-2730A.....	70-1
84GSE-2731A.....	70-1
84GSE-3011A Tel. Rec. (See Model 94HA-1527C).....	67
84HA-1527A, 84HA-1528A, 84HA-1529A, 84HA-1530A.....	85-2
84HA-1810A.....	69-2
84HA-1810C.....	69-2
84HA-2727A.....	99-3
84HA-3002A, 84HA-3002B Tel. Rec. (See Model 84HA-3007A, B, C Tel. Rec. 84HA-3010A, B, C).....	94-2
84HA-3010A, B, C Tel. Rec. Prod. Chge.....	118-1
84KR-1209A.....	56-4
84KR-1520A.....	68-4
84KR-2511A.....	42-1
84WG-1060A.....	42
84WG-1060C (See Model 84WG-1060A).....	38-1
84WG-2015A.....	46
84WG-2721A (See Model 84WG-2721A).....	46
84WG-2506B.....	58-5
84WG-2712A.....	43-3
84WG-2712B (See Model 84WG-2712A).....	43
84WG-2714A.....	36-2
84WG-2714F, G, H, I.....	56-5
84WG-2718A, 84WG-2718B, 84WG-2720A, 84WG-2721A, B, 84WG-2722A (See Model 84WG-2718A).....	45
84WG-2728A (See Models 84WG-2718A, B; 84WG-2720A).....	45
84WG-2732A, B (See Model 84WG-2712A, B).....	43
84WG-2734A (See Models 84WG-2718A, B; 84WG-2720A).....	43
84WG-3006, 84WG-3008, 84WG-3009 (See Model 94WG-3006A) Tel. Rec.....	72
94BR-1525A.....	88-1
94BR-1526A.....	88-1
94BR-1533A.....	89-1
94BR-2740A, 94BR-2741A, B.....	89-1
94BR3004, C Tel. Rec. (See Model 94BR-3017A).....	91A-3
94BR-3017A Tel. Rec.....	89-2
94BR-3017B Tel. Rec. Prod. Chge. Bul. 7.....	110-1
94BR-3021, 94BR-3024A Tel. Rec. (See Model 94GCB-3654A).....	95-1
94GCB-1064A.....	96-2

ARTONE

AR-23TV-1 Tel. Rec. 80-1
524 76-6

ARVIN

140-P (Ch. RE-209) 25-6
150-TC, 151-TC
(Ch. RE-228) (Lote) 25-7
150TC, 151TC
(Ch. RE-228-1) 39-2
152-T, 153-T 33-1
160T, 161T (Ch. RE-232) 49-5
182TFM (Ch. RE-243) 32-3
240-P (Ch. RE-243) 42-2
241P, 244P, 2410P (Ch.
RE-244, RE-254, RE-255,
RE-256, RE-259) 47-3
242T, 243T (Ch. RE-251) 32-3
250-P (Ch. RE-248) 43-4
253T, 254T, 255T, 256T
(Ch. RE-252) 53-5
264T, 265T (Ch. RE-265) 64-2
280TFM, 281TFM
(Ch. RE-253) 44-2
341T (Ch. RE-274) 84-3
350P (Ch. RE-267) 69-3
350-PB (Ch. RE-267-1)
350-PL (Ch. RE-267-2) 100-4
351P (Ch. RE-267) (See
Model 350P) 69
351-PB (Ch. RE-267-1),
351-PL (Ch. RE-267-2)
(See Model 350-PB) 100
352-PL, 353-PL (Ch.
RE-267-2) (See Model
350-PB) 100
355T (Ch. RE-213)
(See Model 356T) 78
356T, 357T (Ch. RE-273) 78-2
358-T (Ch. RE-233)
(See Model 152-T) 33
360TFM, 361TFM (Ch.
RE-260) 70-2
440T, 441T (Ch. RE-278) 96-3
442 (Ch. RE-91) 34-2
444, 444A (Ch. RE-200) 1-3
444AM, 444M
(Ch. RE-200M) 23-3
446P (Ch. RE-280) 106-2
450T, 451T (Ch. RE-281) 110-3
460T, 461T (Ch. RE-284) 107-3
462-CB, 462-CM
(Ch. RE-287-1) 116-3
480TFM, 481TFM
(Ch. RE-277, RE-277-1) 107-4
482CFB, 482CFM
(Ch. RE-288-1) 117-4
544, 544A, 544AR,
544R (Ch. RE-201) 1-7
547A (Ch. RE-242) 42-3
552AM, 552N (Ch.
RE-231), 555, 555A
(Ch. RE-202) 13-9
558 (Ch. RE-204) 3-16
664, 664A (Ch. RE-206) 3-23
664, 664A (Ch. RE-206-1),
664C (Ch. RE-206-2) 29-2
665 (Ch. RE-229) 18-10
2120CM (Ch. TE289-2)
Tel. Rec. 120-3
2121TM (Ch. TE289-2)
Tel. Rec. 120
(See Model 2120CM) 120
2122TM (Ch. TE-289)
Tel. Rec. 97A-1
2123TM (Ch. TE289-2)
Tel. Rec. 120
(See Model 2120CM) 120
2124CM (Ch. TE289-2)
Tel. Rec. 120
(See Model 2120CM) 120
2126CM (Ch. TE289-2)
Tel. Rec. 120
(See Model 2120CM) 120
2160, 2161, 2162, 2164
(Ch. TE-290) Tel. Rec. 126-3
3100TB, 3100TM, 3101CM,
3120TM, 3121TM (Ch.
TE-272-1, TE-272-2)
Tel. Rec. 80-2
3160CM (Ch. TE-276)
Tel. Rec. 93-2
4080T (Ch. TE282) Tel.
Rec. 104-2
4081T Tel. Rec. 104
(See Model 4080T) 104
4162 (Ch. TE-286)
Tel. Rec. 34
Ch. RE-91 (See Model 442) 34
Ch. RE-200 (See Model
444) 1
Ch. RE-200M (See Model
444M) 23
Ch. RE-201 (See Model
544) 1
Ch. RE-202 (See Model
552AN) 13
Ch. RE-204 (See Model
55B) 3
Ch. RE-206 (See Model
664) 3
Ch. RE-206-1, 206-2
(See Model 664 Lote) 29
Ch. RE-209 (See Model
140P) 25
Ch. RE-228 (See Model
150TC) 25
Ch. RE-228-1 (See
Model 150TC Lote) 39
Ch. RE-229 (See Model
665) 18
Ch. RE-231 (See Model
552AN) 13
Ch. RE-232 (See Model
160T) 49
Ch. RE-233 (See Model
152T) 33
Ch. RE-237 (See Model
182TFM) 32

ARVIN—Cont.

Ch. RE-242 (See Model
547A) 42
Ch. RE-243 (See Model
240P) 42
Ch. RE-244 (See Model
241P) 47
Ch. RE-248 (See Model
250P) 43
Ch. RE-251 (See Model
242T) 52
Ch. RE-252 (See Model
253T) 53
Ch. RE-253 (See Model
280TFM) 44
Ch. RE-254, 255, 256,
259 (See Model 241P) 47
Ch. RE-260 (See Model
360TFM) 70
Ch. RE-265 (See Model
264T) 64
Ch. RE-267 (See Model
350P) 69
Ch. RE-267-1, RE-267-2
(See Model 350-PB) 100
Ch. RE-273 (See Model
356T) 78
Ch. RE-274 (See Model
341T) 84
Ch. RE-277, RE-277-1
(See Model 480TFM) 107
Ch. RE-280 (See
Model 446P) 106
Ch. RE-281 (See
Model 450T) 110
Ch. RE-284 (See
Model 460T) 107
Ch. RE-287-1
(See Model 462-CB) 116
Ch. RE-288-1
(See Model 482CFB) 117
Ch. TE-272-1, 2
(See Model 3100TB) 80
Ch. TE-276 (See Model
3100TB) 93
Ch. TE282 (See Model
4080T) 104
Ch. TE-289 (See Model
2122TM) 97A-1
Ch. TE289-2
(See Model 2120CM) 120
Ch. TE-290 (See
Model 2160) 126

ASTRONIC

T-3 121-4
748 53-6

ATLAS

AB-45 14-5

AUDAR

MAS-4 "Bingo Amp." 26-6
P-1A 5-10
P-4 19-3
P-5 5-11
P-7 44-3
PR-6 13-10
PR-6A 19-4
RE-8A 25-8
Telvar BM-25, BMP-25 62-5
Telvar FMC-12 35-2
Telvar RER-9 65-2

AUTOMATIC

Tom Boy 27-4
Tom Thumb Buddy 53-7
Tom Thumb Camera Radio 49-6
Tom Thumb Jr. 26-7
Tom Thumb Personal ATTP 23-4
B-44 60-5
C60 5-20
C-60X 24-10
C-65X (See Model C-60X) 24
C300 102-1
D300 104-3
F-100 103-6
F-790 23-5
M-86 34-3
M-90 67-4
TV-P490 Tel. Rec. 81-3
TV-707, TV-709, TV-710
Tel. Rec. 60-6
TV-712 Tel. Rec. 60
(See Model TV-707) 60
TV-1205 Tel. Rec. 103
(See Model TV-1249) 103
TV-1205 Tel. Rec.
Prod. Chge. Bul. 5 106-1
TV-1249, TV1250 Tel.
Rec. 103-5
TV-1294 Tel. Rec. 103
(See Model TV-1249) 103
TV-1294 Tel. Rec.
Prod. Chge. Bul. 5 106-1
TV-1605 Tel. Rec. (See
Model TV-1249) 103
TV-1615 Tel. Rec. (See
Model TV-1249) 103
TV-1649, TV-1650,
TV-1651 Series B
Tel. Rec.
TV-1694 Tel. Rec. (See
Model TV-1249) 103
TV-5006 Tel. Rec.
TV-5061 Tel. Rec.
TV-5077 Tel. Rec.
TV-5116 Tel. Rec.
TV-5160 Tel. Rec.
TVX313 Tel. Rec.
TVX404 Tel. Rec.
(See Model TV-707) 60
601, 602 (Series A) 13-11
601, 602 (Series B) 22-5
612X 1-34
613X (See Model 612X) 1-34
614X, 616X 8-2
620 12-3

AUTOMATIC—Cont.

640, Series B 10-4
660, 662, 666 22-6
677 22-7
720 21-4

AVIOLA

509 7-3
611
611 15-3
608 16-6
612 (See Model 601) 15
618 (See Model 608) 16

BELL SOUND SYSTEMS

B-23 75-4
511
RC-47 (RE-CORD-O-FONE) 30-3
4401, 4405 "Belfone" 25-9
2075 10-5
2122 77-3
2122R 76-7
2159 22-8
371 22-9
3725 24-11
3728M 31-5
3750 31-5

BELLTONE

500 5-33

BELMONT (Also See Raytheon)

A-6D110 17-7
3AW7 10-7
4B115
4B17 2-27
4B112, 4B113 (Series A) 10-6
5D110 22-10
5D128 (Series A) 9-4
5P19 (Series A) 9-5
5P113 "Boulevard" 28-2
6D113 2-33
6D120 24-12
8A59 6-4
21A21 Tel. Rec. 93A-4
22A21, 22AX21, 22AX22
Television Receiver 55-5

BENDIX

C174 Tel. Rec. 111
(See Model 2051) 111
T170 Tel. Rec. 111
(See Model 2051) 111
T173 Tel. Rec. 111
(See Model 2051) 111
0526A, 0526B, 0526F 1-22
PAR 80 39-3
5512, 5513, 55P2, 55P3 51-4
55X4 58-6
65P4 52-4
69B8, 69M8, 69M9 63-3
75B5, 75M5, 75M8,
75P6, 75W5 59-5
79M7 66-3
95B3, 95M3, 95M9 60-7
110, 110W, 111, 111W,
112, 114, 115 41-3
235B1, 235M1 (Ch. Codes
MA, MB, MC, MD)
Tel. Rec. 69-4
300, 300W, 301, 302 40-2
416A 43-5
526MA, 526MB, 526MC 29-3
613 40-3
626-A (0626A) 12-4
636A, 636C 15-4
636D (See Model 636A) 15
646A 2-28
656A 2-31
676B, 676C, 676D 5-23
687A 61-3
697A 26-8
736B 10-8
847-B 27-5
847-S "Facto Meter" 28-3
1217, 1217B, 1217D 29-4
1217D (Lote) 46-5
1518, 1519, 1524, 1525 37-3
1521 42-4
1531, 1533 43-6
2001, 2002 Tel. Rec. 84-4
2020, 2021 Tel. Rec. 84
(See Model 2001) 84
2025 Tel. Rec. 99-5
2051 Tel. Rec. 111-3
2051 Tel. Rec.
Prod. Chge. Bul. 16 126-1
2060 Tel. Rec. 111
(See Model 2051) 111
2060 Tel. Rec. 111
(See Model 2051) 111
Prod. Chge. Bul. 16 126
2071 Tel. Rec. 111
(See Model 2051) 111
2071 Tel. Rec.
Prod. Chge. Bul. 16 126
3001, 3002 Tel. Rec. 84
(See Model 2001) 84
3030, 3031 Tel. Rec. 84
(See Model 2001) 84
3033 Tel. Rec. 99
(See Model 2025) 99
3051 Tel. Rec. 111
(See Model 2051) 111
3051 Tel. Rec. 111
(See Model 2051) 111
Prod. Chge. Bul. 16 126
6001 Tel. Rec. 111
(See Model 2051) 111
6001 Tel. Rec. 111
(See Model 2051) 111
Prod. Chge. Bul. 16 126
6002 Tel. Rec. 99
(See Model 2025) 99
6003 Tel. Rec. 111
(See Model 2051) 111

BENDIX—Cont.

6003 Tel. Rec. 111
(See Model 2051) 111
Prod. Chge. Bul. 16 126
6100 Tel. Rec. 111
(See Model 2051) 111
6100 Tel. Rec. 111
(See Model 2051) 111
Prod. Chge. Bul. 16 126
7001 Tel. Rec. 111
(See Model 2051) 111
7001 Tel. Rec. 111
(See Model 2051) 111
Prod. Chge. Bul. 16 126
BOGEN (See Devid Bogen)

BREWSTER

9-1084, 9-1085, 9-1086 2-13

BROOK

10C 41-4
10C2-A 43-7
10C3 72-5
10D (See Model BOC) 4
12A 89-3

BROWNING

PF-12, RJ-12 47-4
RJ-12A, RJ-14A 56-6
RJ-20, RJ-22 67-5
RV-10, RV-11 46-6

BRUNSWICK

BJ-6836 "Tuscony,"
C-3300 "Darby" 28-4
D-1000, D-1100 56-7
D-6876 "Buckingham"
(See Model T-4000) 29
T-4000, T-4000 1/2 "Buck-
ingham" 29-5
T-4000, T-4000 1/2 61-4
T-6000, T-6000 1/2
T-6000S, T-6000SS,
T-6000SX, T-6000SX 29
(See Model T-4000) 29
T-9000 (See Model D-1000) 56
512, 513 Tel. Rec.
812 Tel. Rec.
816 Tel. Rec.
911 Tel. Rec.
922B, M Tel. Rec.
5000 42-5
5125 Tel. Rec.
6165 Tel. Rec.
8125 Tel. Rec.
8165 Tel. Rec.

BUICK

980690, 980733 18-9
980744, 980745 19-5
980782 62-6
980797, 980798 59-6
980868 104-4

BUTLER BROS.
(See Air Knight or Sky Rover)

CADILLAC

7241938
7253207
7256609 60-8
725815
7258755 109-2

CALLMASTER (See Lyman)

CAPEHART

B-504-P16 Tel. Rec. (See
Model 41P Set 87
and 35P7 Set 93A)
P9, P10
19N4, 21P4, 24N4, 24P4,
26N4, 29P4, 31P4, 65-3
31N4, 31P4 65-3
32P9, 33P9 64-3
34P1 (See Model 32P9) 64
35P7 (Ch. P7) 93A-4
114N4, 116N4, 116P4,
118P4 (See Model
19N4) 65
151P2 67-6
320-B, 320-M (Ch.
CX-33) Tel. Rec. 112
320-M (Ch. CX-33) Tel. Rec. 112
320-B, 320-M (Ch.
CX-33) Tel. Rec. 122-1
Prod. Chge. Bul. 13 122-1
321-B, 321-M, 322-B,
322-M (Ch. CX-33) Tel.
Rec. (See Model 323M) 112
321-B, 321-M, 322-B,
322-M (Ch. CX-33)
Tel. Rec. Prod. Chge. 122-1
Bul. 13 122-1
323M (Ch. CX-33F), 324M,
325F (Ch. CX-33)
Tel. Rec. 112-3
324-M, 325-F, 325-M
(Ch. CX-33) Tel. Rec.
Prod. Chge. Bul. 13 122-1
326-M (Ch. CX-33) Tel.
Rec. (See Model 323M) 112
326-M (Ch. CX-33) Tel.
Rec. Prod. Chge. Bul. 13 122-1
332-B, 332-M, 334-M
(Ch. CX-33F) Tel. Rec. 112
(See Model 323M) 112
332-B, 332-M, 334-M
(Ch. CX-33F) Tel. Rec.
Prod. Chge. Bul. 13 122-1
413P, 414P 67
461P, 462P12 Tel. Rec. 87-2
501P, 502P, 504P Tel.
Rec. (See Model 461P
Set 87 and 35P7 Set
93A)
610P, 651P, 661P Tel. Rec. 95A-1
3001, 3002 (Ch. CX-30, A,
Prod. C-272) Tel. Rec. 99A-1

CAPEHART—Cont.

3001, 3002 (Ch. CX-30A-2,
Prod. C-272) Tel. Rec. 99A-2
3004-M (Ch. CX-31, Prod.
C-268) Tel. Rec. 93A-5
3005 (Ch. CX-32, Prod.
C-279) Tel. Rec. 93A-5
3006-M (Ch. CX-31, Prod.
C-274) Tel. Rec. (See
Model 3004-M) 93A
3007 (Ch. CX-30, Prod.
C-276) 99A-2
3008 (Ch. CX-32, Prod.
C-278 Tel. Rec. (See
Model 3005) 93A
3011B, M, 3012B, M
(Ch. CX-33) Tel. Rec. 112
(See Model 323M) 112
4001-M (Ch. CX-31, Prod.
C-268) Tel. Rec. (See
Model 3004-M) 93A
4002-M (Ch. CX-31, Prod.
C-274) Tel. Rec. (See
Model 3004-M) 93A
(Ch. CX-33, CX-33F
(See Model 323M) 112

CAPITOL

D-17 30-4
T-13 28-5
U-24 29-6

CARDWELL, ALLEN D.

CE-26 14-6

CENTURY (Also See Industrial Television)

226, 326 (Ch. IT-26R,
IT-35R, IT-39R, IT-46R)
Tel. Rec. 99A-7
721, 821, 921, 1021 (Ch.
IT-21R) Tel. Rec. 97A-8

CENTURY (20th)

100X, 101, 104 12-5
200 21-5
300 21-6

CHALLENGER

CC8 63-4
CC10 67-7
CC18 68-6
CC60 70-3
CC618 66-4
CD6 65-4
20R 69-5
60R 62-7
200 (See Model 20R) 69
600 (See Model 60R) 62

CHANCELLOR (See Radionic)

35P 30-25

CHEVROLET

985792 6-5
985793 19-6
985986
986067 90-2
986146 28-6
986240 75-5
986241 58-7
986388 104-5

CHRYSLER (See Mopar)

CISCO

1A5 37-4
9A3 20-3

CLARION

C100 1-5
C101 5-9
C102 9-6
C103 6-6
C104 1-4
C105 (See Model C104) 1
C105A 6-7
C108 (Ch. 101) 8
150
155
167 Tel. Rec. 95A-1
11011 17-8
11305 18-11
11411-N 30-5
11801 23-6
11802V-M (See Model
11801) 23
1210M 54-5
12310-W 31-6
12708 41-5
12801 61-5
13101 46-7
13201 13203 62-8
14601 60-9
14965 65-5
16703 Tel. Rec. 102-2

CLARK

PA-10 12-6
PA-10A 18-12
PA-20 13-12
PA-20A 18-13
PA-30 19-7

CLEARSONIC
(See U. S. Television)

COLLINS AUDIO PRODUCTS

FMA-6 99-6
45-D 72-6

COLLINS RADIO

75A-1 34-4

COMMANDER INDUSTRIES

Commander 3 Tube
Record Player 17-10

CONCORD-EMERSON

CONCORD

Table listing various models and prices for CONCORD products, including CD61P, IN434, IN435, IN436, and others.

CONRAC

Table listing CONRAC models and prices, including 36, 39, Tel. Rec. and 110-4.

CONTINENTAL ELECTRONICS

(See Skyweight)

CONVERSA-FONE

Table listing CONVERSA-FONE models and prices, including MS-5 and 55-5.

CO-OP

Table listing CO-OP models and prices, including 6AWC2, 6AWC3, 6A47WCR, 6A47WT, 6A47WTR.

CORONADO

Table listing various models and prices for CORONADO products, including FA43-8965, 43-8965A, 43-8965B, etc.

CORONADO-Cont.

Table listing various models and prices for CORONADO-Cont. products, including 94RA1-43-7605A, 94RA1-43-7656A, etc.

CORONET

Table listing CORONET models and prices, including C2.

CRESCENT

Table listing CRESCENT models and prices, including H-16A1.

CROMWELL

(Mercantile Stores)

Table listing CROMWELL models and prices, including 1010, 1020.

CROSLY

Table listing various models and prices for CROSLY products, including 9-101, 9-102, 9-103, etc.

CROSLY-Cont.

Table listing various models and prices for CROSLY-Cont. products, including 11-461WU, 11-465WU, etc.

CROSLY CAR

Table listing CROSLY CAR models and prices, including 5MX080.

CRYSTAL PRODUCTS

(See Coronet)

DALBAR

Table listing DALBAR models and prices, including Barcambo Jr., Barcambo Sr., etc.

DAVID BOGEN

Table listing various models and prices for DAVID BOGEN products, including DB-10, E66, E73, etc.

DELCO-Cont.

Table listing various models and prices for DELCO-Cont. products, including R-1408, R-1409, R-1410, etc.

DeSOTO (See Mopar)

DETROLA

Table listing various models and prices for DETROLA products, including 554-1-61A, 558-1-49A, etc.

DEWALD

Table listing various models and prices for DEWALD products, including A500, A501, A502, A503, etc.

EMERSON

Table listing various models and prices for EMERSON products, including 501, 502, 503, 504, etc.

ECA

Table listing various models and prices for ECA products, including 101 (Ch. AA), 102, 103, etc.

ECHOPHONE

(Also See Hallicrafters)

Table listing various models and prices for ECHOPHONE products, including EC-1A, EC-13, EC-306, etc.

EDWARDS

Fidelotuner

Table listing EDWARDS models and prices, including 602.

ELCAR

Table listing ELCAR models and prices, including 602.

ELECTONE

Table listing ELECTONE models and prices, including T5T53.

ELECTRO

Table listing ELECTRO models and prices, including B20.

ELECTROMATIC

Table listing ELECTROMATIC models and prices, including AFH301-A, AFH301-C, etc.

ELECTRO-TONE

Table listing ELECTRO-TONE models and prices, including 555, 706, 712, etc.

ELECTRONIC CORP.

OF AMERICA (See ECA)

ELECTRONIC SPECIALTY CO.

(See Ranger)

E/L (ELECTRONIC LABS.)

Table listing various models and prices for E/L products, including 75 (Sub-Station), 76E, 76K, 76M, 76W, etc.

EMERSON

Table listing various models and prices for EMERSON products, including 501, 502, 503, 504, etc.

EMERSON—Cont.

551A (See Model 536A)..... 24
 552 (See Model 525)..... 20
 553A (See Model 536A)..... 24
 556, 557 (Ch. 120018B)..... 70-4
 557B (Ch. 120048B)..... 43-10
 558 (Ch. 120038)..... 31-11
 559A (Ch. 120059)..... 31-12
 560 (Ch. 120016)..... 25-14
 561 (Ch. 120018)..... 63-7
 563 (Ch. 120063B)..... 73-4
 564 (Ch. 120027) (See Model 540A Ch. 120042) 20
 565 (Ch. 120018B)..... 70
 (See Model 556).....
 566 (Ch. 120051) (See Model 549 Ch. 120051) 26
 567 (Ch. 120016) (See Model 560 Ch. 120016) 25
 567 (Ch. 120042) (See Model 540A)..... 20
 568A (Ch. 120070A)..... 58-9
 569A (Ch. 120062A)..... 42-10
 570 (Ch. 120064)..... 97-3
 571 (Ch. 120066)..... 46-25
 Television Receiver.....
 571 (Ch. 120066B).....
 Tel. Rec.
 571 (Ch. 120088B).....
 Tel. Rec.
 572 (Ch. 120065) (See Model 540A Ch. 120042) 20
 573B (Ch. 120039B)..... 42-11
 574 (Ch. 120064) (See Model 570)..... 97
 575 (Ch. 120068A, 120068B)..... 85-6
 576A (Ch. 120069A)..... 40-5
 577B (Ch. 120012B)..... 41-6
 578 (Ch. 120050) (See Model 547A Ch. 120050) 25
 579A (Ch. 120034A)..... 61-6
 580 (Ch. 120064) (See Model 570)..... 97
 581 (Ch. 120014A, B)..... 68-7
 582 (See Model 548)..... 30
 583 (See Model 573B)..... 42
 584 (See Model 558)..... 31
 585 (Tel. Rec.)..... 61-7
 585 (Ch. 120025B).....
 Tel. Rec.
 585 (Ch. 120088B).....
 Tel. Rec.
 586 (Ch. 120023B, 120083B)..... 72-9
 587 (Ch. 120033A, B)..... 71-10
 588 (See Model 547A)..... 25
 590 (Ch. 120104, B)..... 87-5
 591 (Ch. 120055A)..... 67-9
 593 (Chassis 120063B) (See Models 563)..... 73
 594, 595 (Ch. 120071A) (See Model 581)..... 68
 596 (See Model 579A)..... 61
 597 (Ch. 120073B)..... 90-5
 599 (Ch. 120075B)..... 69-8
 600 (Chassis 120103-B) (See Model 571)..... 87-6
 600 (Ch. 120103-B) Tel. Rec. Prod. Chge. Bul. 9. 114-1
 601 (Chassis 120075B) (See Model 599)..... 69
 602 (Ch. 120072A, 120082A)..... 56-10
 603 (Chassis 120063B) (See Model 563)..... 73
 604A (See Model 576A)..... 40
 605 (Ch. 120076B)..... 66-8
 606 (Ch. 120066) Tel. Rec. (See Model 571)..... 46
 606 (Ch. 120066B) Tel. Rec.
 606 (Ch. 120087B-D) Tel. Rec. (See Model 570 Ch. 120088B)..... 76
 606 (Ch. 120088B) Tel. Rec. (See Model 571 Ch. 120088B)..... 76
 607 (Ch. 120074A) (See Model 597)..... 90
 608A (Ch. 120089B) Tel. Rec. (Chassis 120084-B)..... 84-6
 609 (Chassis 120084-B)..... 90-6
 610 (Chassis 120100A, B) (See Model 587)..... 71
 611, 612 (Ch. 120087B-D) (See Model 571 Ch. 120088B)..... 76
 613A (Ch. 120085A, B)..... 79-7
 614, B, BC, C (Ch. 120110, B, BC, C) Tel. Rec. 97-4
 614D (Ch. 120095-B) Tel. Rec. 95A-3
 615 (Ch. 120001B) (See Model 561)..... 63
 616 (Chassis 120100A, B) (See Model 587)..... 71
 618 (Ch. 120090B, D) Tel. Rec. 108-5
 619 (Ch. 120092D) Tel. Rec. (See Model 571 Ch. 120088B)..... 76
 620 (Ch. 120091D-QD) Tel. Rec. (See Model 571 Ch. 120088B)..... 76
 621 (Ch. 120098B) Tel. Rec. 108-5
 622 (Ch. 120098P) Tel. Rec. (See Model 621)..... 108
 623 (Ch. 120101A, B) (See Model 590)..... 87
 624 (Ch. 120087B-D) Tel. Rec. (See Model 571 Ch. 120088B)..... 76
 625 (Ch. 120105B)..... 103-8
 626 (Ch. 120104B, 120104B) Tel. Rec. (See Model 608A)..... 84

EMERSON—Cont.

627 (Ch. 120107B) Tel. Rec. (See Model 571 Ch. 120088B)..... 76
 628 (Ch. 120098B) Tel. Rec. (See Model 621)..... 108
 629B, 629C (Ch. 120120) Tel. Rec. 119-6
 629D (Ch. 120124B) Tel. Rec. 116-5
 630 (Ch. 120099B) Tel. Rec. (See Model 621)..... 108
 631 (Ch. 120109) Tel. Rec. 93A-6
 632 (Ch. 120096B) Tel. Rec. 93A-7
 633 (Ch. 120114) Tel. Rec. (See Model 631)..... 93A
 634B (Ch. 120097B)..... 111-4
 635 (Ch. 120108)..... 92-1
 636A (Ch. 120106A)..... 99-7
 637, B, BC, C (Ch. 120110, B, BC, C) Tel. Rec. (See Model 614)..... 97
 637A (Ch. 120095-B) Tel. Rec. (See Model 614D)..... 95A
 638 (Ch. 120087D) Tel. Rec. (See Model 571)..... 76
 639 (Ch. 120103B) Tel. Rec. (See Model 600)..... 87
 639 (Ch. 120103-B) Tel. Rec. Prod. Chge. Bul. 9. 114-1
 640 (Ch. 120112)..... 93-5
 641B (Ch. 120125B)..... 120-5
 642 (Ch. 120117A)..... 98-3
 643A (Ch. 120111A)..... 91-4
 644, B, BC, C (Ch. 120113, B, BC, C) Tel. Rec. (See Model 614)..... 97
 645 (Ch. 120115)..... 94-4
 646A (Ch. 120121A)..... 102-6
 646B (Ch. 120121B)..... 102-6
 647, B, BC, C (Ch. 120113, B, BC, C) Tel. Rec. (See Model 614)..... 97
 648B (Ch. 120110E) Tel. Rec. (See Model 614)..... 97
 649A (Ch. 120094A) Tel. Rec. 106-7
 650 (Ch. 120118B) Tel. Rec. 113-2
 650D (Ch. 120123-B) Tel. Rec. 109-3
 650F (Ch. 120138-B).....
 Tel. Rec.
 651B (Ch. 120120) Tel. Rec. (See Model 629B)..... 119
 651C (Ch. 120109) Tel. Rec. (See Model 631)..... 93A
 651C (Ch. 120124) Tel. Rec. (See Model 629D)..... 116
 651D (Ch. 120124, B) Tel. Rec. (See Model 629D)..... 116
 652 (Ch. 120032B) (See Model 642)..... 98
 653 (Ch. 120080B) (See Model 642)..... 98
 654 (Ch. 120118B) Tel. Rec. (See Model 650)..... 113
 654D (Ch. 120123-B) Tel. Rec. (See Model 650D)..... 109
 654F (Ch. 120138-B).....
 Tel. Rec.
 655B (Ch. 120123-B).....
 Tel. Rec. (See Model 650D)..... 109
 655F (Ch. 120138-B).....
 Tel. Rec.
 656B, 657B (Ch. 120122B) 111-5
 658B (Ch. 120124, B) Tel. Rec. (See Model 629D)..... 116
 658C (Ch. 120124) Tel. Rec. (See Model 629D)..... 116
 658D (Ch. 120124B) Tel. Rec.
 660B (Ch. 120133B)..... 121-1A
 661B (Ch. 120134-B).....
 Tel. Rec.
 662B, 663B (Ch. 120127-B, 120128-B) Tel. Rec. 125-6
 664B (Ch. 120133B)..... 121-1A
 666B (Ch. 120135-B).....
 Tel. Rec.
 667B (Ch. 120134-B).....
 Tel. Rec.
 668B (Ch. 120134-B).....
 Tel. Rec.
 669B (Ch. 120129-B)..... 126-5
 671B (Ch. 120137-B)..... 118-6
 671D (Ch. 120137D) Tel. Rec. 118
 673B (Ch. 120133B)..... 121-1A
 674B (Ch. 120134B).....
 Tel. Rec.
 675B (Ch. 120129-B)..... 126
 676B (Ch. 120140B).....
 Tel. Rec.
 677B, 678B (Ch. 120134B).....
 Tel. Rec.
 680D, 681B (Ch. 120140B).....
 Tel. Rec.
 684B, 685B (Ch. 120134B).....
 Tel. Rec.
 686D (Ch. 120140B).....
 Tel. Rec.
 688B, 689B, 690B (Ch. 120129-B) Tel. Rec. 126
 1002 (See Model 669B)..... 16-14
 1003 (See Model 1002)..... 16

EMERSON—Cont.

Ch. 120002B (See Model 529)..... 18
 Ch. 120003 (See Model 506)..... 6
 Chassis 120023B (See Model 586)..... 72
 Ch. 120043 (See Model 537)..... 23
 Chassis 120083B (See Model 586)..... 72

EMPRESS
 55, 56..... 7-14

ESPEY (Also see Philharmonic)
 RR13, RR13L..... 13-17
 7B..... 47-8
 18B..... 90-7
 31..... 103-9
 512..... 68-8
 513, 514..... 63-8
 522 (See Model 18B)..... 90
 581..... 14-10
 e21..... 10-17
 o41, 642..... 8-11
 651..... 9-14
 652, 653 (See Model 651) 9
 751 (See Model 18B)..... 90
 6511, 6511-2, 6511-5, 6514, 6516, 6517, 6520, 6520-2, 6521, 6533 (Ch. F197) See model 651
 6540, 6541..... 8-12
 6542 (Ch. F197)..... 9
 (See Model 651).....
 6545 (Ch. F197)..... 5-16
 6546 (Ch. F197).....
 (See Model 651).....
 6547 (See Models 6540, 6541)..... 8
 5560 (Ch. F197)..... 9
 (See Model 651).....
 6611, 6612, 6613, 6614, 6615, 6630, 6631, 6632, 6634, 6635 (Ch. 97A) 18-16
 7541 (Ch. F197)..... 9
 7552 (See Model 18B)..... 90

ESQUIRE
 60-10, 65-4..... 14-11

FADA
 G-925 Tel. Rec. 89-6
 P80..... 27-9
 P82..... 21-16
 P100..... 27-10
 R-1050 Tel. Rec. 114-4
 (See Model R-1025).....
 54C20 Tel. Rec. 114
 54C40 Tel. Rec.
 54T15 Tel. Rec.
 54T30 Tel. Rec.
 51015 Tel. Rec. (See Model 51015)..... 109
 51030 Tel. Rec. (See Model 51015)..... 109
 S-1055 Tel. Rec.
 S-1060 Tel. Rec.
 TV30 Tel. Rec. 74-3
 602..... 14-12
 605, 606 Series..... 1-13
 609, 610 Series..... 1-15
 633..... 17-13
 637..... 17-14
 652 Series..... 1-23
 700..... 32-7
 711, 740..... 28-10
 790..... 64-6
 795..... 36-6
 799 Tel. Rec. (See Model TV30)..... 74
 830..... 97-5
 845..... 97-6
 855..... 92-2
 880 Tel. Rec. 95A-5
 899 Tel. Rec. (See Model TV30)..... 74
 925 (See Model G-925)..... 89
 930, 940 Tel. Rec. 74
 (See Model G-925).....
 965 (See Model G-925)..... 89
 1000 Series..... 1-17
 1001..... 17-15

FARNSWORTH
 EK-260..... 7-15
 EK-081, EK-082, EK-083, EK-262, EK-263B1, E-263W1, E-264B1, EK-264W1, EK-265 (See Model EK-260)..... 7
 EK-681 (See Model EK-081) 26
 ET-060, ET-061, ET-063, ET-064, ET-065, ET-066..... 4-2
 GK-100, GK-102..... 23-8
 GK-103, GK-104..... 23-8
 GK-111, GK-112..... 60-11
 GK-114, GK-115..... 60-11
 GK-140, GK-141, GK-142, GK-143, GK-144..... 24-18
 GT-050, GT-051, GT-052, GT-060, GT-061, GT-064, GT-065..... 35-6
 GV220, GV240, GV260 Tel. Rec.
 K-267, K-669 (See Model EK-260)..... 7
 Ch. 150 (See Model ET-060)..... 6
 Ch. 152, 153 (See Model EK-260)..... 7
 Ch. 156, 157 (See Model EK-081)..... 26
 Ch. 158, 159 (See Model ET-064)..... 4

FARNSWORTH—Cont.

Ch. 162 (See Model EC-260)..... 7
 Ch. 170 (See Model GK-100)..... 23
 Ch. 193 (See Model EK-081)..... 26
 Ch. 194, 201, 216 (See Model GK-100)..... 23

FEDERAL MFG. CO.
 104 (Select-A-Call)..... 18-17
 135 (Select-A-Call)..... 11-7

FEDERAL TEL. & RADIO CORP.
 1021 (See Model 1030T)..... 8
 1030T..... 8-13
 1031, 1032 (See Model 1030T)..... 8
 1040T, 1040TB..... 23-9
 1540T (See Model 1030T)..... 8

FERRAR
 C-81-B..... 17-16
 T-61B..... 39-4
 WR-11..... 15-10

FIRESTONE (AIR CHIEF)
 4-A-2 (Code No. 297-6-LMML-143) 14-4
 4-A-3 (Code No. 297-6-LMFU-134) 31-13
 4-A-10 (Code No. 297-7-RN228) 28-11
 4-A-11 (Code No. 188-8-4A11)..... 41-7
 4-A-12 (Code No. 213-8-8370)..... 49-8
 4-A-13 (Code 177-7-4A15) 36-7
 4-A-17 (Code No. 213-7-7270)..... 35-7
 4-A-20 (Code 5-5-9000-A) 15-11
 4-A-21 (Code No. 5-5-9001A); 4-A 22X (Code No. 5-5-9001B) 11-19
 4-A-23 (5-5-9003-A)..... 2-29
 4-A-24 (Code 291-6-566) 13-5
 4-A-25 (Code 291-6-572) 13-6
 4-A-26 (Code No. 307-6-9030-A) 33-5
 4-A-27..... 28-12
 4-A-30.....
 4-A-31 (Code No. 177-5-4A31) 11-20
 4-A-37 (Code 177-5-4A37) 13-7
 4-A-40.....
 4-A-41 (Code 291-7-576)..... 52-8
 4-A-42 (Code No. 177-7-4A42) 30-9
 4-A-60 (Code No. 307-8-9047A)..... 38-6
 4-A-61 (Code No. 332-8-13712)..... 48-7
 4-A-62, 4-A-63..... 67-10
 4-A-64, 4-A-65..... 68-9
 4-A-66 (Code No. 177-8-4A66)..... 74-4
 4-A-68 (Code No. 332-8-143653)..... 53-11
 4-A-69 (Code No. 155-8-85)..... 61-8
 4-A-71 (Code 291-8-628)..... 59-9
 4-A-78, 4-A-79..... 117-5
 4-A-85..... 118-7
 4-A-87..... 119-7
 4-A-89.....
 (See Model 4-A-85)..... 118
 4-B-1 (Code 7-6-PM15)..... 7-1
 4-B-2 (Code 7-6-PM14)..... 18-18
 4-B-6 (Code No. 177-7-PM18)..... 29-8
 4-B-31.....
 4-B-57 (Code 124-4).....
 4-C-1..... 19-17
 4-C-5 (Code 291-7-574)..... 33-6
 4-C-6 (See Model 4C3)..... 19
 4-C-13 (Code 332-8-140623)..... 66-9
 4-C-16, 4-C-17..... 120-8
 4-C-18..... 110-8
 13-G-3 Tel. Rec. 86-5
 13-G-4 (Code 347-9-2498) 73-5
 13-G-5 (Code 291-9-651) Tel. Rec. 83-3
 13-G-33 Tel. Rec. 108-6
 13-G-46, 13-G-47 Tel. Rec.

FLUSH WALL
 5P..... 26-14

FORD
 GF890 (OA-18805-B)..... 109-5
 M-1 (BA-18805A)..... 46-4
 M-1A (OA-18805-A1)..... 106-8
 OB (OA-18805-A1) (See Model M-1A-1)..... 106
 OZF (OA-18805-B) (See Model GF890)..... 109
 6MF080 (51A-18805-A1) Ch. 6CA1)..... 10-18
 6MF780 (51A-18805-A1)..... 62-12
 8MF880 (8A-18805B)..... 42-12
 8MF881 (8C-18805B)..... 47-9
 8MF980 (8A-18805B)..... 61-9
 8MF983 (8A-18805-B-1)..... 83-4
 8MF983-E (8A-18805)..... 83-4
 8ZT (8A-18805-B) (See Model 8MF881)..... 47
 98F (8A-18805-A1) (See Model M-1)..... 46
 90F (8A-18805-A2) (See Model 8072)..... 44
 9MF (8A-18805-A3) (See Model 8072)..... 44
 9ZF (8A-18805-B1) (See Model 8MF983)..... 83
 7070 (51A-18805-B2)..... 45-10
 8072 (8A-18805-A)..... 44-4

FREED EISEMAN
 46..... 11-8
 54, 55, 56, 58 (Ch. 1620C) Tel. Rec. 113-1A

GALVIN (See Motorola)

GAMBLE-SKOOMO (See Coronado)

GAROD
 4A-1, 4A-2..... 29-9
 4B-1..... 51-6
 5A-1..... 22-15
 5A-2..... 5-28
 5A-3..... 44-5
 3A-4..... 40-6
 5AP1-Y "The Companion" 15-12
 5D, 5D-2..... 12-12
 5D-3, 5D-3A..... 26-16
 5D-4, 5D-5..... 33-7
 5RC-1..... 36-8
 6A-2..... 28-13
 6AU-1..... 5-29
 6BU-1A "The Senator" 13-18
 6DPS, 6DPS-A..... 12-13
 10T21, 10T22, 10T23, 10T24, 10T25 Tel. Rec. 60-12
 10T220, 10T221, 10T222, 10T223 Tel. Rec. 95A-4
 11FMP..... 38-7
 12T21, 12T22, 12T23, 12T24, 12T25, 12T26A, 12T27A, 15T26, 15T27 Tel. Rec. (See Model 10T21)..... 60
 12T220, 12T221, 12T222, 12T223 Tel. Rec. 95A
 15T22, 15T225, 15T226, 15T227 Tel. Rec. 95A-4
 16CT4, 16CT5 (97 Series) Tel. Rec. 97A-4
 19C6, 19C7 (97 Series) Tel. Rec. (See Model 16CT4) 97A
 62B..... 29-10
 306..... 48-8
 900..... 100-0

Television Receiver..... 50-7
 1042G, 1043G Tel. Rec. 99A-5
 1042T, 1043T Tel. Rec. 93A-7
 1100 Series Tel. Rec. (See Model 900)..... 50
 1142, 1143 Tel. Rec.
 1200 Series Tel. Rec. (See Model 900)..... 50
 1242, 1245G Tel. Rec. (See Model 1042G)..... 99A
 1244T, 1245T Tel. Rec. (See Model 1042T)..... 93A
 1344, 1345 Tel. Rec.
 1546G, 1547G, 1548G, 1549G Tel. Rec. (See Model 1042G)..... 99A
 1546T, 1547T, 1548T, 1549T.....
 (See Model 1042T)..... 93A
 1646, 1647, 1648, 1649 Tel. Rec.
 1671 (98 Series) Tel. Rec. 97A-3
 1672, 1673, 1674, 1675 (97 Series) Tel. Rec. (See Model 16CT4)..... 97A
 1900 Tel. Rec.
 1900 97 Series Tel. Rec.
 1974, 1975 (97 Series) Tel. Rec. (See Model 16CT4) 97A
 2042T, 2043T Tel. Rec. (See Model 1042T)..... 93A
 2546T, 2547T, 2548T, 2549T Tel. Rec. (See Model 1042T) 93A
 3912 TVFMP, 3915 TVFMP Tel. Rec. 95A-6

GENERAL ELECTRIC
 YRB-60-1, YRB-60-2..... 33-8
 YRB-60-12..... 33-8
 10C101, 10C102 Tel. Rec. 96-4
 10T1 Tel. Rec. (See Model 10C101)..... 96
 10T4, 10T5, 10T6 Tel. Rec. (See Model 10C101)..... 96
 12C101, 12C102, 12C105 Tel. Rec. (See Model 10C101)..... 96
 12C107, 12C107B, 12C108, 12C108B, 12C109, 12C109B Tel. Rec. 125-7
 12K1 Tel. Rec. 95A-6
 12T1 Tel. Rec. (See Model 10C101)..... 96
 12T2, 12T3B, 12T4, 12T4B Tel. Rec. (See Model 12C107)..... 125
 12T7 Tel. Rec. 99A-5
 14T1 (OA-18805-A1) (See Model M-1A-1)..... 106
 14C12, 14C103 Tel. Rec. 123-4
 14T2, 14T3 Tel. Rec. (See Model 14C102)..... 123
 16C103 Tel. Rec. (See Model 14C102)..... 123
 16C110, 16C111 Tel. Rec. (See Model 14C102)..... 123
 16C113 Tel. Rec. (See Model 14C102)..... 123
 16C115, 16C116, 16C117 Tel. Rec. (See Model 14C102)..... 123
 16T1, 16T2, 16T3, 16T4, 16T5, Tel. Rec. (See Model 14C102)..... 123
 17C101, 17C102 Tel. Rec. (See Model 14C102)..... 123
 19C101 Tel. Rec. 99A-6
 41, 42, 43, 44, 45..... 32-8
 50..... 7-16
 60, 62..... 36-9
 64, 65..... 98-4
 66, 67..... 76-12

GENERAL ELECTRIC-LYRIC

GENERAL ELECTRIC-Cont.

100, 101	6-13
102, 102W	41-8
103, 105 (See Models 100, 101)	6
106	8-14
107, 107W (See Models 102, 102W)	41-8
113	51-7
114, 114W, 115, 115W (See Models 102, 102W)	41
118, 119M, 119W	39-5
123, 124	97-7
135, 136	81-8
140	30-10
143	75-5
145	60-13
150	56-11
160	56-12
165	89-7
180	20-11
186.4	57-7
200, 201, 202, 203, 205, 205M	8-15
210, 211, 212	51-8
218, 218 "H"	121-5
219, 220, 221	4-1
226	91-5
230 (See Kaiser-Frazer 200001)	35
250	4-13
254	32-9
260	15-13
280	23-10
303	18-19
304	32-10
321	3-26
324	64-7
326, 327	30-11
328 (See Model 324)	64
329, 330 (See Model 324)	64
354, 355	33-9
356, 357, 358	37-6
376, 377, 378	45-11
400, 401	118-8
404, 405	121-6
408	16-6
410 (See Model 404)	121
411 (See Model 400)	118
417	16-15
500, 501 (See Model 64)	98
502	35-9
505, 506, 507, 508, 509 (See Model 64)	98
510, 511	120-7
521, 522	114-5
530 (See Model 64)	98
600	109-6
601, 603, 604	115-3
650	101-3
752, 753	123-5
800A, B, C, D Tel. Rec. (See Model 805)	78
801 Tel. Rec. (Photofact Servicer)	78
802 Tel. Rec.	91A-7
803 Tel. Rec.	97A-4
805, 806, 807, 809 Series Tel. Rec.	78-7
810 Tel. Receiver	53-12
811 Tel. Receiver	63-9
814 Tel. Rec.	69-9
815 Tel. Rec.	97A-5
817 Tel. Rec. (See Model 805)	78
818 Tel. Rec.	95A-7
820 Tel. Rec.	97A
821 Tel. Rec. (See Model 805)	78
830 Early Tel. Rec.	81-9
835 Early Tel. Rec. (See Model 830 Early)	81
840 Tel. Rec. (See Model 830 Early)	81
901 Tel. Rec.	97A-5
910 Tel. Rec. (See Model 901)	97A
GENERAL IMPLEMENT	
9A5	37-7
GENERAL MOTORS CORP. (GMC)	
2233029	93-6
GENERAL TELEVISION	
1A5, 2A5, 3A5, 5A5 (Ch. 1-1)	1-21
485	27-11
585G, 585Y	27-12
9A5	39-6
986P	36-10
14A4F	3-21
15A5 (Ch. 1-1) (See Models 1A5, 2A5, 3A5, 5A5)	1
17A5	5-22
19A5 (Ch. 1-1) (See Models 1A5, 2A5, 3A5, 5A5)	1
21A4	12-14
22A5C	13-19
23A6	14-14
2486	37-8
2585	26-15
2685	29-11
27C5	36-11
GILFILLAN	
56A, 56B	1-27
56BC1, 56BCR, 56C, 56D, 56E (See Model 56A)	1
58M, 58W	45-12
66A, 66AM	8-16
66B "The Overland"	8-17
66D, 66DM (See Model 66A)	8
66P, 66PM "The El Dorado"	9-15

GILFILLAN-Cont.

68B-D	46-10
68F	46-11
68-48	61-10
86C, 86P, 86U (86 Series)	26-16
108-48	59-10
GLOBE	
5BP1	18-20
6AP1 (See Model 6P1)	20
6D1	20-13
6P1	20-12
6U1 (See Model 6D1)	20
7CP-1	28-14
51	19-18
62C	19-19
85	49-9
454	41-9
456	40-7
457	39-7
500	21-18
517	21-17
551	16-16
552	27-13
553	28-15
559	50-8
GODFREY	
6AD	28-16
65M	28-17
GON-SET	
3-30 Meter Converter	61-11
10-11 Meter Converter	37-9
B. F. GOODRICH (See Mantola)	
GOODELL	
ATB-3	70-5
NSA-20	73-6
W. T. GRANT (See Grantline)	
GRANTLINE	
300 (Series B)	9-16
500, 501 (Series A)	9-17
501-7	35-10
504-7	21-19
508-7	34-8
510-A	24-19
605, 606	2-17
641	12-15
651	11-9
5610	35-11
6547	11-10
HALLICRAFTERS (Also See Echophone)	
CA-2, CA-2A	30-12
CA-4	36-13
S-38	3-7
S-38B	121-7
S-40	2-19
S-40A	33-10
S-40B	122-4
S-41G, S-41W	10-19
S-47	46-12
S-51	40-8
S-52	48-9
S-53	39-8
S-55, S-56	55-9
S-58	57-8
S-59	58-10
S-72	82-6
S78	124-5
ST-74	125-8
SX-42	44-6
SX-43	45-13
SX-62	61-12
SX-71	111-6
T-54 Tel. Receiver	48-10
T-54 (Late) Tel. Rec.	91-6
T-60 Tel. Receiver	63-10
T-61, T-64, T-67 Tel. Rec.	65-7
T-68 (Tel. Rec.) (See Model T-60)	63
T-69 Tel. Rec.	400
400, 406, 409, 410, 411, 412	52-9
505, 506 Tel. Rec. (See Model T-54)	48
505, 506 (Late) (See Model T-54 Late)	91
509, 510 Tel. Rec. (See Model T-61)	65-7
511 Tel. Rec.	96-5
512C, 513 Tel. Rec.	80-7
514 Tel. Rec. (See Model T-54 Late)	91
515 Tel. Rec. (See Model 512C)	80
518, 519, 520 Tel. Rec.	92-3
520E Tel. Rec. (See Model 512C)	80
521 Tel. Rec. (See Model 518)	92
521E Tel. Rec. (See Model 512C)	80
524 Tel. Rec. (See Model 512C)	80
600, 601, 602, 603, 604 Tel. Rec. (See Model 518)	92
605, 606 Tel. Rec.	107-5
680, 681 Tel. Rec.	113-3
690 Tel. Rec. (See Model 680)	113
715 Tel. Rec. (See Model 680)	113
730, 731 (Run 1) Tel. Rec. (See Model 680)	91A
740, 741 (Run 1) Tel. Rec. (See Model 680)	91A
745 Tel. Rec.	105-4
750, 751, Tel. Rec. (See Model 745)	105
760, 761 Tel. Rec. (See Model 745)	105
805, 806 Tel. Rec.	123-1A
810A, 811 Tel. Rec.	124-6

HALLICRAFTERS-Cont.

810C Tel. Rec. (See Model 805)	125-1A
815 Tel. Rec. (See Model 810A)	124
818, 820, 822 Tel. Rec. (See Model 810A)	124
832, 833 Tel. Rec.	121-1A
860, 861 Tel. Rec. (See Model 810A)	124
870, 871 Tel. Rec. (See Model 810A)	124
880 Tel. Rec. (See Model 810A)	124
HAMILTON ELECTRONICS	
H-15-5	16-17
H-50-25	16-18
HAMILTON RADIO CORP. (See Olympic)	
HAMMARLUND	
HQ-129-X	8-18
SP-400-X	10-20
HARVEY-WELLS	
AT-3B-6, AT-3B-12	32-11
ATR-3-6, ATR-3-12	36-14
HEATH	
HBR-5	24-20
HOFFMAN	
A-200 (Ch. 103)	4-23
A-202 (Ch. 119)	11-11
A-309 (Ch. 119)	4-41
(See Model A-202)	11
A-401 (Ch. 102)	11-12
A-500 (Ch. 107)	4-34
A-501 (Ch. 1085T)	3-35
A-700 (Ch. 1105)	12-16
B-1000	17-17
B-1000	20-14
C-501	48-11
C-502	51-9
C-503	50-9
C-504 (Ch. 123)	47-10
C-506, C-507	49-10
C509, C510	
C-511 (See Model C-501)	48
C-512 (See Model C-502)	51
C-513 (See Model C-503)	50
C-514 (See Model C-504)	47
C-518	61-13
C710 (Ch. 133)	54-9
C1006, C1007	54-9
CT-800, CT-801, CT-900, CT-901 (Tel. Rec.)	63-11
522, 524 (Ch. 138)	
600, 601 (Ch. 154, 155) Tel. Rec.	95A-8
610 (Ch. 140) Tel. Rec.	97A-6
612 (Ch. 142) Tel. Rec. (See Model 610)	97A
613 (Ch. 149) Tel. Rec. (See Model 610)	97A
630, 631 (Ch. 159) Tel. Rec.	
630, 631 (Ch. 170) Tel. Rec.	117-1A
632, 633 (Ch. 160) Tel. Rec.	
632, 633 (Ch. 171) Tel. Rec.	117-1A
820, 821, 822 (Ch. 146) Tel. Rec.	
826, 827, 828 (Ch. 143) Tel. Rec.	95A-8
830, 831 (Ch. 151) Tel. Rec. (See Model 830)	97A
836, 837 (Ch. 153) Tel. Rec.	93A-8
840 (Ch. 153) Tel. Rec. (See Model 836)	93A
846 (Ch. 151) Tel. Rec. (See Model 830)	97A
847, 848, 849 (Ch. 156) Tel. Rec.	97A-7
860, 861, 862 (Ch. 157) Tel. Rec. (See Model 847)	97A
866, 867, 868 (Ch. 173) Tel. Rec.	117-1A
870, 871, 872 (Ch. 170) Tel. Rec.	117-1A
876, 877, 878 (Ch. 171) Tel. Rec.	117-1A
890, 891, 892 (Ch. 175) Tel. Rec.	117-1A
912, 913 (Ch. 147) Tel. Rec. (See Model 826)	95A
914, 915 (Ch. 150) Tel. Rec. (See Model 610)	97A
917, 918 (Ch. 152) Tel. Rec. (See Model 830)	97A
920 (Ch. 152) Tel. Rec. (See Model 830)	97A
946, 947, 948 (Ch. 164) Tel. Rec. (See Model 847)	97A
950, 951, 952 (Ch. 172), 950A, 951A, 952A (Ch. 174) Tel. Rec.	127-6
960, 961, 962, (Ch. 176) Tel. Rec. (See Model 950)	127
Chassis 102 (See Model A401)	11
Chassis 103 (See Model A200)	4
Chassis 107 (See Model A500)	4
Chassis 1085T (See Model A501)	3
Chassis 1105 (See Model A700)	12

HOFFMAN-Cont.

Chassis 114 (See Model B1000)	20
Chassis 119 (See Model A202)	11
Chassis 123 (See Model C504)	47
Ch. 138 (See Models 912, 913)	
Ch. 140 (See Model 610)	97A
Ch. 142 (See Model 612)	97A
Ch. 143 (See Model 826)	95A
Ch. 146 (See Model 820)	*
Ch. 147 (See Model 826)	95A
Ch. 149 (See Model 613)	97A
Ch. 150 (See Model 914)	97A
Ch. 151 (See Model 830)	97A
Ch. 152 (See Model 917)	97A
Ch. 153 (See Model 836)	93A
Ch. 154 (See Model 600)	95A
Ch. 155 (See Model 600)	95A
Ch. 156 (See Model 847)	97A
Ch. 157 (See Model 860)	97A
Ch. 164 (See Model 946)	117-1A
Ch. 170, 171 (See Model 630)	117-1A
Ch. 172 (See Model 950)	127
Ch. 173 (See Model 630)	117-1A
Ch. 174 (See Model 950)	127
Ch. 175 (See Model 630)	117-1A
Ch. 176 (See Model 950)	127
HOWARD	
472AC, 472AF, 472C, 472F	31-14
474	32-12
475V Tel. Rec. (Photofact Servicer)	84
481B, 481C, 481M	67-11
482, 482A	48-12
901A-E, 901A-H, 901A-I, 901A-M, 901A-W (See 901A Series)	1
901A Series	1-8
901AP	10-21
902	
906, 906C	17-18
909M	25-15
920	5-7
HUDSON	
DB47 (Fact. No. 6MH089)	25-16
DB48 (Fact. No. 6MH889)	39-9
HUDSON ELECTRONICS	
332-H	123-6
347B1	121-8
350	126-6
INDUSTRIAL ELECTRONIC CORP. (See Siplon)	
INDUSTRIAL TELEVISION (Also See Century)	
IT-40R, IT-42R (Ch. IT-26R, IT-35R, IT-39R, IT-46R) Tel. Rec.	99A-7
IT-48R Tel. Rec.	
JACKSON	
5000, 5050 Tel. Rec.	88-5
5200, 5250 (See Model 5000) Tel. Rec.	88
5600, 5650 (See Model 5000) Tel. Rec.	88
JEFFERSON-TRAVIS	
MR-28	10-22
MR3	17-19
JEWEL	
300	23-11
304	35-12
500A, B, C; 501A, B, C; 502A, B, C; 503A, B, C; 504A, B, C; 505A, B, C	15-14
505 "Pin-Up"	18-21
801 (Trixie)	45-14
814	51-10
910	99-8
915 (See Model 910)	55-10
920	99-8
935 (See Model 920)	55
949	105-5
955	98-5
960	97-8
985 (See Model 910)	99
5010	111-7
5057U	109-7
KAISER-FRAZER	
200001	35-13
200002	56-13
KAPPLER	
102T	54-10
KARADIO	
80-C	66-10
1275, 1275A	85-7
1276	115-4
KAYE-HALBERT	
231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241 Tel. Rec.	
242 Tel. Rec.	
731 Tel. Rec.	
732 Tel. Rec.	
821-C, 821-T Tel. Rec.	
921-C, 921-D Tel. Rec.	
1621-C, 1621-T Tel. Rec.	
KAY MUSICAL INSTRUMENT CO.	
77	42-13
KITCHENAIRE	
5 Tube Radio	6-14

KNIGHT

4D-450	40-9
4G420	88-6
5A150, 5A152, 5A154	12-17
5A-190	14-15
5B-160	20-15
5B-175, 5B-176	20-16
5B-185	22-17
5C-290	30-13
5D-250, 5D-251	55-11
5D-455	34-9
5E-250, 5E-251 (Similar to Chassis)	36-25
5E-457 (Similar to Chassis)	53-23
5F-525, 5F-526	53-13
5F-565	55-12
5G-563 (Similar to Chassis)	97-1
5H-607, 5H-608 (Similar to Chassis)	97-15
5H-678, 5H-679 (Similar to Chassis)	109-7
5H-700	123-7
6A-122	9-18
6A-127	9-19
6A-195	16-19
6B-122 (See Model 6A-122)	9
6B-127 (See Model 6A-127)	9
6C-225, 6D-225, 6D-226	30-14
6D-235	54-11
6D-360	39-10
6G-400 (See Model 449)	83
6H580	126-7
7B-220	27-14
7D-405	39-11
8B-210	20-17
8D-340	46-13
8G-200 (Similar to Chassis)	33-28
9V-101 Tel. Rec.	78-8
1021A-E, 1021A-H, 1021A-I, 111C-300	29-12
11D302	57-9

MAGIC TONE

500, 501	5-40
504 (Bottle Receiver)	22-18
508 (Keg Radio)	38-9
510	52-10
900 (See Model 508)	38

MAGNAVOX

Chassis AMP-101A, AMP-101B	43-12
Chassis AMP-108A, AMP-108B	41-10
Chassis AMP-109	*
Chassis AMP-110	*
Chassis AMP-116	68-10
Chassis CR-188 (1558)	*
Regency Symphony	18-22
Chassis CR190A, CR190B	46-14
Chassis CR-192A, CR-192B	41-11
Chassis CR-197C	37-11
Chassis CR-198A, B, C (Hepplewhite, Modern Symphony)	17-20
Chassis CR-199	63-13
Chassis CR-200A, B, C, D, E, F	44-9
Chassis CR-202	*
Chassis CR-203	*
Chassis CR-204	*
Chassis CR-206	*
Chassis CR-207A, B, C, D	41-12
Chassis CR-208A, CR-208B	43-13
Chassis CR-209	*
Chassis Models CR-210A, CR-210B	52-11
Chassis CR-211A, B (See Ch. AMP-111A)	68
Chassis CR-213	*
Chassis CR-215	*
Chassis CR-216	*
Chassis CR-217	*
Chassis CR-223	*
Chassis CR-229	*
Chassis CT-214, CT-218, Tel. Rec.	62-13
Chassis CT-219, CT-220, Tel. Rec.	82-7
Chassis CT-221 Tel. Rec. (See Ch. CT-214)	62
Chassis CT-222 Tel. Rec. (See Ch. CT-219)	82
Chassis CT-224 Tel. Rec.	97A-8
Chassis CT-232 Tel. Rec.	93A-9
Chassis CT-235 Tel. Rec. (See Ch. CT-224)	97A
Chassis CT-236 Tel. Rec. (See Model CT-232)	93A
Chassis CT237, CT238 Tel. Rec. (Supp. to CT219)	95A-9
Chassis CT239 Tel. Rec. (See Ch. CT232)	93A
Chassis CT244, CT245, CT246 Tel. Rec. (See Ch. CT232)	93A
Chassis CT252, CT253, Tel. Rec.	95A-9
Chassis CT257, CT258, CT259, CT260 Tel. Rec.	119-1A
Chassis MCT228 Tel. Rec.	95A-9

MAGUIRE

500B1, 500BW, 500D1, 500DW	6-15
561B1, 561BW, 561D1, 561DW	6-16
571	44-10
661, 661A	12-18
700A	7-18
700E	15-17

MAJESTIC

5A410 (Ch. 4501)	*
5A430 (Ch. 4504)	1-30
5A445, 5A445R	23-12
5AK711	27-17
5AK731, 5AK780, (Ch. 5805A)	28-19
6FM714 (Ch. 6802D)	50-10
6FM773 (Ch. 6811D)	57-10
7BK758 (See Model 7JK777R)	27
7C432 (Ch. 4706), 7C447 (Ch. 4707)	14-17
7FM677, 7FM688 (Ch. 7C11D)	56-14
7JK777R (Ch. 4708R)	27-18
7L866 (Ch. 7C25A)	60-14
7P420 (Ch. 4705)	26-17
7S433, 7S450, 7S470 (Ch. 4702, 4703)	22-19
7TV850, 7TV852 (Ch. 18C90, 18C91) Tel. Rec.	29-13
7YR752 (Ch. 7804A)	29-13
7YR753 (Ch. 7809A-1), 7YR772 (Ch. 7809A)	42-17
8FM744 (Ch. 8B06D)	30-15
8FM773 (Ch. 8B08D), 8FM776 (Ch. 8B07D)	29-14
8FM889 (Ch. 8C07D)	34-12
8J1885 (Ch. 4810B)	47-11
8S452, 8S473 (Ch. 4810)	8-19
10FM891 (See Model 10FM981)	65
10FM981 (Ch. 10C23E)	65-8
12C4, 12C5 Tel. Rec.	108-7
12FM475, 12FM778, 12FM779 (Ch. 41201)	28-20
12FM893 (Ch. 12C22E)	59-11
12T2, 12T3 Tel. Rec. (See Model 12C4)	108
14C4 Tel. Rec. (See Model 12T2)	108
14T2 Tel. Rec. (See Model 12T2)	108
16C4, 16C5 Tel. Rec. (See Model 12C4)	108
16CT4, 16CT5 Tel. Rec.	108

MAJESTIC—Cont.

16K1 (94 Series)	*
R643-PM, R643W	4-29
R652, R652N	9-22
R654-PM, R654-PV	3-5
R655W (Ch. No. 501APH)	8-20
R662, R662N	3-33
R664-PM, R664-PV, R664W	23-13
R-743-W (See Model R-643-W)	4
R-7543	18-23
R-75143	39-12
R-75152	38-10
R-75343 (See Model 75143)	39
Rec. 76143 (See Model 2486)	40-10
R-76162	40-10
R-76262 (Fact. No. 7160-17)	51-12
R-78162	43-11
11-701	*
2486	25-17
92-520, 92-521, 92-522	68-11
92502 (See Model R643W)	4
92503, 92504 (See Models R654PM, PV)	3
92505, 92506 (See Models R664PM, PV, PW)	23
92516, 92517	*
92752	*

MARK SIMPSON (See Masco)

MA5CO

IM-5	41-13
JMR	31-17
JR (Master Station), JR (Sub-Station)	42-18
MA-5NO	45-15
MA-8N	119-8
MA-10HF	112-4
MA-10EX	113-4
MA-12HF	51-13
MA-17	16-32
MA-17N	50-11
MA-17P (See Model MA-17)	50
MA-17PN (See Model MA-17N)	50
MA-20HF	28-21
MA-25	16-24
MA-25EX	60-15
MA-25HF	54-13
MA-25N	43-14
MA-25NR	49-12
MA-25P (See Model MA-25)	49
MA-25PN (See Model MA-25N)	43
MA-35	21-20
MA-35N	44-11
MA-35RC (See Model MA-35)	21
MA-50	30-16
MA-50N (See Model MA-50)	45
MA-50NR	53-14
MA-60	119-9
MA-75	28-22
MA-75N	52-27
MA-121	24-21
MA-808	26-18
MAP-15	26-19
MAP-18	59-12
MAP-105	25-18
MAP-105N	52-12
MAP-120	21-21
MAP-120N	46-15
MB-50N	58-12
MB-60	127-8
MB-75	61-15
MC-10	47-12
MC-25, MC-25P, MC-25N, MC-25PC, MC-25PN, MC-25RC	57-11
MC-126, MC-126P	111-8
MHP-110	114-6
MHP-110X	115-5
Midgetalk	116-7
MPA-3, MPT-4	16-25
MR-3	18-18
MU-5	117-6
RK-5 (See Model RFact 33-11)	33-11
T-16	123-8
TD-16	120-8
TP-16A	30-17
76, 711	20-20
86, 811	20-21

MASON

45-1A	14-18
45-1B, 45-1P, 45-3, 45-4, 45-5 (See Model 45-1A)	14

MA5FAIR

510, 510W, 520, 520W, 530, 530W	25-20
550, 550W	24-22

McGRADE

M-100	16-27
-------	-------

MECK (Trail Blazer-Plymouth)

CD-500 (PX-5C5-EW-19)	33-12
CE-500 (5C5-P12)	34-10
CM-500 (5D7-W18)	34-11
CR-500	38-11
CX-500	40-11
CX-500	48-13
DA601, DB6021	81-10
EC270	85-8
EF-730, EG-731	85-8
Ch. 10003	89-8
EV-760	104-7
MM510T, MM512T, MM516C, MM516T	110-9
MM614C, T Tel. Rec.	117-8
MM614C, T Tel. Rec.	117-8
Prod. Chge. Bul. 12	120-1

MANTOLA (B. F. Goodrich Co.)

R630-RP	3-22
R643-PM (See Model R643W)	4

MANTOLA—Cont.

R463W	4-29
R643-PM, R643W	4-29
R652, R652N	9-22
R654-PM, R654-PV	3-5
R655W (Ch. No. 501APH)	8-20
R662, R662N	3-33
R664-PM, R664-PV, R664W	23-13
R-743-W (See Model R-643-W)	4
R-7543	18-23
R-75143	39-12
R-75152	38-10
R-75343 (See Model 75143)	39
Rec. 76143 (See Model 2486)	40-10
R-76162	40-10
R-76262 (Fact. No. 7160-17)	51-12
R-78162	43-11
11-701	*
2486	25-17
92-520, 92-521, 92-522	68-11
92502 (See Model R643W)	4
92503, 92504 (See Models R654PM, PV)	3
92505, 92506 (See Models R664PM, PV, PW)	23
92516, 92517	*
92752	*

MARK SIMPSON (See Masco)

MA5CO

IM-5	41-13
JMR	31-17
JR (Master Station), JR (Sub-Station)	42-18
MA-5NO	45-15
MA-8N	119-8
MA-10HF	112-4
MA-10EX	113-4
MA-12HF	51-13
MA-17	16-32
MA-17N	50-11
MA-17P (See Model MA-17)	50
MA-17PN (See Model MA-17N)	50
MA-20HF	28-21
MA-25	16-24
MA-25EX	60-15
MA-25HF	54-13
MA-25N	43-14
MA-25NR	49-12
MA-25P (See Model MA-25)	49
MA-25PN (See Model MA-25N)	43
MA-35	21-20
MA-35N	44-11
MA-35RC (See Model MA-35)	21
MA-50	30-16
MA-50N (See Model MA-50)	45
MA-50NR	53-14
MA-60	119-9
MA-75	28-22
MA-75N	52-27
MA-121	24-21
MA-808	26-18
MAP-15	26-19
MAP-18	59-12
MAP-105	25-18
MAP-105N	52-12
MAP-120	21-21
MAP-120N	46-15
MB-50N	58-12
MB-60	127-8
MB-75	61-15
MC-10	47-12
MC-25, MC-25P, MC-25N, MC-25PC, MC-25PN, MC-25RC	57-11
MC-126, MC-126P	111-8
MHP-110	114-6
MHP-110X	115-5
Midgetalk	116-7
MPA-3, MPT-4	16-25
MR-3	18-18
MU-5	117-6
RK-5 (See Model RFact 33-11)	33-11
T-16	123-8
TD-16	120-8
TP-16A	30-17
76, 711	20-20
86, 811	20-21

MASON

45-1A	14-18
45-1B, 45-1P, 45-3, 45-4, 45-5 (See Model 45-1A)	14

MA5FAIR

510, 510W, 520, 520W, 530, 530W	25-20
550, 550W	24-22

McGRADE

M-100	16-27
-------	-------

MECK (Trail Blazer-Plymouth)

CD-500 (PX-5C5-EW-19)	33-12
CE-500 (5C5-P12)	34-10
CM-500 (5D7-W18)	34-11
CR-500	38-11
CX-500	40-11
CX-500	48-13
DA601, DB6021	81-10
EC270	85-8
EF-730, EG-731	85-8
Ch. 10003	89-8
EV-760	104-7
MM510T, MM512T, MM516C, MM516T	110-9
MM614C, T Tel. Rec.	117-8
MM614C, T Tel. Rec.	117-8
Prod. Chge. Bul. 12	120-1

MECK—Cont.

MM616C, T Tel. Rec. (See Model MM614C)	117
MM616C, T Tel. Rec.	120-1
Prod. Chge. Bul. 12	120-1
MM619C Tel. Rec. (See Model MM614C)	117
MM619C Tel. Rec.	120-1
Prod. Chge. Bul. 12	120-1
PM-5C5-DW10	2-4
PM-5C5-PW10	12-19
RC-5C5-P	1-9
RC-6A7-P6	31-19
SA-10, SA-20	101-4
XA-701 Tel. Rec.	61-16
Rec. 705 (See Model XA-701)	61
XF-777 Tel. Rec.	101-5
XL750 Tel. Rec.	76-14
XN-752 Tel. Rec. (See Model XF-777)	101
XOB Tel. Rec. (See Model MM510T)	110
XP-775, XQ-776, XQA-776	101
XL750 Tel. Rec. (See Model XF-777)	101
XQA, XQB Tel. Rec. (See Model MM510T)	110
XRA, XRP Tel. Rec. (See Model MM510T)	110
XR-778, XS-786, XT-785	101
Tel. Rec. (See Model XF-777)	101
XSA Tel. Rec. (See Model MM510T)	110
XSB Tel. Rec. (See Model MM614C)	117
XSB Tel. Rec.	120-1
Prod. Chge. Bul. 12	120-1
XSPT Tel. Rec.	110
(See Model MM510T)	110
XTA, XTR Tel. Rec. (See Model MM510T)	110
XX900 Tel. Rec. (See Model MM510T)	110
487	35-14
4C7	31-18
5A7-P11, 5A7-PB11	21-22
5D7/W18	16-26
6A6-W4	16-26
514C, T (Ch. 9018)	*
616C, T (Ch. 9018)	*
619C (Ch. 9018)	*

MEDCO (See TeleSonic)

MEISSNER

TV-1 (Ch. 24TV) Tel. Rec.	56-15
5A (See Maguire Model 571)	44
6H (See Maguire Model 661, 661A)	12
8C	37-12
9A1	123-9
9-1065	3-15
9-1091A, 9-1091B	35-15
9-1091C	116-8
9-1093	55-13
16A	105-6
24TV Tel. Rec. (See Model TV1)	56
25TV Tel. Rec.	*
574 (See Maguire Model 571)	44
661 (See Maguire Model 661)	12
2961 Series	27-19

MERCURY

6MM790 (See Ford Model 6MF780)	62
8MM890 (Ch. 8E90) (8M-18805-B)	49-13
8MM990 (8M-18805-B)	69-10
8MM991 (8M-18805-B), 8MM991-E (8M-18805-B)	83-4

MIDLAND

M6B	2-30
-----	------

MIDWEST

P-6, P8-6	14-19
R-12, RG-12, RT-12 (Ch. RGT-12)	44-12
R-12, RG-12, RT-12 (Ch. RGT-12)	44-13
R-12, RG-16, RT-16 (Ch. RGT-16)	45-16
SB, ST-8, TM-8 (Ch. STM-8)	15-19
S-12, SG-12, ST-12 (Ch. SGT-12)	21-23
S-16, SG-16, ST-16 (Ch. SGT-16)	21-24
716, 716A (See Model S-16)	21

MINERVA

L-702 (See W-702B)	12
L-728, W-728	11-15
W-117, Tropic Master	6-17
W-117-3	11-14
W-702B	12-20
W710, W710A (W119)	5-25
W-728 (See Model L-728)	11
410, 411	41-14
702H, 702H-1	30-18
729 (Portapone)	23-14

MIRRORTONE (See Meck)

MITCHELL

1250, 1251	55-14
1268R	127-9

MOLDED INSULATION CO. (Also See Viz)

MR-6 (Wiratone)	41-15
-----------------	-------

MONITOR

M-403 (Fact. No. 470-2)	22-20
M-500 (Fact. No. 475)	28-23
M-510 (Fact. No. 472)	23-15
M-3070	29-15
RA-50	24-23
TA56M, TW56M	6-18

MONTGOMERY WARD

(See Airline)

MOPAR

602 (Colonial Model 671A)	19-20
603	65-9
604	106-9
802 (Philco C-4608)	18-24

MOTOROLA—MUNTZ

MOTOROLA—Cont.

5X11U, 5X12U, 5X13U (Ch. HS-243) 114-7
 5X21U, 5X22U, 5X23U (Ch. HS-259) 120-9
 6F11, 6F11B (Ch. HS-264) 107-10
 6L1, 6L2 (Ch. HS-226) 112-5
 6X11U, 6X12U (Ch. HS-245) 112-5
 7F11, 7F11B (Ch. HS-265) 113-5
 7V11, 7V12, 7V15 (Ch. TS-18) Tel. Rec. (See Ch. 8A) 83-6
 8FDT, 8GMT (See Ch. 8A) 46
 8FM21, 8FM21B (Ch. HS-247) 121-9
 9FM21, 9FM21B (Ch. HS-246) 114-8
 9T1 (Ch. TS-18, A) Tel. Rec. (See Model 7V11) 83
 9V11, 9V15 (Ch. TS-18) Tel. Rec. (See Model 7V11) 83
 10T2 (Ch. TS14, A, B) Tel. Rec. (See Model 10V9) 92-4
 10VK9 (Ch. TS-9E, TS-9E1) Tel. Rec. (See Model VK106) (Ch. TS-9E) 77
 10VK12 (Ch. TS14, A, B) Tel. Rec. (See Model 10T2) 92
 10VK22 (Ch. TS14, A, B) Tel. Rec. (See Model 10T2) 92
 10VT3 (Ch. TS-9E, TS-9E1) Tel. Rec. (See Model VK106) 77
 10VT10 (Ch. TS14, A, B) Tel. Rec. (See Model 10T2) 92
 10VT24 (Ch. TS14, A, B) Tel. Rec. (See Model 10T2) 92
 12K1 (Ch. TS-23, A, B) Tel. Rec. (See Model 10T2) 92
 12K2 (Ch. TS-23, A, B) Tel. Rec. (See Model 10T2) 92
 12K2 (Ch. TS-53) Tel. Rec. (See Model 115-7) 115-7
 12T1 (Ch. TS-23, A, B) Tel. Rec. (See Model 10T2) 92
 12T3 (Ch. TS-53) Tel. Rec. (See Model 12K2) 115
 12VF4R, 12VF26 (Ch. TS-23, A, B) Tel. Rec. (See Model 10T2) 92
 12VK11 (Ch. TS-23, A, B) (See Model 10T2) 92
 12VK15 (Ch. TS-30, A) Tel. Rec. Prod. (See Model 10T2) 92
 12VK18B, 12VK18R (Ch. TS-15C, TS-15C1) Tel. Rec. (See Model VK106) (Ch. TS-9E) 77
 12VT13 (Ch. TS-23, A, B) Tel. Rec. (See Model 10T2) 92
 12VT16, 12VT16R (Ch. TS-15C, TS-15C1) (See Model VK106) (Ch. TS-9E) 77
 14K1, B (Ch. TS-88) 112-6
 14K18B, 14K18R (Ch. TS-115) Tel. Rec. (See Model 14K1) 112
 14T1, B (Ch. TS-88) Tel. Rec. (See Model 14K1) 112
 14T3 (Ch. TS-114) Tel. Rec. (See Model 14K18B) 121
 16F1 (Ch. TS-60 & Radio Ch. HS-234) Tel. Rec. (See Model 16F1H) (Ch. TS-89 & Radio Ch. HS-234) Tel. Rec. (See Model 14K18B) 121
 16K2 (Ch. TS-52) Tel. Rec. (See Model 16F1) 102
 16K2 (Ch. TS-74) Tel. Rec. (See Model 16F1) 102
 16K2BH, 16K2H (Ch. TS-94) Tel. Rec. (See Model 14K18B) 121
 16T1 (Ch. TS-60) Tel. Rec. (See Model 16F1) 102
 16T1BH, 16T1H (Ch. TS-89) Tel. Rec. (See Model 14K18B) 121
 16VF8 (Ch. TS-16, A) Tel. Rec. (See Model 12VK15) 93
 16VF8, 16VK7 (Ch. TS-16, A) Tel. Rec. Prod. (See Model 106-1) 106-1
 16VK1 (Ch. TS-52) Tel. Rec. (See Model 16K2) 93A
 16VK7 (Ch. TS-16, A) Tel. Rec. (See Model 12VK15) 93
 17F1 (Ch. TS-118 & Radio Ch. HS-253) Tel. Rec. (See Model 14K18B) 121
 17F1A (Ch. TS-89 & Radio Ch. HS-253) Tel. Rec. (See Model 14K18B) 121
 17F1B (Ch. TS-118 & Radio Ch. HS-253) Tel. Rec. (See Model 14K18B) 121
 17F1BA (Ch. TS-89 & Radio Ch. HS-253) Tel. Rec. (See Model 14K18B) 121

MOTOROLA—Cont.

17F2W (Ch. TS-118 & Radio Ch. HS-253) Tel. Rec. (See Model 14K18B) 121
 17F2WA (Ch. TS-89 & Radio Ch. HS-253) Tel. Rec. (See Model 14K18B) 121
 17F3B (Ch. TS-118 & Radio Ch. HS-253) Tel. Rec. (See Model 14K18B) 121
 17F3BA (Ch. TS-89 & Radio Ch. HS-253) Tel. Rec. (See Model 14K18B) 121
 17F4 (Ch. TS-118 & Radio Ch. HS-253) Tel. Rec. (See Model 14K18B) 121
 17F4A (Ch. TS-89 & Radio Ch. HS-253) Tel. Rec. (See Model 14K18B) 121
 17F5, 17F5B (Ch. TS-118 & Radio Ch. HS-261) Tel. Rec. (See Model 14K18B) 121
 17F5A, 17F5BA (Ch. TS-89 & Radio Ch. HS-261) Tel. Rec. (See Model 14K18B) 121
 17F6, B (Ch. TS-118) Tel. Rec. (See Model 14K18B) 121
 17F6B, C (Ch. TS-174) Tel. Rec. (See Model 14K18B) 121
 17F7B (Ch. TS-118) Tel. Rec. (See Model 14K18B) 121
 17F7BC (Ch. TS-174) Tel. Rec. (See Model 14K18B) 121
 17F8 (Ch. TS-118) Tel. Rec. (See Model 14K18B) 121
 17F8C (Ch. TS-174) Tel. Rec. (See Model 14K18B) 121
 17F9, B (Ch. TS-118) Tel. Rec. (See Model 14K18B) 121
 17F9C, C (Ch. TS-174) Tel. Rec. (See Model 14K18B) 121
 17K1A, 17K1BA (Ch. TS-95) Tel. Rec. (See Model 14K18B) 121
 17K1BE, 17K1E (Ch. TS-172) Tel. Rec. (See Model 14K18B) 121
 17K2BE, 17K2E (Ch. TS-172) Tel. Rec. (See Model 14K18B) 121
 17K3, 17K3B (Ch. TS-118) Tel. Rec. (See Model 14K18B) 121
 17K3A, 17K3BA (Ch. TS-89) Tel. Rec. (See Model 14K18B) 121
 17K4A (Ch. TS-95) Tel. Rec. (See Model 14K18B) 121
 17K5 (Ch. TS-118) Tel. Rec. (See Model 14K18B) 121
 17K5C (Ch. TS-174) Tel. Rec. (See Model 14K18B) 121
 17K6 (Ch. TS-118) Tel. Rec. (See Model 14K18B) 121
 17K6C (Ch. TS-174) Tel. Rec. (See Model 14K18B) 121
 17K7, B (Ch. TS-118) Tel. Rec. (See Model 14K18B) 121
 17K7BC, C (Ch. TS-174) Tel. Rec. (See Model 14K18B) 121
 17T1, 17T1B (Ch. TS-118) Tel. Rec. (See Model 14K18B) 121
 17T1A, 17T1BA (Ch. TS-89) Tel. Rec. (See Model 14K18B) 121
 17T2A, 17T2BA (Ch. TS-89) Tel. Rec. (See Model 14K18B) 121
 17T2, 17T2B (Ch. TS-118) Tel. Rec. (See Model 14K18B) 121
 17T3 (Ch. TS-118) Tel. Rec. (See Model 14K18B) 121
 17T3A (Ch. TS-89) Tel. Rec. (See Model 14K18B) 121
 17T4 (Ch. TS-118) Tel. Rec. (See Model 14K18B) 121
 17T4C (Ch. TS-174) Tel. Rec. (See Model 14K18B) 121
 19F1, 19K1 (Ch. TS-67 and Radio Ch. HS-230) Tel. Rec. (See Model 19K2) 111-9
 19K2, 19K2B (Ch. TS-101) Tel. Rec. (See Model 19K2E) (Ch. TS-119) Tel. Rec. (See Model 19K2) 122
 19K2BE, 19K2E (Ch. TS-119) Tel. Rec. (See Model 19K2) 122
 19K3, 19K4, 19K4B (Ch. TS-101) Tel. Rec. (See Model 19K2) 122

MOTOROLA—Cont.

20F1, 20F1B (Ch. TS-119 & Radio Ch. HS-230) Tel. Rec. (See Model 19K2) 122
 20F2, B (Ch. TS-119) Tel. Rec. (See Model 19K2) 122
 20K1, B, 20K2 (Ch. TS-119) Tel. Rec. (See Model 19K2) 122
 20T1, B (Ch. TS-119) Tel. Rec. (See Model 19K2) 122
 45B12 (Ch. HS-8) 9-23
 47B11 (Ch. HS-72) 29-17
 48L11 (Ch. HS-113) 47-13
 49L11Q, 49L13Q (Ch. HS-183) 77-7
 55F11 (Ch. HS-30) 4-14
 55X11A, 55X12A, 55X13A 2-22
 56X11 (Ch. HS-94) 28-24
 57X11, 57X12 (Ch. HS-60) 28-25
 58A11, 58A12 (Ch. HS-158) 52-13
 58G11, 58G12 (Ch. HS-160) 64-8
 58L11 (Ch. HS-114) 45-17
 58R11, 58R12, 58R13, 58R14, 58R15, 58R16 (Ch. HS-114) 49-14
 58R11A, 58R12A, 58R13A, 58R14A, 58R15A, 58R16A (Ch. HS-184) 69-11
 58X11, 58X12 (Ch. HS-125) 53-15
 59F11 (Ch. HS-188) 68-12
 59H11U, 59H21U (Ch. HS-210) 97-9
 59L11Q, 59L12Q, 59L14Q (Ch. HS-187) 78-10
 59R11, 59R12, 59R13M, 59R14E, 59R15G, 59R16E (Ch. HS-167) 79-10
 59X11, 59X12 (Ch. HS-180) 81-11
 59X21U, 59X22U (Ch. HS-192) 98-6
 65F11 (Ch. HS-31) 6-19
 65F12 (See Model 65F11) 6
 65F21 (Ch. HS-26) 4-12
 65L11, 65L12 (Ch. HS-7) 8-22
 65T21, 65T22 (Ch. HS-32) 1-1
 65X11A, 65X12A, 65X13A, 65X14A, 65X14B (Ch. HS-2) 4-8
 67F11, 67F12, 67F12B, 67F14 (Ch. HS-63) 31-20
 67F14 (Ch. HS-122) 35-15
 67F618B (Ch. HS-69) 44-14
 67L11 (Ch. HS-59) 31-21
 67X11, 67X12, 67X13 (Ch. HS-58) 30-20
 67X2M21 (Ch. HS-64) 32-14
 68F11, 68F12, 68F14, 68F14B, 68F14M 58-13
 68L11 (Ch. HS-119) 45-18
 68T11 (Ch. HS-144) 54-14
 68X11, 68X12 (Ch. HS-127), 68X11A, 68X12A (Ch. HS-127A) 56-16
 69L11 (Ch. HS-175) 76-15
 69X11, 69X12 (Ch. HS-181) 82-9
 75F21 (Ch. HS-91) 19-21
 75F31 (Ch. HS-36), 75F31A, B (Ch. HS-36A), 76F31 (Ch. HS-98) 29-18
 77FM21 (Ch. HS-89) 77FM22, 77FM22M, 77FM22WA, 77FM23 (Ch. HS-97) 33-13
 77X2M21, 77X2M22, 77X2M22B (Ch. HS-102) 34-12
 78F11, 78F11M (Ch. HS-150), 78F12M (Ch. HS-155) 56-17
 78FM21, 78FM21M (Ch. HS-132), 78FM22M (Ch. HS-128) 59-13
 79FM21, 79FM21B, 79FM21R (Ch. HS-178) 88-7
 79X2M21, 79X2M22 (Ch. HS-168) 85-9
 85F21 (Ch. HS-22) 6-20
 85K21 (Ch. HS-52) 5-3
 88FM21 (Ch. HS-133) 54-15
 95F31, 95F31B (Ch. HS-39) 19-22
 99FM21R (Ch. HS-170) 80-10
 107F31, 107F31B (Ch. HS-87) 33-14
 309 63-14
 400 99-10
 505 (Ch. AS-13) 3-8
 405M 21-25
 408 38-12
 409 (See Model 408) 38
 500 98-7
 505 (Ch. AS-14) 4-37
 508 39-13
 509 (See Model 508) 39
 600 97-10
 605 (Ch. AS-15) 39-14
 608 39
 609 (See Model 608) 39
 700 100-8
 705 (Ch. AS-16) 7-19
 708 40-12
 709 (See Model 708) 40
 800 103-10
 Ch. AS-13 (See Model 405) 3
 Ch. AS-14 (See Model 505) 3
 Ch. AS-15 (See Model 605) 4
 Ch. AS-16 (See Model 705) 7
 Ch. AS-22 (See Model 8K-6) 10
 Ch. HS-2 (See Model 65X11A) 4

MOTOROLA—Cont.

Ch. HS-6 (See Model 5A1) 2
 Ch. HS-7 (See Model 65L11) 8
 Ch. HS-8 (See Model 45B12) 9
 Ch. HS-15 (See Model 5A5) 3
 Ch. HS-18 (See Model WR6) 5
 Ch. HS-22 (See Model 85F21) 6
 Ch. HS-26 (See Model 65F21) 4
 Ch. HS-30 (See Model 55F11) 4
 Ch. HS-31 (See Model 65F11) 6
 Ch. HS-32 (See Model 65T21) 1
 Ch. HS-36 (See Model 75F31) 29
 Ch. HS-36A (See Model 75F11A) 29
 Ch. HS-38 (See Model 95F33) 19
 Ch. HS-39 (See Model 95F31) 19
 Ch. HS-50 (See Model 55X11A) 2
 Ch. HS-52 (See Model 85K21) 5
 Ch. HS-58 (See Model 67X11) 30
 Ch. HS-59 (See Model 67L11) 31
 Ch. HS-60 (See Model 57X11) 28
 Ch. HS-62 (See Model 5A7) 29
 Ch. HS-62A (See Model 5A7A) 29
 Ch. HS-63 (See Model 67F11) 31
 Ch. HS-64 (See Model 67X2M21) 31
 Ch. HS-69 (See Model 67F618B) 44
 Ch. HS-72 (See Model 47B11) 29
 Ch. HS-87 (See Model 107F31) 33
 Ch. HS-89 (See Model 77F421) 33
 Ch. HS-91 (See Model 75F21) 19
 Ch. HS-94 (See Model 56X11) 28
 Ch. HS-97 (See Model 77FM22) 33
 Ch. HS-98 (See Model 76F31) 29
 Ch. HS-102 (See Model 77X2M21) 34
 Ch. HS-108 (See Model VK-101) 51
 Ch. HS-113 (See Model 48L11) 47
 Ch. HS-114 (See Model 58L11) 45
 Ch. HS-116 (See Model 58R11) 49
 Ch. HS-119 (See Model 68L11) 45
 Ch. HS-122 (See Model 67F14) 55
 Ch. HS-124 (See Model 68F11) 58
 Ch. HS-125 (See Model 58X11) 53
 Ch. HS-127 (See Model 68X11) 56
 Ch. HS-127A (See Model 68X11A) 56
 Ch. HS-128 (See Model 78FM22M) 59
 Ch. HS-132 (See Model 78FM21) 59
 Ch. HS-133 (See Model 88F421) 54
 Ch. HS-137 (See Model VK101) 51
 Ch. HS-144 (See Model 68T11) 54
 Ch. HS-150 (See Model 78F11) 56
 Ch. HS-155 (See Model 78F12M) 56
 Ch. HS-158 (See Model 58A11) 52
 Ch. HS-160 (See Model 58G11) 64
 Ch. HS-167 (See Model 59R11) 79
 Ch. HS-168 (See Model 79X2M21) 85
 Ch. HS-170 (See Model 99FM21R) 80
 Ch. HS-175 (See Model 69L11) 76
 Ch. HS-178 (See Model 79FM21) 88
 Ch. HS-180 (See Model 59X11) 81
 Ch. HS-181 (See Model 69X11) 82
 Ch. HS-183 (See Model 49L11Q) 77
 Ch. HS-184 (See Model 58R11A) 69
 Ch. HS-187 (See Model 59L11Q) 78
 Ch. HS-188 (See Model 59R11) 68
 Ch. HS-192 (See Model 59X21U) 98
 Ch. HS-210 (See Model 59H11U) 97
 Ch. HS-223 (See Model 5M1) 101
 Ch. HS-224 (See Model 5J1) 100

MOTOROLA—Cont.

Ch. HS-226 (See Model 6L1) 102
 Ch. HS-228 (See Model 5C1) 116
 Ch. HS-230 (See Model 19F1) 111
 Ch. HS-234 (See Model 16F1) 102
 Ch. HS-242 (See Model 5R11U) 115
 Ch. HS-243 (See Model 5X11U) 114
 Ch. HS-244 (See Model 5H11U) 117
 Ch. HS-245 (See Model 6X11U) 112
 Ch. HS-246 (See Model 9FM21) 114
 Ch. HS-247 (See Model 8FM21) 121
 Ch. HS-249 (See Model 5M1) 101
 Ch. HS-250 (See Model 5J1) 100
 Ch. HS-253 (See Model 17F1) 121
 Ch. HS-258 (See Model 5C1) 116
 Ch. HS-259 (See Model 5X21U) 120
 Ch. HS-261 (See Model 17F5) 121
 Ch. HS-262 (See Model 5C1) 116
 Ch. HS-264 (See Model 6F11) 117
 Ch. HS-265 (See Model 7F11) 113
 Ch. HS-270 (See Model 5C1) 116
 Ch. HS-271, HS-272 (See Model 5C1) 116
 Ch. M-5 (See Model AR96-23) 11
 Ch. OB (See Model SROB) 105
 Ch. TS-3 (See Model VK-101) 51
 Ch. TS-4B Thru J (See Model VT-71) 55
 Chassis TS-4J Late (See Model VT-73) 71
 Ch. TS-5 (See Model VK101) 51
 Ch. TS-7 (See Model VK101) 51
 Chassis TS-8 (See Model VT103) 73
 Ch. TS-9, TS-9A, TS-9B, TS-9C (See Model VT105) 67
 Ch. TS-9D (See Model VT105) Photofact Servicer 82
 Ch. TS-9D1 82
 Ch. TS-9E, TS-1E1 (See Model VK106) 77
 Ch. TS-14, A, B (See Model 10T2) 92
 Ch. TS-15 (See Model VT121) 91A
 Ch. TS-15A *
 Ch. TS-15B *
 Ch. TS-15C, TS-15C1 (See Model 12VK18B) 77
 Ch. TS-16, A (See Model 12VK15) 93
 Ch. TS-18, A (See Model 7V11) 83
 Ch. TS-23, A, B (See Model 10T2) 92
 Ch. TS-30, A (See Model 12VK15) 93
 Ch. TS-52 (See Model 16K2) 93A
 Ch. TS-53 (See Model 12K2) 115
 Ch. TS-60 (See Model 16F1) 102
 Ch. TS-67 (See Model 19F1) 111
 Ch. TS-74 (See Model 16F1) 102
 Ch. TS-88 (See Model 14K1) 112
 Ch. TS-89 (See Model 16F18B) 121
 Ch. TS-94 (See Model 16K2BH) 121
 Ch. TS-95 (See Model 17K1A) 121
 Ch. TS-101 (See Model 19K2) 122
 Ch. TS-114 (See Model 14T3) 121
 Ch. TS-115 (See Model 14K18B) 121
 Ch. TS-119 (See Model 19K2) 122
 Ch. TS-172 (See Model 14K18B) 121
 Ch. TS-174 (See Model 14K18B) 121
 Ch. 8A 46-16
 Ch. 10A 106-10

MUNTZ

M30 (Ch. TV-16A1) Tel. Rec. (See Model M30) 108-8
 M31 (Ch. TV-16A2) Tel. Rec. (See Model M30) 108
 M31 (Ch. TV17A2) Tel. Rec. (See Model M31) 116-10
 M31R (Ch. TV17A3) Tel. Rec. (See Model M31) 116
 M31R, M32 (Ch. TV-16A3) Tel. Rec. (See Model M30) 108
 M32 (Ch. TV17A2) Tel. Rec. (See Model M31) 116

MUNTZ-Cont.

M32, M32R (Ch. TV17A3) Tel. Rec. (See Model M31) 116
 M33 (Ch. TV17A4) Tel. Rec. (See Model M31) 116
 M41, M42 (Ch. TV17A3A) Tel. Rec. (See Model M31) 116
 M46 (Ch. TV17A7) Tel. Rec. (See Model M31) 116
 M49 (Ch. TV17A7) Tel. Rec. (See Model M31) 116
 M-158 Tel. Rec. 97A-10
 M-159 Tel. Rec. 97A-10
 M-159A, B Tel. Rec. 97A-10
 M-169 Tel. Rec. 96-6

MURPHY
 112 2-15
 113 2-2
 122 (See Model 112) 2

MUSTRON
 PT-10 15-20
 PX 16-28
 SRC-3 (See Model 101) 13
 101 "Piccolo" 13-21
 103 "Piccolo" 15-21
 105 21-26
 202 21-27

NASH
 6MN082 9-25
 Ch. C682 (See Model 6MN082) 9

NATIONAL CO.
 HFS 62-14
 HRO-7R, HRO-7T 50-12
 HRO-50 112-7
 NC-TV7, NC-TV7M, NC-TV7W Tel. Rec. 67-14
 NC-TV-10C, T, W Tel. Rec. 94-5
 NC-TV-10C, T, W Tel. Rec. Prod. Chgs. Bul. 1 103-19
 NC-TV-12C, W Tel. Rec. (See Model NC-TV-10C) 94
 NC-TV-12C, W Tel. Rec. Prod. Chgs. Bul. 1 103-19
 NC-TV-1001 Tel. Rec. (See Model NC-TV-10C) 94
 NC-TV-1001 Tel. Rec. Prod. Chgs. Bul. 1 103-19
 NC-TV-1025 Tel. Rec. (See Model NC-TV-10C) 94
 NC-TV-1025 Tel. Rec. Prod. Chgs. Bul. 1 103-19
 NC-TV-1201, NC-TV-1202 Tel. Rec. (See Model NC-TV-10C) 94
 NC-TV-1201 Tel. Rec. Prod. Chgs. Bul. 1 103-19
 NC-TV-1225, NC-TV-1226 Tel. Rec. (See Model NC-TV-10C) 94
 NC-TV-1225, NC-TV-1226 Tel. Rec. Prod. Chgs. Bul. 1 103-19
 NC-2-40DR, NC-2-40DT 41-16
 NC-33 47-14
 NC-46 9-26
 NC-57 48-14
 NC-108R, NC-108T 47-15
 NC-173R, NC-173T 40-13
 NC-183R, NC-183T 49-15
 TV-1201 Tel. Rec. 119-10
 TV-1226 Tel. Rec. (See Model TV-1201) 119
 TV-1601 Tel. Rec. (See Model TV-1201) 119
 TV-1625 Tel. Rec. (See Model TV-1201) 119

NATIONAL UNION
 G-613 "Commuter" 19-23
 G-619 11-35
 571, 571A, 571B 17-22

NEWCOMB
 H-10 14-20
 H-14 15-22
 KX-30 15-23

NIELSON
 1018 Tel. Rec. *
 1618 Tel. Rec. *

NOBLITT SPARKS (See Arvin)

OLDSMOBILE
 982375 20-25
 982376 20-25
 982399 59-14
 982420 57-12
 982421 87-7
 982454 60-16
 982455 60-16
 982544, 982573 96-7

OLYMPIC
 DX-214, DX-215, DX-216 Tel. Rec. 106-11
 DX-619, DX-620, DX-621, DX-622 Tel. Rec. (See Model DX-214) 106
 DX-931, DX-932 Tel. Rec. (See Model DX-214) 106
 DX-950 Tel. Rec. (See Model DX-214) 106
 RTU-3M (Duplicator) 62-15
 TV-104, TV-105 Tel. Rec. 67-15
 TV-106, TV-107, TV-108 Tel. Rec. (See Model TV-104) 67
 TV-922 Television Receiver 58-14
 TV-922L Tel. Rec. (See Model TV-104) 67

OLYMPIC-Cont.

TV928 Tel. Rec. (See Model TV922) 58
 TV-944, TV-945, TV-946 Tel. Rec. (See Model TV-944) 67
 TV-947 Tel. Rec. 85-10
 TV-948 Tel. Rec. (See Model TV-104) 67
 TV-949, TV-950 Tel. Rec. (See Model TV-947) 85
 XL-210, XL-211 Tel. Rec. 109-8
 XL-612, XL-613 Tel. Rec. (See Model XL-210) 109
 6-501, 6-502, 6-502-P, 6-503 4-10
 6-501U (See Model 6-501U-U) 3
 6-501U-U, 6-502-U 3-20
 6-504, 6-504L 3-25
 6-601W, 6-601V, 6-602 8-24
 6-604 Series 22-21
 6-604V-110, 6-604V-220, 6-604W-110, 6-604W-150, 6-604W-220 (See Model 6-604 Series) 22
 6-606 4-36
 6-606-A 11-17
 6-606-U 11-18
 6-617 4-7
 6-617U (See Model 6-617) 4
 7-421V, 7-421W, 7-421X, 7-435V, 7-435W 34-13
 7-526 30-21
 7-532W, 7-532V 32-15
 7-537 37-13
 7-622, 7-638 34-14
 7-724 29-19
 7-728 (See Model 7-724) 29
 7-925, 7-934, 7-936, 7-939 31-22
 8-431 48-15
 8-533V, 8-533W 37-14
 8-618 35-16
 8-925, 8-934, 8-936, 752, 752U, 753, 753U, Tel. Rec. 126-8
 753, 753U Tel. Rec. (See Model 752) 126
 764, 764U Tel. Rec. (See Model 752) 126
 766 Tel. Rec. (See Model 752) 113
 767 Tel. Rec. (See Model 752) 126

OPERADIO
 1A30 34-15
 1A35 33-15
 1A45 48-16
 1A65 52-14
 1A70-A 47-16
 1A140 46-17
 4A25-E 101-8
 4A30-A 102-9
 4A35, 4A55 100-9
 4A50-A, 4A51-A (See Model 4A30-A) 102
 4M25C 99-11
 11A55 113-6
 530, 531, 1335 "Soundcaster" 37-14

ORTHOSONIC (See Electronic Labs.)

PACKARD
 PA-382042 20-26
 PA-393607 57-15

PACKARD-BELL
 C1362 12-21
 C1461 12-22
 5DA 16-29
 5DB 44-15
 5FP 1-29
 100 53-16
 261 47-21
 271 30-22
 281 2-7
 351-D (See Model 551) 2
 561 2-35
 563 (See Model 561) 2
 566 (See Model 551) 2
 568 19-24
 571 (See Model 572) 22
 572 22-22
 581 (See Model 5DB) 44
 651 4-25
 661 8-22
 662 13-22
 673A, 673B 46-18
 682 54-16
 771 44-16
 861 17-23
 871 31-23
 880 "SBOA" (See Model 673A) 46
 881-A, 881-B 47-17
 882 47-17
 884, 892 74-6
 1052, 1052A 8-26
 1054B 13-23
 1063 18-25
 1091 Tel. Rec. 1181, 1181A 75-12
 1272 75-12
 1273 46-19
 1291TV Tel. Rec. 48-17
 1472 17-51
 1751 47-18
 2001TV, 2002TV Tel. Rec. 98-8
 2091, 2092 Tel. Rec. 2101, 2102 Tel. Rec. 123-10
 2101, 2105A Tel. Rec. (See Model 2101) 123
 2202, 2204 Tel. Rec. (See Model 2101) 123

PACKARD-BELL-Cont.

2291TV, 2292TV, 2293TV, 2294TV, 2295TV, 2296TV Tel. Rec. 82-10
 2297-TV De Luxe, 2297-TV Standard Tel. Rec. (See Model 2291-TV) 82
 2298-TV Tel. Rec. (See Model 2291-TV) 82
 2301-TV Tel. Rec. 126-9
 2601-TV Tel. Rec. 122-6
 2602 Tel. Rec. (See Model 2101) 123
 2692-TV Tel. Rec. (See Model 2601-TV) 122
 2801-TV, 2801TV Tel. Rec. (See Model 2301-TV) 126
 2803 Tel. Rec. 94-6
 2991TV Tel. Rec. 3191, 3192 Tel. Rec. 3381 Tel. Rec. 4580 Tel. Rec. 4691TV Tel. Rec.

PHILCO
 C-4608 (See Mopar Model 802) 18
 C-4608 (Revised) (See Mopar Model 802 Revised) 42
 C-4908 (See Mopar Model 805) 71
 CR-2 35-17
 CR-4, CR-6 32-17
 CR-8 38-13
 CR-9 44-17
 CR-12 39-16
 P-4635 (See Packard Model PA-382042) 20
 P-4733 (See Packard Model PA-393607) 57
 PD-4908 (See Mopar Model 803) 66
 S-4624, S-4625 (See Studdebaker Model S-4624) 21
 S-4626, S-4627 (See Studdebaker Model S-4626) 19
 UN6-100 19-26
 UN6-400 30-23
 UN6-450 18-26
 UN6-500 17-24
 UN6-550 31-24
 46-131 5-13
 46-131 (Revised) 32-16
 46-132 4-20
 46-142 36-16
 46-200 Series 1-24
 46-200-1, 46-200-2, 46-203 (See Model 46-200 Series) 1
 46-250, 46-250-1, 46-251 2-12
 46-350 10-24
 46-420, 46-420-1 6-22
 46-421, 46-421-1 5-12
 46-427 2-25
 46-480 19-25
 46-1201 4-35
 46-1201 (Revised) 29-21
 46-1203 6-23
 46-1209 13-24
 46-1213 12-33
 46-1226 13-24
 47-204, 47-205 33-18
 47-1227 25-22
 47-1230 22-23
 48-141, 48-145 25-23
 48-150 34-16
 48-200, 48-200-1 33-19
 48-206 37-16
 48-214 (See Model 48-200) 33
 48-225, 48-230 37-15
 48-250, 48-250-1 32-17
 48-300 37-17
 48-366 38-14
 48-460, 48-460-1 34-17
 48-461 38-15
 48-464 26-20
 48-472, 48-472-1 43-15
 48-472 (Revised) 48-18
 48-475 40-14
 48-482 30-24
 48-485 47-19
 48-700 Tel. Rec. 68-13
 48-1000 (Code 121) Tel. Rec. 53-17
 48-1000 (Code 125) Tel. Rec. 121 & 122) Tel. Rec. (See Model 48-1000 Code 122) 53
 48-1030, 48-1030-5 (Code 122) Tel. Rec. (See Model 48-1000 Code 122) 53
 48-1200 29-20
 48-1201 31-25
 48-1259 36-17
 48-1256 34-18
 48-1260 (See Model 48-1201) 31
 48-1262 35-18
 48-1263 32-18
 48-1264 36-18
 48-1266 39-15
 48-1270 42-20
 48-1274, 48-1276 41-17
 48-1282, 48-1283 (See Model 48-1262) 35
 48-1284 45-20
 48-1286 51-15
 48-1290 47-18
 48-2500, 48-2500-5 Tel. Rec. (Codes 121 and 122) 89-10
 49-101 87-8
 49-500, 49-500-1 48-19
 49-501, 49-501-1 56-18
 49-503 52-15

PHILCO-Cont.

49-504, 49-504-1 54-17
 49-505 53-18
 49-506 (See Model 49-500) 48
 49-507 42-21
 49-602 41-18
 49-603 59-15
 49-605, 49-607 58-15
 49-900-E, 49-900-1 49-16
 49-901 56-19
 49-902 51-16
 49-904 58-16
 49-905 52-16
 49-906 57-16
 49-909 55-17
 49-1002 (Code 121) Tel. Rec. 91A-10
 49-1040 (Code 121) Tel. Rec. (See Model 49-1002) 91A
 49-1040 (Code 123) Tel. Rec. 92-5
 49-1075 (Codes 121 and 121) Tel. Rec. 93A-11
 49-1076 (Code 122) Tel. Rec. (See Model 49-1075) 93A
 49-1076 (Code 123), 49-1077 (Code 122) Tel. Rec. (See Model 49-1040) 92
 49-1100 (See Model 48-485) 47
 49-1101 (See Model 49-909) 55
 49-1150 (Codes 121 & 123) Tel. Rec. 70-6
 49-1150 (Codes 122, 124) Tel. Rec. (See Model 49-1040) 92
 49-1175 (Codes 121 & 123) Tel. Rec. (See Model 49-1150 Code 121) 70
 49-1175 (Codes 122, 124) Tel. Rec. (See Model 49-1040) 92
 49-1240 (Codes 121, 123) Tel. Rec. (See Model 49-1075) 93A
 49-1240 (Code 124) Tel. Rec. (See Model 49-1040) 92
 49-1275 (Code 121) Tel. Rec. (See Model 49-1075) 93A
 49-1278 (Code 122) Tel. Rec. (See Model 49-1075) 93A
 49-1278 (Code 123), 49-1279 (Code 122), 49-1280 (Code 121) Tel. Rec. (See Model 49-1040) 92
 49-1401 45-21
 49-1404 (See Model 49-1405) 54
 49-1405 54-24
 49-1450 (Codes 121A or B, 123A or B, 123T A or B) Tel. Rec. 77-8
 49-1475 (Codes 121A or B, 123A or B, 123T A or B) (See Model 49-1450) 77
 49-1480 (Codes 121A or B, 123A or B, 123T A or B) (See Model 49-1450) 77
 49-1600 50-13
 49-1601 (See Model 49-1600) 50
 49-1602, 49-1603, 49-1604, 49-1605 55-18
 49-1606, 49-1607 53-19
 49-1609, 49-1611 (See Model 49-1606) 53
 49-1613 91-9
 49-1615 64-9
 50-520, 50-520-1 73-9
 50-522, 50-522-1, 50-524 78-11
 50-526 96-8
 50-527, 50-527-1 80-11
 50-620 85-11
 50-621 89-11
 50-702 (Code 122) Tel. Rec. 88-8
 50-920, 50-921, 50-922 88-8
 50-925 (Code 123) 50-926 99-12
 50-1420, 50-1421, 50-1422, 50-1423 97-11
 50-1720 93-8
 50-1721, 50-1723, 50-1724 98-9
 50-1725 (See Model 50-1720) 93
 50-1726 (See Model 49-1613) 91
 50-1727 86-7
 50-11104 (Code 123) Tel. Rec. 114-9
 50-11105, 50-11106 Tel. Rec. *
 50-T1400, 50-T1401, 50-T1402 (Code 121) Tel. Rec. (See Model 50-T1104) 114
 50-T1400 (Code 123) Tel. Rec. *
 50-T1402 (Code 123) Tel. Rec. *
 50-T1403 (Code 125), 50-T1404, 50-T1406 (Codes 123, 124, 125) Tel. Rec. 115-8
 50-T1430 (Code 121) Tel. Rec. (See Model 50-T1104) 114
 50-T1431 (Code 124) Tel. Rec. *
 50-T1403 (Code 123) Tel. Rec. *
 50-T1443 (Codes 122, 123) Tel. Rec. 94-7

PHILCO-Cont.

50-T1477, 50-T1478, 50-T1479, 50-T1481 Tel. Rec. 93A-12
 50-T1482 Tel. Rec. 93A-12
 50-T1483 Tel. Rec. (See Model 50-T1477) 93A
 50-T1600 Tel. Rec. 91A-10
 50-T1600 (Code 122) Tel. Rec. 110-10
 50-T1606 (Code 131) Tel. Rec. (See Model 50-T1600 Code 121) 91A
 50-T1630 Tel. Rec. 99A-8
 50-T1632, 50-T1633 Tel. Rec. (See Model 50-T1600) 91A
 50-T1632, 50-T1633 (Code 122) Tel. Rec. (See Model 50T1600) 110
 51-PT1207, 51-PT1208 Tel. Rec. *
 51-PT1282 Tel. Rec. *
 51-T1443B1, M, X, XL (Code 121) Tel. Rec. 125-10
 51-T1443P1, 51-T1443PM, 51-T1443PW Tel. Rec. 123-11
 51-T1601, T, 51-T1602 (Code 121) Tel. Rec. 115-1A
 51-T1604 (Code 122) Tel. Rec. (See Model 50-T1600 Code 122) 110
 51-T1606 (Code 122) Tel. Rec. (See Model 50-T1600 Code 122) 110
 51-T1634 (Code 122) Tel. Rec. (See Model 50-T1600 Code 122) 110
 51-T1634 (Code 123) Tel. Rec. (See Model 50-T1600 Code 122) 110
 51-1731, 51-1732 124-7
PHILHARMONIC
 100C 38-16
 100T 33-20
 149-C, 249-C 55-19
 349-C 58-17
 6810, 8701, 8702, 8703, 8710, 8711, 8712 (Ch. RR14) 18-27
 Ch. RR14 (See Model 6810) 18
PHILLIPS 66 (See Wealorac)
 3-62A (See Wealorac Model 3-71A) 36
 3-81A 48-20
PHONOLA
 K-92, K-104 51-17
 K-105 (See Model 79-11) 79-11
 K-202, K-263 55-20
 TK-134 12-24
 TK-234 108-9
PILOT
 T-411-U 15-25
 T-500 Series 12-23
 T510, T511 5-24
 T-521 19-27
 T-530 Series 12-24
 T-601 "Pilotuner" 28-26
 T-700 7-70
 T-741 37-18
 TV-37 Tel. Rec. 62-16
 TV-40 Tel. Rec. *
 TV-950 Tel. Rec. *
PLYMOUTH (See Mopar)
PLYMOUTH (Interstate Stores)
 1010 88-2
 1020 89-5
POLICALARM
 PB-8 103-12
 PR-31 105-8
PONTIAC
 984170 20-27
 984171 14-22
 984172 *
 984247 *
 984248, 984249 *
 984273 *
 984296, 984570 95-4
PORTO BARADIO (Also See Porto Products)
 PA-510 (9008-A), PB-520 (9008-B) 33-16
 PA-510, PB-520 (Revised) 48-21
PORTO PRODUCTS
 SR-600 (Ch. 9040A "Smokerette") (See Porto Baradio Model PA-510) 33
PREMIER
 151W 6-24
PURE OIL (See Puritan)
 501 (Ch. 5D15WG), 502 (Ch. 5D25WG) 4-5
 501X (Ch. 5D15WG) 4-26
 503 (Ch. 5D25WG) 10-25
 503W (See Model 503) 10
 504 (Ch. 6A35WG) 5-39
 504W (See Model 504) 5

PURITAN—RADIO MANUFACTURING ENGINEERS

PURITAN—Cont.

506 (6D155W) 3—10
 507 (6D255W) 3—10
 506X, 507X (See Model 506) 3
 508 (Code 7A355W) 4—31
 508 26—21
 515 25—24

RADIO APPARATUS CORP.
 (See Patentarm)

RCA VICTOR

AAPU-1 109—10
 A55 (Ch. RC-1087) 97—12
 A106 (Ch. RC-622) 97—12
 B1-A, B1-B, B1-C (Ch. KCS24-1, KRK1-1, KR520-1, KR521-1) Tel. Rec. *

B2-C, B2-F, B2-G, B2-H (Ch. KCS24-1, KRK1-1, KR520-1, KR521-1) Tel. Rec. *

B3-A, B3-B, B3-C *

B4-A, B4-B, B4-C *

B5-A, B5-B *

BX6 (Ch. RC-1082) 103—13
 BX55 (Ch. RC-1088), BX57 (Ch. RC-1088A) 102—11
 MI-12224, MI-12224A 81—12
 MI-12236, -A, -B, -C, -D, -E, -F, -G, -H, -I, -J, -K, -L, -M, -N, -O, -P, -Q, -R, -S, -T, -U, -V, -W, -X, -Y, -Z, -AA, -AB, -AC, -AD, -AE, -AF, -AG, -AH, -AI, -AJ, -AK, -AL, -AM, -AN, -AO, -AP, -AQ, -AR, -AS, -AT, -AU, -AV, -AW, -AX, -AY, -AZ, -BA, -BB, -BC, -BD, -BE, -BF, -BG, -BH, -BI, -BJ, -BK, -BL, -BM, -BN, -BO, -BP, -BQ, -BR, -BS, -BT, -BU, -BV, -BW, -BX, -BY, -BZ, -CA, -CB, -CC, -CD, -CE, -CF, -CG, -CH, -CI, -CJ, -CK, -CL, -CM, -CN, -CO, -CP, -CQ, -CR, -CS, -CT, -CU, -CV, -CW, -CX, -CY, -CZ, -DA, -DB, -DC, -DD, -DE, -DF, -DG, -DH, -DI, -DJ, -DK, -DL, -DM, -DN, -DO, -DP, -DQ, -DR, -DS, -DT, -DU, -DV, -DW, -DX, -DY, -DZ, -EA, -EB, -EC, -ED, -EE, -EF, -EG, -EH, -EI, -EJ, -EK, -EL, -EM, -EN, -EO, -EP, -EQ, -ER, -ES, -ET, -EU, -EV, -EW, -EX, -EY, -EZ, -FA, -FB, -FC, -FD, -FE, -FF, -FG, -FH, -FI, -FJ, -FK, -FL, -FM, -FN, -FO, -FP, -FQ, -FR, -FS, -FT, -FU, -FV, -FW, -FX, -FY, -FZ, -GA, -GB, -GC, -GD, -GE, -GF, -GG, -GH, -GI, -GJ, -GK, -GL, -GM, -GN, -GO, -GP, -GQ, -GR, -GS, -GT, -GU, -GV, -GW, -GX, -GY, -GZ, -HA, -HB, -HC, -HD, -HE, -HF, -HG, -HH, -HI, -HJ, -HK, -HL, -HM, -HN, -HO, -HP, -HQ, -HR, -HS, -HT, -HU, -HV, -HW, -HX, -HY, -HZ, -IA, -IB, -IC, -ID, -IE, -IF, -IG, -IH, -II, -IJ, -IK, -IL, -IM, -IN, -IO, -IP, -IQ, -IR, -IS, -IT, -IU, -IV, -IW, -IX, -IY, -IZ, -JA, -JB, -JC, -JD, -JE, -JF, -JG, -JH, -JI, -JJ, -JK, -JL, -JM, -JN, -JO, -JP, -JQ, -JR, -JS, -JT, -JU, -JV, -JW, -JX, -JY, -JZ, -KA, -KB, -KC, -KD, -KE, -KF, -KG, -KH, -KI, -KJ, -KK, -KL, -KM, -KN, -KO, -KP, -KQ, -KR, -KS, -KT, -KU, -KV, -KW, -KX, -KY, -KZ, -LA, -LB, -LC, -LD, -LE, -LF, -LG, -LH, -LI, -LJ, -LK, -LL, -LM, -LN, -LO, -LP, -LQ, -LR, -LS, -LT, -LU, -LV, -LW, -LX, -LY, -LZ, -MA, -MB, -MC, -MD, -ME, -MF, -MG, -MH, -MI, -MJ, -MK, -ML, -MM, -MN, -MO, -MP, -MQ, -MR, -MS, -MT, -MU, -MV, -MW, -MX, -MY, -MZ, -NA, -NB, -NC, -ND, -NE, -NF, -NG, -NH, -NI, -NJ, -NK, -NL, -NM, -NN, -NO, -NP, -NQ, -NR, -NS, -NT, -NU, -NV, -NW, -NX, -NY, -NZ, -OA, -OB, -OC, -OD, -OE, -OF, -OG, -OH, -OI, -OJ, -OK, -OL, -OM, -ON, -OO, -OP, -OQ, -OR, -OS, -OT, -OU, -OV, -OW, -OX, -OY, -OZ, -PA, -PB, -PC, -PD, -PE, -PF, -PG, -PH, -PI, -PJ, -PK, -PL, -PM, -PN, -PO, -PP, -PQ, -PR, -PS, -PT, -PU, -PV, -PW, -PX, -PY, -PZ, -QA, -QB, -QC, -QD, -QE, -QF, -QG, -QH, -QI, -QJ, -QK, -QL, -QM, -QN, -QO, -QP, -QQ, -QR, -QS, -QT, -QU, -QV, -QW, -QX, -QY, -QZ, -RA, -RB, -RC, -RD, -RE, -RF, -RG, -RH, -RI, -RJ, -RK, -RL, -RM, -RN, -RO, -RP, -RQ, -RR, -RS, -RT, -RU, -RV, -RW, -RX, -RY, -RZ, -SA, -SB, -SC, -SD, -SE, -SF, -SG, -SH, -SI, -SJ, -SK, -SL, -SM, -SN, -SO, -SP, -SQ, -SR, -SS, -ST, -SU, -SV, -SW, -SX, -SY, -SZ, -TA, -TB, -TC, -TD, -TE, -TF, -TG, -TH, -TI, -TJ, -TK, -TL, -TM, -TN, -TO, -TP, -TQ, -TR, -TS, -TU, -TV, -TW, -TX, -TY, -TZ, -UA, -UB, -UC, -UD, -UE, -UF, -UG, -UH, -UI, -UJ, -UK, -UL, -UM, -UN, -UO, -UP, -UQ, -UR, -US, -UT, -UU, -UV, -UW, -UX, -UY, -UZ, -VA, -VB, -VC, -VD, -VE, -VF, -VG, -VH, -VI, -VJ, -VK, -VL, -VM, -VN, -VO, -VP, -VQ, -VR, -VS, -VT, -VU, -VV, -VW, -VX, -VY, -VZ, -WA, -WB, -WC, -WD, -WE, -WF, -WG, -WH, -WI, -WJ, -WK, -WL, -WM, -WN, -WO, -WP, -WQ, -WR, -WS, -WT, -WU, -WV, -WW, -WX, -WY, -WZ, -XA, -XB, -XC, -XD, -XE, -XF, -XG, -XH, -XI, -XJ, -XK, -XL, -XM, -XN, -XO, -XP, -XQ, -XR, -XS, -XT, -XU, -XV, -XW, -XX, -XY, -XZ, -YA, -YB, -YC, -YD, -YE, -YF, -YG, -YH, -YI, -YJ, -YK, -YL, -YM, -YN, -YO, -YP, -YQ, -YR, -YS, -YT, -YU, -YV, -YW, -YX, -YY, -YZ, -ZA, -ZB, -ZC, -ZD, -ZE, -ZF, -ZG, -ZH, -ZI, -ZJ, -ZK, -ZL, -ZM, -ZN, -ZO, -ZP, -ZQ, -ZR, -ZS, -ZT, -ZU, -ZV, -ZW, -ZX, -ZY, -ZZ

RCA VICTOR—Cont.

8BX65 (See Model 8BX6) 44
 8F43 (Ch. RC-1037B) 97—13

8PCS41, 8PCS41B, 8PCS41C (Ch. RC524B-1, KRK1-1, KR520A-1, KR520B-1, KR521A-1, RS-123C) Tel. Rec. 90—9

8R71 (Ch. RC-1060), 8R72 (Ch. RC-1060A) 53—20
 8R74, 8R75, 8R76 (Ch. RC-1060, A) (See Model 8R71) 53

8T21, 8T245, 8T244 (Ch. KCS28) Tel. Rec. 74—8

8T270 (Ch. KCS29, KCS29A) Tel. Rec. 85—13

8TC270, 8TC271 (Ch. KCS29, KCS29A) Tel. Rec. (See Model 8T270) 85

8TK29 (Ch. KCS32, KCS32A, KCS32B, KCS32C, RK135, RK135A) Tel. Rec. 88—9

8TK320 (Ch. KCS33A-1) (Radio Ch. RK-135A-1) Tel. Rec. (See Model 8T270) 85

8TR29 (Ch. KCS32, KCS32A, KCS32B, KCS32C, RK135, RK135A) Tel. Rec. (See Model 8TK29) 88

8T530 Tel. Rec. (See Model 630TS) 54

8TV41 (Ch. KCS25D-1, KCS25E-2, RK117A, RS-123A) Tel. Rec. *

8TV321, 8TV321B, 8TV323, 8TV323B (Ch. KCS30-1) (Radio Ch. RC616B, C, J, K) Tel. Rec. (See Model 8T241) 74

8V7 (Ch. RC-615) (See Model 630TS) 38

8V90 (Ch. RC-618A, RC-616A, RC-616B, RC-616C, RC-616D, RC-616E, RC-616F, RC-616G, RC-616H, RC-616I, RC-616J, RC-616K, RC-616L, RC-616M, RC-616N, RC-616O, RC-616P, RC-616Q, RC-616R, RC-616S, RC-616T, RC-616U, RC-616V, RC-616W, RC-616X, RC-616Y, RC-616Z, RC-616AA, RC-616AB, RC-616AC, RC-616AD, RC-616AE, RC-616AF, RC-616AG, RC-616AH, RC-616AI, RC-616AJ, RC-616AK, RC-616AL, RC-616AM, RC-616AN, RC-616AO, RC-616AP, RC-616AQ, RC-616AR, RC-616AS, RC-616AT, RC-616AU, RC-616AV, RC-616AW, RC-616AX, RC-616AY, RC-616AZ, RC-616BA, RC-616BB, RC-616BC, RC-616BD, RC-616BE, RC-616BF, RC-616BG, RC-616BH, RC-616BI, RC-616BJ, RC-616BK, RC-616BL, RC-616BM, RC-616BN, RC-616BO, RC-616BP, RC-616BQ, RC-616BR, RC-616BS, RC-616BT, RC-616BU, RC-616BV, RC-616BW, RC-616BX, RC-616BY, RC-616BZ, RC-616CA, RC-616CB, RC-616CC, RC-616CD, RC-616CE, RC-616CF, RC-616CG, RC-616CH, RC-616CI, RC-616CJ, RC-616CK, RC-616CL, RC-616CM, RC-616CN, RC-616CO, RC-616CP, RC-616CQ, RC-616CR, RC-616CS, RC-616CT, RC-616CU, RC-616CV, RC-616CW, RC-616CX, RC-616CY, RC-616CZ, RC-616DA, RC-616DB, RC-616DC, RC-616DD, RC-616DE, RC-616DF, RC-616DG, RC-616DH, RC-616DI, RC-616DJ, RC-616DK, RC-616DL, RC-616DM, RC-616DN, RC-616DO, RC-616DP, RC-616DQ, RC-616DR, RC-616DS, RC-616DT, RC-616DU, RC-616DV, RC-616DW, RC-616DX, RC-616DY, RC-616DZ, RC-616EA, RC-616EB, RC-616EC, RC-616ED, RC-616EE, RC-616EF, RC-616EG, RC-616EH, RC-616EI, RC-616EJ, RC-616EK, RC-616EL, RC-616EM, RC-616EN, RC-616EO, RC-616EP, RC-616EQ, RC-616ER, RC-616ES, RC-616ET, RC-616EU, RC-616EV, RC-616EW, RC-616EX, RC-616EY, RC-616EZ, RC-616FA, RC-616FB, RC-616FC, RC-616FD, RC-616FE, RC-616FF, RC-616FG, RC-616FH, RC-616FI, RC-616FJ, RC-616FK, RC-616FL, RC-616FM, RC-616FN, RC-616FO, RC-616FP, RC-616FQ, RC-616FR, RC-616FS, RC-616FT, RC-616FU, RC-616FV, RC-616FW, RC-616FX, RC-616FY, RC-616FZ, RC-616GA, RC-616GB, RC-616GC, RC-616GD, RC-616GE, RC-616GF, RC-616GG, RC-616GH, RC-616GI, RC-616GJ, RC-616GK, RC-616GL, RC-616GM, RC-616GN, RC-616GO, RC-616GP, RC-616GQ, RC-616GR, RC-616GS, RC-616GT, RC-616GU, RC-616GV, RC-616GW, RC-616GX, RC-616GY, RC-616GZ, RC-616HA, RC-616HB, RC-616HC, RC-616HD, RC-616HE, RC-616HF, RC-616HG, RC-616HH, RC-616HI, RC-616HJ, RC-616HK, RC-616HL, RC-616HM, RC-616HN, RC-616HO, RC-616HP, RC-616HQ, RC-616HR, RC-616HS, RC-616HT, RC-616HU, RC-616HV, RC-616HW, RC-616HX, RC-616HY, RC-616HZ, RC-616IA, RC-616IB, RC-616IC, RC-616ID, RC-616IE, RC-616IF, RC-616IG, RC-616IH, RC-616IJ, RC-616IK, RC-616IL, RC-616IM, RC-616IN, RC-616IO, RC-616IP, RC-616IQ, RC-616IR, RC-616IS, RC-616IT, RC-616IU, RC-616IV, RC-616IW, RC-616IX, RC-616IY, RC-616IZ, RC-616JA, RC-616JB, RC-616JC, RC-616JD, RC-616JE, RC-616JF, RC-616JG, RC-616JH, RC-616JI, RC-616JJ, RC-616JK, RC-616JL, RC-616JM, RC-616JN, RC-616JO, RC-616JP, RC-616JQ, RC-616JR, RC-616JS, RC-616JT, RC-616JU, RC-616JV, RC-616JW, RC-616JX, RC-616JY, RC-616JZ, RC-616KA, RC-616KB, RC-616KC, RC-616KD, RC-616KE, RC-616KF, RC-616KG, RC-616KH, RC-616KI, RC-616KJ, RC-616KK, RC-616KL, RC-616KM, RC-616KN, RC-616KO, RC-616KP, RC-616KQ, RC-616KR, RC-616KS, RC-616KT, RC-616KU, RC-616KV, RC-616KW, RC-616KX, RC-616KY, RC-616KZ, RC-616LA, RC-616LB, RC-616LC, RC-616LD, RC-616LE, RC-616LF, RC-616LG, RC-616LH, RC-616LI, RC-616LJ, RC-616LK, RC-616LL, RC-616LM, RC-616LN, RC-616LO, RC-616LP, RC-616LQ, RC-616LR, RC-616LS, RC-616LT, RC-616LU, RC-616LV, RC-616LW, RC-616LX, RC-616LY, RC-616LZ, RC-616MA, RC-616MB, RC-616MC, RC-616MD, RC-616ME, RC-616MF, RC-616MG, RC-616MH, RC-616MI, RC-616MJ, RC-616MK, RC-616ML, RC-616MM, RC-616MN, RC-616MO, RC-616MP, RC-616MQ, RC-616MR, RC-616MS, RC-616MT, RC-616MU, RC-616MV, RC-616MW, RC-616MX, RC-616MY, RC-616MZ, RC-616NA, RC-616NB, RC-616NC, RC-616ND, RC-616NE, RC-616NF, RC-616NG, RC-616NH, RC-616NI, RC-616NJ, RC-616NK, RC-616NL, RC-616NM, RC-616NN, RC-616NO, RC-616NP, RC-616NQ, RC-616NR, RC-616NS, RC-616NT, RC-616NU, RC-616NV, RC-616NW, RC-616NX, RC-616NY, RC-616NZ, RC-616OA, RC-616OB, RC-616OC, RC-616OD, RC-616OE, RC-616OF, RC-616OG, RC-616OH, RC-616OI, RC-616OJ, RC-616OK, RC-616OL, RC-616OM, RC-616ON, RC-616OO, RC-616OP, RC-616OQ, RC-616OR, RC-616OS, RC-616OT, RC-616OU, RC-616OV, RC-616OW, RC-616OX, RC-616OY, RC-616OZ, RC-616PA, RC-616PB, RC-616PC, RC-616PD, RC-616PE, RC-616PF, RC-616PG, RC-616PH, RC-616PI, RC-616PJ, RC-616PK, RC-616PL, RC-616PM, RC-616PN, RC-616PO, RC-616PP, RC-616PQ, RC-616PR, RC-616PS, RC-616PT, RC-616PU, RC-616PV, RC-616PW, RC-616PX, RC-616PY, RC-616PZ, RC-616QA, RC-616QB, RC-616QC, RC-616QD, RC-616QE, RC-616QF, RC-616QG, RC-616QH, RC-616QI, RC-616QJ, RC-616QK, RC-616QL, RC-616QM, RC-616QN, RC-616QO, RC-616QP, RC-616QQ, RC-616QR, RC-616QS, RC-616QT, RC-616QU, RC-616QV, RC-616QW, RC-616QX, RC-616QY, RC-616QZ, RC-616RA, RC-616RB, RC-616RC, RC-616RD, RC-616RE, RC-616RF, RC-616RG, RC-616RH, RC-616RI, RC-616RJ, RC-616RK, RC-616RL, RC-616RM, RC-616RN, RC-616RO, RC-616RP, RC-616RQ, RC-616RR, RC-616RS, RC-616RT, RC-616RU, RC-616RV, RC-616RW, RC-616RX, RC-616RY, RC-616RZ, RC-616SA, RC-616SB, RC-616SC, RC-616SD, RC-616SE, RC-616SF, RC-616SG, RC-616SH, RC-616SI, RC-616SJ, RC-616SK, RC-616SL, RC-616SM, RC-616SN, RC-616SO, RC-616SP, RC-616SQ, RC-616SR, RC-616SS, RC-616ST, RC-616SU, RC-616SV, RC-616SW, RC-616SX, RC-616SY, RC-616SZ, RC-616TA, RC-616TB, RC-616TC, RC-616TD, RC-616TE, RC-616TF, RC-616TG, RC-616TH, RC-616TI, RC-616TJ, RC-616TK, RC-616TL, RC-616TM, RC-616TN, RC-616TO, RC-616TP, RC-616TQ, RC-616TR, RC-616TS, RC-616TU, RC-616TV, RC-616TW, RC-616TX, RC-616TY, RC-616TZ, RC-616UA, RC-616UB, RC-616UC, RC-616UD, RC-616UE, RC-616UF, RC-616UG, RC-616UH, RC-616UI, RC-616UJ, RC-616UK, RC-616UL, RC-616UM, RC-616UN, RC-616UO, RC-616UP, RC-616UQ, RC-616UR, RC-616US, RC-616UT, RC-616UU, RC-616UV, RC-616UW, RC-616UX, RC-616UY, RC-616UZ, RC-616VA, RC-616VB, RC-616VC, RC-616VD, RC-616VE, RC-616VF, RC-616VG, RC-616VH, RC-616VI, RC-616VJ, RC-616VK, RC-616VL, RC-616VM, RC-616VN, RC-616VO, RC-616VP, RC-616VQ, RC-616VR, RC-616VS, RC-616VT, RC-616VU, RC-616VV, RC-616VW, RC-616VX, RC-616VY, RC-616VZ, RC-616WA, RC-616WB, RC-616WC, RC-616WD, RC-616WE, RC-616WF, RC-616WG, RC-616WH, RC-616WI, RC-616WJ, RC-616WK, RC-616WL, RC-616WM, RC-616WN, RC-616WO, RC-616WP, RC-616WQ, RC-616WR, RC-616WS, RC-616WT, RC-616WU, RC-616WV, RC-616WW, RC-616WX, RC-616WY, RC-616WZ, RC-616XA, RC-616XB, RC-616XC, RC-616XD, RC-616XE, RC-616XF, RC-616XG, RC-616XH, RC-616XI, RC-616XJ, RC-616XK, RC-616XL, RC-616XM, RC-616XN, RC-616XO, RC-616XP, RC-616XQ, RC-616XR, RC-616XS, RC-616XT, RC-616XU, RC-616XV, RC-616XW, RC-616XX, RC-616XY, RC-616XZ, RC-616YA, RC-616YB, RC-616YC, RC-616YD, RC-616YE, RC-616YF, RC-616YG, RC-616YH, RC-616YI, RC-616YJ, RC-616YK, RC-616YL, RC-616YM, RC-616YN, RC-616YO, RC-616YP, RC-616YQ, RC-616YR, RC-616YS, RC-616YT, RC-616YU, RC-616YV, RC-616YW, RC-616YX, RC-616YY, RC-616YZ, RC-616ZA, RC-616ZB, RC-616ZC, RC-616ZD, RC-616ZE, RC-616ZF, RC-616ZG, RC-616ZH, RC-616ZI, RC-616ZJ, RC-616ZK, RC-616ZL, RC-616ZM, RC-616ZN, RC-616ZO, RC-616ZP, RC-616ZQ, RC-616ZR, RC-616ZS, RC-616ZT, RC-616ZU, RC-616ZV, RC-616ZW, RC-616ZX, RC-616ZY, RC-616ZZ

RCA VICTOR—Cont.

54B1, 54B1-N, 54B2, 54B3 (Ch. RC589) 7—22
 54B5 (Ch. RC1047) 17—25
 55A1 (Ch. RC1017) 2—16
 55U (See Model 55AU) 4
 55F (Ch. RC-1004E) 4—6
 55FA (See Model 55F) 4
 56X, 56X2, 56X3 (Ch. RC-1011) 1—16
 56X5 (See Model 56X10) 1
 56X10 (Ch. RC-1023B) 1—12
 58AV, 58V (Ch. RC-604) 1—32
 59AV1, 59V1 (Ch. RC-605) 6—25
 63E (64F2 (Ch. RC1037), 64F1, RS-127) 28—28
 64F3 (Ch. RC1037A) 4—16
 65B89 (Ch. RC-1045) 23—16
 65F (See Model 55F) 4
 65AU (Ch. No. RC-1017A) 14—23
 65U, 65U-1 (See Model 65AU) 14
 65X1, 65X2 (Ch. RC-1034) 4—30
 65X1, 65X2 (Ch. RC-1064) 31—26
 65X8, 65X9 (See Model 65X1) 4
 66B8 (Ch. RC-1040, RC-1040A) 14—24
 66E (Ch. RS-126) 17—26
 66X1, 66X2, 66X3, 66X4, 66X7, 66X8, 66X9 (See Model 66X1) 7
 66X11 (Ch. RC-1046A), 66X12 (Ch. RC-1046), 66X13, 66X14, 66X15 (Ch. RC-1046B) 27—20
 67V1, 67AV1 (Ch. RC-606) 9—27
 68R1, 68R2, 68R3, 68R4 (Ch. RC-608) 23—17
 75X11, 75X12 (Ch. RC-1050) 33—21
 75X14, 75X15 (Ch. RC-1050) (See Model 75X11) 33
 75X16, 75X17, 75X18, 75X19 (Ch. RC-1050B) (See Model 75X11) 33
 77U (Ch. RC-1057A) 38—17
 77V1 (Ch. RC-615) 38—18
 77V2 (Ch. RC-606-C) 39—18
 610V1 (Ch. RC610C) 610V2 (Ch. RC610) 31—27
 612V1, 612V2, 612V3 (Ch. RK-121, RS-123) 17—27
 612V4 (See Model 612V1) 17
 621TS (Ch. KCS21-1) Tel. Rec. (Servicer) 78
 630TCS Tel. Rec. (See Model 630TS) 54
 630TS Tel. Rec. 54—18
 641TV (Ch. KCS24A-1, KCS25C-2, RK117A, RS-123A) Tel. Rec. 91A-11
 648PTK (Ch. KCS24-1, KRK1-1, KR520-1, KR521A-1, RK-121A, RS-123A) Tel. Rec. (See Model 8PCS41) 90
 648PV (Ch. KCS24A-1, KRK1-A, KR520-1, KR521A-1, RK-121A, RS-123B) Tel. Rec. (See Model 8PCS41) 90
 710V2 (Ch. RC-613A) 40—15
 711V1 (See Model 711V2) 22
 711V2, 711V3 (Ch. RK-117 & RS-123) 22—24
 721TCS (Ch. KCS26-1, 2) Tel. Rec. (See Model 730TV1) 70
 730TV1 (Ch. KCS27, RC610A) Tel. Rec. 70—7
 730TV2 (Ch. KCS27, RC610B) Tel. Rec. (See Model 730TV1) 70
 741PCS (Ch. KCS24B-1, KRK1-A-1, KR520A-1, KR521A-1, RS-123C) Tel. Rec. (See Model 8PCS41) 90
 Ch. KCS-20A 54
 Ch. KCS-20B-1 54
 Ch. KCS-20J-1 54
 Ch. KCS-20K-1 54
 Ch. KCS-20L-1 54
 Ch. KCS-20M-1 54
 Ch. KCS-20N-1 54
 Ch. KCS-20O-1 54
 Ch. KCS-20P-1 54
 Ch. KCS-20Q-1 54
 Ch. KCS-20R-1 54
 Ch. KCS-20S-1 54
 Ch. KCS-20T-1 54
 Ch. KCS-20U-1 54
 Ch. KCS-20V-1 54
 Ch. KCS-20W-1 54
 Ch. KCS-20X-1 54
 Ch. KCS-20Y-1 54
 Ch. KCS-20Z-1 54
 Ch. KCS-20AA-1 54
 Ch. KCS-20AB-1 54
 Ch. KCS-20AC-1 54
 Ch. KCS-20AD-1 54
 Ch. KCS-20AE-1 54
 Ch. KCS-20AF-1 54
 Ch. KCS-20AG-1 54
 Ch. KCS-20AH-1 54
 Ch. KCS-20AI-1 54
 Ch. KCS-20AJ-1 54
 Ch. KCS-20AK-1 54
 Ch. KCS-20AL-1 54
 Ch. KCS-20AM-1 54
 Ch. KCS-20AN-1 54
 Ch. KCS-20AO-1 54
 Ch. KCS-20AP-1 54
 Ch. KCS-20AQ-1 54
 Ch. KCS-20AR-1 54
 Ch. KCS-20AS-1 54
 Ch. KCS-20AT-1 54
 Ch. KCS-20AU-1 54
 Ch. KCS-20AV-1 54
 Ch. KCS-20AW-1 54
 Ch. KCS-20AX-1 54
 Ch. KCS-20AY-1 54
 Ch. KCS-20AZ-1 54
 Ch. KCS-20BA-1 54
 Ch. KCS-20BB-1 54
 Ch. KCS-20BC-1 54
 Ch. KCS-20BD-1 54
 Ch. KCS-20BE-1 54
 Ch. KCS-20BF-1 54
 Ch. KCS-20BG-1 54
 Ch. KCS-20BH-1 54
 Ch. KCS-20BI-1 54
 Ch. KCS-20BJ-1 54
 Ch. KCS-20BK-1 54
 Ch. KCS-20BL-1 54
 Ch. KCS-20BM-1 54
 Ch. KCS-20BN-1 54
 Ch. KCS-20BO-1 54
 Ch. KCS-20BP-1 54
 Ch. KCS-20BQ-1 54
 Ch. KCS-20BR-1 54
 Ch. KCS-20BS-1 54
 Ch. KCS-20BT-1 54
 Ch. KCS-20BU-1 54
 Ch. KCS-20BV-1 54
 Ch. KCS-20BW-1 54
 Ch. KCS-20BX-1 54
 Ch. KCS-20BY-1 54
 Ch. KCS-20BZ-1 54
 Ch. KCS-20CA-1 54
 Ch. KCS-20CB-1 54
 Ch. KCS-20CC-1 54
 Ch. KCS-20CD-1 54
 Ch. KCS-20CE-1 54
 Ch. KCS-20CF-1 54
 Ch. KCS-20CG-1 54
 Ch. KCS-20CH-1 54
 Ch. KCS-20CI-1 54
 Ch. KCS-20CJ-1 54
 Ch. KCS-20CK-1 54
 Ch. KCS-20CL-1 54
 Ch. KCS-20CM-1 54
 Ch. KCS-20CN-1 54
 Ch. KCS-20CO-1 54
 Ch. KCS-20CP-1 54
 Ch. KCS-20CQ-1 54
 Ch. KCS-20CR-1 54
 Ch. KCS-20CS-1 54
 Ch. KCS-20CT-1 54
 Ch. KCS-20CU-1 54
 Ch. KCS-20CV-1 54
 Ch. KCS-20CW-1 54
 Ch. KCS-20CX-1 54
 Ch. KCS-20CY-1 54
 Ch. KCS-20CZ-1 54
 Ch. KCS-20DA-1 54
 Ch. KCS-20DB-1 54
 Ch. KCS-20DC-1 54
 Ch. KCS-20DD-1 54
 Ch. KCS-20DE-1 54
 Ch. KCS-20DF-1 54
 Ch. KCS-20DG-1 54
 Ch. KCS-20DH-1 54
 Ch. KCS-20DI-1 54
 Ch. KCS-20DJ-1 54
 Ch. KCS-20DK-1 54
 Ch. KCS-20DL-1 54
 Ch. KCS-20DM-1 54
 Ch. KCS-20DN-

RADIO WIRE TELEVISION
(See Lafayette)

RAULAND

BA21 87-10
W-819-A 43-16
1814 93-13
1820 100-10
1821, 1822 59-17
1825 97-14
1835 60-17
1841 58-19

2100-S (Sub-station)
(See Model 2101-A) 39
2101-A (Master Station) 39-20
2105 (Master Station) 36-21
2206, 2206H, 2212,
2212H, 2218, 2218H,
2226, 2224H 80-13
2306, 2312, 2324
(See Model BA21) 87
2400 Series 33-22

RAY ENERGY

AD 7-24
AD4 7-25
SRB-1X 13-26

RAYTHEON (Also See Belmont)

A-7DX22P Tel. Rec.
(See Model 7DX21) 81
Models A-10DX24,
B-10DX22 Tel. Rec. 75-14
A-10DX24, B-10DX22
Tel. Rec. Prod. Chge.
Bul. 1 103-19
C1102 (Ch. 12AX22)
Tel. Rec. 94-8
C1102, C1104 (Ch. 12AX
22) Tel. Rec. Prod.
Chge. Bul. 3 105-1
C1104 (Ch. 12AX22) Tel.
Rec. (See Model C1102) 94
C-1104B (Ch. 12AX22)
Tel. Rec. 93A-13
C-1401 (Ch. 14AX21)
Tel. Rec. 123-12
C1602 (Ch. 16AX23, 25,
26) Tel. Rec. 99-14
C-1602 (Ch. 16AX22,
16AX25, 16AX26),
C1602 Series 2 (Ch.
16AX29) Tel. Rec.
Prod. Chge. Bul. 16 126-1
C-1615A (Ch. 16AY211),
C-1615B (Ch. 16AY28)
Tel. Rec. 124-8
C-1616A (Ch. 16AY211),
C-1616B (Ch. 16AY28)
Tel. Rec. (See
Model C-1615A) 124
C-1714B (Ch. 17AY21)
Tel. Rec. (See
Model C-1615A) 124
C-1715A (Ch. 17AY24),
C-1715B (Ch. 17AY21)
Tel. Rec. (See
Model C-1615A) 124
C-1716A (Ch. 17AY24),
C-1716B (Ch. 17AY21)
Tel. Rec. (See
Model C-1615A) 124
C-1718A, C-1719A (Ch.
17AY24) Tel. Rec.
(See Model C-1615A) 124
M701 (Ch. 10AX22) Tel.
Rec. (See Model C1102) 94
M701 (Ch. 10AX22) Tel.
Rec. Prod. Chge. Bul. 3 105-1
M1101 (Ch. 12AX22) Tel.
Rec. (See Model C1102) 94
M1101, M1103, M1105
(Ch. 12AX22) Tel. Rec.
Prod. Chge. Bul. 3 105-1
M1103 (Ch. 12AX22) Tel.
Rec. (See Model C1102) 94
M1105 (Ch. 12AX22) Tel.
Rec. (See Model C1102) 94
M-1105B, M-1106, M-1107
(Ch. 12AX27) Tel. Rec.
(See Model C1102) 93A
M-1402, M-1403, M-1404
(Ch. 14AX21) Tel. Rec.
(See Model C-1401) 123
M-1601 (Ch. 16AX23, 25,
26) Tel. Rec.
(See Model C1602) 99
M-1611A (Ch. 16AY211),
M-1611B (Ch. 16AY28)
Tel. Rec. (See Model
C-1615A) 124
M-1612A (Ch. 16AY211),
M-1612B (Ch. 16AY28)
Tel. Rec. (See Model
C-1615A) 124
M-1613A (Ch. 16AY211),
M-1613B (Ch. 16AY28)
Tel. Rec. (See Model
C-1615A) 124
M-1614A (Ch. 16AY211),
M-1614B (Ch. 16AY28)
Tel. Rec. (See Model
C-1615A) 124
M-1711A (Ch. 17AY24),
M-1711B (Ch. 17AY21)
Tel. Rec. (See Model
C-1615A) 124
M-1712A (Ch. 17AY24),
M-1712B (Ch. 17AY21)
Tel. Rec. (See Model
C-1615A) 124
M-1713A (Ch. 17AY24),
M-1713B (Ch. 17AY21)
Tel. Rec. (See Model
C-1615A) 124
M-1714A (Ch. 17AY24)
Tel. Rec. (See Model
C-1615A) 124
P-301 (See Model 7DX21)
Tel. Rec. 81

RAYTHEON—Cont.

RC-1405 (Ch. 14AX21)
Tel. Rec. 14-27
RC-1618A (Ch. 16AY211),
RC-1618B (Ch. 16AY24)
Tel. Rec. (See Model
C-1615A) 124
RC-1619A (Ch. 16AY211),
RC-1619B (Ch. 16AY28)
Tel. Rec. (See Model
C-1615A) 124
RC-1718B, RC-1719B (Ch.
17AY21) Tel. Rec. (See
Model C-1615A) 124
7DX21, 7DX22P Tel. Rec. 81-13
10AXF43 Tel. Rec. 75
10AXF43, 10DX22 Tel.
Rec. Prod. Chge. Bul. 1 103-19
10AXF44 Tel. Rec. (See
Model C-1102 (Set 94)
and Model A-10DX24
(Set 75)) 75
10DX21, 10DX22 Tel. Rec.
(See Model A-10DX24) 75
10DX24 Tel. Rec. 75
18DX21A Tel. Rec. 81
(See 7DX21) 81
Ch. 10AX22 (See Model
M701) 94
Ch. 12AX22 (See Model
C1102) 94
Ch. 14AX21 Tel. Rec. 99
Ch. 16AX23, 25, 26
(See Model C1602) 99
Ch. 16AY28 (See Model
C-1615B) 124
Ch. 16AY210 Tel. Rec. 124
Ch. 16AY211 (See Model
C-1615A) 124
Ch. 17AY21 (See Model
C-1714B) 124
Ch. 17AY24 (See Model
C-1715A) 124

RECORDIO (Wilcox-Gay)

6A10, 6A20 (Ch. 6A) 10-27
6B10, 6B20, 6B30, 6B32 8-27
7D42, 7D44 (Ch. 7D1) 52-18
7E40, 7E44 47-20
8J10, 8J50 91-10
9G10 91-10
9G40M, 9G42 86-9
9H40B 89-13
Ch. 6A (See Model 6A10) 10
Ch. 7D1 (See Model 7D42) 52

REGAL (TOK-FONE)

Tok-Fone (20-watt Amp.) 13-27
A-16731 Tel. Rec. 15-26
AP40, ARP400, ARP450 49-18
BP48 49-18
CD31 Tel. Rec. 80
(See Model 16731) 80
CD36 Tel. Rec. 50-16
CR761 68-14
FM78 5-18
L-76 14
W700 (See Model W800) 14
W800, W801 14-26
W900, W901 13-28
16731 Tel. Rec. 80-14
16736 Tel. Rec. 26-23
205 26-23
208 (See Model W800) 14
247 27-22
777 53-21
1007 Tel. Rec. 83-9
1030, 1031 Tel. Rec. 80
(See Model 16731) 80
1049 17-28
1107 41-19
1207, 1208 Tel. Rec. 83
(See Model 1007) 83
1230 Tel. Rec. 80
(See Model 16731) 80
1500 38-19
1607 Tel. Rec. 83
(See Model 1007) 83
1749 26-29
7152 70-8
7162 69-12
7163 66-14
7251 40-16

REMBRANDT

80 Tel. Rec.
130 Tel. Rec.
721, 1606, 1606-15,
1950 Tel. Rec. 65-11

REMLER

MP5-5-3 8-28
5300B, 5300B1, 53001 23-18
5310 40-17
5400, 5410 44-19
5500 "Scottie Pup" 27-23
5505, 5510, 5515 "Scottie
Pup" (See Model 5500) 27
5520, 5530 "Scottie Jun-
ior" (See Model 5500) 27
6000 77-9

RENARD

L-1A, PT-1A, 1B5T-1 9-28

SCOTT (E. H.)

Musicole 44-20
Music Control, Dymonic
Noise Suppressor 46-21
6T11, 6T11A Television
Receiver 52-19
6T11, 6T11A Tel. Rec.
Prod. Chge. Bul. 4 105-2
13A Tel. Rec. 40-18
16A Tel. Rec. 40-18
300 Tel. Rec. 99-15
400 Tel. Rec. 52
(See Model 6T11) 52
400 Tel. Rec. Prod. Chge.
Bul. 4 105-2

SCOTT—Cont.

510 103-14
800-B 14-27
800BT Tel. Rec. (See
Model 6T11 (Set 52)
and Model 800B Set 14)
800BT Tel. Rec. Prod.
Chge. Bul. 4 105-2

SCOTT (H. H.)

210-A 79-15
211-A 81-14

SEARS-ROEBUCK
(See Silvertone)

SENTINEL

*U-284GA (See Model
284GA) 22
1U-2841, 1U-284NA,
1U-284N1, 1U-284W
(See Model 2841) 1
1U-285P (See Model 285P) 6
1U-293CT (See Model
293CT) 29
1U-2931, 1U-293T,
1U-293W (See Model
294 Series) 1
1U-2941, 1U-294N,
1U-294T (See Model
294 Series) 1
1U312PG, 1U312PW 103-15
1U-3131, 1U-313W
(See Model 3131) 39
1U-314E, 1U-314I,
1U-314W (See Model
314E) 38
1U-316PM, 1U-316PT
(See Model 316PM) 48
1U-325PC, P1, P4, P4W, P105-9
1U338-W 122-9
1U339-K 111-12
1U416 Tel. Rec. 117-12
1U419, 1U420 Tel. Rec. 115-9
1U420B Tel. Rec. 124-9
1U423, 1U424 Tel. Rec.
(See Model 1U420B) 124
1U425 Tel. Rec. (See
Model 1U425) 127
1U432 Tel. Rec. (See
Model 1U425) 127
L-2841, L-284NA, L-284N1,
L-284NR, L-284W 23-19
284GA 22-25
284I 1-2
(See Model 284I) 1
285P 6-27
286P, 286PR 23-20
289T 6-28
292K 16-30
293 Series 1-14
293-CT 29-22
2931, 293T, 293W 1-11
294 Series 1-11
2941, 294N, 294T
(See Model 294 Series) 1
295-T 22-26
296B, 296M 46-22
302-I, 302-T, 302-W 33-23
305-I, 305-I-3, 305-W,
305-W3 33-24
309-I, 309N, 309-R, 28-30
312PG, 312 PW (See Model
1U312PG) 103
313-I, 313-W 39-21
314-E, 314-I, 314-W 38-21
315-I, 315-W 40-19
316PM, 316PT 48-22
332 (See Model 313-I) 39
333 (See Model 315-I) 40
335P, P1, P4, P4W (See
Model 1U-335PG) 105
338-I, 338-R, 338-W (See
Model 1U338) 122
339-K
(See Model 1U339-K) 111
400TV Tel. Rec. 73-11
401, 402 Series Tel. Rec. 70-9
403STM Tel. Rec. 73
(See Model 400TV) 73
406 Series Tel. Rec.
(See Model 401 Series) 70
407 Series Tel. Rec.
409 Series Tel. Rec.
411 Series Tel. Rec.
(See Model 401 Series) 70
412, 413, 414, 415 (Series
YA, YB, YC, YD, YE, YF)
Tel. Rec. 100-11
412, 413, 414, 415 Tel.
Rec. Prod. Chge. Bul. 4 105-2
416 Tel. Rec.
(See Model 1U416) 117
419, 420 Tel. Rec.
(See Model 1U419) 115
420B Tel. Rec. (See Model
1U420B) 124
423, 424 Tel. Rec. (See
Model 1U420B) 124
425 Tel. Rec. (See
Model 1U425) 127
428 Tel. Rec. (See Model
1U425) 127
432 Tel. Rec. (See Model
1U425) 127

SETCHELL-CARLSON

416 2-14
427 21-29
437 39-22
447 40-20
458-RD 106-13
469 99-15
570 97-15

SHERIDAN ELECTRONICS
(See Vogue)

SIGNAL

AF252 37-19
441 44-21
241 33-25
341-A 39-23
341-T 25-25

SILVERTONE

1, 2 (Ch. 132.878) 101-10
33 (Ch. 548.363) 111-13
41, 41A (Ch. 135.245) 101-11
51, 53 (Ch. 132.887) 112-8
54, 56 (Ch. 132.888) 115-10
64, 65 (Ch. 101.859-2) 113-8
101 (Ch. 549.100), 101A
(Ch. 549.100-1) Tel. Rec.
105 (Ch. 132.882) 102-12
Tel. Rec.
106 (Ch. 132.889)
Tel. Rec.
108 (Ch. 549.100) Tel.
Rec. (See Model 101) 102
112 (Ch. 478.289)
Tel. Rec. 118-9
120 (Ch. 478.311)
Tel. Rec. 115-11
122 (Ch. 478.289)
Tel. Rec.
125 (Ch. 478.257) Tel.
Rec. 104-10
133 (Ch. 100.043)
Tel. Rec.
138 (Ch. 549.100-3)
Tel. Rec. 99A-10
143A (Ch. 100.111)
Tel. Rec. 121-12
159 (Ch. 478.309) Tel.
Rec. (See Model 120) 115
160-12 (Ch. 549.100-4)
Tel. Rec. 97A-12
161-16 (Ch. 100.112)
Tel. Rec. 99A-10
179-16 (Ch. 132.890)
Tel. Rec.
180-16 (Ch. 132.890)
Tel. Rec.
194-16 (Ch. 132.890)
Tel. Rec.
195-16 (Ch. 132.890)
Tel. Rec.
210 (Ch. 132.890) 109-12
215 (Ch. 528.174) 117-13
220 (Ch. 528.173) 110-13
225 (Ch. 528.171-1) 107-8
239 (Ch. 548.360-1) 115-12
245 (Ch. 548.358-1) 107-9
246 (Ch. 137.906) 111-14
249 (Ch. 548.360-1)
(See Model 239) 115
1300 (Ch. 319.200-1) 90-10
1300-1 (Ch. 319.200-1) 90-10
1304 (Ch. 185.706) 5-35
6002 (Ch. 132.814)
6011 (Ch. 132.816) 15-27
6012 (Ch. 132.816A) 27-24
6050 (Ch. 132.825-4) 15-28
6051 (Ch. 110.451) 13-29
6052 (Ch. 110.452) 13-29
6071 (Ch. 132.826-1) 15-29
6072 (Ch. 110.454) 13-30
6092 (Ch. 101.672-1A)
6093 (Ch. 101.672-1A) 10-28
6100 (Ch. 101.660-1A) 6-29
6104 (Ch. 101.662-2D)
(See Model 6103) 7
6105 (Ch. 101.662-2B) 7-26
6106A (Ch. 101.662-4E) 29-23
6111 (Ch. 101.662-3C)
(See Model 6105) 7
6111A (Ch. 101.662-5F)
(See Model 6106A) 29
6200A (Ch. 101.800-3) 65-12
6200A (Ch. 101.800-1) 9-29
6203 (Ch. 101.801) 9
(See Model 6200A) 9
6220, 6220A (Ch. Nos.
101.801, 101.801-A) 9-30
6230 (Ch. 101.802)
6230 (Ch. 101.802-1) 11-21
6285A (Ch. 101.666-1B) 20-28
6290 (Ch. 101.677-8) 20-29
6293 (Ch. 528.6293-2) 99-16
6295 (Ch. 528.6295) 99-12
6685 (Ch. 139.150,
Ch. 139.150-1) 13-30
Power Shifter
7010
7011
7012
7013
7014
7017
7020 (See Model 7021) 16
7021 (Ch. 101.807,
101.807A) 16-31
7025 (Ch. 132.807-2) 29-24
7054 (Ch. 101.808) 15-31
7070 (Ch. 101.817) 30-26
7080 (Ch. 101.809) 30-32
7081, 7080A (Ch.
101.809-2) 58-20
7085 (Ch. 101.814) 30-27
7086 (Ch. 110.466) 27-25
7090 (Ch. 101.810) 13-32
7095 (Ch. 101.826)
(See Model 7115) 16
7100 (Ch. 101.817) 17-29
7102 (Ch. 101.814-1A)
(See Model 7085) 30
7103 (Ch. 110.466-1) 27
(See Model 7084) 30
7105, 7106
(Ch. 434.140) 30-28
7115 (Ch. 101.825)
7116 (Ch. 101.825-1A) 16-33
7117 (Ch. 101.825-1B) 16-33
7119 (Ch. 101.825-2C) 62-18

SILVERTONE—Cont.

7145 (Ch. 436.200) 23-21
7148 (Ch. 431.188)
7148A (Ch. 431.188-1) 23-22
7152 (Ch. 109.626) 25-26
7153 (Ch. 109.627) 26-30
7165 (Ch. 101.823-A, 1A),
7166 (Ch. 101.823,
101.823-1) 10-29
7210 (Ch. 101.820) 32-20
7220 (Ch. 161.801-2C)
(See 6220) 9
7226 (Ch. 101.819A) 31-28
7230 (Ch. 101.802-2A)
(See 6230) 11
7300 (Ch. 435.240) 45-22
7350 (Ch. 435.410) 38-22
7351
7352
7353 (See Model 7350) 38
8000 (Ch. 132.838) 31-29
8003 (Ch. 132.818-1) 53-22
8004 (See Model 8003) 53
8005 (Ch. 132.839) 33-26
8010 (Ch. 132.840) 40-21
8011 (See Model 8010) 40
8020 (Ch. 132.841) 43-17
8021 (Ch. 132.868) 70-10
8022
8024, 8025 (Ch.
478.206-1) 80-15
8050 (Ch. 101.813) 33-27
8051 (Ch. 101.839) 49-19
8052 (Ch. 101.808-1C) 68-15
8053 (Ch. 101.808-1D)
(See Model 8052) 68
8070 (Ch. 101.817-1A)
(See Model 7070) 30-26
8072
8072 (Ch. 101.834) 34-19
8073 (Ch. 135.243) 84-9
8080 (Ch. 101.852) 52-20
8083, 8083A (Ch.
101.809-1A) (See
Model 7080) 58
8084, 8084A (See
101.809-1B) (See
Model 7080) 58
8086 (Ch. 101.814-5C) 61-18
8086A, 8086B (Ch.
101.814-4C) (See
Model 8086) 61
8090 (Ch. 101.821) 49-20
8092
8097A (Ch. 101.825-4)
(See Model 7119) 62
8100 (Ch. 101.829) 51-19
8101, 8101A, 8101B,
8101C (Ch. 101.809-3C)
(See Model 7080) 58
8102 (Ch. 101.814-2B)
(See Model 8086) 61
8102A (Ch. 101.814-3B)
(See Model 8086) 61
8102B (Ch. 101.814-2B)
(See Model 8086) 61
8103 (Ch. 110.473) 56-21
8104 (See Model 8086) 61
8105, 8105A
(Ch. 101.833) 35-20
8106, 8106A (See
101.833-1A) (See
Model 8105) 35
8107A, 8108, 8108A (Ch.
101.851) 8109 (Ch.
101.851-1) 64-10
8112, 8113 (See
Model 8115) 62
8115 (Ch. 101.825-3D),
8115A, B, C (Ch.
101.825-4), 8117 (Ch.
101.825-3E), 8118, B,
C (Ch. 101.825-4) (See
Model 7119) 62
8124, 8125, 8126 (Ch.
101.831A, C)
101.831B (See
Model 8127) 41
8127, A, B, C (Ch.
101.831A), 8128, A, B,
C (Ch. 101.831), Wire
Recorder Amp. (Ch.
101.773) 41-20
8130 Television Receiver
8132 (Ch. 101.854)
Tel. Rec. 66-15
8133 (Ch. 101.829-1, Ch.
101.846) Tel. Rec.
(See Model 8132) 66
8144 (Ch. 431.199) 32-21
8145 (Ch. 109.631) 45-23
8148 (Ch. 109.632) 44-22
8149 (Ch. 109.633) 48-23
8150 (Ch. 109.634) 32-22
8151 (Ch. 109.635)
(See Model 8153) 42
8153 (Ch. 109.635)
8153A (Ch. 109.635-1) 42-22
8155 (Ch. 463.155) 57-17
8160 (Ch. 109.636)
8160A (Ch. 109.636A) 50-17
8168 (Ch. 109.638) 46-23
8169 (Ch. 109.638)
(See Model 8168) 46
8200 (Ch. 101.800-2B)
(See Model 6200A
[Ch. 101.800-3]) 65
8201 (See Model 6200A) 65
8210 (Ch. 101.820-1A) 71-13
8220, 8221 (Ch.
101.801-3D), 8222
(See 6220) 9
8230 (Ch. 101.835) 59-18
8231 (See Model 8230) 59
8260 (Ch. 101.823-2B)
(See Models 7155, 7166) 10-29
8270 (Ch. 101.822)
8270A (Ch. 101.822A) 57-18

SILVERTONE—STEWART-WARNER

SILVERTONE—Cont.

9000 (Ch. 132.857)..... 65-13
 9003, 9006 (Ch. 132.858) 72-11
 9022 (Ch. 132.871)..... 76-17
 9054 (Ch. 101.849)..... 63-16
 9073, 9073A (Ch. 135.244-1)..... 83-10
 135.244, 9073B
 (Ch. 135.244-1)..... 83-10
 9073C (Ch. 135.243-1)..... 83
 (See Model 9073)..... 83
 9082 (Ch. 135.245) (See Model 41)..... 101
 9101 (Ch. 101.809-3C) (See Model 7080)..... 58
 9102 (See Model 7080)..... 58
 9105 (Ch. 132.875)..... 89-14
 9107A (Ch. 101.851-1) (See Model 8107A)..... 64
 9115 (Ch. 478.224), 9116 (Ch. 478.221) Tel. Rec. 97-16
 9119, 9120 (Ch. 101.865) Tel. Rec.
 9120A (Ch. 101.865-1).....
 9121 (Ch. 101.867).....
 9122 (Ch. 101.864) (See Model 8132)..... 66
 9122A (Ch. 101.868).....
 9123 (Ch. 110.499), 9124 (Ch. 110.499-1), 9126 (Ch. 110.499-2)..... 79-16
 9125 (Ch. 478.252).....
 9125A (Ch. 478.253) Tel. Rec. (See Model 125)..... 104
 9128A (Ch. 101.868).....
 9131 (Ch. 478.210).....
 9133, 9134 (Ch. 101.866, Radio Ch. 101.859)..... 95-5
 9153 (Ch. 435.417)..... 67-16
 9161 (Ch. 548.358)..... 88-10
 9260 (Ch. 101.850)..... 51-20
 9270 (Ch. 547.245)..... 82-11
 9280 (Ch. 528.168)..... 94-9
 Ch. 100.043 (See Model 133).....
 Ch. 100.111 (See Model 143A)..... 121
 Ch. 100.112 (See Model 161-16)..... 99A-10
 Ch. 101.660-1A (See Model 6100)..... 6
 Ch. 101.662-2B, 101.662-2D, 101.662-3C (See Model 6105)..... 7
 Ch. 101.662-4E, 101.662-5F (See Model 6106A)..... 29
 Ch. 101.666-1B (See Model 6285A)..... 20
 Ch. 101.672-1A, 101.672-1B (See Model 6092)..... 10
 Ch. 101.677B (See Model 6290)..... 20
 Ch. 101.773 (See Model 8127)..... 41
 Ch. 101.800-1, 101.800-1A (See Model 6200A)..... 9
 Ch. 101.800-3 (See Model 6200A)..... 65
 Ch. 101.801, 101.801-1A (See Model 6220)..... 9
 Ch. 101.802, 101.802-1 (See Model 6230)..... 11
 Ch. 101.807, 101.807A (See Model 7021)..... 16
 Ch. 101.808 (See Model 7054)..... 15
 Ch. 101.808-1C, 101.808-1D (See Model 8052)..... 68
 Ch. 101.809 (See Model 7080)..... 16
 Ch. 101.809-1A, B, 101.809-2, 101.809-3C (See Model 7080)..... 58
 Ch. 101.810 (See Model 7090)..... 15
 Ch. 101.811 (See Model 7100)..... 17
 Ch. 101.813 (See Model 8050)..... 13
 Ch. 101.814, 101.814-1A (See Model 7085)..... 30
 Ch. 101.814-2B, 101.814-3B, 101.814-5C, 101.814-6C (See Model 8086)..... 61
 Ch. 101.817 (See Model 7070)..... 30
 Ch. 101.819A (See Model 7226)..... 31
 Ch. 101.820 (See Model 7210)..... 32
 Ch. 101.821 (See Model 8090)..... 49
 Ch. 101.822, 101.822A (See Model 8270)..... 57
 Ch. 101.823, 101.823A, 101.823-1, 101.823-1A (See Model 7166)..... 10
 Ch. 101.825, 101.825-1A, 101.825-1B (See Model 7115)..... 16
 Ch. 101.825-2C, 101.825-3D, 101.825-3E, 101.825-3F, 101.825-4 (See Model 7119)..... 62
 Ch. 101.829 (See Model 8100)..... 51
 Ch. 101.829-1 (See Model 8132)..... 66
 Ch. 101.831, 101.831A, 101.831-1 (See Model 8127)..... 41

SILVERTONE—Cont.

Ch. 101.833 (See Model 8105)..... 35
 Ch. 101.834 (See Model 8072)..... 34
 Ch. 101.835 (See Model 8230)..... 59
 Ch. 101.839 (See Model 8051)..... 49
 Ch. 101.846 (See Model 8132)..... 66
 Ch. 101.849 (See Model 9054)..... 63
 Ch. 101.850 (See Model 9260)..... 51
 Ch. 101.851, 101.851-1 (See Model 8107A)..... 64
 Ch. 101.852 (See Model 8080)..... 52
 Ch. 101.854 (See Model 8132)..... 66
 Ch. 101.859 (See Model 9133)..... 95
 Ch. 101.859-2 (See Model 64)..... 113
 Ch. 101.864 (See Model 9122)..... 66
 Ch. 101.865 (See Model 9119).....
 Ch. 101.865-1 (See Model 9120A).....
 Ch. 101.866 (See Model 9133)..... 95
 Ch. 101.867 (See Model 9121).....
 Ch. 101.868 (See Model 9122A).....
 Ch. 109.626 (See Model 7152)..... 25
 Ch. 109.627 (See Model 7153)..... 26
 Ch. 109.631 (See Model 8145)..... 45
 Ch. 109.632 (See Model 8148)..... 44
 Ch. 109.633 (See Model 8149)..... 48
 Ch. 109.634 (See Model 8150)..... 32
 Ch. 109.635, 109.635-1 (See Model 8153)..... 42
 Ch. 109.636, 109.636A (See Model 8160)..... 50
 Ch. 109.638 (See Model 8168)..... 46
 Ch. 110.451, 110.452 (See Model 6051)..... 13
 Ch. 110.454 (See Model 6072)..... 13
 Ch. 110.466, 110.466-1 (See Model 7086)..... 27
 Ch. 110.473 (See Model 8103)..... 56
 Ch. 110.499 (See Model 9123)..... 79
 Ch. 110.499-1 (See Model 9124)..... 79
 Ch. 110.499-2 (See Model 9126)..... 79
 Ch. 132.807-2 (See Model 7025)..... 29
 Ch. 132.816, 132.816A (See Model 6011)..... 15
 Ch. 132.818 (See Model 6002)..... 5
 Ch. 132.818-1 (See Model 8003)..... 53
 Ch. 132.820 (See Model 6016)..... 27
 Ch. 132.825-4 (See Model 6050)..... 15
 Ch. 132.826-1 (See Model 6071)..... 15
 Ch. 132.838 (See Model 8000)..... 31
 Ch. 132.839 (See Model 8005)..... 33
 Ch. 132.840 (See Model 8010)..... 40
 Ch. 132.841 (See Model 8020)..... 43
 Ch. 132.858 (See Model 9005)..... 72
 Ch. 132.868 (See Model 8021)..... 70
 Ch. 132.871 (See Model 9022)..... 76
 Ch. 132.875 (See Model 9105)..... 89
 Ch. 132.878 (See Model 1)..... 101
 Ch. 132.880 (See Model 210)..... 109
 Ch. 132.882 (See Model 105).....
 Ch. 132.887 (See Model 51)..... 112
 Ch. 132.888 (See Model 54)..... 115
 Ch. 132.889 (See Model 106).....
 Ch. 132.890 (See Model 179-16).....
 Ch. 135.243 (See Model 8073)..... 84
 Ch. 135.243-1 (See Model 9073)..... 83
 Ch. 135.244, 135.244-1 (See Model 9073)..... 83
 Ch. 135.245 (See Model 41)..... 101
 Ch. 137.906 (See Model 246)..... 111
 Ch. 139.150, 139.150-1 (See Model 6685)..... 15
 Ch. 185.706 (See Model 1304).....
 Ch. 319.190 (See Model 1301)..... 91

SILVERTONE—Cont.

Ch. 319.200, 319.200-1 (See Model 1300)..... 90
 Ch. 431.188, 431.188-1 (See Model 7148)..... 23
 Ch. 431.199 (See Model 8144)..... 32
 Ch. 431.202 (See Model 8130)..... 49
 Ch. 434.140 (See Model 7111)..... 30
 Ch. 435.240 (See Model 7300)..... 45
 Ch. 435.410 (See Model 7350)..... 38
 Ch. 435.417 (See Model 9153)..... 67
 Ch. 436.200 (See Model 7145)..... 23
 Ch. 463.155 (See Model 8155)..... 57
 Ch. 478.206-1 (See Model 8024)..... 80
 Ch. 478.210 (See Model 9131)..... 84
 Ch. 478.221 (See Model 9115)..... 97
 Ch. 478.224 (See Model 9115)..... 97
 Ch. 478.252 (See Model 125)..... 104
 Ch. 478.253 (See Model 9125).....
 Ch. 478.257 (See Model 125)..... 104
 Ch. 478.289 (See Model 112)..... 118
 Ch. 478.309 (See Model 120)..... 115
 Ch. 478.311 (See Model 120)..... 115
 Ch. 528.168 (See Model 9280)..... 94
 Ch. 528.171-1 (See Model 225)..... 107
 Ch. 528.173 (See Model 220)..... 110
 Ch. 528.174 (See Model 215)..... 117
 Ch. 528.6293-2 (See Model 6293)..... 99
 Ch. 528.6295 (See Model 6295)..... 98
 Ch. 547.245 (See Model 9270)..... 82
 Ch. 548.358 (See Model 9161)..... 88
 Ch. 548.358-1 (See Model 245)..... 107
 Ch. 548.360-1 (See Model 239)..... 115
 Ch. 548.363 (See Model 331)..... 111
 Ch. 549.100, 549.100-1 (See Model 101)..... 102
 Ch. 549.100-3 (See Model 138)..... 99A
 Ch. 549.100-4 (See Model 160-12)..... 97A

SIMPLON
 CA-5..... 22-27
 WV2..... 17-30

SKY KNIGHT (See Air Knight)

SKYRIDER (See Hallicrafters)

SKYROVER
 N5-RD-250 (9022-N), N5-RD-251 (9022-H)..... 6-31
 N5-RD295 (Ch. 5A7)..... 21-30

SKY WEIGHT
 818..... 20-30
 82..... 13-13

SONOGRAPH
 BL100..... 122-10

SONORA
 RB-176..... 5-31
 RB-207 (See Model RB-176)..... 5
 RCU-208..... 5-30
 RDU-209..... 2-29
 RET-210..... 24-24
 RGMF-212, RGMF-230..... 27-26
 RKRU-215 (Ch. RKRU)..... 9-31
 RMR-219..... 19-28
 RMR-220, RMR-245 (See Model RMR-219)..... 19
 RQU-222..... 8-23
 RWFU-238..... 23-24
 RX-223..... 19-29
 WAU-243..... 27-27
 WBRU-239..... 32-23
 WDU-246..... 25-22
 WDU-233..... 25-27
 WDU-249..... 37-20
 WEU-262..... 33-28
 WGFU-241, WGFU-242..... 24-25
 WJU-252..... 36-23
 WKRU-254A..... 34-20
 WLRU-219A (See Model WLRU-219A)..... 37
 WLRU-245A (See Model WLRU-219A)..... 37
 WXTU-700, WXTUA-700A.....
 YB-299..... 112-9
 100..... 41-21
 101..... 48-24
 102..... 53-23
 171..... 109-13
 172 (See Model 171)..... 109
 302, 303 Tel. Rec. 97A-13
 306..... 108-11
 401..... 47-21

SONORA—Cont.

402A (See Model RMR-219) 19
 402F (See Model WLRU-219A)..... 37

SOUND, INC.
 "Interound"..... 7-27
 MB6P3, MB6P6, MB6P30, MB4R4..... 35-21
 MB7E3..... 28-31
 MB7E8..... 26-24
 5R2..... 28-32

SPARKS-WITHINGTON (See Sparton)

SPARTON
 4AW17 (Ch. 417)..... 50-18
 4AW17-A (Ch. 417A)..... 49-22
 5AW06 (See Model 5AW06)..... 4
 5A116 (Ch. 5-16)..... 30-29
 5AM26-PS (Ch. 5-26-PS)..... 5-17
 5AW06 (Ch. 5-06)..... 4-17
 5AW16 (Ch. 5-16) See Model 5A116 (Ch. 5-16)..... 30
 6AM06 (Ch. 6-06)..... 34-21
 6AM26 (See Model 6AW26PA)..... 15
 6AW26PA (Ch. PCS-6-26)..... 15-33
 6-66A (Ch. 666A)..... 51-21
 7AM46 (Ch. 7-46)..... 1-31
 7AM46PA, 7BAM46PA, 7BW46PA, 8AM46 (See Model 7AM46)..... 1
 10AB76-PA, 10AM76-PA, 10BM76-PA (See Model 10BW76-PA)..... 15
 10BW76-PA (Ch. 10-76PA)..... 15-34
 100, 101 (Ch. 5A7)..... 38-23
 102, 103, 104 (See Model 100)..... 38
 121 (Ch. 819)..... 57-19
 122 (See Model 121)..... 57
 130, 132, 135, 139 (Ch. 5A10)..... 94-10
 141 (See Model 121)..... 57
 141A (Ch. 8110)..... 92-6
 141XX, 142XX (Ch. 8W10)..... 126-12
 142 (See Model 121)..... 57
 150, 151, 152, 155 (Ch. 4E10)..... 91-12
 201.....
 1000, 1001, 1003 (Ch. 1217)..... 60-18
 1005, 1006, 1007, 1008 (Ch. 8-57)..... 29-25
 1010 (Ch. 717)..... 35-22
 1015 (See Model 10BW76PA)..... 15
 1020, 1021, 1023 (See Model 1000)..... 60
 1030, 1030A (Ch. 618)..... 37-22
 1031, 1031A (See Model 1030)..... 37
 1035, 1035A, 1036, 1036A, 1037, 1037A, 1039, 1040, 1041 (Ch. 918)..... 62-19
 1040XX, 1041XX (Ch. 8W10) (See Model 141XX)..... 126
 1051, 1052 (Ch. 680)..... 58-21
 1058, 1059, 1060, 1061, 1064, 1071, 1072 (See Model 121)..... 57
 1085, 1086 (Ch. 8W10) (See Model 141XX)..... 126
 1090, 1091 (Ch. 8W10) (See Model 141XX)..... 126
 4900TV (Ch. 24TV9C, 3TV9C, 918A) Tel. Rec. 64-11
 4916, 4917, 4918 (Ch. 24T110, 3T110, 6S10) Tel. Rec.
 4920, 4921, 4922 (Ch. 24T110, 3T110, 6S10) Tel. Rec.
 4935 (Ch. 23TC10).....
 4937TV, 4940TV, 4941TV (Ch. 24TV9, 3TV9) Tel. Rec. (See Model 4900TV)..... 64
 4942 (Ch. 23TC10).....
 4944, 4945 (Ch. 3TB10, 24TB10) Tel. Rec. 86-10
 4951, 4952 (See Model 4900TV)..... 64
 4954 (Ch. 23TC10).....
 4960 (Ch. 23TC10).....
 4964, 4965 (Ch. 23TB10, 3TB10) Tel. Rec. 93A-14
 4970, 4971 (Ch. 8510)..... 92
 5002, 5003 (Ch. 23TD10) Tel. Rec. (See Model 5006, 5007 (Ch. 23TD10) Tel. Rec. (See Model 5006X (Ch. 23TK10A) Tel. Rec. 121-13
 5007X (Ch. 23TK10A) Tel. Rec. (See Model 5006X)..... 121
 5010, 5011 (Ch. 19TS10, A) Tel. Rec. 104-11
 5014, 5015 (Ch. 19TS10, A) Tel. Rec. 104
 5025 (See Model 5010)..... 104
 5029, 5030 Tel. Rec.
 5035, 5036, 5037.....
 5052 (Ch. 24TR10, 3TR10) Tel. Rec. 97A-13

SPARTON—Cont.

5056, 5057 (Ch. 19TS10, A) Tel. Rec. (See Model 5010)..... 104
 5064, 5065 (Ch. 23TB10 and 3TB10) Tel. Rec. (See Model 4964)..... 93A
 5068, 5069 (Ch. 24TV9C) Tel. Rec. (See Model 4900TV)..... 64
 5071, 5072 (Ch. 19TS10, A) Tel. Rec. (See Model 5010)..... 104
 5076, 5076BB, 5077, 5077BB Tel. Rec.
 5079, 5080 Tel. Rec.
 5082, 5083 Tel. Rec.
 5088, 5089 Tel. Rec.
 Ch. PC-5-6-26 (See Model 6AW26PA)..... 37
 Ch. 3TB10 (See Model 4944)..... 86
 Ch. 3TR10 (See Model 5052)..... 97A
 Ch. 3TV9, 3TV9C (See Model 4900TV)..... 64
 Ch. 4E10 (See Model 150) 91
 Ch. 5A7 (See Model 100)..... 38
 Ch. 5-06 (See Model 5AW06)..... 4
 Ch. 5A10 (See Model 130) 94
 Ch. 5-16 (See Model 5A116)..... 30
 Ch. 5-26PS (See Model 5AM26PS)..... 5
 Ch. 6B9 (See Model 1051) 58
 Ch. 618 (See Model 1030) 37
 Ch. 6-06 (See Model 6AM06)..... 34
 Ch. 717 (See Model 1010) 35
 Ch. 7-46 (See Model 7AM46)..... 1
 Ch. 819 (See Model 121)..... 57
 Ch. 8110 (See Model 141A) 92
 Ch. 8510 (See Model 141A) 92
 Ch. 8W10 (See Model 141XX)..... 126
 Ch. 8-46 (See Model 8AM46)..... 1
 Ch. 8-57 (See Model 1005) 29
 Ch. 918 (See Model 1035) 62
 Ch. 918A (See Model 4900TV)..... 64
 Ch. 10-76PA (See Model 10BW76PA) 15
 Ch. 1217 (See Model 1000) 60
 Ch. 19TS10, 19TS10A (See Model 5010)..... 104
 Ch. 23TB10 (See Model 4964)..... 93A
 Ch. 23TC10 (See Models 4935, 4942, 4954, 4960).....
 Ch. 23TD10 (See Model 5002)..... 102
 Ch. 24TB10 (See Model 4944)..... 86
 Ch. 24TR10 (See Model 5052)..... 97A
 Ch. 24TV9, 24TV9C (See Model 4900TV)..... 64
 Ch. 25TK10A (See Model 5006X)..... 121
 Ch. 417 (See Model 48W17)..... 50
 Ch. 417A (See Model 48W17A)..... 49
 Ch. 666 (See Model 6-66A)..... 51

SPIEGEL (See Aircastle)

STARK
 410..... 40-22
 1010..... 88-2
 1020..... 89-5

STARRETT
 Gotham Tel. Rec. 101-12
 Henry Hudson, Henry Parks Tel. Rec. 92-7
 Jan Hancock Tel. Rec. 96-10
 Nathan Hale Tel. Rec. 87-12
 Robert E. Lee Tel. Rec. (See Model Henry Hudson)..... 92

STEELEMAN
 200..... 23-25
 303..... 19-31
 350, 351..... 21-31

STEWART-WARNER
 AVC1 (Code 9054B), AVC2 (Code 9054C) AVY1 (Code 9054-A) AVY1 (Code 9054-A) Tel. Rec. 64-12
 AS111 (Code 9020-A), AS112 (Code 9020-B), AS113 (Code 9020-C), AS114 (Code 9020-D)..... 17-32
 A61CR1 (Code 9034-C), A61CR2 (Code 9034-D), A61CR3 (Code 9034-E), A61CR4 (Code 9034-F)..... 39-25
 A61P1 (Code 9036-A), A61P2 (Code 9036-B), A61P3 (Code 9036-C)..... 42-23
 A72T1 (Code 9026-A), A72T2 (Code 9026-B), A72T3 (Code 9026-C), A72T4 (Code 9026-D)..... 32-24
 A92CR3, A92CR5 (Code 9028-C), A92CR6, A92CR8 (Code 9028-F)..... 29-26
 B51T1, B51T2, B51T3 (Code 9044A, B, C)..... 58-22
 B61T1, B61T2 (Code 9046A, B)..... 59-19
 B72CR1 (Code No. 9038A) 47-22

STEWART-WARNER-Cont.

892CR1, 892CR2, 892CR3, 892CR4, 892CR8, 892CR9, 892CR10 (Codes 9043A, B, C, D, K, L, M)..... 65-14
 CS171 (Code 9034-A)..... 41-22
 T-711 (Code 9031-A)..... 95A-12
 Tel. Rec. (See Model 158)..... 95A-12
 T-711M (Code 9031-AM) Tel. Rec. (See Model T-711)..... 95A
 T-712 (Code 9031-B) Tel. Rec. (See Model T-711)..... 95A
 TRC-721 (Code 9037-A) Tel. Rec. (See Model T-711)..... 95A
 51T46 (Code 9024-B)..... 39-24
 51T56 (Code 9024-C)..... 39-24
 51T126 (Code 9018-C)..... 15-35
 51T136 (Code 9018-F), 51T146 (Code 9018-H), 51T176 (Code 9018-B)..... 15-35
 61T16 (Code 9022-A)..... 1-6
 61T26 (Code 9022-B)..... 1-6
 62T16 (Code 9022-C), 62T16 (Code 9023-D), 62T26 (Code 9023-E), 62T36 (Code 9023-F)..... 2-21
 72CR16, 72CR26..... 18-28
 9000-B..... 11-22
 9001-C, D, E, F..... 8-29
 9002-A, 9002-B, 9002-P, 9002-R..... 38-24
 9005-A, B, 9005-C..... 13-31
 9007-A, F, G..... 10-30
 Models 9100A, 9100B, 9100C, 9100D, 9100E, 9100F, 9100G, 9100H Tel. Rec. (See Model 9100A)..... 75-15
 9103-B, -C, 9104-A, -B, -C Tel. Rec. (See Model 9106A)..... 105-10
 9106A, B, 9107-A, B Tel. Rec. (See Model 9106A)..... 118
 9113A Tel. Rec. (See Model 9106A)..... 118
 9120-A, -B, -C, -D, -E, -F Tel. Rec. (See Model 9106A)..... 119-14
 9151-A..... 106-1A
 9152-A, -B, -C..... 102-14
 9153-A..... 108-12

STRATOVOX

579-1-58A..... 6-32

STROMBERG-CARLSON

AU-29..... 125-11
 AV-38..... 126-13
 TC-10 Tel. Rec. (See Model 112022)..... 79-17
 TC-10 Tel. Rec. Prod. Chge. Bul. 1..... 103-19
 TC-19 Tel. Rec. (See Model 112022)..... 97-17
 TC-125 Tel. Rec. (See Model 112022)..... 95A-13
 TS-15, TS-16, TS-125 Series Tel. Rec. (See Model 112022)..... 72-12
 TV-10L, TV-10LV (112020) Tel. Rec. (See Model 112022)..... 72-12
 TV-10PM, TV-10PY (112025, 112022) Tel. Rec. (See Model 112022)..... 72-12
 TV-12 Series PHOTOFAC Servicer..... 88
 TV-125 (Ch. TV-12)..... 68-16
 16-CA, 16-CM, 16-RPM, 16-TA, 16-TM Tel. Rec. (See Model 112022)..... 123-1A
 17 Series Tel. Rec. (See Model 112022)..... 11-23
 24 Series Tel. Rec. (See Model 112022)..... 11-23
 32 Series Tel. Rec. (See Model 112022)..... 11-23
 119 Series Tel. Rec. (See Model 112022)..... 11-23
 1020 (See Model 1220 Series)..... 50
 1100-H, 1100-HI..... 20-31
 1101-HB, 1101-HI (Ch. 112002), 1101-HM, 1101-HW, 1101-HY (Ch. 112001)..... 2-9
 1101-HPW..... 41-23
 1105 (Series 10-11)..... 18-29
 1110-HW, 1110-PTW (Series 10)..... 18-30
 1120 (See Model 1220 Series)..... 50
 1121-HW, LW, M1-0, M2-W, M2-Y, PFM, PFW, PGM, PGW, PLW, PSM (Series 10-11-12)..... 10-31
 1135-PFM, 1135-PLM, 1135-PLW (Series 10-11)..... 23-26
 1200..... 57-20
 1202 (Series 10)..... 53-21
 1204 (Ch. 112021)..... 34-22
 1210M2-M, 1210M2-W, 1210M2-Y, 1210PGM, 1210PGW, 1210PGW (Series 10-11)..... 37-23
 1220 Series..... 50-19
 1235 Series..... 49-23
 1400 (See Model 1200)..... 57
 1407PFM, 1407PLM..... 58-23
 1409M2-M, 1409M2-Y, 1409M2-W, 1409M3-A, 1409M3-M, 1409PG-M, 1409PG-W..... 62-20

STUDEBAKER

S-4624, S-4625..... 21-32
 S-4626, S-4627..... 19-32

SUPREME (Lipson)

711..... 68-17
 712S..... 63-17
 733..... 60-19
 738LP..... 64-13
 750..... 53-22

SWANK

5 Tube Radio-phon (DU101)..... 5-21
 ER61..... 17-33

SYLVANIA

1-075 (Ch. 1-139) Tel. Rec. (See Model 1-075)..... 92-8
 1-076 (Ch. 1-108) Tel. Rec. (See Model 1-075)..... 92
 1-076 (Ch. 1-108) Tel. Rec. Prod. Chge. Bul. 2..... 103-20
 1-090 (Ch. 1-168) Tel. Rec. (See Model 1-075)..... 92
 1-113, 1-114 Tel. Rec. (See Model 1-075)..... 92
 1-124, 1-125 Tel. Rec. (See Model 1-075)..... 92
 1-125-1 (Ch. 1-186) Tel. Rec. (See Model 1-075)..... 92
 1-128 (Ch. 1-108) Tel. Rec. (See Model 1-076)..... 96
 1-128 (Ch. 1-108) Tel. Rec. Prod. Chge. Bul. 2..... 103-20
 1-177 (Ch. 1-186) Tel. Rec. (See Model 1-075)..... 92
 1-197 (Ch. 139) Tel. Rec. (See Model 1-125-1)..... 113
 1-197-1 (Ch. 1-186) Tel. Rec. (See Model 1-125-1)..... 113
 1-210 (Ch. 1-139) Tel. Rec. (See Model 1-075)..... 92
 1-245, 1-246 (Ch. 139) Tel. Rec. (See Model 1-245-1)..... 113
 1-245-1, 1-246-1 (Ch. 1-186) Tel. Rec. (See Model 1-125-1)..... 113
 1-247 (Ch. 1-168) Tel. Rec. (See Model 1-090)..... 99
 1-247-1 (Ch. 1-231) Tel. Rec. (See Model 1-251)..... 103-16
 1-250, 1-251, 1-252 (Ch. 1-215)..... 103-16
 510B, 510H, 510W (Ch. 1-215)..... 103
 540B, 540H, 540M..... 119-11
 4120M (Ch. 1-260) Tel. Rec. (See Model 4120M)..... 124-10
 4130B, 4130E, 4130M, 4130W (Ch. 1-260) Tel. Rec. (See Model 4120M)..... 124
 5130B, M, W (Ch. 1-290) Tel. Rec. (See Model 5130B)..... 120
 5140B, M (Ch. 1-290) Tel. Rec. (See Model 5130B)..... 120
 6110X (Ch. 1-261) Tel. Rec. (See Model 4120M)..... 124
 6120B, 6120M, 6120W (Ch. 1-261) Tel. Rec. (See Model 4120M)..... 124
 6130B, 6130M, 6130W (Ch. 1-261) Tel. Rec. (See Model 4120M)..... 124
 6140M, W (Ch. 1-271) Tel. Rec. (See Model 5130B)..... 120
 7110X (Ch. 1-366, 1-366-66) Tel. Rec. (See Model 4120M)..... 124
 7120B, 7120M, 7120W (Ch. 1-366, 1-366-66) Tel. Rec. (See Model 4120M)..... 124
 7130B, 7130M, 7130W (Ch. 1-366, 1-366-66) Tel. Rec. (See Model 4120M)..... 124
 7140 M, W (Ch. 1-356) Tel. Rec. (See Model 5130B)..... 120
 Ch. 1-186 (See Model 1-125-1)..... 113
 Ch. 1-215 (See Model 1-250)..... 103
 Ch. 1-260 (See Model 4120M)..... 124
 Ch. 1-271 (See Model 4120M)..... 124
 Ch. 1-271 (See Model 5130B)..... 120
 Ch. 1-290 (See Model 5130B)..... 120
 Ch. 1-366, 1-366-66 (See Model 4120M)..... 124

TELECHRON

8H67 "Musaltorm"..... 44-23

TELECON

M5T54..... 25-28

TELE-KING

C716X Tel. Rec. (See Model T-516)..... 114 Tel. Rec. (See Model 116, 116C, 117, 117C, 117CA, 117CAF, 117RO)..... 88
 162 Tel. Rec. (See Model 201, 202)..... 88-12
 210 Tel. Rec. (See Model 310)..... 88-12
 310 Tel. Rec. (See Model 410)..... 88
 410 Tel. Rec. (See Model 410)..... 88
 416 Tel. Rec. (See Model 410)..... 88
 510 Tel. Rec. (See Model 410)..... 88
 512 Tel. Rec. (See Model 410)..... 88
 612 Tel. Rec. (See Model 410)..... 88
 710 Tel. Rec. (See Model 410)..... 88
 712 Tel. Rec. (See Model 410)..... 88
 716 Tel. Rec. (See Model 816-3CR)..... 88
 916C, 916CAF Tel. Rec. (See Model 919, 919CAF)..... 88

TELEQUIP

Ch. 12TR, 14T, 14TR, 16T, 16TR, 19T, 19TR Tel. Rec. (See Model 5135, 5136, 5140A)..... 11-24

TELESONIC (Modco)

1635..... 20-22
 1636..... 21-33
 1642..... 20-23
 1643..... 21-34

TELE-TONE

TV149 Television Rec. (See Model TV-170)..... 54-22
 TV-170 Tel. Rec. (See Model TV-208)..... 83-12
 TV-208 Tel. Rec. (See Model TV-208TR)..... 90-11
 TV208TR Tel. Rec. (See Model TV-249)..... 95-6
 TV-209 Tel. Rec. (See Model TV-210)..... 57
 TV-210 Tel. Rec. (See Model TV208TR)..... 95
 TV-245, 246 Tel. Rec. (See Model TV-249)..... 57-21
 TV-250 Tel. Rec. (See Model TV-254)..... 91-13
 TV-254 Tel. Rec. (See Model TV-250)..... 91
 TV-255, TV-256 (Ch. TS) Tel. Rec. (See Model TV249)..... 101-13
 TV259 Tel. Rec. (See Model TV282)..... 57
 TV-282 Tel. Rec. (See Model TV-283)..... 71-14
 TV-283 Tel. Rec. (See Model TV-284)..... 87
 TV-284 Tel. Rec. (See Model TV-286, 287, 288)..... 93-10
 TV-286, 287, 288 Tel. Rec. (See Model TV-284)..... 93
 TV-300, TV-301 (Ch. TAA, TAB) Tel. Rec. (See Model TV-300, TV-301)..... 99A-12
 TV-300, TV-301 (Ch. TW) Tel. Rec. (See Model TV-304, TV-305)..... 107-10
 TV-304, TV-305 (Ch. TAA, TAB) Tel. Rec. (See Model TV-304, TV-305)..... 99A
 TV-304, TV-305 (Ch. TX) Tel. Rec. (See Model TV-300)..... 107
 TV-306, TV-307 (Ch. TV, TZ) Tel. Rec. (See Model TV-308)..... 104-12
 TV-308 (Ch. TAC) Tel. Rec. (See Model TV314)..... 109-14
 TV314 (Ch. TAJ) Tel. Rec. (See Model TV-315)..... 125-12
 TV-315 (Ch. TAA, TAB) Tel. Rec. (See Model TV-317)..... 115-13
 TV-317 Tel. Rec. (See Model TV318)..... 124-11
 TV322, TV323 (Ch. TAM) Tel. Rec. (See Model TV318)..... 124
 TV324, TV325, TV326 (Ch. TAP, TAP-1) Tel. Rec. (See Model TV328, TV329)..... 127-12
 TV328, TV329 (Ch. TAP, TAP-1, TAP-2) Tel. Rec. (See Model TV340)..... 127
 TV335, TV336 (Ch. TAP, TAP-1, TAP-2) Tel. Rec. (See Model TV324)..... 127
 TV340 (Ch. TAP, TAP-1, TAP-2) Tel. Rec. (See Model TV324)..... 127
 TV345 (Ch. TAP, TAP-1, TAP-2) Tel. Rec. (See Model TV324)..... 127
 100, 100-A, 101, 109 (Ch. Series A)..... 39-26
 109 (Ch. Series J)..... 8-30
 110 (See Model 117-A)..... 1
 111, 113 (See Model 100)..... 1-35
 117-A (Ch. Series "D")..... 1-35
 119, 120 (See Model 117-A)..... 1
 122, 123 (See Model 100)..... 39
 124 (See Model 117-A)..... 1
 125 (See Model 100)..... 39
 126 (See Model 117-A)..... 1
 127, 130, 131..... 39
 132 (See Model 117-A)..... 1
 133..... 11-25
 F-611..... 13-32
 F-616..... 5-38
 F-617..... 12-27
 G-410..... 27-28
 G-415..... 43-18
 G-418, G-419..... 23-29
 G-513..... 23-29
 G-515..... 17-34
 G-516..... 18-31
 G-518..... 29-27
 G-519..... 28-33
 G-522..... 26-26
 G-619..... 22-30
 G-622..... 44-24
 G-721 (See Model G-722)..... 24
 G-722..... 24-27
 G-723 (See Model G-722)..... 24
 G-724..... 38-27
 G-725..... 34-23
 G-1430..... 43-19
 G-410B (See Model G-418)..... 26
 G-720S (See Models G-721, G-722, G-723)..... 24
 H-411..... 47-23
 H-521 (See Model G-521)..... 28
 H-622 (See Model G-622)..... 44
 H-727 (See Model G-725)..... 34
 TV-1776, TV-1777, TV-1778, TV-1779 Tel. Rec. (See Model 66-16)

TELE-TONE-Cont.

176 (Ch. Series U) (See Model 156)..... 35
 182..... 51-22
 183..... 53-24
 185 (Ch. Series AH)..... 52-21
 190 (Ch. Series AZ)..... 61-19
 195 (Ch. Series BH)..... 71-15
 198 (See Model 158)..... 59
 200 (Ch. Series AX) (See Model 190)..... 61
 201 (Ch. Series A)..... 74-9
 205 (Ch. Series B)..... 73-12
 206..... 127-11
 214 (Ch. Series A) (See Model 190)..... 61
 215 (Ch. Series B) (See Model 205)..... 73
 Ch. Series A (See Model 100)..... 39
 Ch. Series AA (See Model 159)..... 38
 Ch. Series AE (See Model 157)..... 49
 Ch. Series AG (See Model 165)..... 50
 Ch. Series AH (See Model 185)..... 52
 Ch. Series AT (See Model 158)..... 59
 Ch. Series AX (See Model 201)..... 74
 Ch. Series AZ (See Model 190)..... 61
 Chassis Series BD (See Model 205)..... 73
 Chassis Series BE (See Model 195)..... 71
 Ch. Series C (See Model 134)..... 13
 Ch. Series CA (See Model 133)..... 11
 Ch. Series D (See Model 117A)..... 1
 Ch. Series H (See Model 135)..... 14
 Ch. Series K (See Model 109)..... 8
 Ch. Series N (See Model 131)..... 23
 Ch. Series R (See Model 145)..... 23
 Ch. Series S (See Model 14H)..... 24
 Ch. Series T (See Model 150)..... 38
 Ch. TAA, TAB (See Model TV-315)..... 115
 Ch. TAC (See Model TV-308)..... 109
 Ch. TAJ (See Model TV314)..... 125
 Ch. TA (See Model TV318)..... 124
 Ch. TAP, TAP-1, TAP-2 (See Model TV324)..... 127
 Ch. TS (See Model TV-255)..... 101
 Ch. TW, TX (See Model TV-300)..... 107
 Ch. TY, TZ (See Model TV-306)..... 104
 Ch. Series U (See Model 156)..... 35
 Ch. Series Y (See Model 160)..... 36

TELEVOX

RP..... 22-29
 27B-2W..... 20-32
 27K-W..... 26-33
 27-P-T..... 22-28

TEL-VAR (See Audar)

TEMPLE

E-301..... 21-35
 E-510..... 2-3
 E-511..... 11-26
 E-512, E-514 (See Model E-51C)..... 2
 E-519 (See Model E-510)..... 2
 F-301..... 12-26
 F-611..... 9-32
 F-616..... 5-38
 F-617..... 12-27
 G-410..... 27-28
 G-415..... 43-18
 G-418, G-419..... 23-29
 G-513..... 23-29
 G-515..... 17-34
 G-516..... 18-31
 G-518..... 29-27
 G-519..... 28-33
 G-522..... 26-26
 G-619..... 22-30
 G-622..... 44-24
 G-721 (See Model G-722)..... 24
 G-722..... 24-27
 G-723 (See Model G-722)..... 24
 G-724..... 38-27
 G-725..... 34-23
 G-1430..... 43-19
 G-410B (See Model G-418)..... 26
 G-720S (See Models G-721, G-722, G-723)..... 24
 H-411..... 47-23
 H-521 (See Model G-521)..... 28
 H-622 (See Model G-622)..... 44
 H-727 (See Model G-725)..... 34
 TV-1776, TV-1777, TV-1778, TV-1779 Tel. Rec. (See Model 66-16)

TEMPOTONE

500 E Series..... 2-8

TEMPLETONE (See Temple)

THORDARSON

T-30W0A..... 8-31
 T-31W10A..... 30-30
 T-31W10-AX..... 57-22
 T-31W25A..... 9-33
 T-31W50A..... 20-34
 T-32W00, T-32W10..... 76-18

TONE PAK

ACBHF..... 24-28

TRANSVISION

Chassis Model A Tel. Rec. (See Model WR5-3)..... 112-10

TRANSVUE

601 (Ch. 16AX23, 25, 26) Tel. Rec. (See Model 610)..... 108
 610 (Ch. 16AX23, 25, 26) Tel. Rec. (See Model 16T)..... 108

TRAVLER

10T Tel. Rec. (See Model 12150, A Tel. Rec. (See Model 12T)..... 86-11
 12150, A Tel. Rec. (See Model 10T)..... 86
 12T Tel. Rec. (See Model 10T)..... 86
 14B50, A, 14C50, A Tel. Rec. (See Model 12150)..... 108
 16G50A Tel. Rec. (See Model 12150)..... 108
 16R50A, 16T50A Tel. Rec. (See Model 12150)..... 108
 16T Tel. Rec. (See Model 10T)..... 86
 5000 (See Model 5000)..... 11
 5001..... 11-28
 5002 Series (Ch. 109)..... 12-27
 5007, 5008, 5009 (Ch. 104)..... 1-36
 5010, 5011, 5012 (Ch. 105)..... 2-5
 5015..... 36-25
 5019..... 23-30
 5020 (Ch. 800)..... 11-28
 5021..... 43-20
 5022..... 101-14
 5027..... 31-30
 5028..... 34-24
 5029..... 33-25
 5030, 5031..... 32-25
 5036..... 54-19
 5049..... 45-24
 5051..... 32-26
 5054..... 36-26
 5055-A..... 90-12
 5060, 5061..... 116-11
 5066..... 42-24
 6040..... 49-25
 6050..... 56-23
 7000, 7001..... 59-21
 7003 (Ch. 501)..... 12-29
 7010 (See Model 7000)..... 59
 7016, 7017..... 84-11
 7023..... 83-13
 7036..... 112-11
 Chassis 104 (See Model 5007)..... 1
 Chassis 105 (See Model 5010)..... 2
 Chassis 109 (See Model 5002)..... 12
 Chassis 501 (See Model 7003)..... 12
 Chassis 800 (See Model 5021)..... 11

TRELA

HW301..... 14-28

TRUETONE

D1034B, C (See Model D1046A)..... 102
 D1046A (See Model D1046A)..... 102-15
 D1046C, D (See Model D1046A)..... 102
 D1090 Tel. Rec. (See Model D1092)..... 28-34
 D1612..... 28-30
 D1645 (Factory Model 26A76-650)..... 4-33
 D1747, D1748..... 32-27
 D1752 (Factory Model 7901-14)..... 34-25
 D1835 (Factory Model 25A86-856)..... 44-25
 D1836, D1836A (Factory Model 26A85-856)..... 44-25
 D1844 (Fact. No. 138PCM)..... 46-24
 D1845..... 31-31
 D1846A, B, C..... 40-23
 D1850 (Series A)..... 51-23
 D1949..... 60-20
 D1950, D1951 (See Model D1850)..... 51
 D1952 (See Model D1949)..... 60
 D1953, D1952 (Factory Model 7AF22) Tel. Rec. (See Model D1991, B, D1993, B, D1994)..... 69-13
 D1991, B, D1993, B, D1994 Tel. Rec. (See Model D2983)..... 68
 D1994A Tel. Rec. (See Model D2017)..... 101-15
 D2017, D2018..... 106-15
 D2020..... 106-15
 D2025A (Fact. Mod. 26A95-906)..... 83-14
 D2027A..... 97-18
 D2050A Tel. Rec. (See Model 26203)..... 13-33
 D2604 (Factory No. 461)..... 13-34
 D2604..... 13-34
 D2605 (Factory Model 2A42)..... 9-34
 D2606..... 65-15
 D2612 (Code SW-9022-G)..... 3-9
 D2613..... 13-37
 D2615 (Factory Model 6D110)..... 2-18

ZENITH—Cont.

G-2322 (Ch. 23G22) Tel. Rec. 98-17

G2322Z (Ch. 23G24) Tel. Rec. 91A-13

G-2322Z1 (Ch. 23G24Z1) Tel. Rec. 91A

G-2340, R (Ch. 23G22) Tel. Rec. (See Model G2322Z) 98

G2340R, Z (Ch. 23G24) Tel. Rec. 91A

G2340Z1, RZ1 (Ch. 23G24Z1) Tel. Rec. 91A

G2346R (Ch. 23G22) Tel. Rec. (See Model G2322Z) 98

G2346RZ (Ch. 23G24) Tel. Rec. 91A-12, 13

G2350RZ, Z (Ch. 23G24) Tel. Rec. 91A

G2353E (Ch. 23G22) Tel. Rec. 98

G2353EZ (Ch. 23G24) Tel. Rec. 91A

G2353EZ1 (Ch. 23G24Z1) Tel. Rec. 91A

G2356EZ (Ch. 23G24) Tel. Rec. 91A

G2420E (Ch. 24G20) 93-11

G2420-EOX (Ch. 24G20-EOX) Tel. Rec. (See Model G2420E) 93

G2420R (Ch. 24G20) Tel. Rec. 93

G2420-ROX (Ch. 24G20-ROX) Tel. Rec. (See Model G2420E) 93

G2437R, G2438RZ, Z, G2439RZ (Ch. 24G26) 91A-12

G2441 (Ch. 24G24) Tel. Rec. (See Model G2322Z) 98

G2441R (Ch. 24G22/23) Tel. Rec. 98

G2441RZ, Z (Ch. 24G26) Tel. Rec. 91A

G2441Z1, RZ1 (Ch. 24G26Z1) Tel. Rec. 98

G2442E, R (Ch. 24G22/23) Tel. Rec. (See Model G2322Z) 98

G2442RZ (Ch. 24G26) Tel. Rec. 91A

G2442EZ1, RZ1 (Ch. 24G26Z1) Tel. Rec. 98

G2448R (Ch. 24G22/23) Tel. Rec. (See Model G2322Z) 98

G2448RZ (Ch. 24G26) Tel. Rec. 91A

G2448RZ1 (Ch. 24G26Z1) Tel. Rec. 98

G2454R (Ch. 24G21) Tel. Rec. 93

G-2454-ROX (Ch. 24G21-ROX) Tel. Rec. (See Model G2420E) 93

G2951, G2951R, G2952R, G2952-ROX (Ch. 29G20) Tel. Rec. 95-8

G2957R (Ch. 23G23 & Radio Ch. 66201) Tel. Rec. (See Model G2322Z) 98

G2958R (Ch. 23G23 & Radio Ch. 66201) Tel. Rec. (See Model G2322Z) 98

G3059R (Ch. 24G24/25 & Radio Ch. 6G201) Tel. Rec. (See Model G2322Z) 98

ZENITH—Cont.

G3042 (Ch. 24G24/25 & Radio Ch. 6G201) Tel. Rec. (See Model G2322Z) 98

G3062Z (Ch. 24G26) Tel. Rec. 91A-13

G3157RZ, Z (Ch. 23G24, 8G20/22) Tel. Rec. 91A-13

G3157Z1, RZ1 (Ch. 23G24Z1) Tel. Rec. 91A

G3158RZ (Ch. 23G24, 8G20/22) Tel. Rec. (See Model G3157RZ) 91A

G3158RZ1 (Ch. 23G24Z1) Tel. Rec. 91A

G3173RZ, Z (Ch. 23G24, 8G20/22) Tel. Rec. (See Model G3157RZ) 91A

G3174RZ (Ch. 23G24, 8G20/22) Tel. Rec. (See Model G3157RZ) 91A

G3259RZ (Ch. 24G26, 8G20/22) Tel. Rec. 91A-12, 13

G3259RZ1 (Ch. 24G26Z1) Tel. Rec. 91A

G3262Z (Ch. 24G26, 8G20/22) Tel. Rec. 91A

G3262Z1 (Ch. 24G26Z1) Tel. Rec. 91A

G3275RZ (Ch. 24G26, 8G20/22) Tel. Rec. 91A

G3276Z (Ch. 24G26, 8G20/22) Tel. Rec. 91A

H615 (Ch. 6G05) 86

H661E, H661R (Ch. 6H01) 125-13

H665, R, Z, Z (Ch. 6H01) (See Model H661E) 125

H723 (Ch. 7H04) 122-12

H724 (Ch. 7H02) 126-15

H880, H880R (Ch. 8H20) 127-15

H2229R, H2230E, R (Ch. 22H21) 127-1A

H880RZ (Ch. 8H20) 114-12

H-1083E (Ch. 10H20) (See Model H2437E) 120

H1087R, H1087R (Ch. 10H20) (See Model H2437E) 120

H2226R, H2227E, H2227R (Ch. 22H20) Tel. Rec. 114-13

H2241R (Ch. 22H21) Tel. Rec. (See Model H2229R) 127-1A

H2250R, H2255E (Ch. 22H20) Tel. Rec. (See Model H2226R) 114

H2252R, H2253E (Ch. 22H21) Tel. Rec. (See Model H2229R) 127-1A

H2328EZ, RZ (Ch. 23H22Z) Tel. Rec. 118-11

H2352RZ, H2353EZ (Ch. 23H22Z) Tel. Rec. (See Model H2328EZ) 118

H2437E, R, H2438R, H2437E (Ch. 24H20) Tel. Rec. 120-13

H2445R (Ch. 24H21) Tel. Rec. (See Model H2437E) 120

H2447R (Ch. 24H21) Tel. Rec. (See Model H2437E) 120

H2449E (Ch. 24H20) Tel. Rec. (See Model 112437E) 120

H3068R (Ch. 22H21) Tel. Rec. (See Model H2229R) 127-1A

H3267R (Ch. 24H20 and Radio Ch. 8H20) Tel. Rec. (See Model H2437E [Set 120] and Model H880RZ [Set 114]) 127-1A

H3273E, H3274R (Ch. 22H21) Tel. Rec. (See Model H2229R) 127-1A

H3467R (Ch. 24H20 and Radio Ch. 10H20) Tel. Rec. (See Model H2437E) 120

ZENITH—Cont.

H3475R (Ch. 24H20 and Radio Ch. 10H20) Tel. Rec. (See Model H2437E) 120

H3477R (Ch. 24H21 and Radio Ch. 10H20) Tel. Rec. (See Model H2437E) 120

H3479R (Ch. 24H21 and Radio Ch. 10H20) Tel. Rec. (See Model H2437E) 120

4G800 (Ch. 4E41) 35-27

4G800WZ, 4G800YZ, 4G800Z (Ch. 4E41Z) 52-23

4G903, 4G903Y (Ch. 4F40) 74-20

4K016 (Ch. 4C52) 6-39

4K035 (Ch. 4C53) 6-40

5D011, 5D027 (Ch. 5C01, 5C01Z) 3-17

5D810 (Ch. 5C02) 54-21

5G003 (Ch. 5C40) 17-35

5G003Z (Ch. 5C40Z1) 30-31

5G036 (Ch. 5C51) 30-32

5R080-5R086 (Ch. 5C02, 5C04) 4-4

6D014, 6D014W, 6D029, 6D029G (Ch. 6C01) 9-35

6D015, 6D015Y, 6D030 (Ch. 6C05, 6C05Z) 3-24

6D815, 6D815W, 6D815Y (Ch. 6E05) 55-24

6G001, 6G001Y (Ch. 6C40) 3-14

6G001Y21 (See Model 6G001) 3

6G004Y (Ch. 6C41) 20-35

6G038 (Ch. 6C50) 32-30

6G801 (Ch. 6E40) 53-26

6R060 (Ch. 6C21) 20-36

6R087 (Ch. 6C22) 7-32

6R86 (Ch. 6C40) 34-30

7H820, 7H820W (Ch. 7E01) 43-24

7H822 (Ch. 7E02Z) 55-25

7H918 (Chassis 7F03) 75-18

7H920, 7H920W (Ch. 7F01) 77-13

7H921 (Chassis 7F04) 73-16

7H922 (Ch. 7F02) 87-15

7R070 (Ch. 6C06) 37-25

7R887 (Ch. 7E22) 54-22

8G005Y (Ch. 8C40) 7-33

8G005YT (Z1) (Ch. 8C40T) (Z1), 8G005YT1 (Z2) (Ch. 8C40T) (Z2) 53-27

8H023 (Ch. 8C01) 4-40

8H032, 8H033 (Ch. 8C20) 1-33

8H034 (See Model 8H023) 4

8H050, 8H051, 8H052, 8H061 (See Model 8H032) 1

8H832, 8H861 (Ch. 8E20) 52-24

9H079, 9H079E, 9H079R, 9H081, 9H082R, 9H085R, 9H088R (Ch. 8C21) 7-34

9H881, 9H882R, 9H885, 9H888R (Ch. 9E21) 43-25

9H984, 9H984PL (Ch. 9F22) 64-14

9H995 (Chassis 9E21Z) 74-12

12H090, 12H091, 12H092, 12H093, 12H094 (Ch. 11C21) 2-20

14H789 (Ch. 13D22) 41-24

277958R (Ch. 27F20) Tel. Rec. (See Model G2951) 95

28T925 (Chassis 28F22) Tel. Rec. 64-15

28T926E, 28T926R (Chassis 28F25) Tel. Rec. (See Model 28T925) 64

28T960, 28T961, 28T962, 28T963 (Ch. 28F20, 28F20Z, 28F21) Tel. Rec. (See Model 28T925) 64

ZENITH—Cont.

28T964R (Chassis 28F23) Tel. Rec. 74-13

29T926R, E (Ch. 28F25) Tel. Rec. (See Model 28T925) 64

37T996 RLP (Ch. 28F23, 9E21Z) Tel. Rec. (See Models 42T999RLP and 9H995) 74

37T998 R1PU (Chassis 28F20, 9E21Z) Tel. Rec. (See Model 28T925 [Set 64] and Model 9H995 [Set 74]) 64

42T999RLP (Chassis 28F23, Radio Ch. 13D22) Tel. Rec. See Model 28T964R) 74

Ch. 4C52 (See Model 4K016) 6

Ch. 4C53 (See Model 4K035) 6

Ch. 4E41 (See Model 4G800) 35

Ch. 4E41Z (See Model 4G800Z) 52

Ch. 4F40 (See Model 4G903) 76

Ch. 5C01, 5C01Z (See Model 5D011) 3

Ch. 5C02, 5C02Z (See Model 5R080) 4

Ch. 5C04 (See Model 5R080) 4

Ch. 5C40 (See Model 5G003) 17

Ch. 5C40Z, 5C40Z1 (See Model 5G003Z) 30

Ch. 5C51 (See Model 5G036) 30

Ch. 5E02 (See Model 5D810) 54

Ch. 5G01 (See Model G511) 85

Ch. 5G02 (See Model G510) 84

Ch. 5G03 (See Model Model G516) 109

Ch. 5G40 (See Model G500) 83

Ch. 5G41 (See Model G503) 99

Ch. 6C01 (See Model 6D014) 9

Ch. 6C05, 6C05Z (See Model 6D105) 3

Ch. 6C06 (See Model 7RC70) 37

Ch. 6C21 (See Model 6R084) 20

Ch. 6C22 (See Model 6R087) 7

Ch. 6C40 (See Model 6G001) 3

Ch. 6C41 (See Model 6G004Y) 20

Ch. 6C50 (See Model 6G038) 32

Ch. 6E02 (See Model 6R886) 34

Ch. 6E05 (See Model 6D815) 55

Ch. 6E40 (See Model 6G801) 53

Ch. 6G01 (See Model G660) 96

Ch. 6G05 (See Model G615) 86

Ch. 6G20 (See Model G2957) 98

Ch. 6H01 (See Model H661E) 125

Ch. 7E01 (See Model 7H820) 43

Ch. 7E02, 7E02Z (See Model 7H822) 55

Ch. 7E22 (See Model 7R887) 54

Ch. 7F01 (See Model 7H920) 77

Ch. 7F02 (See Model 7H922) 87

Chassis 7F03 (See Model 7H918) 75

ZENITH—Cont.

Chassis 7F04 (See Model 7H921) 73

Ch. 7G01 (See Model G725) 101

Ch. 7G02 (See Model G724) 103

Ch. 7G04 (See Model G723) 104

Ch. 7H02 (See Model H724) 126

Ch. 7H04 (See Model H723) 122

Ch. 8C01 (See Model 8H023) 4

Ch. 8C20 (See Model 8H032) 1

Ch. 8C21 (See Model 9H079) 7

Ch. 8C40 (See Model 8G005Y) 7

Ch. 8C40T(Z1), 8C40T(Z2) (See Model 8G005YT(Z1)) 53

Ch. 8E20 (See Model 8H832) 52

Ch. 8G20 (See Model G881) 98

Ch. 8C20/22 (See Model G3157RZ) 91A

Ch. 8H20 (See Model H880RZ) 114

Ch. 8H20 Revised (See Model H880) 127

Ch. 9E21 (See Model 9H881) 43

Chassis 9E21Z (See Model 9H995) 74

Ch. 9F22 (See Model 9H984) 64

Ch. 10H20 (See Model H2437E) 120

Ch. 11C21 (See Model 12H090) 2

Ch. 13D22 (See Model 14H789) 41

Ch. 22H20 (See Model H2226R) 114

Ch. 22H21 (See Model H2229R) 127-1A

Ch. 23G22 (See Model G2322Z) Tel. Rec. 98

Ch. 23G23 (See Model G2957) 98

Ch. 23G24 (See Model G2322Z) 91A

Ch. 23G24Z1 (See Model G2322Z1) 98

Ch. 23H22Z (See Model H2328EZ) 118

Ch. 24G20 (See Model G2420E) 93

Ch. 24G20-EOX (See Model G2420E) 93

Ch. 24G21 (See Model G2454R) 93

Ch. 24G21-ROX (See Model G2454-ROX) 93

Ch. 24G22/23 (See Model G2441R) 98

Ch. 24G24 (See Model G2441) 98

Ch. 24G24/25 (See Model 3059R) 98

Ch. 24G26 (See Model G2437RZ) 91A

Ch. 24G26Z1 (See Model G2441Z1) 98

Ch. 24H20, 24H21 (See Model H2437E) 120

Ch. 27F20 (See Model 27T958R) 95

Ch. 28F20, 28F20Z, 28F21, 28F22 (See Model 28T925) 64

Ch. 28F23 (See Model 28T964R) 74

Ch. 28F25 (See Model 28T925) 64

Ch. 29G20 (See Model G2951) 95

ADDITIONAL BENEFITS FROM PHOTOFACTS

From time to time, PHOTOFAC T Folder Sets include valuable "bonus" materials, as well as useful data of a special nature. The following useful materials are extra benefits available in the Sets indicated at no additional cost.

Set No.	Set No.	Set No.
1—RMA Production Source Code (July 1, 1946)..... 5	6—Record Changer Cross Reference by Manufacturer and Model..... 118	12—Certificate entitling subscriber to PHOTO-FACT Volume Labels for Vols. 11-20... 102
2—RMA Production Source Code (Jan. 1, 1949)..... 70	7—Mica Capacitor Color Codes..... 48	13—Certificate entitling subscriber to 100 Door Knob Hangers..... 80
3—RMA Production Source Code (Revisions as of July 1, 1949)..... 92	8—Ion Trap Alignment..... 62	14—Photofact Television Course appearing serially in..... 38-51, 54
4—TRADE DIRECTORY—Parts Manufacturers..... 12	9—"Let's Look at the Sync Pulses"..... 64	15—CR Tube Dimension Chart..... 112
5—National Electrical Code on Antennas..... 88	10—Replacement of Disc & Plate Type Ceramic Capacitors..... 68	16—CR (Electromagnetic) Tube Characteristics Chart..... 112
	11—Certificate entitling subscriber to PHOTO-FACT Volume Labels for Vols. 1-10..... 62	17—CR Tube Interchangeability Chart..... 112

See next page for Photofact Folder Sets covering Record Changers and Recorders.

RECORD CHANGERS

(CM-1) indicates service data also available in Howard W. Sams 1947 Record Changer Manual. (CM-2) indicates service data available in Howard W. Sams 1948 Record Changer Manual. (CM-3) indicates service data available in Howard W. Sams 1949, 1950 Record Changer Manual.

ADMIRAL RC-150(CM-1) 26-31 RC-160, RC-160A, RC-161, RC-161A (Supplement to RC-200)(CM-1) 21-37 RC-170, RC-170A(CM-1) 31-2 RC-180, RC-181(CM-2) 76-1 RC-182 Supplement (CM-2) 76-2 RC-200(CM-1) 9 RC210, RC211, RC212 (CM-3) 72-1 RC220, RC221, RC222 Changes(CM-3) 108-2 RC320, RC321, RC322 (See Model RC220 Changes)(CM-3) 108 RC400(CM-3) 104-1	FARNSWORTH P-51, P56(CM-1) 13-36 P-72, P73(CM-2) 75-8	OAK 6666(CM-1) 19-35 9201(CM-3) 111-10	THORENS CD-40(CM-1) 39-29	WEBSTER-Cont. 246(CM-2) 74-11 256(CM-2) 88-13 346(CM-3) 100-12 356, 357(CM-3) 106-16
AERO 46A(CM-1) 19-34 47A(CM-2) 77-2	GARRAD RC-60(CM-2) 81-7	PHILCO D10, D10A(CM-1) 14-21 M-4(CM-1) 25-30 M-7(CM-1) 28-35 M-8(CM-2) 83-7 M-9C(CM-2) 83-7 M-12C(CM-3) 74-7 M-20(CM-3) 103-11	TRAV-LER A(CM-3) 72-13	WESTINGHOUSE V4914(CM-2) 47-26 V4944(CM-2) 86-13
AVIOLA 100(CM-1) 33-32	GENERAL ELECTRIC P6(CM-2) 79-8	RCA RP168(CM-3) 72-10 RP-176(CM-1) 25-31 RP-177(CM-2) 44-27 RP-178(CM-2) 79-12	UNIVERSAL CAMERA 100(CM-1) 36-30	ZENITH S11468(CM-1) 23-35 S11680(CM-1) 27-32 S14001(CM-2) 75-17 S13675, S14002, S14006, S14008 (CM-2) 85-15 S14004, S14007 (CM-2) 79-18 S14012, S14014 (CM-3) 110-14 S14022(CM-3) 112-15 S14023(CM-3) 105-14 S14024, S14025 (See Model S14022) (CM-3) 112 S14026 (See Model S14023)(CM-3) 105 S14027 (See Model S14022)(CM-3) 112
BELMONT C-9(CM-2) 34-31	GENERAL INDUSTRIES RC130L(CM-1) 22-33	SEEBURG K(CM-1) 11-36 L(CM-1) 24-34 M(CM-1) 32-19 S, SQ(CM-2) 78-12	UTAH 550(CM-1) 8 650(CM-1) 22-34 7000(CM-1) 27-31 7001(CM-2) 83-15	MISCELLANEOUS Series 700F(CM-2) 89-9 Series 700F 33/45 (CM-3) 75-11 Series 700FIP(CM-2) 101-4 Series 700F5(CM-2) 104-8 Series 700R(CM-2) 91-8
COLUMBIA 104(CM-2) 124-2	GENERAL INSTRUMENT 204(CM-1) 23-34 205(CM-1) 10	SILVERTONE 101.761-2, 101.762-2(CM-2) 77-10 101.761-3, 101.762-3(CM-2) 83-11 101.762, 101.763(CM-2) 88-11	V-M 200-B(CM-1) 15-36 400(CM-1) 24-33 400 (Lote)(CM-2) 90-13 402, 400C(CM-2) 82-12 402D, 400D(CM-2) 87-14 404 (See Model 405) (CM-3) 73 405(CM-3) 73-14 406, 407(CM-3) 102-16 800(CM-1) 21-38 800-D(CM-2) 84-12 802(CM-3) 77-12 910(CM-3) 115-14 950(CM-3) 107-13	
CRESCENT C-200(CM-1) 20-37 6 Series(CM-3) 89-4 250 Series(CM-2) 78-5 350 Series(CM-2) 80-3	LEAR PC-206A(CM-1) 18-33	SPARTON C48(CM-2) 87-11	WEBSTER 50(CM-1) 24-35 56(CM-1) 17-36 70(CM-1) 29-28 133(CM-2) 82-13 148(CM-2) 86-12	

RECORDERS

BRUSH SOUND MIRROR BK-401 Tape Recorder (CM-1) 42-25 BK-403(CM-2) 78-3 BK-416(CM-2) 81-4	CRESCENT-Cont. M-2000, M-3000 Series... 120-4 1000 Series(CM-2) 1000 Series Revised (CM-3) 77-4	INTERNATIONAL ELECTRONICS PT3(CM-2) 88-4	RCA MI-12875(CM-2) 85-12	ST. GEORGE 1100 Series Wire Recorder ..(CM-1) 40-24
BRUSH MAIL-A-VOICE BK-501, BK-502, BK-503(CM-1)	CRESTWOOD CP-201(CM-3) 118-4	LEAR DYNAPORT WC-311-D(CM-2) 80-8	REELEST CIA(CM-2) 123-13	WEBSTER-CHICAGO 79-80 Wire Recorder (CM-1) 37-26 178(CM-3) 113-12
CRESCENT H-2A1 Series(CM-3) 119-4 H-19 Series "Steno" 122-3 H-22A1(CM-3) 125-4	ECOR 1000(CM-3) 90-4	MAGNECORD AUDIAD AD-1R(CM-2) 84-7	SILVERTONE 70 (Ch. 567.230, 567.231) 121-11 771(CM-1) 26-32 101.774-2, 101.774-4 (CM-3) 114-10	WEBSTER ELECTRIC Ekatape(CM-3) 116-12
	GENERAL INDUSTRIES R70, R90(CM-1) 35-28	MASCO 375(CM-3) 117-7		WIRE RECORDING CORP. WP(CM-2) 76-19

"SHOP TALK" (Continued from page 4)

high-voltage circuits and the horizontal deflection system. This is indeed the most logical method of approach to the problem. But in this instance it will seemingly not lead you anywhere.

Whenever you come up against a really tough servicing job, it has been the writer's habit to put the set aside, concentrate on the set schematic, and try to determine whether any apparently unrelated section of the set is affiliated somehow with the section to which the symptoms point. In the Capehart set mentioned, such perusal will reveal that the cathode of the 6BG6 horizontal output amplifier and the cathode of the 6AH6 video amplifier both connect to the same -90 volt point in the B+ power supply. What happens is simply this: The cathode of the 6AH6 is biased 90 volts negative. The filament of this miniature tube has one side grounded. If the 6AH6 has a slight defect in construction, a difference of potential this large between filament and cathode will be powerful enough to break down the insulation between these elements and effectively ground out the 90 volts. With the proper biasing voltages removed from the 6BG6, it ceases to operate normally and no high voltage is produced. Replacement of the 6AH6 video amplifier tube corrects the situation.

"Hidden Ball" service defects have many parallels in radio receivers. Thus, it frequently happens that cases of severe hum arise because of leakage

between filter capacitors which, while located in the same container, actually serve different sections of the receiver. Hence, what we encounter in television is not something radically new, but a familiar friend disguised in new clothes.

Another lesson to learn from the foregoing is that whenever there exists a large difference of potential between filament and cathode of a tube, there also exists the very definite possibility of a voltage breakdown. This is especially true of miniature tubes.

FIELD STRENGTH METERS. A very useful instrument, for any man who is going to do any amount of outside service or installation work, is a field strength or a field intensity meter. The uses for such an instrument are numerous, not only for yourself, but for customer relations as well. With such a meter, it is possible to locate the best position and the optimum height for an antenna, to compare the attenuation of one lead-in against another, to determine conclusively which antenna is best suited for your particular purpose, and to know precisely how much signal is actually reaching the set.

A major factor in determining just how good a picture you get is the amount of signal that you feed the set. If the sensitivity of the set is high, you may be able to overcome some loss in signal, but generally the limits in this respect are quite narrow because you have the noise that the set itself generates to contend with. In 9 receivers out of 10, operating a

set within 75 per cent of its maximum sensitivity will give you a picture which is too spotty to watch unless you live so far from a station that you have no other choice. Thus, the only solution is to get as much signal to your set as possible and only with a field intensity meter can you be sure.

The common practice of stationing one man at the receiver screen is generally good for spotting ghosts and checking gross differences in signal strength. But after 5 minutes of concentrating on the screen, this man is usually unable to differentiate between signals as far apart as 500 microvolts in strength. The same two man installation crew can do a better job in less time with a field intensity meter.

Finally, there is the very useful job in public relations that such a meter can perform. Any sign of poor performance on the part of a set is often erroneously blamed on a poor installation, i. e., the wrong antenna was used, or the antenna was not properly positioned, or the lead-in has too high an attenuation, etc. With a reliable field intensity meter indicating the strength of the signal reaching the set, there is very little room for argument.

And, as every serviceman is only too well aware, a customer must be given as much attention (if not more) as the set. To get a customer on your side is sometimes worth many times the cost of the meter.

A servicing job recently came up that could have been solved with a field intensity meter. A serviceman found that a set was overloading on channels 4 and 5, but apparently operating satisfactorily on channels 7 and 9. The first guess, of course, was the tuner, but after everything that could be done to this unit had been done, the symptoms remained. Valuable time went by while every conceivable test was made on the chassis. Finally it was noted that the A. G. C. voltage was not negative enough, permitting the controlled tubes to operate at almost full gain. As a result, normal signals were amplified to such an extent that sync clipping occurred, producing all the symptoms of overloading. For weak signals, which in this case turned out to be true of channels 7 and 9, the excessive amplification was not quite as noticeable and therefore escaped attention.

Some clue to the source of this trouble (i. e., defective A. G. C. action) could have been obtained by using a field strength meter to measure the intensity of the incoming signals. A properly functioning A. G. C. system should not permit the set to overload with any but excessively strong signals.

REVIEW: The article selected for review this month concerns insurance protection for servicemen. After reading the article, "Servicemen Need Protection," you will agree that indeed they do.

SERVICEMEN NEED PROTECTION
by Herbert S. Brier
RADIO and TELEVISION MAINTENANCE
(August 1950)

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International Publishing Corporation,
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Above and beyond the technical knowledge that a man must possess in order to successfully operate a radio and television service shop, he must also have a fair grasp of business. He must know how to operate efficiently, he must know how to build up his business, and, above all, he must know how to protect what he does have. And the only satisfactory method of protection lies in insurance.

For the radio or television service shop owner, insurance may be divided into two broad general classifications. First, there is insurance against actual property loss, as from fire, windstorm, boiler explosion, automobile collision, and theft, as well as health, accident, and life insurance. Secondly, there is liability insurance, or the protection you get when some one sues you for damage you have supposedly caused them.

Now, let us consider only insurance against actual property loss. Your prime objective, with any type of insurance, is to obtain as extensive a coverage as possible. In the case of fire insurance, for example, you want protection not only from the actual ravages of the fire itself, but from such accompanying destructive effects as loss caused by water and other agents used in fighting fires. And generally, for a slight addition to your premium, you can obtain protection against losses caused by windstorms, cyclones, hail, vehicles, aircraft, riot, etc. Maybe you are a little skeptical about some of the items listed. Remember, however, that the additional cost is usually very small and it takes only one cyclone, or one riot, or one windstorm to put you out of business.

On a par with not having the right type of insurance coverage is not having enough. Don't look for bargains in insurance. The rates of all reputable companies are very much alike and if some agent comes along with a fast deal involving (supposedly) greater coverage at considerably less cost, BEWARE! Fine print and fast deals have put more men out of business than you can count in a month of Sundays. If you are the least bit doubtful about an insurance company, its financial rating can be obtained by writing to the state insurance board at your state capitol.

Another form of insurance against property loss that may become more and more important as parts and equipment become scarcer is theft or dishonesty insurance. Outside losses are covered by various forms of robbery, burglary, theft, and open stock insurance; employee dishonesty is coverable by fidelity bonds.

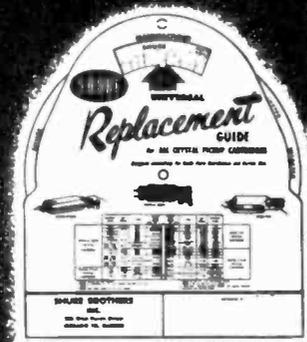
Fidelity bonds are usually available in two forms. In one, each employee is bonded, and in the other, one bond covers all employees. With individual position bonds, losses caused by the collusion of several employees are covered up to the sum of their individual bonds. But with a blanket bond, protection extends only to the amount of the bond, no matter how large the loss or how many are involved; but in that case it is not necessary to prove that a bonded employee is guilty. An indirect advantage of bonding employees is that insurance companies investigate those whom they bond and may save you from hiring a dishonest one.

Liability Insurance: Liability insurance is the second general classification previously mentioned

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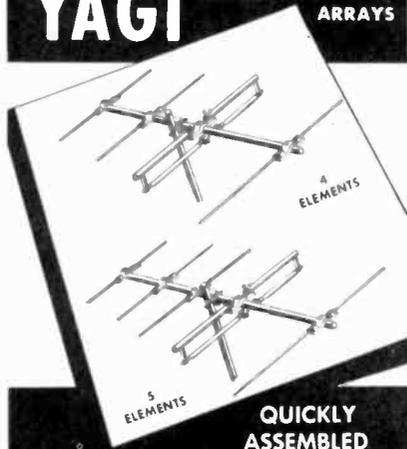
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"SHOP TALK" (Continued)

and in many respects, the most important form of insurance. While property losses are limited to the value of the property, it is difficult to set a definite value on a human injury.

Suppose a customer trips over a loose floor board in your shop and wrenches her back; suppose one of your trucks runs over a small boy playing in the street; suppose a customer's son picks up the wrong end of your hot soldering iron: How much injury has been done in each instance? In the case of a suit, a jury would decide - and juries are as variable in their verdicts as a loose antenna mast flapping in the wind. The only way to remove this potential sleep-killing load from your shoulders is by the proper type of liability insurance. You can purchase medical liability insurance, property damage liability, and many other forms of liability insurance in separate policies. However, many of these liability policies may be combined in a general or comprehensive liability policy. The main difference between a specific and a comprehensive liability policy is that the specific policy covers only those liabilities actually mentioned in the policy, and no others. On the other hand, a comprehensive policy covers every liability not specifically mentioned. Usually the comprehensive policy is preferable.

To keep the cost of insurance premiums low, while still enjoying as much coverage as you feel is necessary, it is suggested that insurance policies be bought for a period of from three to five years. Another way to lower premium costs is by eliminating a fire hazard, or installing a few fire extinguishers. Again, there are such cost-saving measures as burglar alarms, better locks, or removing valuable papers and money from your shop to a bank safety deposit box. And accepting a higher deduction clause in automobile collision and similar policies written with a "deductible" clause will also reduce premiums, but will require you to absorb small losses while losses which could prove fatal to your business.

For greater detail on insurance problems study the original text and similar article appearing in the August 1950 Radio and Television News Magazine. Both are well worth while.

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PHOTOFACT INDEX

◆ ◆ Continued from page 23 ◆ ◆

Under each of the printed circuit oscillator coils is a small plate of non-magnetic material, mounted on a screw, which varies the frequency of the local oscillator. The screw adjustment is accessible from the front end of the tuner.

Some components of the tuner are available for observation through an opening in the right side of the assembly. The turret must be removed to inspect the remaining components.

The arrangement of components has made it possible to hold lead lengths to a minimum. It is extremely important, when replacing a defective part, that the location and lead length exactly duplicate the original. At the same time, avoid moving other components any more than necessary.

A shaft concentric with the channel selector switch shaft operates the fine tuning trimmer. Fine tuning is accomplished by moving a cam-shaped piece of material between two fixed plates, thus changing capacity by varying the dielectric.

To minimize the presence of stray RF fields, shielding in this tuner is provided by several means. Both tubes have shields, with an additional lead shield around the 6J6 to reduce microphonics. Inside the tuner a metal shield separates grid and plate circuits of the RF tube. Another shield is placed between the plate circuit components of the RF tube and the grid circuit components of the mixer tube. An additional stationary contact connects the mixer coils on the adjacent channel strip to ground, providing further shielding.

The turret is so constructed that shields are placed between the printed circuit coils, and ears extending from the shields aid in locking the channel segments securely in position.

In order that the turret is correctly replaced in the tuner, the following procedure should be used. The spiral spring is placed on the turret shaft and the

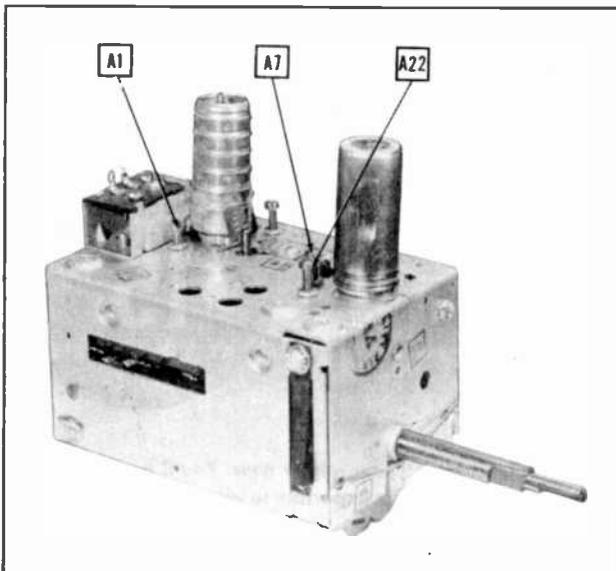


Fig. 1-12B. Hallicrafters Printed Circuit Tuner Alignment Points.

concentric fine tuning shaft is put in position. The turret shaft and the fine tuning shaft each have a grooved bearing which fits into slots in opposite ends of the tuner. At the same time that the turret is placed in the tuner the cam shaped dielectric is fitted between the fixed plates of the fine tuning trimmer. Care should be taken that the dielectric is not damaged, which might result if placed outside the fixed plates. The two lengths of spring wire are then put in place so that they press on the edge of the bearings rather than the turret or fine tuning shafts. Undue wear and stiffness in operation may result if the spring wires are allowed to rest on the shafts instead of on the bearings.

A 6CB6 tube is used in the single RF stage. This tube provides high gain, low noise, and has low interelectrode capacity. The second tube is a 6J6; one triode section is used as the mixer, the other serves as the local oscillator.

A low-pass pi network is used in the grid circuit of the RF amplifier, while a double-tuned bandpass network is employed in the plate circuit. The oscillator is of the Colpitts type.

Referring to the schematic diagram, Figure 1-12G, antenna coil L1 is designed to match a 300-ohm input line and has its primary center-tapped to ground. The low side of the secondary is grounded and the high side connected in series with L2, C1, and C2. The junction of C1 and C2 is connected in series with the printed circuit RF coil, L3, and A1 to ground. The junction of L3 and A1 is connected to the grid of V1. The tuned grid circuit of V1 consists of C2, the printed circuit RF coil, L3, A1, the distributed capacity of the circuit elements, and the interelectrode capacity of the tube.

The correct bandpass on the low channels, as observed on a scope, is obtained by adjusting A1 for maximum amplitude between sound and video markers. A2 is adjusted for maximum amplitude on the high channels. R1 is the grid return to the AGC line,

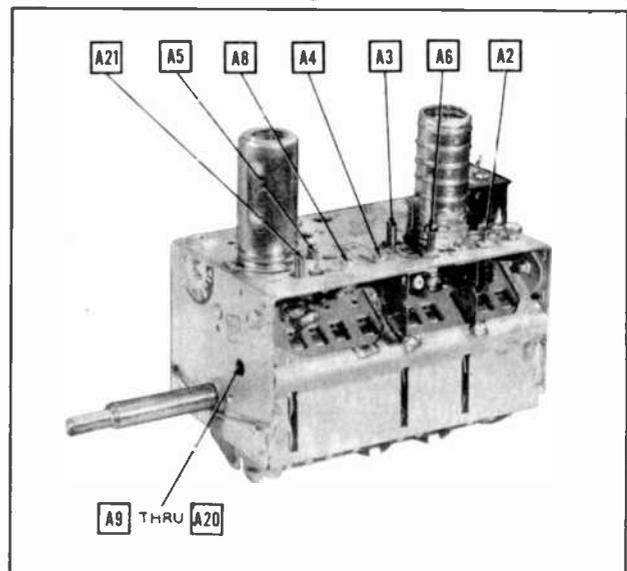


Fig. 1-12C. Hallicrafters Printed Circuit Tuner Alignment Points.



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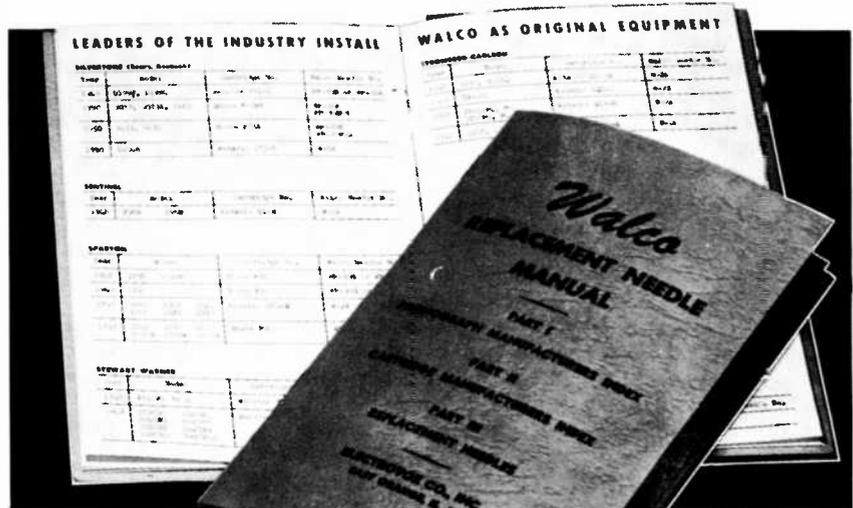
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and C4 is an AGC filter. C2 bypasses the filament of V1 to ground.

The coupling between V1 and V2 is an M-derived bandpass filter. The tuned circuit portion consists of L5, A6, the printed circuit mixer coils, A4, C7, A8, C8, A7, and L6, and the interelectrode capacity of V1 and V2. A3, A4, and A5 are adjusted for the correct bandpass on channel 13. A6 and A7 are adjusted for correct bandpass on channel 7. Low channel bandpass is obtained by adjusting A8.

Three printed circuit coils are used in the coupling network of V1 and V2. Coil Z, C7 and A4, or A8 and C8, function as a common impedance coupling between the plate circuit of the RF amplifier and the mixer grid network. Coils X and Y are shielded from each other. The signal developed across coil Z, A4, and C7 is common to the plate circuit section of the RF amplifier and the grid circuit of the mixer. Changing the capacity of A4 or A8 varies the impedance of the common impedance coupling network and thus controls the bandpass. A4 is adjusted for correct bandpass on high channels, and A8 controls bandpass on low channels.

In the screen circuit of the RF amplifier, a small amount of inductance, L4, is placed in series with the screen bypass, C5, to increase input resistance of the tube and, thereby, reduce loading of the grid circuit, particularly on the high channels.

The mixer is one triode section of a 6J6 tube. The series network of R5 and R6 makes up the mixer grid load. The junction of these resistors is brought out to the top of the tuner for alignment purposes. The local oscillator signal is coupled to the grid circuit of the mixer through C2, a 2.2 mmf. capacitor.

The other triode section of the 6J6 tube is used in a modified Colpitts oscillator circuit. The printed

circuit oscillator coil of each channel is placed in series with L9 as the turret is rotated. The tuned portion consists of the printed circuit oscillator coil, L9, C14, A22, C16, and the fine tuning trimmer. A22 and C16 provide the necessary feedback. The value of these capacitors is large compared to the interelectrode capacity of the oscillator tube; therefore, realignment should not be necessary when the 6J6 tube is replaced. This also decreases oscillator drift during warmup.

C15 serves as a DC blocking capacitor, and R9 is the grid return. The plate load for the oscillator is R10 and the parallel combination of L8 and R11. R12 and C17 decouple the oscillator from B+, while C12 and R8 decouple the mixer plate circuit.

Troubles which might be encountered in servicing the tuner may involve dirty contacts. If erratic operation is encountered on some of the channels when the turret is rotated, the fault may lie in dirty contacts or insufficient tension from one of the stationary contacts. If the trouble is still present after cleaning the contacts, an instrument, such as an insulated alignment tool, can be gently pressed against each of the stationary spring contacts to determine which one is at fault. If one is found which makes poor contact, remove one of the channel segments and rotate the turret until the blank space is beneath the spring contacts. The faulty contact is then bent slightly, with the alignment tool, to obtain the proper tension.

Complete alignment instructions for this tuner are given in this section, including Figures 1-12B through 1-12F.

We wish to acknowledge the cooperation of the Hallicrafters Co. in supplying us with technical data and samples which were used in this presentation.

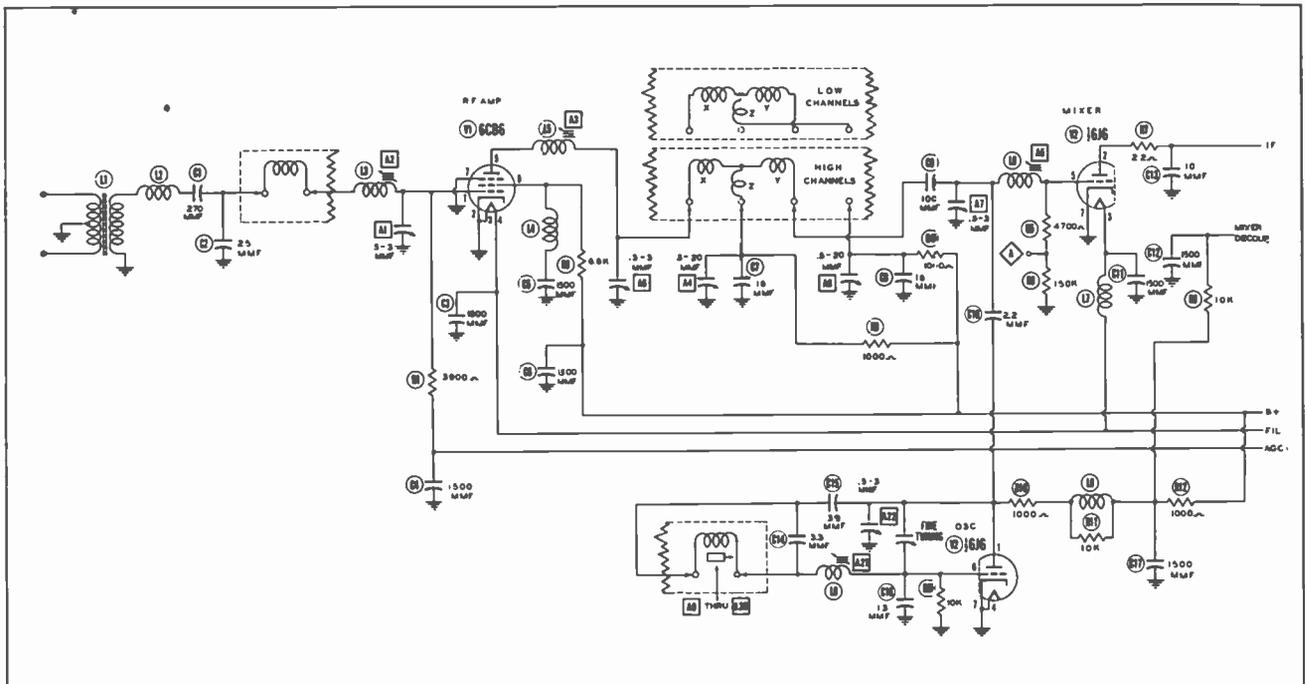


Fig. 1-12G. Schematic of Hallicrafters Printed Circuit Tuner.

ALIGNMENT INSTRUCTIONS

HALLICRAFTER TV TUNER

ALIGNMENT INSTRUCTIONS—READ CAREFULLY BEFORE ATTEMPTING ALIGNMENT

Connect the negative lead of a 1.5 volt battery to the AGC terminal on the tuner, connect the positive lead to B-. The sweep generator output lead should be terminated with its characteristic impedance, usually 50 ohms.

ANTENNA ALIGNMENT

DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
1. Two 120Ω carbon resistors	Across antenna terminals with 120Ω in each lead.	85MC (12MC SWP)	83.25MC 87.75MC	6	Vert. amp. thru detector (fig. 1-12D) to pin 5 (plate) of 6CB6 RF amp.	A1	Adjust for maximum amplitude between the channel 6 sound and video markers.
2. "	"	177MC (10MC SWP)	175.25MC 179.75MC	7	"	A2	Adjust for maximum amplitude between the channel 7 sound and video markers.
3. "	"	79MC (12MC SWP)	77.25MC 81.75MC	5	"		Check all low band channels for response curve similar to figure 1-12E. If necessary retouch A1 for best compromise across the low band channels.
		69MC (12MC SWP)	67.25MC 71.75MC	4			
		63MC (12MC SWP)	61.25MC 65.75MC	3			
		57MC (12MC SWP)	55.25MC 59.75MC	2			
4. "	"	183MC (12MC SWP)	181.25MC 185.75MC	8	"		Check all high band channels for response curve similar to figure 1-12E. If necessary retouch A2 for best compromise across the high band channels.
		189MC (12MC SWP)	187.25MC 191.75MC	9			
		195MC (12MC SWP)	193.25MC 197.75MC	10			
		201MC (12MC SWP)	199.25MC 203.75MC	11			
		207MC (12MC SWP)	205.25MC 209.75MC	12			
		213MC (10MC SWP)	211.25MC 215.75MC	13			

RF ALIGNMENT

Leave the bias battery connected. The sweep generator output lead should be terminated with its characteristic impedance, usually 50 ohms.

DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
5. Two 120Ω carbon resistors	Across antenna terminals with 120Ω in each lead.	213MC (12MC SWP)	211.25MC 215.75MC	13	Vert. amp. to Point A. Low side to chassis.	A3, A4, A5	Adjust for response curve similar to fig. 1-12F.
6. "	"	177MC (12MC SWP)	175.25MC 179.75MC	7	"	A6, A7	"
7. "	"	85MC (12MC SWP)	83.25MC 87.75MC	6	"	A8	"
8. "	"	79MC (12MC SWP)	77.25MC 81.75MC	5	"		Check all low band channels for response curve similar to figure 1-12F. If necessary retouch A6, A7 and A8 for best compromise over the low band channels.
		69MC (12MC SWP)	67.25MC 71.75MC	4			
		63MC (12MC SWP)	61.25MC 65.75MC	3			
		57MC (12MC SWP)	55.25MC 59.75MC	2			
9. "	"	207MC (12MC SWP)	205.25MC 204.75MC	12	"		Check all high band channels for response curve similar to figure 1-12F. If necessary retouch A3, A4 and A5 for best compromise over the high band channels.
		201MC (12MC SWP)	199.25MC 203.75MC	11			
		195MC (12MC SWP)	193.25MC 197.75MC	10			
		189MC (12MC SWP)	187.25MC 191.75MC	9			
		183MC (10MC SWP)	181.25MC 185.75MC	8			

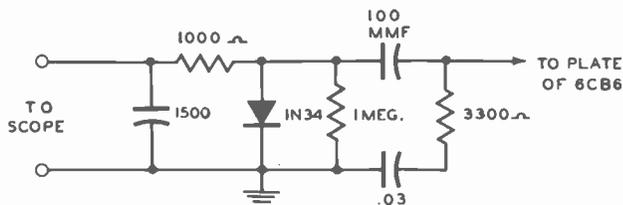


FIG. 1-12D

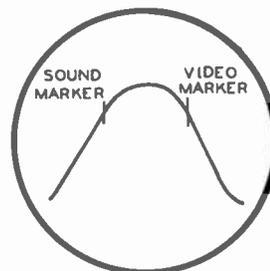


FIG. 1-12E

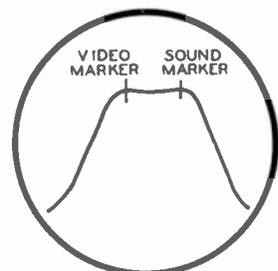


FIG. 1-12F

OSCILLATOR ALIGNMENT

The overall oscillator adjustments (A21 and A22), have been pre-set at the factory and should not normally require adjustment in the field. However, if it is known that the adjustments have been tampered with, or if any of the channel strip adjustments shows insufficient range, they may be adjusted as follows.
 A21 should be adjusted on channel 13 with the channel strip adjustment near the center of its range.
 A22 should be adjusted on channel 2 with the channel strip near the center of its range.
 A21 affects primarily the high channels and A22 affects primarily the low channels, however they are interacting and if either is changed, all channels should be rechecked to see if they have been seriously affected.

SEPARATE SOUND IF RECEIVER OSCILLATOR ALIGNMENT

In the receivers which employ a separate sound channel the oscillator can most conveniently be aligned by feeding the channel sound carrier frequency into the antenna and adjusting for zero voltage reading on the VTVM connected to the sound detector output.
 The signal generator output lead should be terminated with its characteristic impedance, usually 50 ohms.
 Set the fine tuning control to the mid-position of its range.

DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	CHANNEL	CONNECT VTVM	ADJUST	REMARKS
10. Two 120Ω carbon resistors	Across antenna terminals with 120Ω in each lead.	59.75MC (Unmod.)	2	Across sound detector output.	A9	Adjust for zero reading. A positive and negative reading will be obtained on either side of the correct setting.
		65.75MC	3		A10	
		71.75MC	4		A11	
		81.75MC	5		A12	
		87.75MC	6		A13	
		179.75MC	7		A14	
		185.75MC	8		A15	
		191.75MC	9		A16	
		197.75MC	10		A17	
		203.75MC	11		A18	
		209.75MC	12		A19	
		215.75MC	13		A20	

INTERCARRIER RECEIVER OSCILLATOR ALIGNMENT

The most convenient method of oscillator alignment to use with this receiver is the beat frequency method. To employ this method it becomes necessary to determine exactly one of the IF frequencies used in the receiver. The video IF frequency is usually given in the alignment instructions and is therefore used in the following example, although the sound IF frequency could be used in a similar manner. After the video IF frequency is determined it is necessary to add the video IF frequency to the channel video carrier frequency to determine at what frequency the oscillator operates on each channel.

DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
10. Two 120Ω carbon resistors	Across antenna terminals with 120Ω in each lead.	55.25MC plus video IF frequency	2	Vert. amp. to tuner output. (1st video IF amp. grid)	A9	Adjust for zero beat indication on scope. This will be indicated by a narrow trace between two wide traces.
11. "	"	See paragraph above	3 thru 13	"	A10 thru A20	"

"AS I SEE IT" (Continued from page 19)

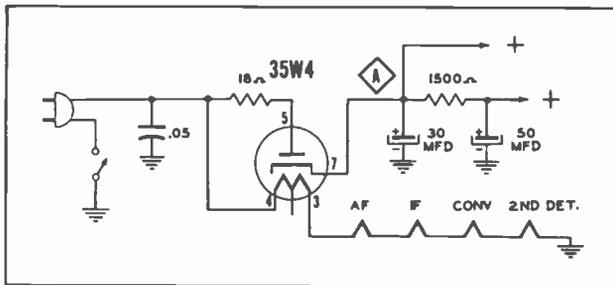


Figure 3

shown in Figure 3, where an 18 ohm resistor is connected in series with the plate of the rectifier to limit the current in case of a short circuit. The resistor connected in this position is called a "rectifier ballast." The circuit diagram shown in Figure 3 is taken from Photofact Set No. 118, Folder No. 6, and is as effective for most purposes as though the resistor were connected as shown in Figure 2. The same examinations of both the defective rectifier tube and the resistor suggested for the circuit illustrated in Figure 2 should be made for receivers wired as indicated in Figure 3.

Occasionally receivers are built which incorporate both "surge limiters" and "rectifier ballasts" and such a receiver schematic is shown in Figure 4, which is taken from Photofact Set No. 118, Folder No. 3. The same precautions should be taken when replacing the rectifier tube, which in this particular

case is a 35Z5GT, as have been suggested for the other circuits.

When the rectifier tube in an AC-DC receiver must be replaced, it is advisable to analyze the tube for open heater as well as possible short circuits, realizing that if the heater wire breaks, then there is always the possibility that one end might touch the cathode and indicate a short. If this has happened, however, there will be no evidence of a short circuit at A, or of a defective electrolytic capacitor, if the defective tube has been removed.

If the circuit is similar to that shown in Figure 1, it is wise to add the resistor provided room can be found where it can be safely mounted. Even though the receiver may be of the latest type it will pay to check the circuit diagram since the four circuits shown are used in current receivers. Parts are both scarce and expensive, so that an analysis of the type and condition of rectifier circuit employed may pay worthwhile dividends in AC-DC service work.

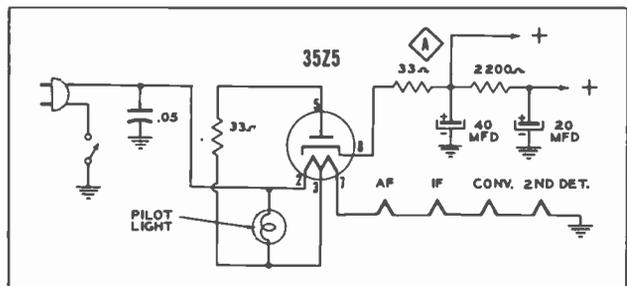


Figure 4

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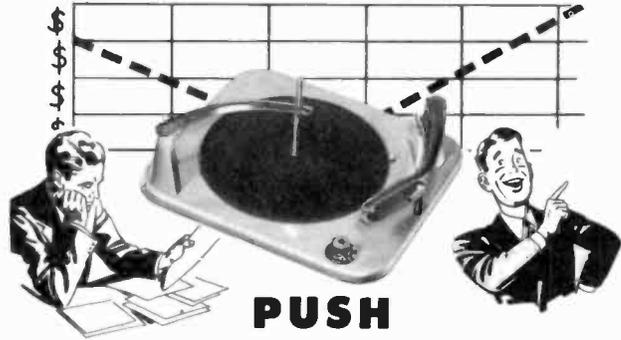
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IMPLOSIONS. What happens when the expressman drops a television set? The accompanying photo tells the story - - the picture tube implodes and makes pretty patterns on the safety-glass window. Not too clearly shown, though, is the inward bellying of the safety glass toward where the picture tube was. The inrush of air to fill the vacuum of the tube volume sucked the glass inward, proving that these big tubes implode instead of explode.

RANGE OF TV STATIONS. FCC engineers used to specify the range of a TV station as 0.5 millivolt per meter, but now they simply say "As far as the station can be received." Programs are going way farther than they're technically supposed to. Recognizing this, stations are revising their sets-in-use figures for program-selling purposes to include all sets within their 0.1 mv/m contour. Roughly this extends the coverage out to 60 miles from the station, whereas 40 miles was considered the limit for good reception heretofore. Some stations even claim good viewing out to the 0.025 mc/m contour, even though this is usable only by sets having the corresponding sensitivity of 25 microvolts (which a few do). New coverage figures are backed by engineering tests and by mail from TV set owners, so you're safe in quoting 60 miles to your customers for average locations. The technical explanation for all this is that people in fringe areas are going to a great deal of trouble and expense to get a picture, and generally are willing to accept considerably less than optimum quality when nothing better is possible.

LIGHT-BULB INTERFERENCE. If the complaint is a horizontal black band blotting out part of the picture, it may be oscillation from one of the old unfrosted electric lamps with the pointed tips, in use in the same house or nearby. Look for them in cellars and out-of-the-way places where the bulbs get so little use that they haven't gotten around to burning out yet. Favorite carrier frequencies of these bulbs fall right in the low-band TV channels.

HIGHER IF VALUES. So far in the current TV models, only Arvin, GE and Westinghouse have gone to 45.75-mv intermediate-frequency values. Teletone uses 37.3 mc on some of their sets, while all the rest of the makes are still down around 25 mc.

THREE-SPEED DOLLARS. Despite the loud original predictions of pandemonium, three speeds have been good for the record business. Now the serviceman is coming in for his benefits. All the publicity, plus some 1.5 million brand-new three-speed changers going into 1950 phono combinations, has made many realize that their prewar hard-to-fix 78-rpm changers are as obsolete as a model T Ford. As a result, more changers were made in 1950 than in any previous year in history. Simplification and improvement in design and manufacture have made the modern changer stand up under terrific punishment in the hands of the kiddies, and the few that do go bad are no longer causing ulcers among servicemen. Don't be scared of a 3-speed job; just dig up the Photofact Folder with the correct exploded view of the works, and in no time at all you'll find the right lever to bend or the right screw to turn.

SALTED TV LINES. Right on the seashore, twin-lead can become useless for television in just a few days because of the high moisture and salt content of the air. The salt deposits on the line, then the night fog wets it to form a practically perfect conducting sheath that changes both impedance and attenuation characteristics drastically. Even ten blocks inland, lines go bad within a few months, with the effect most noticed beyond about 20 miles from the TV station. Suggested partial remedies include putting the twin-lead inside large plastic tubing, using open-air 300-ohm line and coating the spacers with silicone grease to shed water, and using air or nitro-pressurized flexible copper coaxial line in really bad locations. Ordinary coax is of course the answer where its own increased attenuation is acceptable. Runs of 100 feet of coax in a fringe location can be just as bad for the picture as salted standard line. For more details on choice and installation of lines along the coast, read "TV by the Sea" in February 1951 Radio-Electronics.

IN LIGHTER VEIN. In an esteemed high-brow society journal, a scientist proposes as a definition for communication, "the discriminatory response of an organism to a stimulus." Now look at the communications cartoon below for your sign-off chuckle. It must be Love!



The above cartoon appeared in the December 1950 issue of TELEVISION MIS-INFORMATION, published by Sheldon Electric Company, Irvington, New Jersey.

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More About the "Thing"

While we have the opportunity, perhaps a brief description of the makeup of the "Thing" and its application to articles current or projected, appearing in the "Technical Digest" would be in order.

As previously outlined, the "Thing" consists of a rugged rack system with suitable electrical connection features to distribute power to any number or assembly of individual chassis. In the TV field, for example, we have more than twenty such chassis 2' x 5' x 7', each of which is representative of a typical function or popular circuit design. These chassis range from TV tuning units, sound or video IF's and video amplifiers through sync separators, blocking oscillators, vertical and horizontal output, etc. Selection of proper chassis enables operation of a particular TV system design, with ready observation or measurement on any component stage or assembly. You can readily appreciate the value of noting the results of simulated failures or maladjustments, or the ability to substitute chassis functions of the "Thing" for similar portions of existing receivers.

One of the first problems we faced in our original plans for the project was the necessity for providing a filament and plate power source capable of handling requirements extending from those of 2 or 3 tube sub-assemblies, to complete 30-or-more tube receiver systems.

In addition to the heavy duty requirement, means had to be provided for flexible application. Voltage outputs must range from 100 to 450 volts and remain substantially constant regardless of load. Frequently one design needs multiple voltage values without the necessity of dividing resistors within the individual chassis.

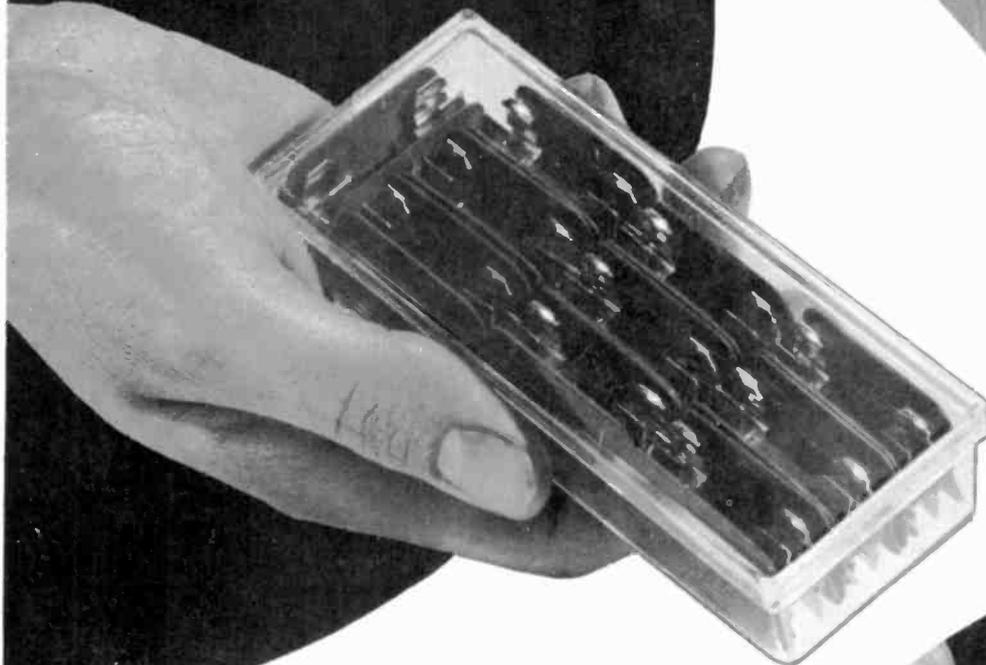
Our final answer to the problem is pictured at the top of this column. The power supply shown provides filament voltage of 12.6 volts center-tapped at currents up to 10 amperes. The plate or B supply has three regulated and metered outputs, each of which can supply up to 250 ma. current in the following ranges: High - 300 to 450 volts; Medium - 200 to 300 volts; Low - 100 to 175 volts. Additionally, a regulated negative supply of 150 volts is available for bias or similar applications.

The power unit employs 2 - 5R4GY HV rectifiers, a 5Y3GT bias rectifier, 4 - 6AS7G pass tubes, 1 - OD3/VR150 and 1 - OB3/VR90 voltage regulators, and 3 - 6AU6 control tubes. The circuit arrangement is a little special. We'll try and include it later when space permits.

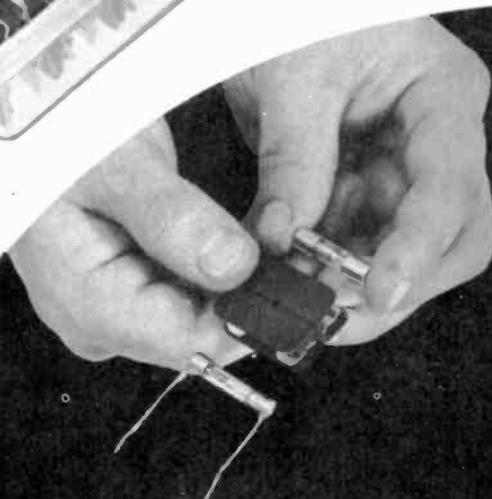
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