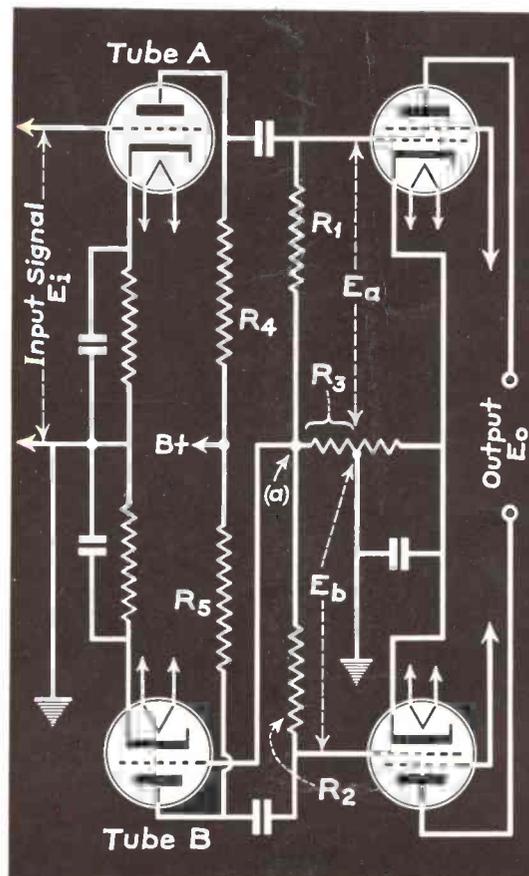


# SERVICE

A MONTHLY DIGEST OF

# RADIO

AND ALLIED MAINTENANCE



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25 CENTS

Self-Balancing Phase Inversion  
(See page 2)

NOVEMBER  
1938



# SERVICE

A Monthly Digest of Radio and Allied Maintenance  
 Reg. U. S. Patent Office. Member, Audit Bureau of Circulations

EDITOR

NOVEMBER, 1938

ROBERT G. HERZOG

VOL. 7, NO. 11

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\*Indicates circuit diagram accompanies text.

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# Antenna

## TELEVISION DEVELOPMENTS

**A**FTER many years of experimental development, it seems that television is advancing toward commercialization. Let us review a few of the recent developments.

To begin with, it has been announced that RCA will place a limited number of television receivers on sale at the opening of New York's World Fair in April of next year. It is also understood that a number of other manufacturers are planning to market television sets in areas served by television programs.

At the present time there are approximately sixteen experimental television stations in various parts of the United States. Some of these stations are already on the air with fairly regular experimental programs. By the time the World Fair opens in New York City, NBC will be broadcasting regular television programs. It is also expected that CBS will have their transmitter in the Chrysler Building on the air, since present plans call for the completion of the installation shortly after the first of the year.

It is also interesting to note that RCA is preparing to supply information on recent television transmitter developments to interested broadcast stations. The same organization is also prepared to assist its licensees who may desire to manufacture television receivers.

The RMA Television Committee have developed and submitted standards to the Federal Communications Commission. While the Commission has taken no action on the matter, we fail to see any logical reason why these standards should not be approved.

Also of significance is the fact that plans for cooperative exchange of data between television and motion picture engineers are understood to have been approved at the recent convention of the Society of Motion Picture Engineers in Detroit.

The first steps have been taken. It would seem that the future of this service is now up to the public.

## IN THIS ISSUE

**W**E ARE continuing, on pages 10, 11 and 12 of this issue, the discussion of the theory and applications of visual indicator tubes. The dual and annular ring types are covered in the present article.

**I**T IS our intention, in succeeding issues of SERVICE, to present articles on the various parts used in the radio receiver, much the same as we have done with visual indicators in the last issue and with dial lamps on pages 5, 6 and 7 of this issue. In early issues you may expect articles on dials, coils, tone controls, etc. In these articles, as a rule, charts of the type shown on

page 6, giving the available types and their characteristics will be given.

We are of the opinion that it is extremely important for you to have first hand information on the parts you use in making repairs and replacements. You should know the availability and interchangeability of the various types of these parts. It is also helpful if you know something of the problems involved in the design and the theory behind their use.

**C**HRISTMAS approaches and with it your customers go gift-y. Why not take advantage of the season and wrap up your principal product in Christmas finery as Mr. Litteljohn suggests on page 38. You can further look forward to increased business through the sale of popular items in allied lines . . . records . . . appliances . . . Christmas tree lighting effects . . . etc.

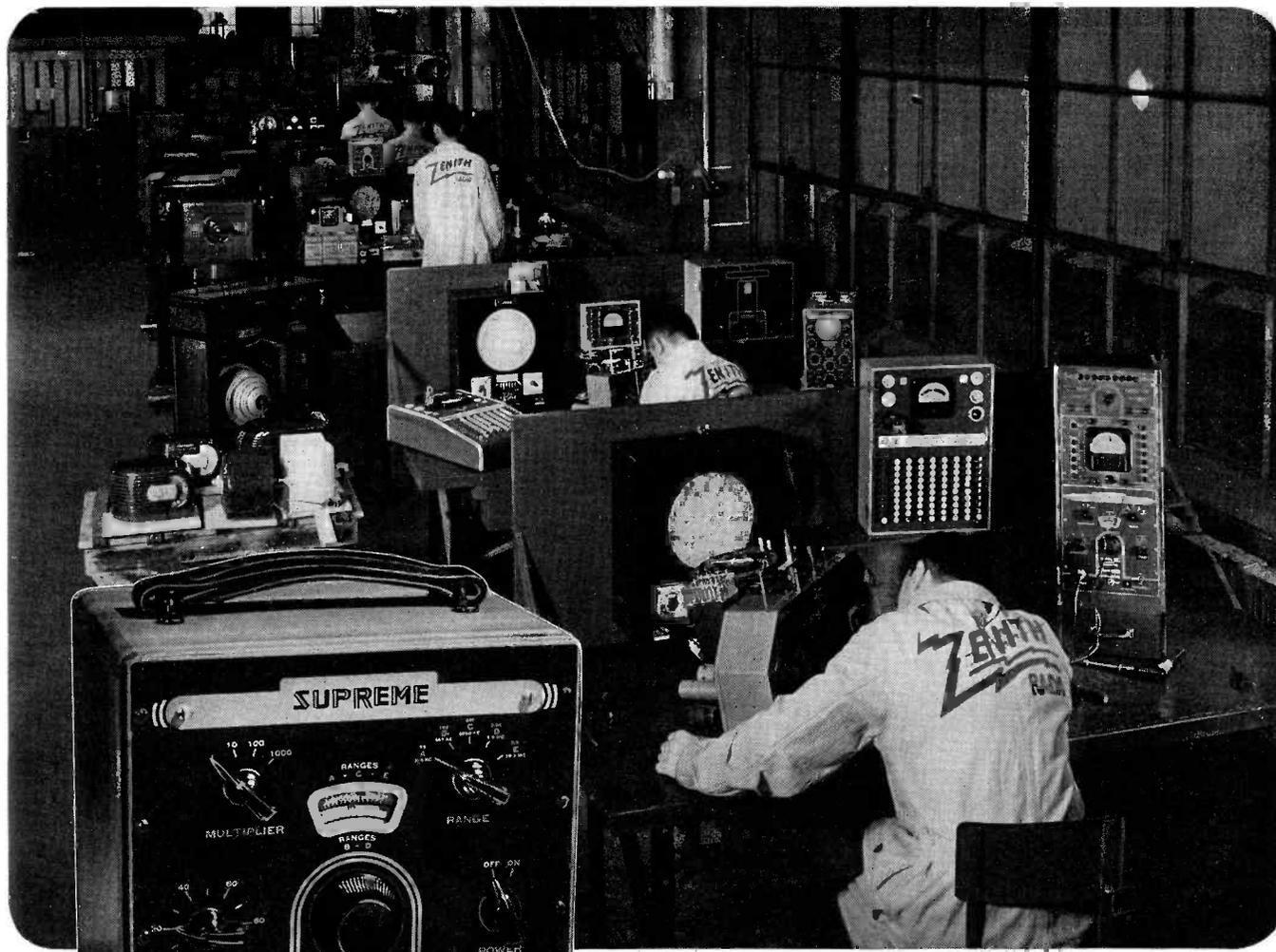
Now is the time to prepare for the increase in business. Stock up on tubes and replacement parts so that you will be able to devote your full time to profitable ends when the rush comes.

## SERVICE CHARGES

**L**AST month we asked, in these columns, "What is a rightful charge?" We have received many and varied answers from our readers.

C. L. Fairchild, Elgin, Ill., writes "Discard the idea that you are selling a condenser and so much work, but rather that you are delivering \$10.00 worth of performance and it matters not whether it took you an hour or all day to deliver that performance." Small wonder you have been in business for 15 years . . . and profitably so. We definitely agree with you that the Service Man should take each job he gets and see to it that *he delivers performance* and gets paid for it. . . . Francis C. Wolven, Saugerties, N. Y., says "As long as we continue to work on junk—we will receive junkmen's wages." Seems to us, hereabouts, that all and sundry who have taken up the latter trade have found the path to riches in short order. (But then again who wants to be a junkman?) . . . Willard Moody, New York City, writes, "I think the guy (Arthur E. Rhine—Ed.) who is preaching the gospel of 'soak 'em and make 'em like it!', is all wet. I would like to see someone, with guts, take the opposing view, the sane slant, the servicing philosophy that has for its keynote the theme of practicality. People are not going to be overcharged and bled. The individual Service Man may not survive . . . but others will take his place with service as a side line." Suppose you take that slant Willard, we might find space to print your views. . . . Al Beers, San Francisco, Cal., feels that the proper charge varies with the customer's ability to pay. Perhaps we would not like to admit it, but doesn't that consideration influence all of us?

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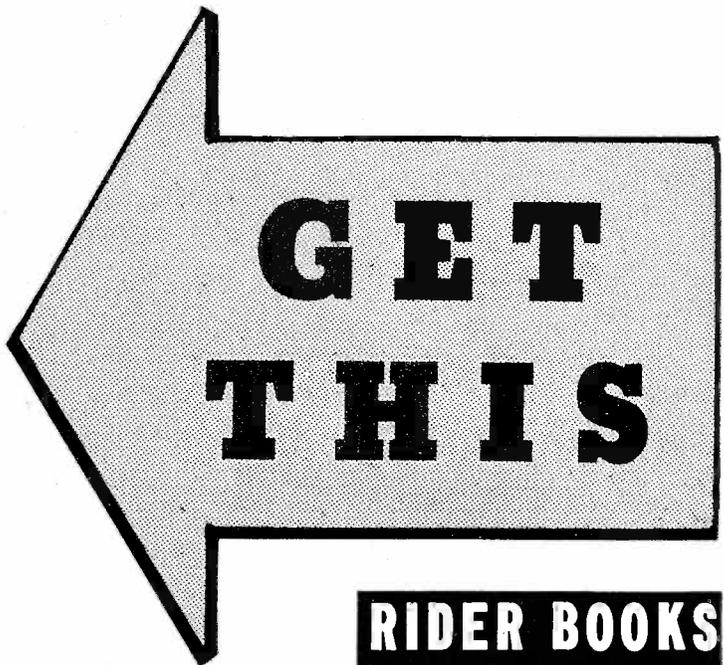
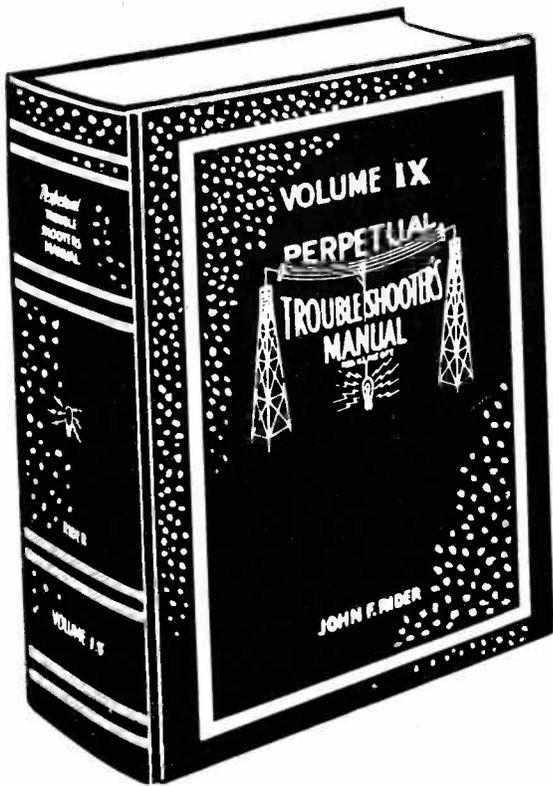
Many familiar SUPREME instruments are illustrated in the above photograph of the Zenith Service Department. In the foreground, at right, is a new SUPREME LABRACK arrangement, consisting of the Model 571 Oscillator, 592 Set Tester and 596 Substitution Box. Individual models, combination portables, or many rack arrangements make SUPREME instruments your logical choice.

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# SERVICE

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FOR NOVEMBER, 1938

## Dial Lamps

AT FIRST glance it might seem that a dial lamp is merely a small light source of low-power requirements, and that no great problem enters into its manufacture. Such a view greatly underestimates the complexity of the factors that enter into the design and use of these small lamps.

When first introduced they were used only to indicate whether the receiver was on or off. As an incidental function they also served to illuminate the markings on the opaque dials used at that time. The lamp was mounted to permit the light to fall directly on the surface of the dial. No severe problems in design or mounting were entailed.

With the advent of highly sensitive receivers, transparent dials, tuning meters, small sized remote control heads, complicated flash-tuning arrangements and the like, new problems in design, shape and placement of these bulbs arise.

### A-C, D-C SETS

Among the many new problems was the means of providing a source of voltage for the dial lamp in the a-c, d-c set. Some of the earliest of these receivers used lamps rated at 2.5 volts, 0.5 amperes, in series with the 0.3-ampere heaters. However, the meager illumination provided and the fact that failure of the lamp caused the receiver to be inoperative, led to discarding of this method.

In the circuit employed today, a No. 40, 44, 46 or 47 type (see Fig. 2) lamp is used. The necessary voltage is developed across a suitable resistor connected in series with the tube filaments and in shunt with the dial lamp. In case of lamp failure the heater circuit is not opened.

Due to the fact that the initial current is considerably greater than the normal operating current, the value of this dial-lamp shunt resistor is very critical. These high starting currents are encountered because the cold resistance of the heaters is considerably lower than the resistance at operating temperatures. In the case of the 25-volt heater, for instance, the hot to cold heater resistance ratio is approximately 7 to 1. The situation may be further aggravated by the use of voltage dropping resistors whose cold resistance is considerably lower than the resistance at operating temperatures.

The initial surge voltage across a lamp, connected as indicated above, increases at a greater rate than the operating voltage for a given increase in the value of the dial-lamp shunt resistor. In cases where more than two 25-volt tubes are employed in one series circuit, the starting current will be considerably higher for the same total number of tubes.

A shunt resistor of 45 ohms would be required in the circuit described, to

obtain rated operating voltage on a type 40 lamp. But this resistor will produce an initial voltage of 14 volts (in a 4-tube set) or an over-voltage of 130 per cent. This overvoltage will cause premature lamp failure.

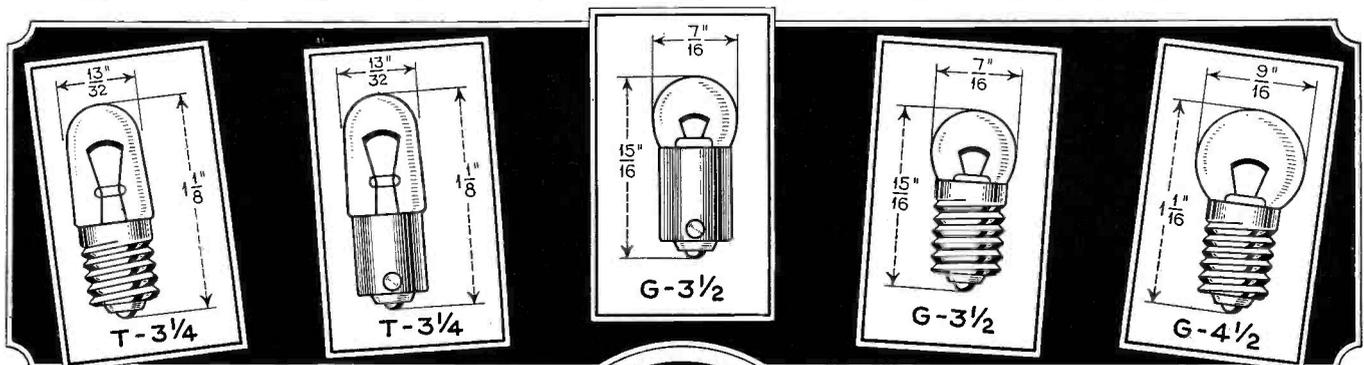
An attempt to remedy this condition has been made by using special a-c, d-c ballast tubes in which the original or cold value of the pilot light shunt resistor is low enough to protect the lamp and whose final or hot value is high enough to provide the recommended operating voltage with its accompanying high illumination. Such resistors utilize the heat generated in the main resistor section for their operation.

In making replacements in a-c, d-c receivers it is important to determine the history of the dial lamp, before making replacement. If its life is persistently short it may also be necessary to replace the dial-lamp shunt resistor. In cases where this is impossible or impractical, an additional resistor may be shunted across the dial light terminals. When replacing ballast resistors in these sets, the new ballast should be matched to the dial light, or the dial light should be changed to suit the new ballast.

### TUNING METERS

It is the practice, in tuning meters of the shadow producing type, to place the lamp directly behind a small aper-

Fig. 1. Sketches showing the several bulb shapes and base types of typical dial lamps. These are drawn to actual size.



ture of predetermined size so that the light shines directly past the edges of a movable vane to cast a shadow of the vane on a translucent screen. The vane, which is actuated by a small magnetic coil through which the tube current flows, will show a minimum deflection for the condition of resonance in the receiver circuits. The shadow of the vane on the screen will, correspondingly, have a minimum width.

To have maximum contrast it is necessary for the edges of the vane to be sharply delineated on the screen and free from penumbra effects. This requires a special straight line form of filament. This filament must be placed in the bulb so that the images reflected from the bulb walls will not pass through the aperture and act as secondary sources of light.

It is extremely important in making lamp replacements in tuning meters to replace with the same type of lamp.

#### LIFE

Fig. 3 is a curve showing the mortality of dial lamps as obtained from tests on vibration-free, accurately controlled life test racks. The No. 40 lamp is designed for 3000 hours and the No. 50 for 1000 hours. These life ratings are based on operation at their respective design voltages. The No. 50 has a 7.5 volt, 0.2 ampere rating as compared with a 6.3 volt, 0.15 rating for the No. 40. (See Fig. 2.) The shorter life expectancy for the No. 50 is the result of this increased efficiency.

The No. 50 and its companion the No. 51 are not in a true sense radio

dial lamps. They were primarily designed for automotive service and while they are satisfactory for use in the remote control heads of auto-radio sets, they are not as strong nor will they withstand audio-frequency vibration nearly as well as the No. 44, for instance.

As mentioned above, life ratings are based upon operation at design voltage. In average service the operating voltage may be so far below the design voltage that the life exceeds the standard expectancy. Suffice to say, that the effects of voltages higher or lower than the design voltage of the lamp are enormous on the life obtained.

There are many other factors, besides the voltage applied to the lamp, that influence its life. The audio frequency vibration set up in the powerful modern sets, for example, is outstanding among factors that have an adverse effect on lamp life.

#### BEADS

The filament lead wires of miniature based lamps are mounted through a small colored glass bead, which is located immediately above the bulb press. The color of this bead will enable the Service Man to identify the lamp for replacement purposes, after the manufacturer's markings have been obliterated. It can be seen, from the chart (Fig. 2) that various colors are used for these beads, and that where any two are identical, other features, such as the type of bulb or base serve to help identify the lamp.

#### BASES

Until two years ago, the only base

used for dial lights was the miniature screw base. As receiver design improved, however, it became necessary to consider another form of base in order to remove many of the difficulties inherent in the screw base type. Approximately one-third of the lamp outages in receivers is due to the lamps vibrating loose in the sockets. The loose bulb often sets up growling noises in the sets as well. Various set manufacturers, in an effort to remedy this condition, found in the screw-base lamps, were using such means as crimping the socket and then forcing the lamp into it with pliers so as to lock the lamp in position. This not only made it extremely difficult to replace the lamps, but also resulted in cracking from 20 to 25 percent of the glass bulbs below the top line of the base where such cracks could not easily be detected. Those lamps then failed early in life due to leakage trouble.

About two years ago, a miniature bayonet base was made available. This base is just like that employed on the common automobile types of lamps, except that it is smaller. The use of this miniature bayonet base has removed many of the troubles formerly encountered with the older screw base types caused by the latter type lamp loosening in the socket. The bayonet base is rapidly gaining in favor and will no doubt eventually supersede the older screw base.

Sketches of the base types are shown in Fig. 1. These are drawn to actual size.

Fig. 2. Complete tabulation of the characteristics of all miniature lamps used in radio receivers.

MAZDA LAMP No.	CIRCUIT VOLTS	DESIGN VOLTS	AMPERES AT DESIGN VOLTS	BASE, MINIATURE	BULB	BEAD COLOR	DESIGN LIFE HOURS	APPROX. CANDLE-POWER	TYPE OF SERVICE	REMARKS	MAZDA LAMP No.
40	6-8	6.3	0.15	Screw	T-3¼	Brown	3000	0.5	Dials		40
40-A	6-8	6.3	0.15	Bayonet	T-3¼	Brown	3000	0.5	Dials	Same as No.47	40-A
41	2.5	2.5	0.5	Screw	T-3¼	White	3000	0.5	Dials		41
42	3.2	3.2	0.35	Screw	T-3¼	Green	1000	0.75	Dials		42
43	2.5	2.5	0.5	Bayonet	T-3¼	White	3000	0.5	Dials and Tuning Meters		43
44	6-8	6.3	0.25	Bayonet	T-3¼	Blue	3000	0.8	Dials and Tuning Meters		44
45	3.2	3.2	0.35	Bayonet	T-3¼	White	3000	0.75	Dials		45
46	6-8	6.3	0.25	Screw	T-3¼	Blue	3000	0.8	Dials and Tuning Meters		46
47	6-8	6.3	0.15	Bayonet	T-3¼	Brown	3000	0.5	Dials	Same as No.40A	47
48	2.0	2.0	0.06	Screw	T-3¼	Pink	1000	-	Dials	For Battery Sets	48
49	2.0	2.0	0.06	Bayonet	T-3¼	Pink	1000	-	Dials	For Battery Sets	49
---	2.1	2.1	0.12	Screw	T-3¼	White	-	-	Dials	Replace with No. 48	---
49-A	2.1	2.1	0.12	Bayonet	T-3¼	-	-	-	Dials	Replace with No. 49	49-A
50	6-8	7.5	0.2	Screw	G-3½	White	1000	1.0	Auto Set Dials and Flashlights		50
51	6-8	7.5	0.2	Bayonet	G-3½	White	1000	1.0	Auto Set Dials and Panel Boards		51
---	6-8	6.5	0.4	Screw	G-4½	White	500	1.75	Auto Set Dials and Flashlights		---
55	6-8	6.5	0.4	Bayonet	G-4½	White	500	1.75	Auto Set Dials and Parking Lights		55
292	2.9	2.9	0.17	Screw	T-3¼	-	-	-	Dials	Use in 2.5 v. sets where line voltage is high	292
292-A	2.9	2.9	0.17	Bayonet	T-3¼	-	-	-	Dials	Use in 2.5 v. sets where line voltage is high	292-A

## BULBS

When dial lamps were first introduced a tubular type bulb was used to distinguish them from flashlight and automotive types. This tubular shape measures approximately  $3\frac{1}{4}$  eighths of an inch and is known as the type T- $3\frac{1}{4}$ . Since that time other forms have been considered, but for the purpose of standardization all panel lamps in home receivers are of the T- $3\frac{1}{4}$  bulb type.

In auto-radio receivers, however, because of the restricted space available in remote control devices the globular or G type of bulb is now standard.

The sketches of various bulb types are shown in Fig. 1. These are drawn to actual size.

In the manufacture and use of dial lamps it is important to select lamp bulbs which are free from seeds, chords and mold marks, which imperfections might produce shadows on the dials.

## FILAMENTS

There are several outstanding filament forms used in the manufacture of radio dial lamps. The straight horizontal coil mentioned in connection with the lamps used for tuning meters is known as the C-6 form. It is somewhat

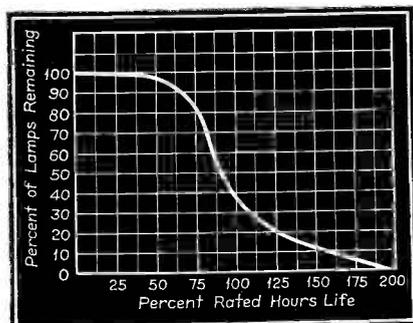


Fig. 3. Curve showing the mortality of dial lamps as obtained from tests on vibration-free, accurately controlled life test racks.

difficult to obtain a perfect C-6 form in such low-priced lamps, where automatic coiling and mounting machinery must necessarily be used for high production, low cost work. In spite of such difficulty, however, very satisfactory results, which fully meet the requirements, are obtained with the present methods.

The first form of coiled filament used in the early panel lamps was the arched, or C-2, type where the filament is mounted bow-shaped between the two copper lead wires. This filament has the advantage of casting light around the lead wires so as to prevent sharp shadows of the leads being cast on the illuminated dial. In some instances, it is necessary to regulate the degree of arching to obtain satisfactory results in practice. This filament form is still used in certain types of lamps, but is only suitable for dial illumination, and since the trend is very definitely toward

## CHARACTERISTIC CURVES FOR MAZDA B DIAL LAMPS

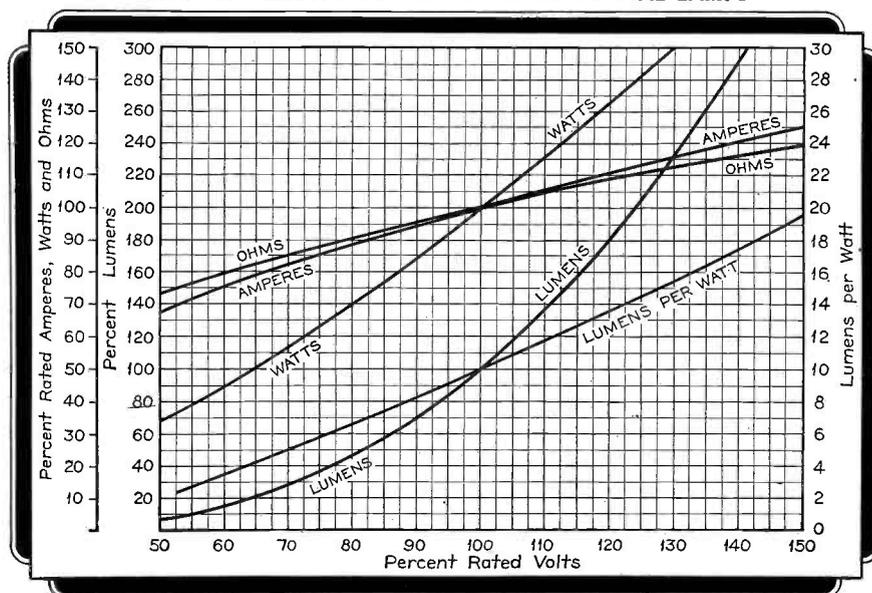


Fig. 4. Variation of lamp characteristics as the operation voltage is altered.

a single filament design, which would be satisfactory for all purposes, it may be superseded by the C-6 form so necessary in shadow meters, and which can also be applied to dial illumination by positioning the lamp so that the filament is parallel to the dial.

In those special forms of lamps used in battery-operated receivers, where the current is of the order of 60 ma and the voltage is also low, a straight wire filament form, known as S-2, is used because the shortness of the filament almost precludes coiling.

A number of years ago it was found that a small percentage of the radio dial lamps had an imperfect joint between the filament legs and the lead wire, of such slight imperfection that no visible flicker of the light output could be observed. This slight imperfection, however, when the lamps were vibrated in radio sets, was sufficiently great to cause a pulsating current to be picked up by the wires in the set and gave a form of interference. Since that time, in addition to the many regular inspections conducted as a routine matter, special precautions are required so as to prevent the lamp from creating extraneous noises in the receiver.

## CHARACTERISTICS

The types of dial lamps now available are shown in the chart of Fig. 2. The current and voltage ratings as well as the rated life, approximate candlepower and other characteristics are given for operation at the design voltage. The curves in Fig. 4 show how these characteristics vary as the operation voltage is altered. The life of these lamps will necessarily vary, as mentioned above, and it can be said that a change of one percent in applied volts will result in a change of approximately ten percent in life.

## RECOMMENDATIONS

One of the chief complaints concerning dial lamps, is one which has to do with making them accessible in receivers. In a number of models it is necessary to remove the entire chassis from the cabinet in order to replace a burned-out lamp. Since special tools are often required to remove the chassis, from two to three hours may be required for this work. More often than not, the set is out of repair pending the visit of a Service Man. It should be only natural to call the set manufacturer to account for such short-sightedness in design.

It is important to remember that while the average life of any given group of lamps is a known factor, the life of any particular lamp is unpredictable. Since greater dependence is being placed upon dial lamps for proper operation of modern receivers, it is only reasonable to expect the manufacturer to make provisions for the easy replacement of such lamps.

Hours spent in replacing a dial lamp cannot prove profitable. For this reason the Service Man should familiarize himself with the type numbers, location and mounting of the dial lamp in as many receiver models as possible. It may be advisable for him to jot these facts down right on the circuit diagrams for the receiver, as the sets pass through his hands.

## BIBLIOGRAPHY

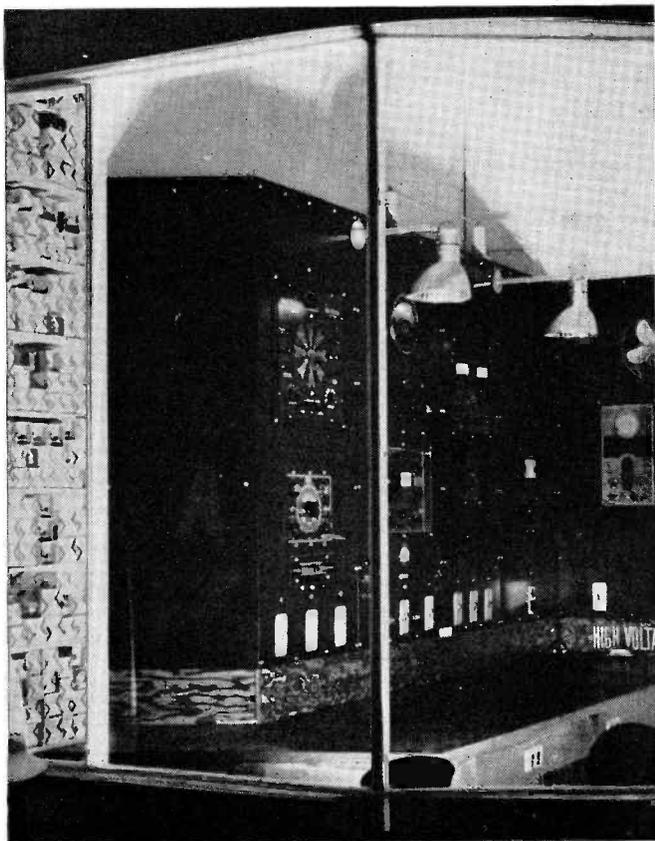
- "Radio Panel Lamps," by J. H. Kurlander; *Proceedings of The Institute of Radio Engineers*, April 1936; page 584.
- Raytheon Databook, first edition; page 34.
- Special appreciation is extended to G. F. Prideaux, General Electric Co.; R. B. Kennett, Tungsol Lamp Works, and J. H. Kurlander, Westinghouse Lamp Co., for help in creating this article.

# AN O.K. SHOP

THE OK Radio Laboratory, Long Beach, Cal., is a carefully designed modern radio sales and service shop. It was moved into its present location about eighteen months ago. Before moving, Marshall A. Williams, its owner, had the opportunity to plan the complete layout on paper. He feels sure that all the available space has been utilized to the greatest advantage.

Fig. 1 shows a close-up of the service bench, through the curved glass partition. From left to right, and from top to bottom can be seen a Wright-DeCoster universal speaker; Solar condenser tester; IRC universal slide resistor; a wattmeter; a preheater; a Triplet tube tester; a series ammeter for auto radios; a magnetic speaker (behind the grill); Hickok signal generator and db meter; an electronic modulator; Triplet vacuum-tube voltmeter; and a soldering-iron indicator. On the right-hand panel is shown a Clough-Brengle oscilloscope. The stand-off insulators on the top of the panel are a concession to show: they merely conduct the antenna lead-in to a post on the first panel. All the instruments are

Fig. 1. A close-up of the service bench of the O.K. Radio Laboratory, Long Beach, Cal., shown through the curved glass partition from the store.



controlled from the 110-volt power lines by means of the row of toggle switches shown.

The panel area is composed of six sections. Each section is independent and can be removed for repairs or changes. The panels are made of tempered masonite. They are sprayed with five coats of non-conductive black lacquer, which achieves a remarkable crinkle effect.

Drawers in the lower sides of the bench provide storage space for small parts and tools.

The entire assembly is not only efficient and useful, but exceptionally appealing to the eye of the customers and helps materially in creating and maintaining good will.

Fig. 2 shows a view of one side of the store, looking toward the glass partitioned service section. In the round mirror, hanging on the wall to the left, the glass partitioned section comprising the office can be seen. Besides the regular office equipment, Rider's manuals, back copies of SERVICE and the customers files are kept in the office.

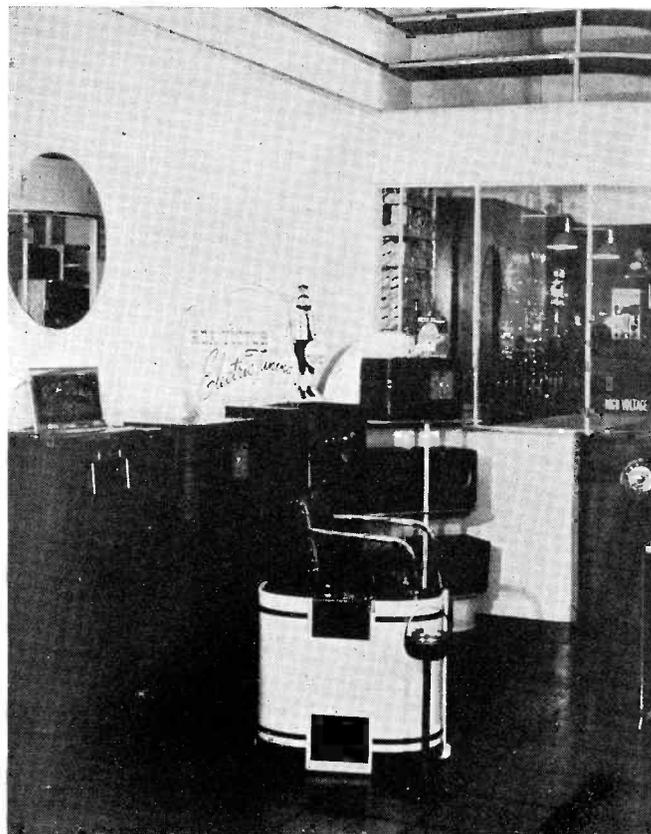
Both the service section and the office section have horizontal louvers at the top, as shown in the illustration, for ventilation. To enhance the general appearance, the lines of these louvers are carried completely around the store in

the form of trimmed wood pieces about 3 inches wide affixed directly to the plaster on the walls. Complementary shading is used on the underside of the louvers and ivory on all other woodwork.

Modernism has also been applied to the selection of furniture for the store, office and service section. The chairs, tables, etc., have vividly colored, geometrically shaped tops and chrome plated, tubular supports and stands.

The business is large and varied, but consists of radio sales and service only (except for a little recording). The OK Radio Laboratory does not sell or service refrigerators or electrical appliances. However, in addition to their own business sources they do contract work in their area for a Los Angeles set manufacturer and for several department stores. As for recording they are entering the field with complete equipment of their own design and manufacture. They have completed a modern studio on the third floor of their building and business in this field is growing by leaps and bounds.

Fig. 2. One side of the O.K. Radio store. The glass partitioned service section can be seen in the rear. A similar section is partitioned for the office. A glimpse of this section can be seen in the round mirror to the left.



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# VISUAL INDICATOR TUBES



By R. LORENZEN

IN A PRECEDING article<sup>1</sup> the theory and applications of the shaded sector visual indicator tubes was discussed. There are, however, two additional types of these tubes, namely, the dual indicator type and the annular ring type.

tubes, but the results were still somewhat unsatisfactory. What was needed was a visual indicator tube that would operate equally well for both weak or strong signals. The dual indicator tube is the answer to that problem. Since it possesses two control electrodes, each controlling its own individual shaded pattern, one of the shadows can be made operable for weak signals and the other for strong signals.

## DUAL INDICATOR

It is necessary, in the case of visual indicator tubes having only one control electrode, to adjust the avc voltage to just close the shaded angular pattern when the receiver is tuned to the strongest carrier. This results in a lack of visual indication sensitivity for weak signals. Such insensitivity was partially remedied by employing a variable-mu triode as a component part of these

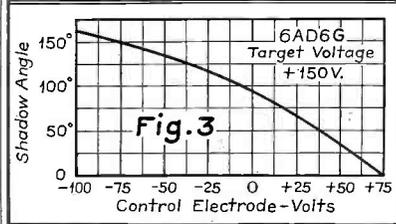
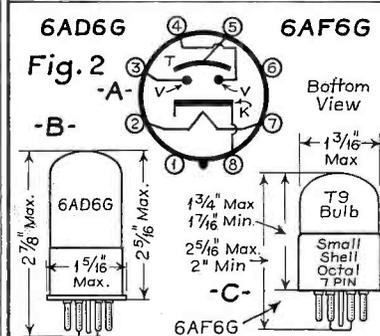
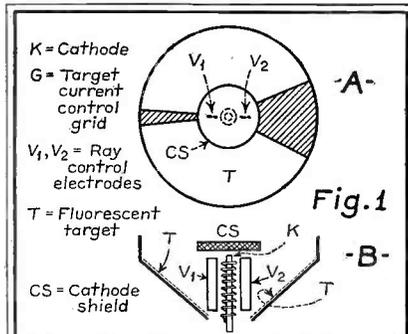
## CONSTRUCTION

Although the principles of operation of dual indicator tubes are fundamentally the same as those for the shaded sector type, there are some important differences that should be considered. All other types of visual indicator tubes are composite structures. They are comprised of the indicator tube proper and a triode control tube in the same envelope. The dual indicator tube, on the other hand, is only an indicating tube and obtains its control voltages from a special control tube. Furthermore, whereas all other visual indicator tubes have a standard 6-pin base, the dual indicator types (Fig. 2) employ the standard octal base.

The constructional details, base connections and characteristics of dual indicator tubes are given in Figs. 1, 2 and 3, respectively. The base connections and internal construction of the 6AE6G control tube are shown in Figs. 4 and 5, respectively. The two tubes used together can be used to give visual resonance indication over a very wide range. One shadow of the dual indicator can be made to close to a fine line with the application of -7 volts to the control grid of the 6AE6G tube, while the other shadow will remain almost fully open until -27 volts are applied to the 6AE6G control grid.

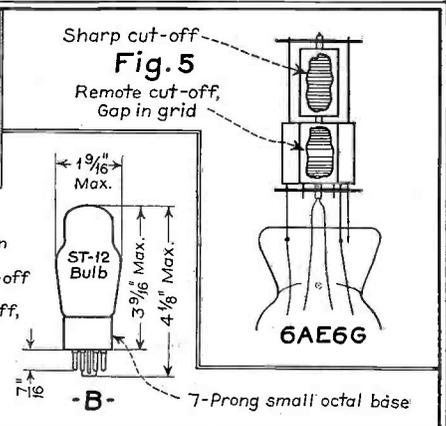
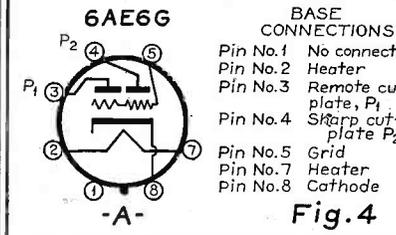
Fig. 1 shows the construction of a dual indicator tube; 1A is a top view and 1B a side view. The cathode (K) is surrounded by a target current control grid (G) which is internally connected to the cathode. This target current control grid limits the target current to safe values, thereby preventing overheating of the tube. A cathode shield (CS) is located so as to prevent direct light from the hot cathode from being visible. The control electrodes  $V_1$  and  $V_2$  are thin metal vanes which are supplied various potentials by a control tube and thus cause a change in the openings of the shaded angular patterns on the target.

Each of the two ray-control vanes have identical characteristics. When the potential between a ray-control vane and the cathode is zero the shaded sector will have an angular opening of approximately 90°. If the ray-control vane voltage is about half the voltage between target and cathode the shadow angle will just close. On the other hand, when the ray-control vane voltage is negative with respect to the cathode the shaded angular shadow will be greater than 90° and may open to 160°. The



6AD6G		
Indirectly heated cathode		
Heater voltage	6.3 V.	
Heater current	0.15 Amp.	
Target voltage	100V.	150V.
Ray-control electrode voltage		
0° Shadow	+45 V.	+75 V.
90° "	0 V.	+8 V.
135° "	-23 V.	-50 V.
Target current		
0° Shadow angle	1.5 Ma.	3.0 Ma.
90° "	1.0 "	2.0 "
135° "	0.8 "	1.2 "
Maximum overall length	2 7/8"	
bulb dia.	1 3/16"	
base "	1 5/16"	
Bulb	T-9	Base - Small octal 7-Pin

6AF6G		
Indirectly heated cathode		
Heater voltage	6.3 V.	
Heater current	0.15 Amp.	
Overall length	2" to 2 5/16"	Max. dia. 1 3/16"
Bulb	T-9	Base - Small octal 7-pin
Target voltage	100V.	135V.
Target current (with 0 volts on ray-control electrodes)	0.9 Ma.	1.5 Ma.
Ray-control electrode voltage		
0° Shadow angle	60V.	81V.
100° "	0V.	0V.



<sup>1</sup>"Visual Indicator Tubes", by R. Lorenzen, SERVICE, Oct., 1938, p. 7.

variation in the shaded angular opening with variation of the ray-control vane voltage for a 6AD6G dual indicator tube having a target voltage of 150 volts is shown in Fig. 3.

### CONTROL TUBE

Although it is possible to use a dual-indicator tube in particular circuits without also using a special control tube, in order to operate these tubes to full advantage they are generally used in conjunction with a control tube, such as the 6AE6G.

The 6AE6G (Fig. 4) is comprised of a heater; a single cathode; a single grid, wound in two parts and two plates. The special grid construction is shown in Fig. 5. One half of the grid is comprised of evenly spaced grid wires, the other half of unevenly spaced grid wires. The evenly spaced portion of the grid controls the electronic flow to the sharp cut-off plate  $P_2$ , while the unevenly spaced portion of the grid, which results in a variable mu characteristic, controls the electronic stream to the remote cut-off plate  $P_1$ .

### DUAL INDICATION

The circuit shown in Fig. 6 is intended for dual indication tuning, that is, one of the shaded sectors will close for weak signals and the other shaded angular pattern closes for a resonant condition on strong signals. Furthermore, these two operations are coordinated so that the "strong signal shadow angle" begins to operate when the "weak signal shadow angle" has just closed. For a strong signal both shadow angles are closed.

This difference in response is due to the fact that the two output control voltages from the control tube are very different since the "weak signal plate" (sharp cut-off plate) is regulated by an evenly spaced section of grid while the "strong signal plate" (remote cut-off plate) is influenced by an unevenly spaced section of grid.

An avc potential of  $-7$  volts just closes the "weak signal shadow angle," whereas it takes approximately  $-27$  volts to close the "strong signal shadow angle." Each of the shadow angles will open to about 160 degrees, if the circuit of Fig. 6 is used.

It will be noted that the cathode of the dual indicator tube is operated at a potential of 100 volts positive. This is done in order that the ray-control vanes may be made negative with respect to the cathode over part of their operating characteristic, the necessity for which will be understood by referring to Fig. 3.

The maximum permissible target volt-

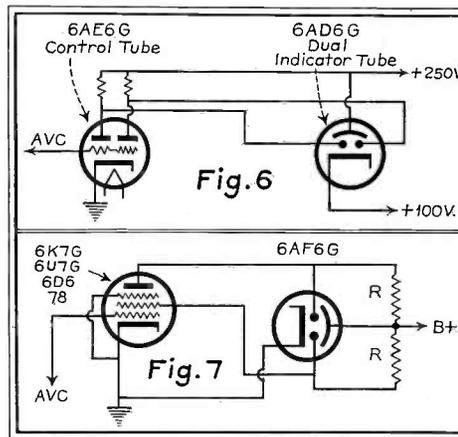


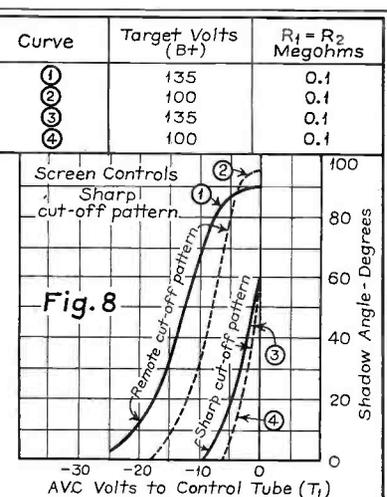
Fig. 6 shows a circuit for dual indication using the 6AE6G tube for control. A similar circuit is shown with a voltage amplifier pentode as the control tube, in Fig. 7. Characteristics of the 6AE6G tube are listed and shown graphically in Fig. 8. Figs. 9 and 10 are the base connections and characteristics and the constructional details of the 6T5 annular ring type visual indicator. This type is the electrical equivalent of the 6G5 described in the October issue of SERVICE. The bulb shape, however, is somewhat different.

age for a dual indicator tube is 150 volts. In Fig. 6 it might appear that this value has been exceeded. This is not the case, however, for, since the cathode is 100 volts positive, the target potential with respect to cathode is 150 volts.

Dual indicator tubes are sometimes erroneously called "twin indicator tubes." The term "twin indicator" is only appropriately applied when both ray-control vanes are connected to the same controlling source, the shadow angles then varying simultaneously and in an identical manner.

### PENTODE CONTROL TUBE

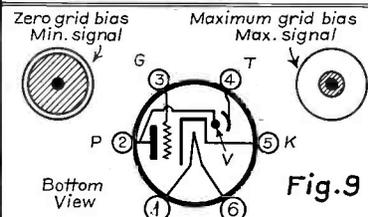
A pentode, such as a 6K7-G, 6U7-G, 6D6, or 78, may be used as a control tube so that dual indication is obtained when used with a dual indicator tube. Such a circuit is shown in Fig. 7. The screen grid gives a sharp cut-off characteristic such that the ray-control electrode to which it is connected will close the shadow angle for low avc voltages. The plate, on the other hand, gives a remote cut-off characteristic such that



Control Tube Characteristics

### 6AE6G

Indirectly heated cathode			
Heater voltage 6.3V.		Heater current 0.3 Amp	
Max. overall length $4\frac{1}{4}$ "		Max. dia. $1\frac{3}{16}$ "	
Bulb ST-12		Base - Small octal 7-pin	
Plate No. 1 (Remote cut-off)	250	250	250 V.
Plate voltage	-35	-15	-6 -1.5 V.
Grid "	0.01	0.8	2.8 6.5 Ma.
Plate current	Mutual conductance 1000 mhos		
Mutual conductance	Ampl. factor 25		
Ampl. factor	Plate No. 2 (Sharp cut-off)		
Plate No. 2 (Sharp cut-off)	250	250	V.
Plate voltage	-9.5	-1.5	V.
Grid "	0.01	4.5	Ma.
Plate current	Mutual conductance 950 mhos		
Mutual conductance	Ampl. factor 33		



Characteristics of 6T5

Indirectly heated cathode			
Heater voltage 6.3V.		Heater current 0.3 Amp	
Overall length - $4\frac{1}{8}$ "		Max. dia. $1\frac{3}{16}$ "	
Bulb T-9		Base - Small 6 prong	
Target voltage	200	250	V.
Plate-target resistor	1.0	1.0	Meg.
Target current	4.5	4.5	Ma.
Plate current (Zero bias)	0.19	0.24	Ma.
Grid bias for minimum shadow dia.	-18.5	-22	V.
Grid bias for max. shadow dia.	0	0	V.

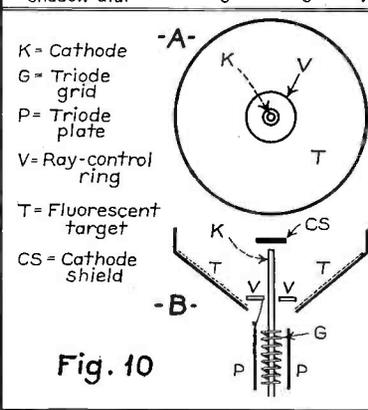


Fig. 10

the ray-control vane to which it is connected will cause practically no motion of the shadow angle for low avc voltages, but will just start to close when the sharp cut-off shadow angle is entirely closed. The remote cut-off ray-control vane will close the shadow angle for high avc voltages. The variation of shadow angle for various values

**VISUAL** tuning indicator tubes can be installed in all types of receivers, even those which do not employ avc. In this article and in the one published in last month's *SERVICE*, Mr. Lorenzen presents the theory and applications of these tubes. A complete survey of the characteristics of all available types was given in the preceding article.<sup>1</sup>

No longer need the operation of these tubes seem like magic to you. Here is the "sesame" that will open up their intricacies. It is now left only to your sales ability for you to glean the rich booty obtainable by installing these devices for your clients.

of target voltage and plate-target resistor and for various avc voltages is shown in Fig. 8.

#### ANNULAR RING INDICATOR

The annular ring type of visual indicator tube, of which the sole representative is the 6T5, has been manufactured for some years. It is considered by some to be superior to the shaded sector type as regards the ease of obtaining a visual indication.

The doughnut-shaped pattern varies in size as the carrier is tuned in by the receiver. As shown in Fig. 9, when no signal is received by the radio the shaded annular ring will almost cover the entire target. On the other hand, when a station is tuned to resonance, thereby applying maximum avc voltage on the triode grid of the tube, the shaded annular ring will contract to a narrow band at the center of the tube.

#### CONSTRUCTION

Annular ring visual indicator tubes are comprised of two parts, one part consisting of a triode, and the other part of a special type of cathode-ray tube (see Fig. 10). The cathode (K) extends upward and is common to both the triode and cathode ray tube. The cathode shield (CS) is so located as to prevent any direct light from the hot cathode being visible. The ray-control electrode (V) consists of a flat metal ring which is located near the bottom of the fluorescent target and is separated therefrom by means of an insulating washer. This ray-control ring controls the size of the shaded annular ring pattern and it is internally connected to the triode plate (P). The fluorescent target (T) is inclined at an angle with respect to the cathode.

In the circuit for the 6T5 annular ring type of visual indicator tube, a resistance (R) is connected between the triode plate (P) and the fluorescent target (T). The target is connected directly to B+ and is always at this potential. The plate voltage, and, therefore, the potential of the ray-control ring (V), since it is directly connected

to the plate, is less than the supply voltage by the amount of the voltage drop in the plate-target resistor (R). The voltage drop in the plate-target resistor (R) is dependent upon the plate current of the triode.

The triode plate current is, in turn, dependent upon the triode grid potential, namely, the avc voltage. When the triode grid is biased to plate current cut-off, that is, when the grid has so high a negative potential that no plate current flows, there will be no voltage drop across the plate-target resistance R. Consequently the triode plate, and therefore the ray-control ring also, will have the same potential as the fluorescent target. Such a state of affairs results when the radio receiver is exactly tuned to the carrier frequency of the transmitting station, for then, a maxi-



RCA 6AF6-G visual indicator tube, a typical dual indicator type.

imum avc voltage is produced, this being applied to the triode grid.

Now consider Fig. 10. The hot cathode (K) is emitting electrons in all directions and since the fluorescent target (T) is positive with respect to the cathode, the target draws these electrons to it. Since the target is coated with a fluorescent substance it becomes illuminated when subjected to this electron bombardment. Now, if the negative avc voltage were so high as to produce a complete triode plate current cut-off, the ray-control ring would be at exactly the same potential as the target since there would be no voltage drop in resistor (R), and consequently the whole target would be illuminated. Complete plate current cut-off is not entirely attained with the result that there is a small voltage drop in resistor (R). Consequently the ray-control ring is slightly negative with respect to the target, this resulting in an electrostatic field between target and ray-control ring of such nature that the electrons are slightly repelled from the

vicinity of the ray-control ring. As a result, a narrow shaded annular ring occurs near the center of the tube.

The opposite extreme to the case just given occurs when the set is tuned so as not to receive any signal. Under these conditions there will be no avc voltage and, consequently, zero volts will be applied to the triode grid. Plate current will flow and a considerable voltage drop will be developed across the plate-target resistor (R). Since the triode plate voltage, and therefore the ray-control ring voltage, is the target voltage minus the voltage drop in the plate-target resistor, it is seen that the ray-control ring is of much lower positive potential with respect to the cathode than the target is. Or, looking at this from a different point of view, the ray-control ring is highly negative with respect to the target. Under these circumstances a strong electrostatic field will exist between the target and the ray-control ring, and this will be of such nature as to strongly repel electrons away from the vicinity of the ray-control ring. In consequence, the entire target surface will become shaded except for a narrow illuminated ring at the periphery where electrons still strike the target.

The 6T5 has identical electrical characteristics and external dimensions as the 6U5 described in a previous article<sup>1</sup> and is interchangeable with it. The 6T5, furthermore, has identical electrical characteristics as the 6G5 and the 6H5, and differs from these tubes only in external bulb shape. Despite the difference in bulb shape it will generally be found that the 6T5 is interchangeable with the 6G5 and 6H5.

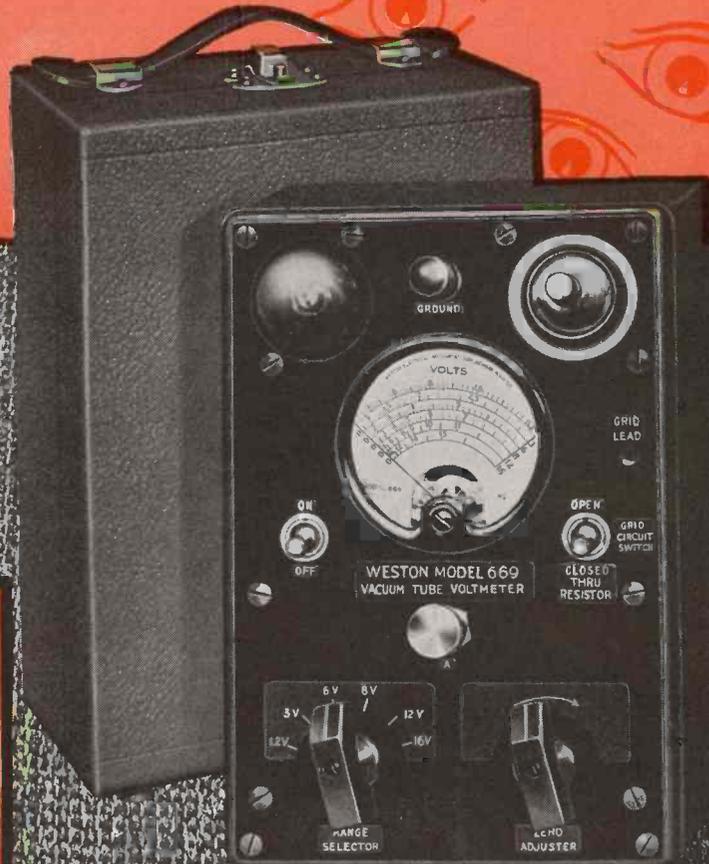
Certain uses of visual indicator tubes, such as, for example, the use of a visual indicator tube in a radio receiver having neither diode detection nor avc action, require that the shadow action operate in a manner just opposite to that normally obtained. This is sometimes considered objectionable in the case of the shaded sector type of visual indicator tube. Such objections are not raised when an annular ring type is used and these tubes may be considered ideal for such use.

#### BIBLIOGRAPHY

- Raytheon Databook.
- National Union Quick Reference Radio Tube Manual.
- RCA Receiving Tube Manual.
- QST, November, 1936.
- Operation Notes on National Union Type 6AD6G tuning indicator and Type 6AD6G control tube.
- RCA Application Note No. 65.
- RCA Application Note No. 82.
- RCA Application Note No. 94.

The author particularly wishes to express his appreciation for the cooperation extended by R. M. Purinton, Raytheon Production Corp.

# ALL EYES ARE ON....



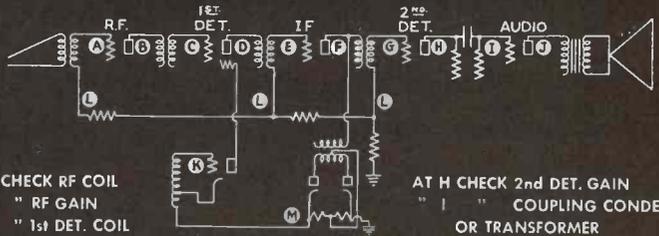
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# SELF-BALANCING PHASE INVERSION\*

(See Front Cover)

**I**N THE usual 2-tube phase-inverter circuit, a portion of the output-signal voltage of a tube (A) is applied to the grid of a second tube (B) in such a manner that the signal voltages between plate and ground of tubes A and B ( $E_a$  and  $E_b$ , respectively) are equal in magnitude and  $180^\circ$  out of phase. In such a circuit, the proper phase relation between  $E_a$  and  $E_b$  is obtained automatically. The ratio  $E_a/E_b$ , a measure of the amplitude balance of the phase inverter, is made equal to unity by adjusting the portion of  $E_a$  that is fed to the grid of tube B.

An analysis of Fig. 1, which is representative of 2-tube phase-inverter circuits, reveals an important disadvantage of this circuit. Possible variations between different tubes of the same type used in position B and variations in the value of  $R_3$  produce corresponding variation in the ratio  $E_a/E_b$ .

## SELF-BALANCING CIRCUIT

A self-balancing phase-inverter circuit that does not have this disadvantage is described in this article. The circuit has been used in other countries for some time with good success, and is shown on the front cover. Resistor  $R_3$  is connected between ground and point (a) and is common to the plate circuit of tube A and to plate and grid circuits of tube B. Because of this common connection, the magnitude of the signal voltage across  $R_3$ , which is applied to the grid of tube B, depends on the difference between the values of output-signal currents of tubes A and B. Hence, the effects of variations in the value of  $R_3$  or the effects of possible variations between different tubes of the same type used in position B are very small. The circuit is degenerative, because a portion of the output of tube B is fed back to the input of tube B. Hence, the stability that is characteristic of degenerative

**T**HE ADVANTAGES of push-pull operation are well known. The greater power output and decreased distortion, due to the cancellation of even order harmonics, are highly desirable features of a push-pull circuit.

The phase inverter, as a simple device for obtaining push-pull operation, has enjoyed considerable success. This is due, no doubt, to the ease with which it lends itself to resistance coupling with the accompanying low cost and high-fidelity possibilities. By and large, the greater majority of moderately priced receivers and amplifiers employing push-pull output stages employ some form of phase inversion. Many of these, however, contain inherent disadvantages. A phase inverter circuit, in which the major disadvantage of these devices has been overcome, is described in the accompanying article.

amplifiers is obtained. It should be noted that the gain measured from the input ( $E_1$ ) to tube A to the output ( $E_o$ ) from the transformer's primary is only a few percent less than that obtained from the circuit of Fig. 1.

The ratio  $E_a/E_b$  cannot be made equal to unity with this self-balancing circuit by any adjustment of the value of  $R_3$ , because of the degenerative action. However, with the values of resistors ordinarily employed in this circuit,  $E_a/E_b$  is approximately 1.1. A 10 percent unbalance in the push-pull output stage of a receiver can be tolerated easily. An analysis of the circuit shows that, as the gain of tube B is increased, the ratio  $E_a/E_b$  approaches unity.

Values and tolerances of resistors  $R_1$ ,  $R_2$ ,  $R_4$ , and  $R_5$  that are usually employed in the circuit of Fig. 1 may be used in the self-balancing circuit.

## TESTS

Tests were conducted in an amplifier using a 6Q7 (tube A), a 6F5 (tube B), and two 6V6's connected in push-pull in the output stage. The amplifier was connected as shown on the front cover. The values of  $R_1$ ,  $R_2$ ,  $R_4$ , and  $R_5$  were 0.25 megohm each; the value of  $R_3$  was varied and corresponding values of  $E_1$ ,  $E_a$ , and  $E_b$  were determined at a power output of 1 watt. The following table shows the performance of the circuit

for two values of  $R_3$ , 0.05 meg and 0.25 meg:

$R_3$ (meg)	$E_1$ (mv)	$E_a$ (volts)	$E_b$ (volts)	$E_a/E_b$
0.05	83	3.35	3.17	1.06
0.25	81	3.30	3.30	1*

Note: Tolerance of resistors used throughout the amplifier was  $\pm 10\%$ .

\*The measured value was slightly less than 1.

It will be noted that the change in gain of the amplifier and the change in the ratio  $E_a/E_b$  is negligible throughout the 5-to-1 change in the value of  $R_3$ .

Another test using a 6C5 in place of the 6F5 was conducted. The results of this test were similar to those shown in the table, except that the gain and balance of the amplifier were somewhat more critical to changes in the value of  $R_3$ . Other tests of this circuit in typical receivers indicate that a good value of  $R_3$  is 0.25 meg for any of the tubes ordinarily used in phase-inverter circuits. It should be noted, however, that it may be necessary to use a lower value of  $R_3$  in order to satisfy recommendations for the maximum value of grid resistor for the output tubes.

## FIXED BIAS

The output tubes in the self-balancing phase-inverter circuit shown, are self-biased. When the bias for these tubes is obtained from a fixed or partial-fixed-bias source, it is necessary to couple the grid of tube B to point (a) through a suitable condenser ( $C_c$ ), as shown in Fig. 3. In addition, a hum filter ( $R$  and  $C$  in Fig. 3) may be required. Because most partial-fixed-bias sources contain appreciable hum voltage; any hum voltage appearing across the grid resistor of tube B is amplified by tube B and by one of the output tubes.

Under many operating conditions, this circuit requires no more components than conventional circuits; and at the same time offers advantages of high stability and freedom from balance adjustments.

Fig. 1. Typical phase-inverter circuit.

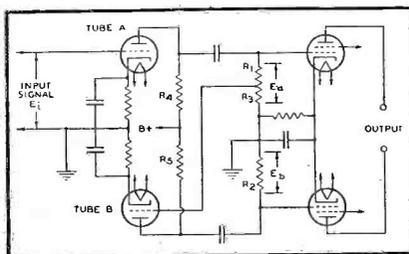
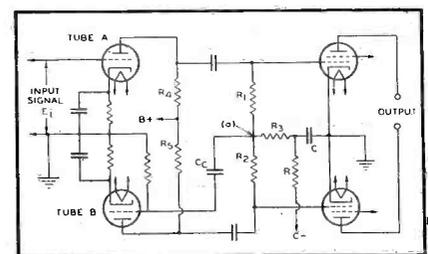


Fig. 3. The self-balancing phase inverter with fixed bias.



# General Data

## PHILCO 38-15 (CODES 121, 124)

WHEN this chassis is built into a type "T" cabinet, the receiver is identified as "Code 121." In a chair-side cabinet, type "CS" the speaker is removed from the receiver chassis and mounted in the cabinet. The receiver is then identified as "Code 124."

### SPECIFICATIONS

Tuning: Manual; dial ratio: 8 to 1.  
 Range: 540 to 1720 kc and 5.7 to 18.0 mc.  
 Power supply: 110 to 120 v, 50 to 60 c.  
 Power consumption: 40 w.  
 Speaker: Code 121, 5 in.; Code 124, 7½ in.; Field resistance: 1700 ohms.  
 Power output: 2 w.  
 Pilot light: Mazda No. 44.

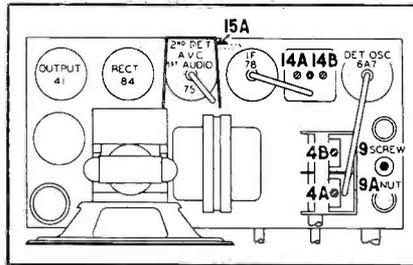


Fig. 2. Philco 38-15 (Codes 121, 124) chassis view showing parts and trimmer layout.

The circuit diagram for this model is shown in Fig. 1. The various voltages encountered on the socket prongs are lettered on the diagram. These voltages were measured with a 1000-ohm-per-volt voltmeter, with the volume control at *minimum* and the line voltage reading 115 volts. There was no signal at the

antenna. The location of trimmers is given in Fig. 2. Alignment operations accompany the text in chart form.

## PHILCO 39-18

*Push-button tuning inoperative:* If the odd shaped brass members of the tuning mechanism seem to be slipping the inoperative condition is caused by a loose shaft within the manual tuning shaft. To remedy it, remove the chassis from the cabinet and remove the two piece outer shaft of the concentric tuning mechanism. Tighten up so that the gang condenser turns as this shaft is rotated. If the shaft is screwed down tightly the condenser will turn when a centrifugal force is applied to it.

If the gang condenser is frozen or turns with difficulty, check the ball bearing. Apply a light grade of oil. Never use grease.  
*Willard Moody*

## STEWART-WARNER 97-561 to 97-569 (CHASSIS 97-565)

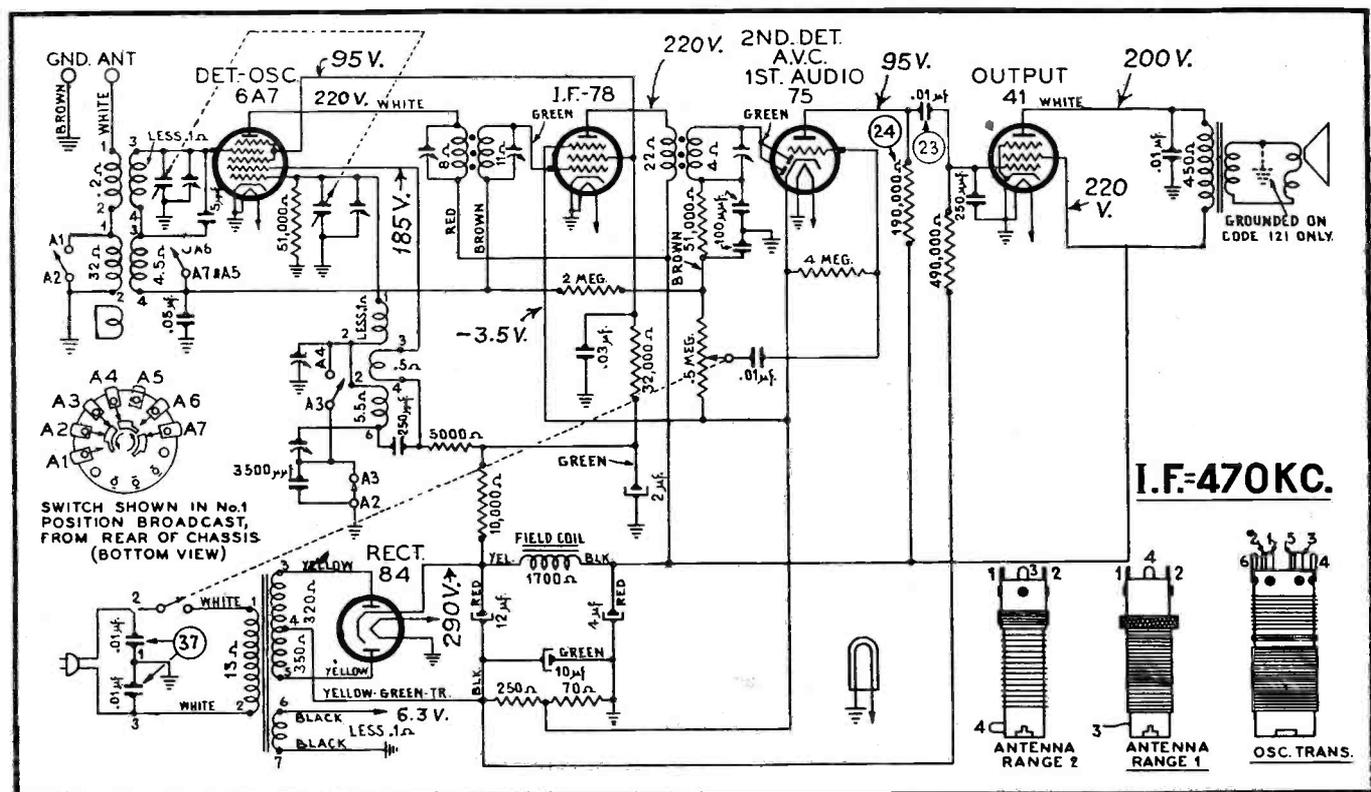
*Inoperative:* These are the new University series in varied colored plastic cabinets. In one model that refused to operate the audio circuits proved O.K. but there was no plate voltage on the 6A8G mixer tube. Careful inspection revealed a broken lead on the i-f transformer which was barely visible because the break was close to the coil.  
*Willard Moody*

## PHILCO 38-15 (CODES 121, 124) ALIGNMENT OPERATIONS

Connect Generator to	Dummy Antenna	Generator Frequency	Band Switch	Dial Setting	Peak Trimmer
6A7 grid	0.1 mfd	470 kc	Brctst	580 kc	15A, 14B, 14A
White ant	400 ohm	18.0 mc	S-W	18.0 mc	4B
White ant	100 mmfd	1550 kc	Brctst	1550 kc	9, 4A
White ant	100 mmfd	580 kc	Brctst	580 kc	9A <sup>1</sup>
White ant	100 mmfd	1550 kc	Brctst	1550 kc	9, 4A

<sup>1</sup>Rock receiver or generator dial while making this adjustment.

Fig. 1. Philco 38-15 (Codes 121, 124) circuit diagram.



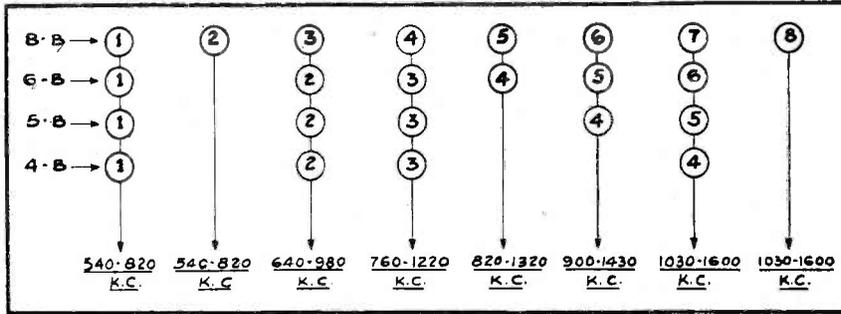


Fig. 2. Frequency ranges of the various buttons of the Zenith automatic tuner. They are numbered from left to right, or from top to bottom as they appear on the receiver, except on Model 6B321 (Chassis 5653) and Models 6S322 and 6S357 (Chassis 5654), which are reversed.

## ZENITH AUTOMATIC TUNING

THIS system makes use of the fact that the inductance of a winding varies directly with any change in permeability of the core material of the coil. A switch is incorporated which allows the normal tuned circuits in each receiver to be replaced by very small fixed windings which may be tuned over a considerable range of frequencies by means of a change in the core material.

Specially prepared iron slugs which have low r-f losses are so arranged that they may be mechanically moved in and out of the field of the aforementioned coils. The permeability of these iron slugs is naturally much higher than that of air. As they are moved in or out of the field of the coil, the inductance and natural period of the coil varies accordingly. It is quite easy to arrange such coils and iron slugs so that they may be tuned in tandem, that is, two or more iron slugs moved simultaneously into corresponding coils. This allows the receiver to be designed having only one tuning adjustment for each bank of coils and corresponding button.

One button can be pressed to disconnect all automatic coils (see Fig. 1), and allows the normal tuning system of a coil and variable condenser to operate. On those receivers having a short-wave band, this switch is a part of the band switch. When the band switch is tuned to the automatic position, or, in the smaller receivers, when one of the automatic buttons is pushed, this tuned circuit is disconnected, and the automatic coils are in circuit. The range of each set of coils will vary from 300 kc to 600 kc depending over which portion of the broadcast band they are designed to operate.

The antenna is coupled to the input of the first detector by means of a 50-mmf. condenser (C2). An antenna compensating condenser (C5) is used to compensate for variations in antenna capacity. This condenser is preset at the factory, and under most conditions it will not be necessary to change it.

However, where there is a seeming lack of sensitivity when tuning automatically, the condenser may be reset by tuning one of the automatic buttons to approxi-

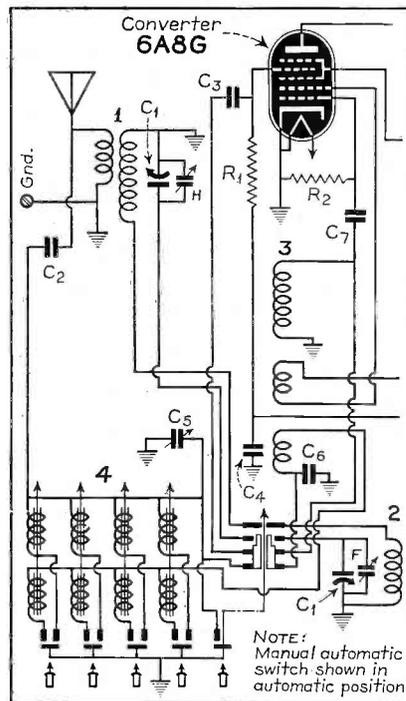


Fig. 1. Zenith automatic tuning circuit.

mately the center of the broadcast band, to a point where no station is heard, and readjusting the antenna compensat-

ing condenser for the loudest background noise. The button may then be reset for whatever station is desired. This setting of the antenna condenser will be effective over the entire broadcast band and for all buttons.

In the oscillator circuit, it is necessary to alter the tuning curve so as to provide for tracking between the oscillator and first detector circuits. A small winding connected in series with the grid end of the automatic windings, and so placed as not to be affected by the iron core will, if properly designed, alter the shape of the tuning curve at the high frequency portion of the coil's range. Also, when two inductances are connected in parallel, the maximum inductance is limited by the size of the smaller of the two inductances. The upper portion of coil No. 3 in Fig. 1 is the padder winding, and also serves as a means of coupling to the oscillator plate circuit. When used in conjunction with the smaller winding, mentioned above, it alters the shape of the tuning curve so as to allow proper tracking.

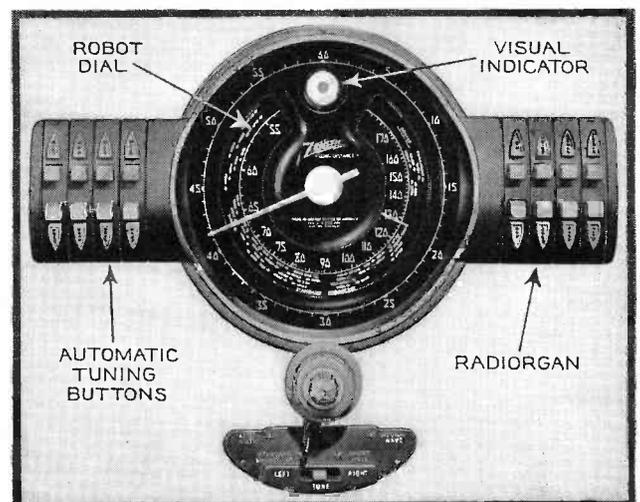
Variations in humidity and temperature are compensated for by means of condenser C6. This condenser is composed of silver surfaces sprayed on a special ceramic tube and changes its capacity in the opposite way from any changes in the coil, so that it will compensate for the latter.

## RCA-R-91 PHONOGRAPH

THE R-91 electric Victrola consists of a crystal pickup, a three-tube audio amplifier, a five-inch dust-proof dynamic speaker, and a motor turntable mechanism all combined in a hinged-top, table type walnut veneer cabinet. Any record, up to and including the 12-inch size, may be played on this instrument.

The crystal pickup unit is securely sealed in a metal casing, against extreme changes of climate. If failure occurs due to a defective crystal unit, no attempt should be made to repair it, but

Fig. 3. Zenith automatic tuning dial. Visual indicator and radiorgan buttons are also featured in this model.





*Included in*

**this  
ADASHAFT  
KIT**

are the  
following:

- 10 Adashaft controls . . . 5 Midget Switch covers . . . 6—4-inch Adashafts . . . 1—10-inch Adashaft . . . 2—3-inch auto type Adashafts . . . 1—6-inch auto type Adashaft . . . 2 Slotted Insacups . . . 2 Square hole Insacups . . . 1—300 Ohm Bias Resistor . . . 5 Ground Straps . . . 10 "C" Washers . . . 5 Switch Insulators . . . 10 Terminal Insulators . . . 1 Instruction form 648.

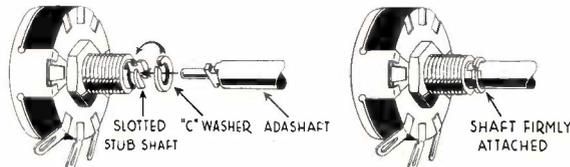
# Centralab MIDGET RADIO H M ADASHAFT Kit

**T**HERE are about ten basic volume control circuits; all past and present receivers incorporate one of these. That is why this ADASHAFT Kit will handle more than 400 different makes . . . (several thousand different models) as far as values and tapers are concerned.

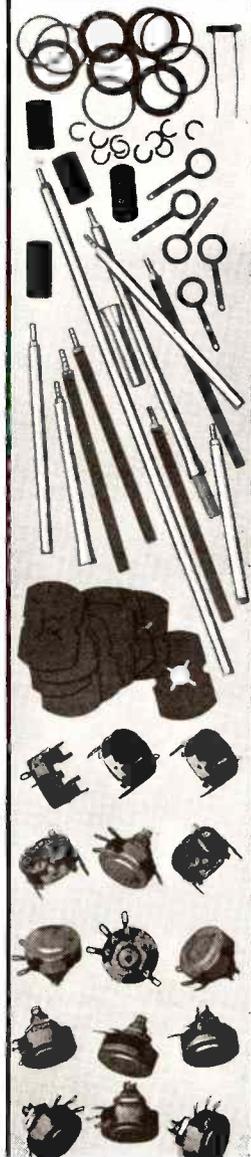
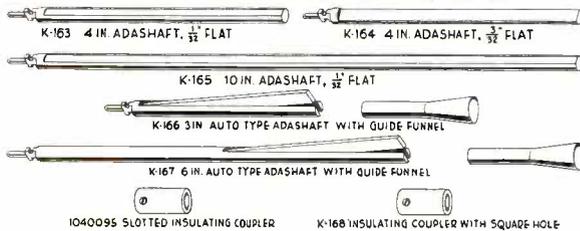
However, no single type of universal shaft can be designed to fit all receivers . . . that is why the small stock of controls and shafts in the ADASHAFT Kit constitutes a valuable and convenient emergency kit.

*See your jobber!*

**CENTRALAB**  
Div. of Globe-Union, Inc.  
Milwaukee, Wisconsin



The complete layout of available ADASHAFTS and accessories is illustrated below. The shaft material is aluminum of adequate strength, yet easily cut off.



a new replacement crystal unit should be installed.

### SPECIFICATIONS

Tubes:

- A-f: 6F5
- Pwr Amp: 25L6
- Rect: 25Z6
- Ballast: BK61B

Power Supply:

- A-5: 105-125 volts, 50 cycles
- A-6: 105-125 volts, 60 cycles

Motor: Manual starting synchronous  
Speed: 78 rpm

Pickup: Crystal

- Impedance: 80,000 ohms at 1,000 cps
- Speaker: Electrodynamic
- Field Res: 3600 ohms
- V-c Imp: 4.9 ohms at 400 cps

### MOTOR HUM

A small amount of hum when starting, decreasing to a negligible amount when running, is normal. If excessive vibration occurs it may be due to:

- (1) Insufficient lubrication, or any failure that will cause binding.
- (2) Leather washer not oiled. (Check

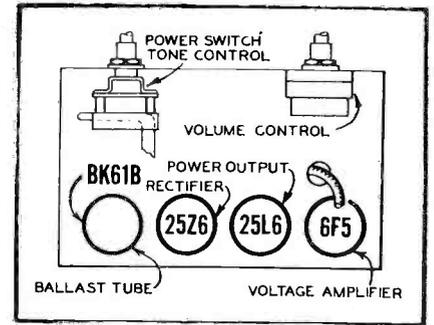
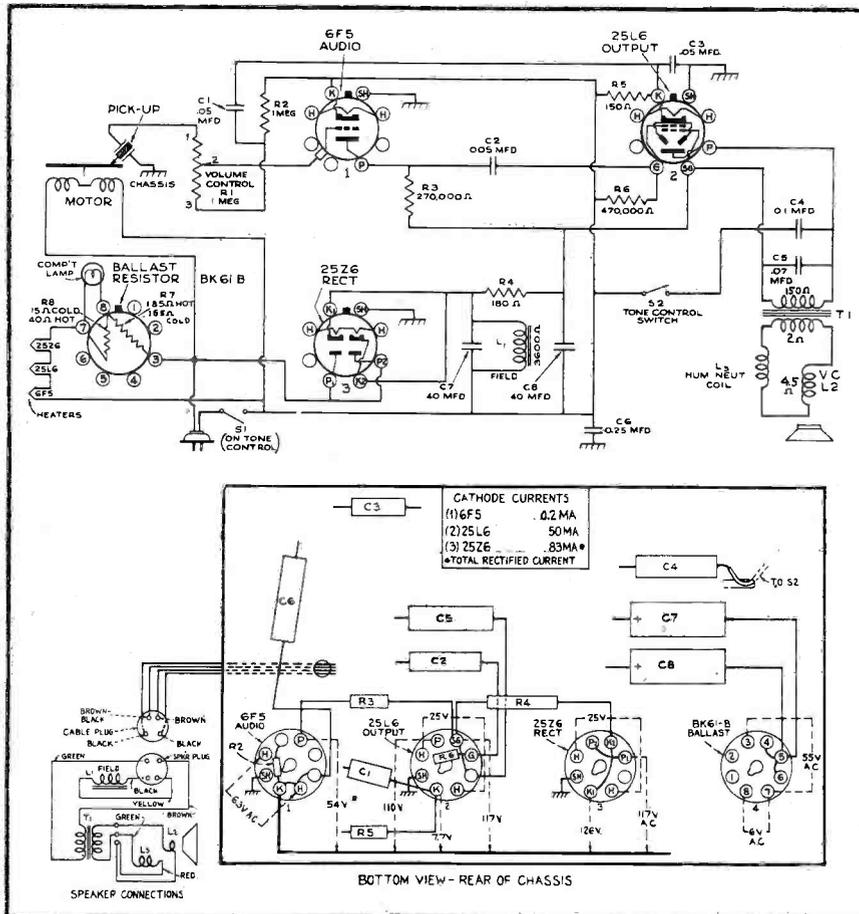
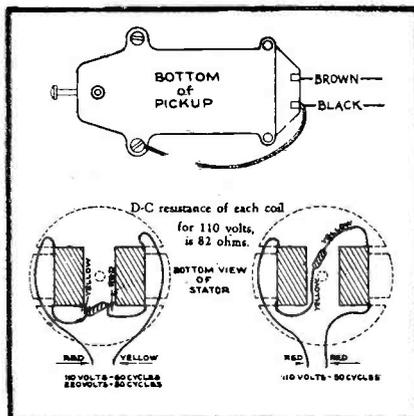


Fig. 3. Tube layout.



Figs. 4 and 5. Schematic and wiring diagram, RCA-Victor R-91 phonograph, showing socket voltages.

Fig. 1. Motor coil and pickup wiring, RCA-Victor R-91.



to make certain that the leather washer is above the steel washer.)

- (3) Motor not properly supported from motor board.
- (4) Burrs on poles of rotor or stator. Remove with fine emory cloth.
- (5) Stator should be free to rotate between limits of damping assembly.

### REMOVING ROTOR

The rotor and turntable assembly simply rests on the ball bearing at bottom of vertical bearing. Remove by lifting upward.

### ROTOR ADJUSTMENT

Remove motor from cabinet. Loosen the three screws that hold the rotor to the turntable, insert three 16-ma shims at equal distances around the gap be-

tween the rotor and stator, and then carefully tighten the three screws. The top of rotor must be flush with top of stator; add additional steel washers beneath the stator if necessary.

### PILOT LAMP

To replace pilot lamp, remove the screws from the small raised block at the front of the motor board, and remove the wooden block. The pilot lamp compartment is then accessible.

### VOLTAGE READING

In Fig. 5 (wiring diagram and socket voltages), values with a (\*) are operating voltages in circuits with high series resistance, and when measured will read lower depending upon the voltmeter loading.

All measurements are to chassis unless otherwise indicated, with volume control set at minimum. Values should hold within approximately plus or minus 20 percent with line voltage at 117.

### AIRLINE REMOTE CONTROL

**T**HE Airline Remote Control consists of three main units, the remote push-button assembly, the magnet assembly and the relay assembly. These units are shown in Fig. 1.

The remote control Model 62-298, described herewith, is for use with Airline receiver models 62-370, 62-390, 62-401, 62-403, 62-470, 62-490, 62-700, 62-900 and 62-1100.

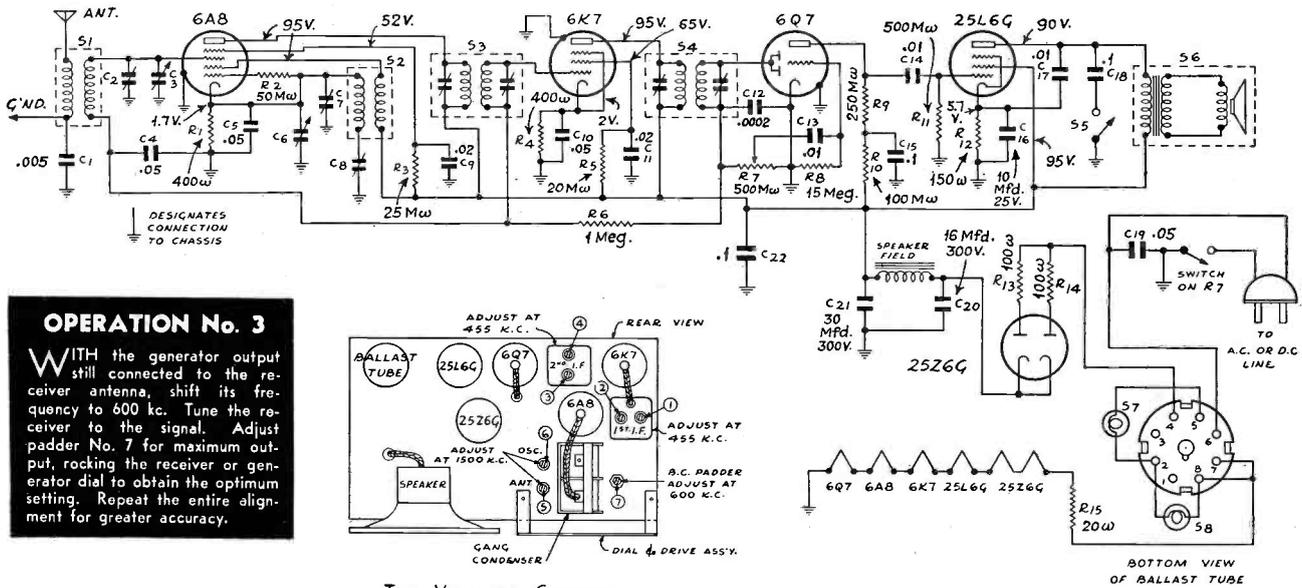
Any station which has been set up on the automatic tuning buttons at the set may be selected at the remote position. Station call letters are supplied for the remote push-button assembly. The tabs with the call letters should be placed in the recessed space alongside their respective buttons.

The button on the remote assembly nearest the end with the connector cable will select the extreme right hand automatic push button on the front of the receiver cabinet.

To install the remote control unit on any of the above mentioned receivers it is advisable to remove the chassis from its cabinet.

(Continued on page 46)

## CIRCUIT DIAGRAM AND ALIGNMENT OPERATIONS PILOT TH-150, H-151



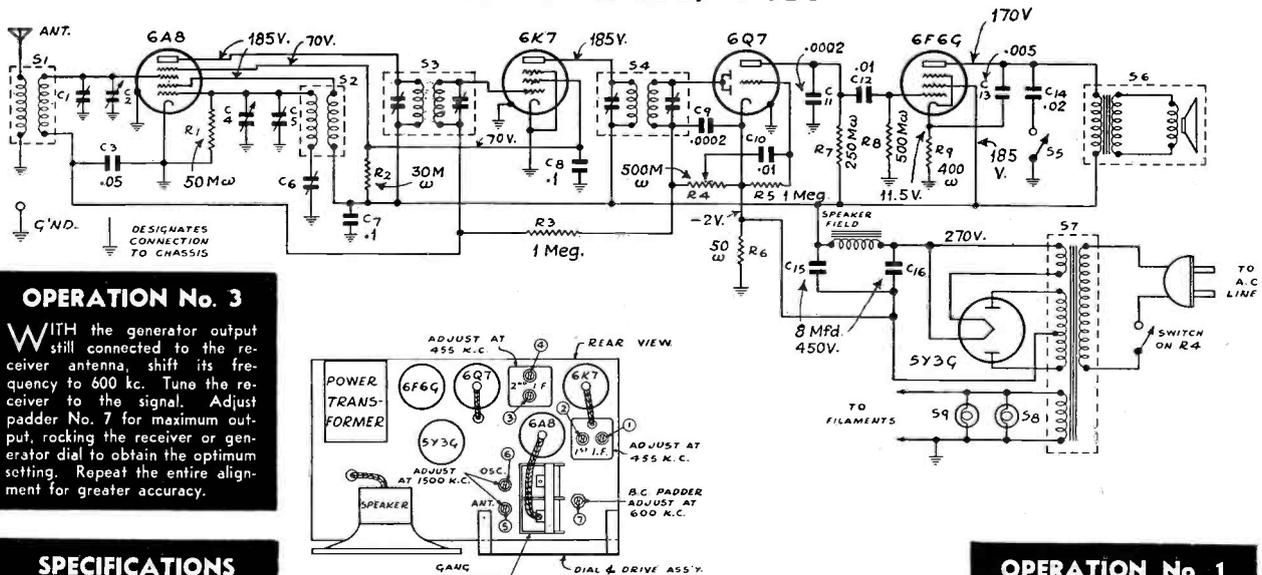
**OPERATION No. 3**  
 WITH the generator output still connected to the receiver antenna, shift its frequency to 600 kc. Tune the receiver to the signal. Adjust padder No. 7 for maximum output, rocking the receiver or generator dial to obtain the optimum setting. Repeat the entire alignment for greater accuracy.

**OPERATION No. 2**  
 SHIFT the generator frequency to 1500 kc and feed this signal to the receiver antenna lead through a 200-mmf condenser. Adjust trimmers 6 and 5 for maximum output. Repeat the entire alignment for greater accuracy.

**OPERATION No. 1**  
 WITH the receiver tuned to a quiet spot near 600 kc, feed a 455-kc signal to the grid of the first-detector-mixer tube through a 0.1-mfd condenser. Adjust i-f trimmers 1, 2, 3, and 4 for maximum output. Repeat the adjustment.

**SPECIFICATIONS**  
 Tuning: Manual.  
 Range: 530 to 1720 kc.  
 I-F: 455 kc.  
 Power Supply: 110 to 125 volts a-c, d-c.  
 Power Consumption: 45 watts.  
 Power Output: 2.2 watts, max.  
 Speaker: 5-in. electrodynamic; Field: 450 ohms.

## CIRCUIT DIAGRAM AND ALIGNMENT OPERATIONS PILOT TH-650, H-651



**OPERATION No. 3**  
 WITH the generator output still connected to the receiver antenna, shift its frequency to 600 kc. Tune the receiver to the signal. Adjust padder No. 7 for maximum output, rocking the receiver or generator dial to obtain the optimum setting. Repeat the entire alignment for greater accuracy.

**SPECIFICATIONS**  
 Tuning: Manual.  
 Range: 530 to 1720 kc.  
 I-F: 455 kc.  
 Power Supply: 110 to 125 volts, 50 to 60 cycles.  
 Power consumption: 50 watts.  
 Power Output: 2 watts, max.  
 Speaker: 5-in. electrodynamic; Field: 2000 ohms.

**OPERATION No. 2**  
 SHIFT the generator frequency to 1500 kc and feed this signal to the receiver antenna lead through a 200-mmf condenser. Adjust trimmers 6 and 5 for maximum output. Repeat the entire alignment for greater accuracy.

**OPERATION No. 1**  
 WITH the receiver tuned to a quiet spot near 600 kc, feed a 455-kc signal to the grid of the first-detector-mixer tube through a 0.1-mfd condenser. Adjust i-f trimmers 1, 2, 3, and 4 for maximum output. Repeat the adjustment.

**SERVICE**

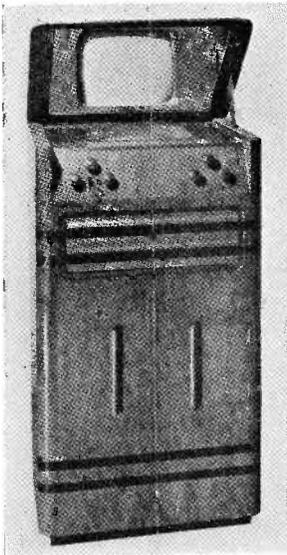
# Television



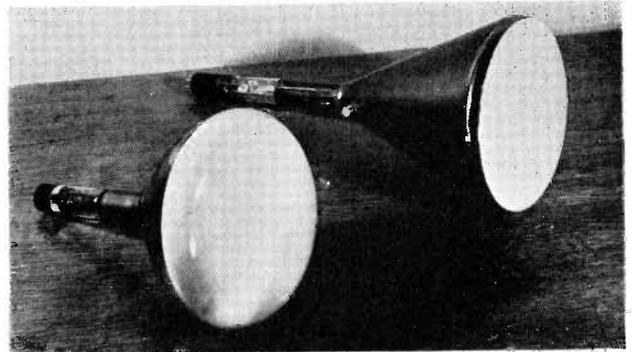
J. R. Duncan, chief television engineer, sits at the monitor panel and studies the television image which Midland Television, Inc., is demonstrating to interested groups in Kansas City, Mo.



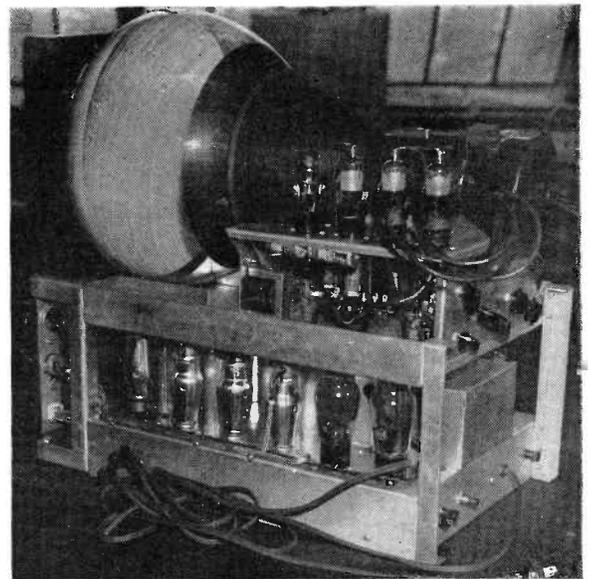
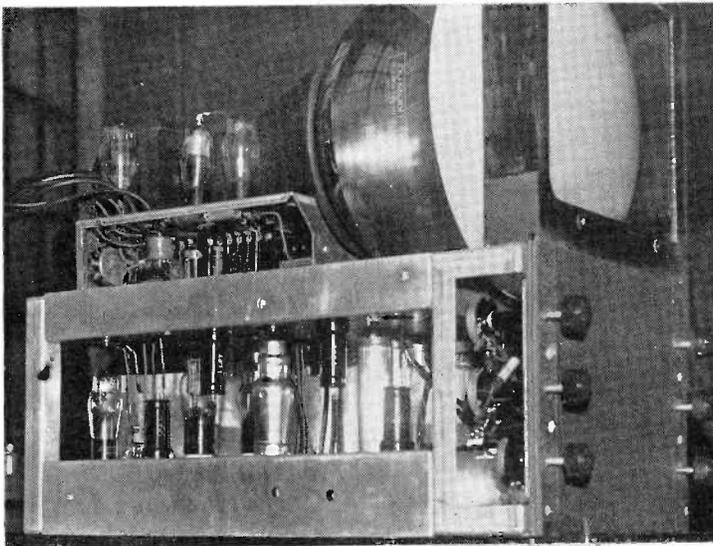
A photograph of the 4 x 5 foot projected image reproduced by Kolorama Laboratories television apparatus.



The new 9-in. short type National Union videtron cathode-ray tube (electromagnetically deflected) is shown in comparison with one of their longer 9-in. electrostatically deflected type.



The 19 tube Baird television receiver Model T5 which sells in England for £85 (approx. \$425). A receiver of this type is used by Midland.



Front and side views of the Allen B. DuMont Model 180 television receiver. The set features a 14-in. tube with 8 x 10 in. black and white pictures.

TESTS THE NEW 50-VOLT TUBES



# Model 1212 MASTER TUBE TESTER



**Has Approved Emission Circuit Constructed to RMA Load Requirements**

- Tests All Receiving Tubes and Has Ballast Tube Continuity Test
- Separate Plate Tests on Diodes and Rectifiers
- Neon Short Test

This model is furnished in a metal case  $7\frac{7}{8}'' \times 6\frac{5}{8}'' \times 4\frac{5}{8}''$  —the last word in compact size and light weight for a high grade, thoroughly professional, thoroughly dependable tube tester. Ideal for field work. Tester has three-color GOOD-BAD scale, line voltage adjustment, and is operated by selector switches from tube charts. Up-to-date charts are provided without charge to all registered owners as new tubes appear. Dealer Net Price, \$22.00.



Only  
**\$22.00**  
net

The Triplett Tube Tester in the Master Case has always been one of the most popular tube testers ever placed on the market. Now comes Model 1212 with new added features, bringing this famous tester right up to the minute, but at **NO ADDED COST!**

## TRIPLETT MASTER TESTERS



Model 1206

Carrying Case holds 4 Master Units—Single, Twin and Triple Cases also available. A series of correlated single unit testers; made in standard case size; the most economical method yet devised for completely equipping the all around service shop with high quality instruments. Start your master test set with this popular tube tester.

**THE TRIPLETT ELECTRICAL INSTRUMENT CO.**  
Bluffton, Ohio

THE TRIPLETT ELECTRICAL INSTRUMENT CO.  
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Please send me more information on

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# Sound Service

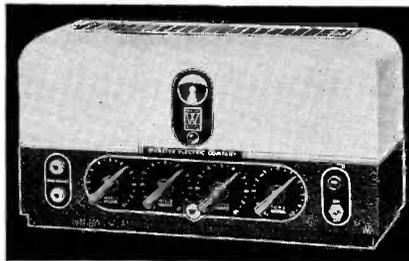
## WEBSTER ELECTRIC 50TN (AMPLIFIER 18-50)

**T**HIS model is a 4-stage, 12-tube amplifier employing 4 beam-power 6L6s in a push-pull, parallel output stage. The unit is capable of delivering 50 watts of undistorted power to 2 extra-heavy duty pm speakers. With properly applied input and supply voltages the system is capable of 80-watts output, which may be desirable where distortion is not of primary importance.

### SPECIFICATIONS

Finish: Black and white.  
 Controls: 2-input microphone controls, 1-input phonograph control, high-low tone control, off-on switch.  
 Microphone input gain: 125 db.  
 Microphone input voltage for full output: 0.004 rms.  
 Microphone input impedance: 2 meg.  
 Phonograph input gain: 82 db.  
 Phonograph input voltage for full output: 0.17 rms.  
 Phonograph input impedance: 500,000 ohms.  
 Power supply: 110-120 volts.  
 Power consumption: 225 watts, at 115 volts.  
 Frequency characteristic: 2 db, 30 to 10,000 cycles.

Output impedances: 2, 4, 83, 125, 166, 250, 500.  
 Power output: 50 watts.  
 Distortion: 5 percent total.  
 Speakers: Permanent magnet dynamic, 12 in.



Webster Electric 50TN amplifier.

### DESCRIPTION

Two separate 6J7 preamplifier stages are used. These are fed to individual volume controls connected in (each of) the grids of the 6N7 amplifier stage. The plates of this tube are tied together and fed to another 6N7 tube. The two triodes of this tube are connected in parallel and used as a driver which is transformer coupled to the output stage. The output stage consists of four 6L6s in a push-pull parallel arrangement. The amplifier output is fed to a multi-tapped transformer whose secondary windings are connected to a series of sockets which permit the use of various combinations of speakers.

### FEATURES

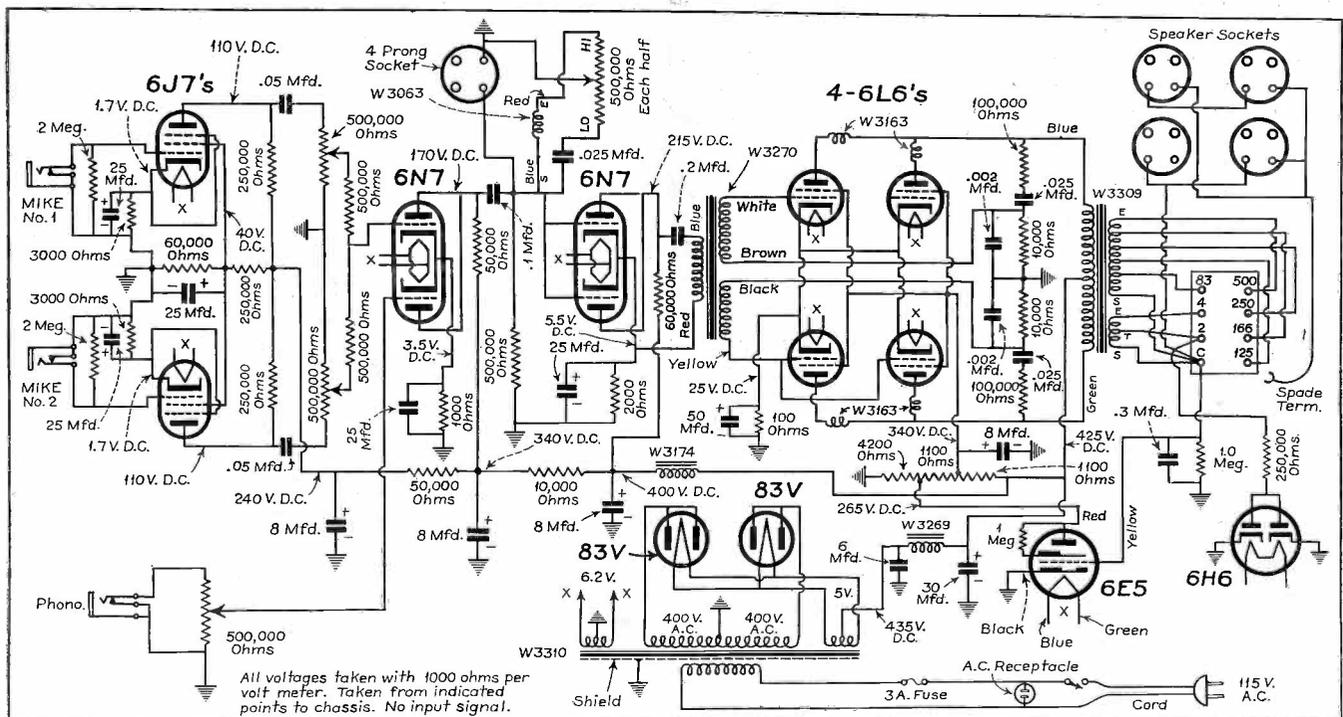
Inverse audio feedback (degeneration) is provided by feeding back a portion of the output signal to the input transformer grid return.

Three independent input channels are provided for electronic mixing of one or two microphones and a phonograph pickup.

Dual tone control permits attenuation of either high or low frequencies. The 6E5 permits monitoring at the amplifier.

Tubes:  
 Preamplifier: 6J7 (2).  
 Amplifier: 6N7.  
 Driver: 6N7.  
 Output: 6L6 (4).  
 Rectifier 83V (2).  
 Signal rectifier: 6H6.  
 Output level indicator: 6E5.  
 Pilot light: No. 44.

Webster Electric 50TN amplifier circuit.



# "Now IT CAN BE TOLD."

THERE are times when it is difficult to make people believe the simple truth! When Simpson Instruments were first announced in August, 1936, the simple truth was that they were predestined, by the very circumstances of their conception, to tower above all other radio testing equipment.

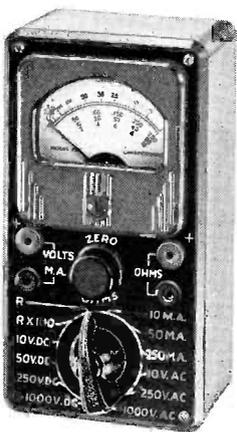
Their background assured this. They had behind them the vast experience of Ray Simpson and a group of associates who had devoted their entire engineering careers to instruments and test equipment. They had behind them an unstoppable "will to win" born of a fresh start—in designing, tooling, and production methods. With such a background, success was inevitable.

Yes, we could have forecast that success in 1936—but we could not have told the story with the force it has since been told by the product itself! Look at the record of those two and a half crowded years. Measure Simpson Instruments by any standard—design, workmanship, range, performance, beauty and, above all, sheer quality in solid terms of dollar-value. Try to find a Simpson Instrument that has failed to do its job—better. Try to find a model that has not been a complete success. Of what other line can this be so truthfully said?

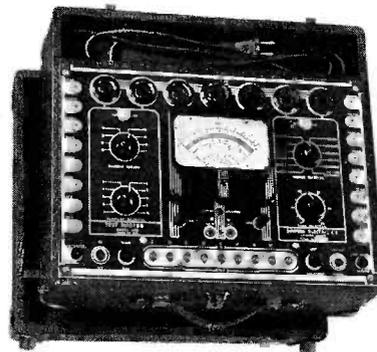
Now it can be told that Simpson alone can give you an instrument covering every conceivable need—each built to that exalted standard which can only be described as Simpson. A few models are briefly described here. Coupon brings details.

SIMPSON ELECTRIC CO. 5214 Kinzie St., Chicago, Ill.

**MODEL 230** — The smallest A.C.—D.C. instrument on the market yet it contains a sufficient number of ranges for the experienced man to do a complete servicing job.  
Price..... **\$14.25**



**MODEL 215** — The first small instrument to have a big 4½-inch meter with easy-reading dial. Five A. C. and D. C. voltage ranges—five Decibel ranges — 0-10-100-500 milliamps; 0-250 microamps; 0-4000-400,000 ohms; 0-4 megohms.  
Price... **\$25.75**



**MODEL 440 "TEST MASTER"**. An all-service tube tester and set servicer—for general servicing, auto radio servicing, public address, sound equipment, etc. Double-filament switching; screen fluorescence and angle test, hot cathode leakage test, "high sensitivity" neon short check, noise test, percentage scales, "good" and "bad" scales. As set tester has six A. C. and D. C. voltage ranges; resistance ranges from 1 ohm to 100 megohms; four milliamp ranges; six decibel ranges; 0-15 ampere scale for auto radio work; meter leakage test, etc. Everything you can possibly need in a tube and set tester. Price. **\$59.00**



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- MODEL 275** Set Tester with 10,000 ohms per volt and "Roto-Ranger" scales..\$42.50
- MODEL 202** D. C. — A. C. Volt - Ohm - Milliammeter with "Roto - Ranger" .....\$35.75
- MODEL 201** D. C. Volt-Ohm-Milliammeter with "Roto-Ranger" .....\$32.50
- MODEL 205** D. C. Volt-Ohm-Milliammeter .....\$13.25
- MODEL 210** Line operated Signal Generator .....\$49.00
- MODEL 211** Battery Type Signal Generator .....\$39.50

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# SIMPSON

INSTRUMENTS THAT STAY ACCURATE

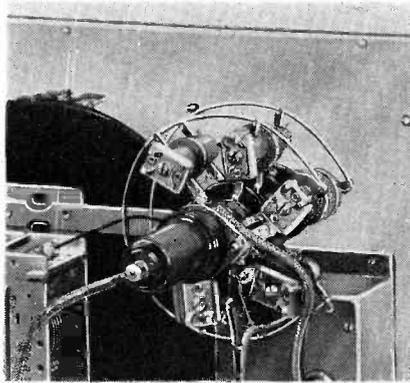
# Test Equipment

## PRECISION E-100 SIGNAL GENERATOR

THE Precision Model E-100 signal generator is an all-wave, 400-cycle modulated instrument with a constant impedance output, built-in dummy antenna and output cable. A 6-in. illuminated dial with a 19 to 1 tuning ratio provides an effective scale length of approximately 4 feet. The scales read directly in frequency with the addition of a double 0 to 100 division scale for easy listing of oft used points.

### SPECIFICATIONS

Finish: Oven-baked black crinkle.  
 Controls: Tuning dial, band selector, r-f attenuator, r-f multiplier, modulation switch, audio attenuator and line switch.

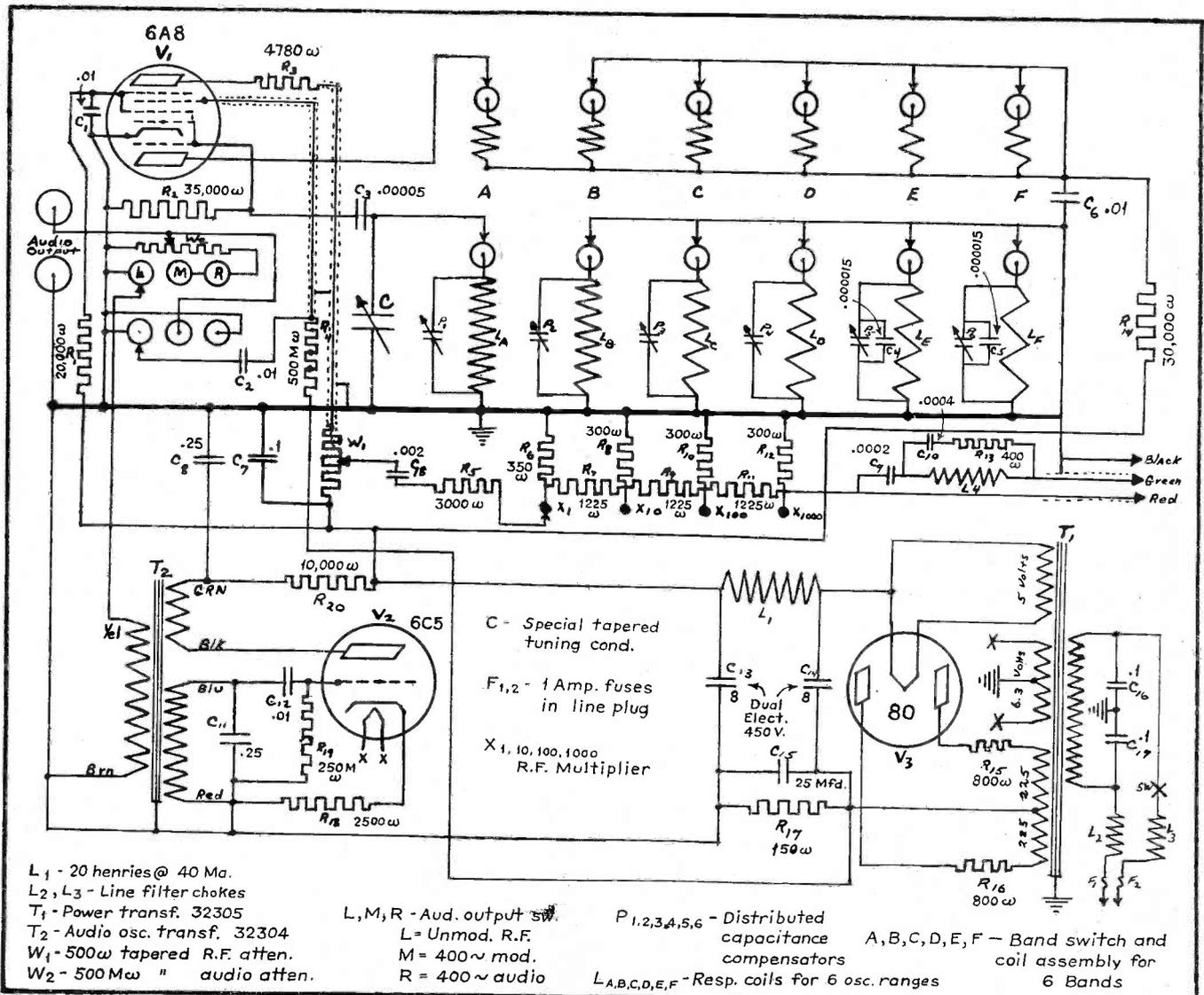


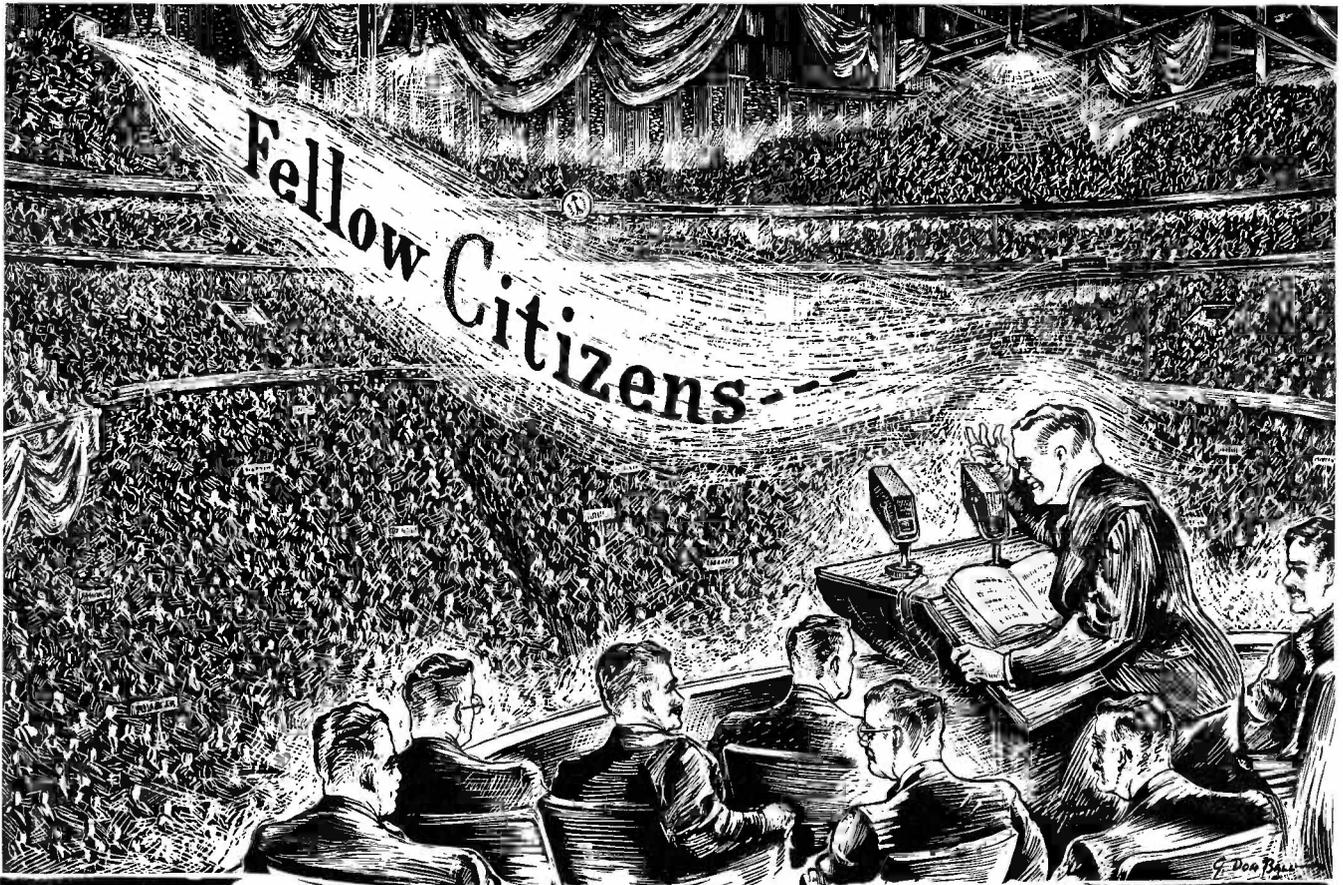
Unit coil assembly used in the Precision E-100 signal generator. The coils, trimmers, all the resistors, etc., associated with them as well as the 6K8 r-f oscillator-buffer amplifier are mounted directly on the band switch.

Power supply: 110 volt, 60 cycle.  
 Power consumption: 30 watts.  
 Frequency range: 100 kc to 15.0 mc continuous.  
 Bands: 6.  
 Modulation: 400-cycle, audio; variable from 0 to 100%.  
 R-F output: Approx. 0.1 volts.  
 A-F output: Approx. 25.0 volts.  
 Accuracy: Better than 2%.  
 Output attenuator: Constant impedance, 4-step ladder and continuously variable input attenuator.  
 Output impedance: Constant at 250 ohms.  
 Tubes:  
 R-F oscillator-buffer amplifier: 6K8.  
 A-F modulator: 6C5.  
 Rectifier: 80.

(Continued on page 52)

Precision E-100 signal generator circuit.





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THE vast Auditoriums and Convention Halls of this country—where large numbers of people gather to listen to inspired oratory, political or otherwise—provide a real test for any sound system speaker. At these important gatherings it is imperative that the orator's message be carried to the most remote listener with utmost clarity and lack of distortion.

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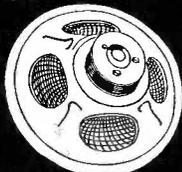
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on any product  
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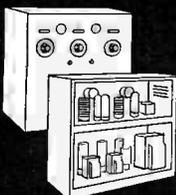
DEPENDABLE SINCE 1922



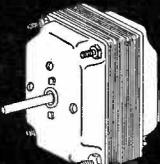
SPEAKERS



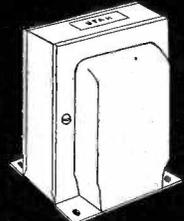
VIBRATORS



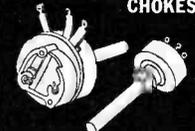
AMATEUR  
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MIDGET MOTORS



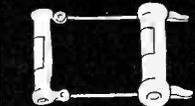
TRANSFORMERS AND  
CHOKES



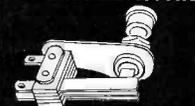
VOLUME  
AND TONE CONTROLS



PLUGS AND JACKS

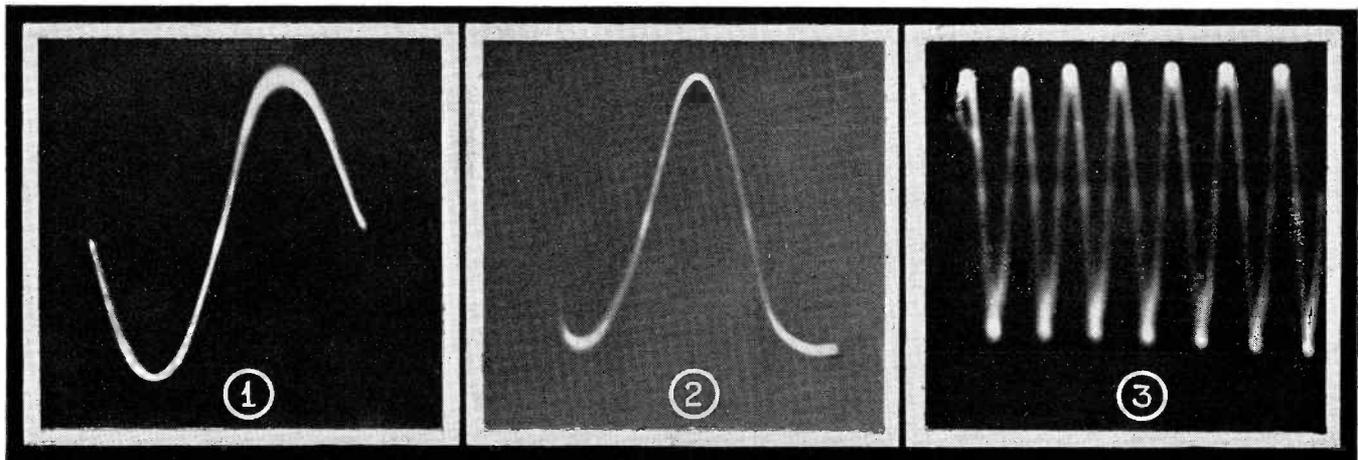


VITREOUS RESISTORS



SWITCHES

# Receiver Case Histories



## BELMONT 777, SERIES C

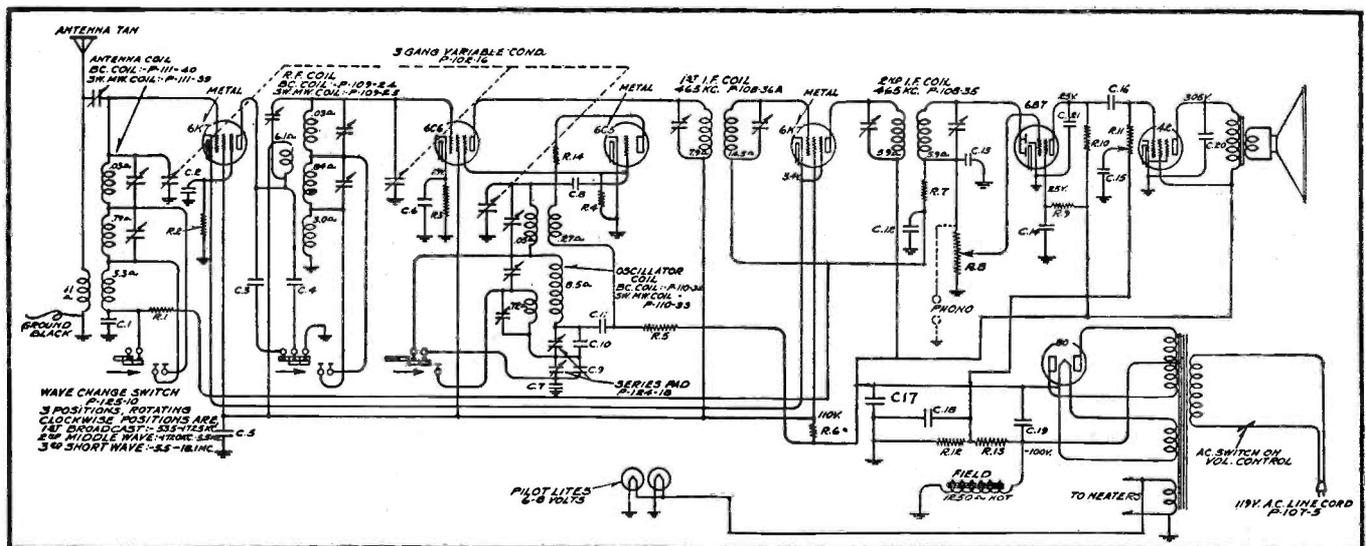
*Low volume; hum:* An oscillograph, a frequency modulated oscillator and an audio voltage generator were used to service this set.

It seemed desirable to view the overall resonance curve of the receiver first,

This pattern indicates that the sweep oscillator was synchronized with the supply frequency.

After removing the supply voltage from the vertical plates. The latter were connected across resistor R-8 (volume control) on diagram. A 1400 kc,

mined that all parts of the receiver up to the input circuit of the 6B7 or second detector tube were operating in a normal manner. In order to test the a-f section the audio voltage generator was placed in service. Its output was first connected to the vertical plates of



so the oscillograph, oscillator and receiver were placed in operation. The vertical plates of the oscillograph were connected to the 60-cycle supply line and adjustments made until the curve of oscillogram No. 1 was formed.

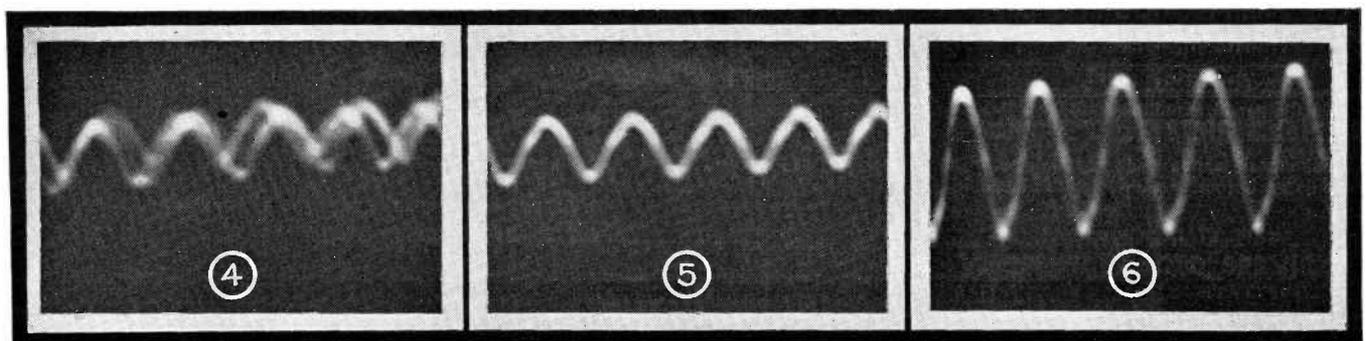
frequency modulated signal was connected to aerial and ground of the receiver and oscillogram No. 2 resulted. This curve seemed normal and showed no trace of hum frequency.

From such observation it was deter-

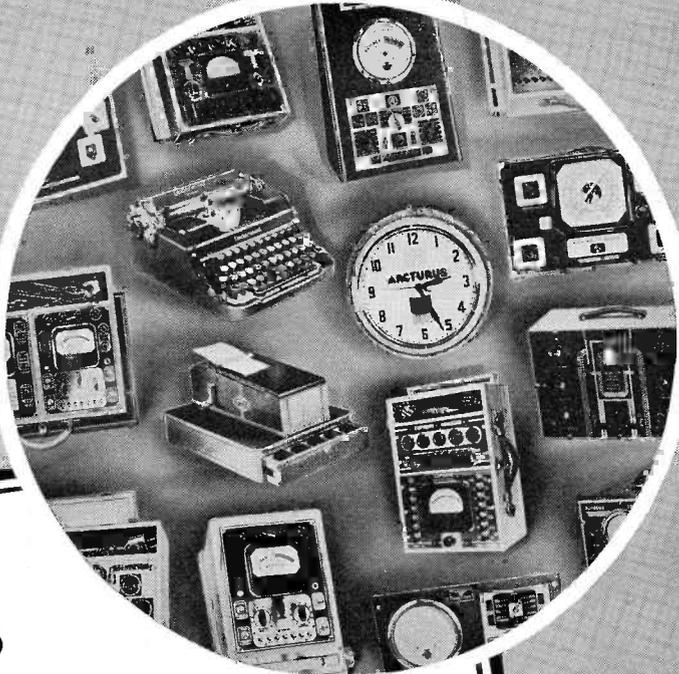
the oscillograph for observation purposes.

At 400 cycles, with all gain controls on full, oscillogram No. 3 appeared.

The output of the audio generator was then connected across the grid of



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the 6B7 tube and ground, while the vertical plates of the oscillograph were attached to the plate of the 42 output tube and ground. Oscillogram No. 4 now appeared on the screen.

The height of this wave form is less than that of No. 3 as the gain controls had been reduced. No. 4 showed a flickering pattern which could not be locked on the screen and definitely indicated hum voltage to exist between the grid of the 6B7 tube and the plate of the 42 tube.

With all equipment operating as for No. 4, the by-pass condensers in this section were shunted with others known to be good. Upon so shunting condenser C-18 (part of a dual condenser, other section being C-14) the hum stopped and oscillogram No. 5 resulted.

Condenser C-18 was found to be open and was the cause of the hum. After substituting a new 0.25-mfd condenser, further tests were made in this section of the receiver for defects that would cause low volume.

Resistor R-10 rated as 250,000 ohms was found to have increased to 350,000 ohms.

The proper replacement of this resistor restored the correct plate voltage to the 6B7 tube. It also resulted in oscillogram No. 6 which shows gain over No. 5, since no adjustments were made.

*Howard J. Surbey*

#### **RCA 8M, 8M1, 8M2, 8M3, 8M4**

*High capacity antennas:* On a number of cars having built-in antennas of relatively high capacitance, it is frequently difficult to obtain best signal-to-noise ratio, due to improper matching of the antenna system to the input. This is particularly true where the insulated steel top insert, running board, or rear trunk is employed as antenna. Improved performance can be obtained by changing the value of the antenna series capacitor C-1 from 680 mmfd to a value 300-400 mmfd. Correct matching is indicated by ability to reach a definite peak adjustment on the "Antenna Compensating Capacitor."

#### **RCA 811-K**

*Receiver dead:* Checks dead from mixer or through. Check 4,700-mmfd condenser (C49) for dead short; this is in plate circuit of triode-connected 6J7 oscillator.

*Willard Moody*

#### **STEWART-WARNER 97-56**

*Adjustment of Sensitivity Control:*

The Stewart-Warner Model 97-56 chassis is equipped with a special sensitivity control trimmer on the back of

the set so that the receiver can be adjusted to have maximum sensitivity on the customer's aerial.

The control is adjusted to an average position at the factory, but to get maximum performance, the control should be adjusted when the set is installed in the customer's home. The adjustment must be made with the set connected to the aerial with which it is to be used.

The sensitivity control is the center trimmer condenser of the three mounted on the back of the chassis. In most receivers, a hole is provided in the center of the back of the receiver cabinet, so that this trimmer screw is easily reached without removing the back. In a small percentage of the sets, no hole is provided, and in these sets, the back must be removed to adjust this trimmer.

To adjust the sensitivity control, proceed as follows: Connect the receiver to the aerial and tune it to a fairly weak station preferably at the low frequency end of the dial. Set the volume control so that the volume is fairly low.

Using an insulated screwdriver turn the sensitivity control trimmer clockwise. The sensitivity will increase up to a certain point at which the set will begin to squeal. Turn the screw back until the squeal disappears and the tone quality is good. In making this adjustment, keep turning the volume control down so that the set will not overload. If this is not done, you may confuse the overloading with oscillation.

Check operation of the set over the entire dial scale with the volume control turned to maximum volume position. It should be understood that under this condition many of the stations will be badly distorted because of overloading. If there is oscillation squealing on any part of the dial, turn the trimmer to the left (counter-clockwise).

#### **STROMBERG-CARLSON PUSH-BUTTON SETS**

*Removing the push-button escutcheon:* The push-buttons on all of the Stromberg-Carlson receivers employing padding capacitors for tuning purposes are set up from the front of the receiver. It is not necessary to get into the back of the receiver to set up the desired stations except to adjust the electric tuning switch on the back of the chassis.

To set up stations, remove the escutcheon over the push-buttons and the adjusting screws become accessible.

These escutcheons are held in place by several Phillips type screws. This type of screw has been used for several reasons. It looks better and it prevents marks and scratches when removing or replacing the escutcheon. Furthermore, it is very simple to put in the station call letters while the escutcheon

is off and they can be placed in the most convenient position. These screws will also discourage the owners from attempting to adjust the tuning which is likely to cause an unnecessary service call and, at the same time, promote chargeable service calls in case the owner desires to have different stations set up.

Of course, these screws may be removed with any kind of a small pointed instrument such as a small nail file or an old knife blade, but this will scratch the screws and is likely to prove generally unsatisfactory. Therefore, the use of a special tool is recommended. This special tool resembles a small screw driver except for the tip.

#### **STROMBERG-CARLSON 235, 245**

*Removing the chassis:* If, for any reason, it becomes necessary to remove the chassis from a Stromberg-Carlson 235 or 245 receiver the electric flash tuning push-button unit must be released from the cabinet first.

The manual dial and bracket assembly extends into the space between this push-button unit and the cabinet so that any attempt to remove the chassis without first releasing this unit from the cabinet will result in damage to this push-button unit.

To remove the push-button unit, it is only necessary to remove the two small screws which hold the metal escutcheon, around the push buttons and call letters, in place. This will make it possible to remove the two screws, located just outside the push buttons, which hold the push-button unit in place. When these two screws have been removed, the complete chassis, including the push-button unit, may be removed in the usual manner by removing only the knobs and the chassis mounting bolts.

If the station call letters are already in place before the chassis is to be removed, it is suggested that care be taken to avoid having the call letters fall out of position when the metal escutcheon is removed and that this metal escutcheon be temporarily replaced after the two push-buttons unit mounting screws have been removed so that the call letters will not be lost while the chassis is out of the cabinet.

After the chassis has been replaced in the cabinet, if there is any difficulty in the operation of the electric-manual switch, it may be adjusted by simply loosening the hexagon head screw, in the electric-manual switch arm assembly located at the left of the variable capacitor assembly and moving the contacts slightly toward the front of the chassis. Retighten the hexagon head screw.

*Stromberg Carlson Telephone Mfg. Co.*

# Auto-Radio

## ADMIRAL 69

THE Admiral Model 69 is a 6-tube auto-radio receiver using some metal grid and some glass tubes. The complete circuit is shown in Fig. 1, with the tubes used and their functions lettered on the diagram. The cathode (K) of the 6A8G, shown without connection in the diagram should be connected to the chassis.

### SPECIFICATIONS

Tuning: Manual.  
Range: 540 to 1,550 kc.  
Power Supply: 6 v, d-c.  
Pilot Light: No. 51.

Speaker: Electrodynamic; Field: 6 ohms; Voice Coil: 5 ohms.  
Vibrator: Non-synchronous.

### DIAL POINTER ADJUSTMENT

After the control unit has been installed the dial pointer must be adjusted to provide a correct calibration of the receiver in operation. Tune to a station of known frequency, around 700 kc. Reach behind the control unit and loosen the knurled nut. This makes it possible to rotate the flexible shaft by hand until the dial is set at the exact frequency of the station. Tighten the knurled nut. If this procedure is carefully followed the dial pointer should indicate 700 kc when a 700-kc station

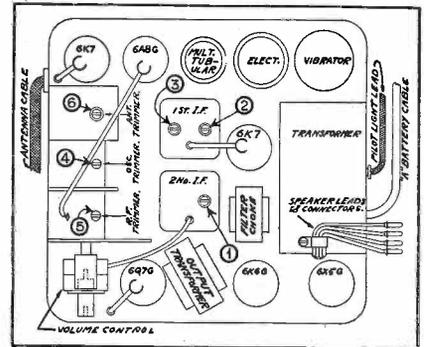


Fig. 2. Parts layout and trimmer locations.

is received. All other points on the dial scale should also be in agreement with frequencies tuned.

### ANTENNA CONNECTION

The shielded antenna lead should be soldered to the antenna lead wire. The position in which the plug is inserted into the receiver depends upon the type of antenna used. The antenna lead plug has two tips, one soldered and one blank. If a low-capacity antenna is used, the soldered tip of the plug is inserted in the hole specified in Fig. 3. If a high-

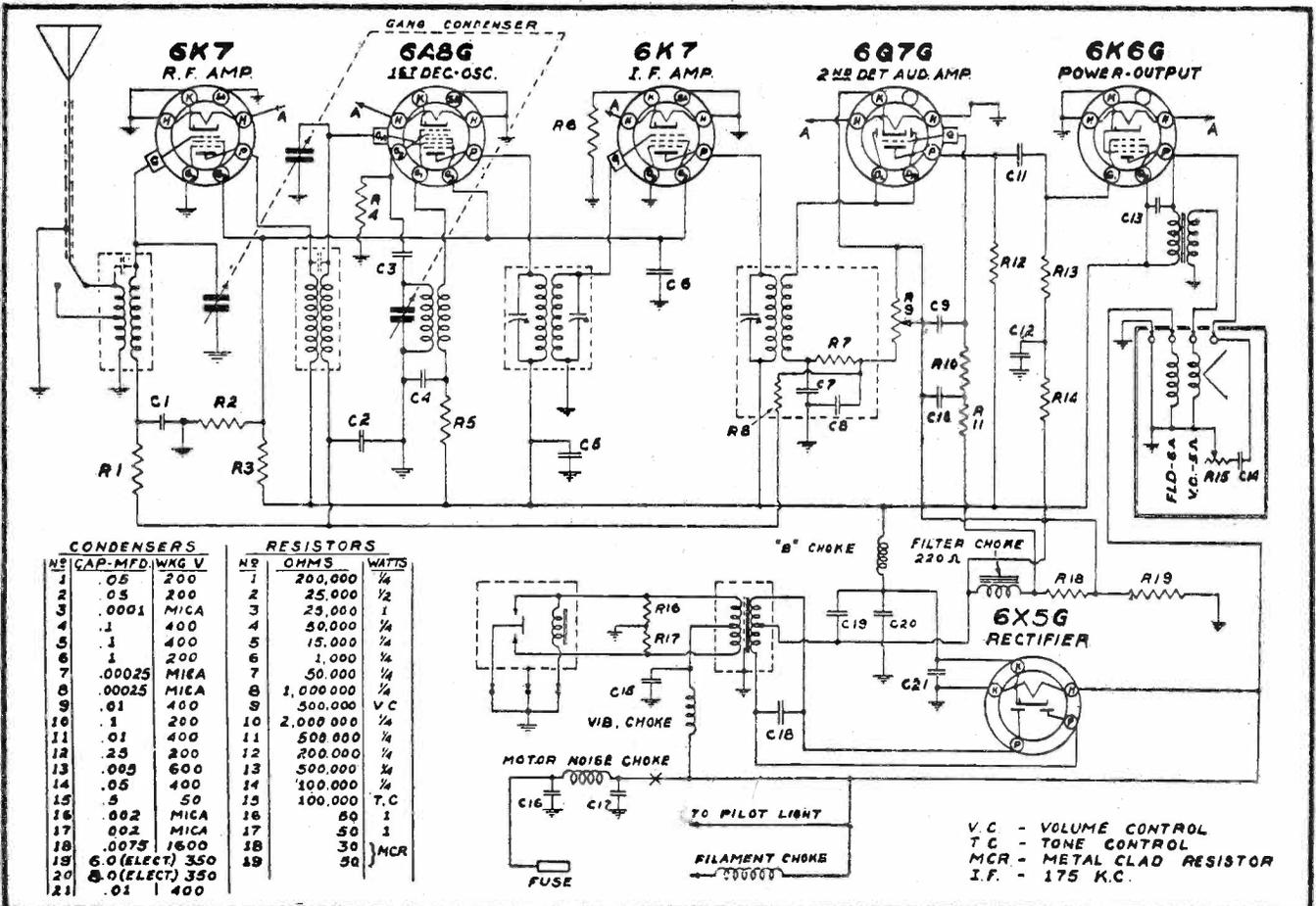
### ADMIRAL 69 ALIGNMENT OPERATIONS

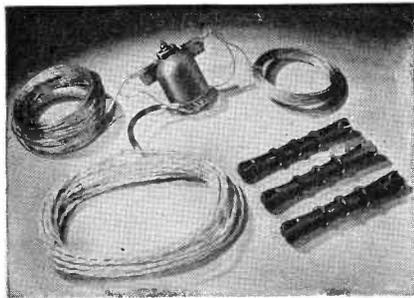
Connect Generator to	Dummy Antenna	Generator Frequency	Dial Setting	Peak Trimmer
6A8G Grid	0.1 mfd	175 kc	Maximum	1, 2, 3
Antenna	50 mmfd <sup>1</sup>	1550 kc	Minimum	4
Antenna	50 mmfd <sup>1</sup>	1400 kc	1400 kc <sup>2</sup>	5, 6

<sup>1</sup>Antenna plug in low capacity position.

<sup>2</sup>Tune receiver to signal. Rock receiver or signal generator dial while making this adjustment.

Fig. 1. Admiral 69 auto-radio. The tone control is located on the cover with the speaker.





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capacity antenna is used, the soldered tip of the antenna plug should be in-

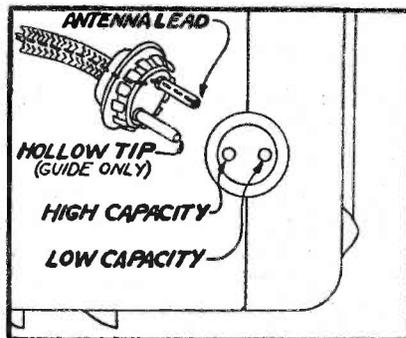
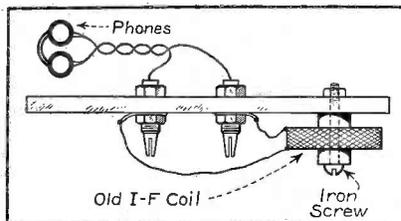


Fig. 3. Two positions are provided for the antenna plug on the Admiral 69 auto radio. Inserted in the hole indicated for the high capacity antenna.

### HUM LOCATOR

THE accompanying illustration shows a device which will detect and show the direction of magnetic leakage surrounding a filter choke, power transformer, etc.

The device consists of coil from an



An effective hum locator can be made from an old i-f coil.

old i-f transformer, mounted on a strip of bakelite or wood, with a soft-iron screw.

With a pair of earphones as a detector, it is merely necessary to explore

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the neighborhood of the suspected choke or transformer with the coil, to determine the existence and direction of stray fields. Where greater sensitivity is desired a vacuum-tube voltmeter can be used as the detector.

Harvey H. Schock

### RCA AUTO-RADIO DATA

Model	Year	Gear Ratio	Dial Direction	I-F kc.
M-30	1932	10:1	CW <sup>1</sup>	175
M-32	1932	21:1	CCW	175
M-34	1933	10:1	CW	175
M-101	1935	10:1	CW	175
M-104	1935	10:1	CW	175
M-105	1934	10:1	CW	175
M-107	1934	7:1	CW	175
M-108	1935	10:1	CW	175
M-109	1935	10:1	CW	175
M-116	1934	2:1	CW	175
M-123	1934	7:1	CW	175
5M	1936	16:1 <sup>2</sup> —12:1 <sup>3</sup>	CW	260
6M	1936	16:1 <sup>2</sup> —12:1 <sup>3</sup>	CW	260
6M2	1936	16:1 <sup>2</sup> —12:1 <sup>3</sup>	CW	260
8M	1938	9:1	CW	460
8M1	1938	16:1	CW	260
8M2	1938	16:1	CW	260
8M3	1938	16:1	CW	260
8M4	1938	16:1	CW	260
67M1	1937	16:1	CW	260
67M	1937	16:1	CW	260
67M2	1937	16:1	CW	260
67M3	1937	16:1	CW	260
9M1	1938-39	2½:1	CW	455
9M2	1938-39	2½:1	CW	455

<sup>1</sup>Clockwise. By clockwise rotation is meant that receiver is being tuned to a higher frequency when dial scale or pointer rotates in a clockwise direction when viewed from front of control head.  
<sup>2</sup>Instrument serial numbers 200,000 and above.  
<sup>3</sup>Serial numbers below 200,000.

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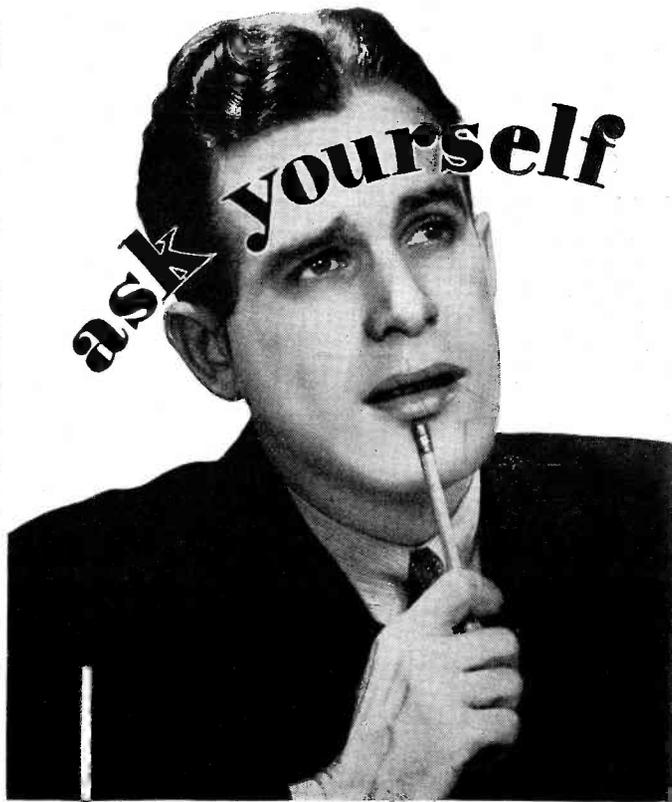
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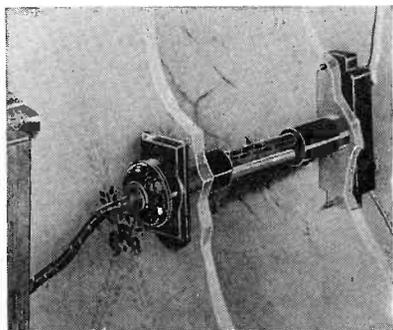
# On The Job

## LIGHTNING ARRESTERS

**I**F LIGHTNING strikes the corner of a house at which an aerial is attached, would an arrester protect the house and radio?

The honest answer is, NO!

As a matter of fact no aerial wire is capable of carrying the current resulting



The Cor-Nex universal aerial entrance fitting contains two complete arrester assemblies which meet all requirements. This unique fitting provides real arrester protection and eliminates the usual makeshift lead-in arrangement.

from a direct hit. It would vaporize. The house would atomize. The presence or absence of the aerial or arrester, would make no difference either way.

Let's not worry about such an incident, however, for they are so extremely rare as to be of no consequence.

Well, then, why use an arrester?

The next time there is a thunder storm in the vicinity of your shop or home, disconnect your aerial from the set and space the end of the lead about  $\frac{1}{8}$  in from a ground connection. You will be amazed at the number of times the current *induced* into your aerial by nearby lightning flashes will cause a good healthy discharge across the air gap provided. Then look up in your electrical handbook to find how many thousand volts are required to jump that gap.

The function of a good lightning arrester is to prevent these destructively high surges from getting into the radio. Once in the set, they do all sorts of odd things, burn up aerial primary coils; spark through by-pass and filter condensers; ruin volume controls; etc. The set is subjected to this abuse whether it is on or off at the time of the lightning storm. The owner thinks he is protecting his radio by turning it off when nearby lightning is bad. All that turning the power switch off does, is protect the speaker cone from being damaged by the crashes.

There are arresters on the market at any price you can expect, from a few

cents to a couple of dollars. Why the price difference?

There are two general types. One is a simple air-gap type which is nothing more than two metal strips spaced usually by a thin piece of mica, with an opening in the mica. If these plates are close to each other, the voltage surges will spark across. To be effective, however, this type must have extremely small spacing between the plates. A heavy spark will frequently cause enough arcing to burn the two plates together, shorting the aerial to the ground. If the plates are spaced a greater distance, the potential necessary becomes so high that little actual protection results. The National Board of Fire Underwriters no longer lists the air-gap type arrester.

The other type arrester contains a special arrester element usually of carborundum. This element is connected from the aerial to ground. In the case of doublet aerials two arrester assemblies are necessary. This carborundum unit has the property of presenting an extremely high resistance between aerial and ground, *until* a certain peak voltage is reached. As soon as a surge is applied, the unit drops in resistance practically to zero ohms, effectively providing a surge path from aerial to ground directly, so that a negligible voltage flows through the radio.

As soon as the surge has passed the resistance increases to its original high value.

The National Board of Fire Underwriters require that the resistance from aerial to ground through the arrester shall be not less than 75,000 ohms, measured with 6-volts d-c. The arrester is then tested by applying a 2-mfd paper condenser charged to a potential of 500 volts across its terminals. This test is repeated a number of times, at the end of which test the resistance must still read 75,000 ohms or more.

W. F. Osler,

CORNISH WIRE CO., INC.

## USE GOOD PARTS

**"I** DO very little advertising," Gus Ginocchio, owner of Gus' Radio Service, Kerrville, Texas, explains.

"The best way I've found to build my business, without advertising, is to be sure to do satisfactory work and then charge enough for the work to justify doing it right."

"The most important policy in connection with doing satisfactory work is that of using only the best parts for replacement.

"There is comparatively little difference in the cost of really good parts and cheaper parts," Gus explains, "so why take a chance on ruining a job for only a few cents additional profit? You lose money in the long run, by producing jobs that are not satisfactory."

"In an average repair job that would cost about three dollars, for example, there's only about fifteen cents difference between the best standard parts available and the cheapest on the market. The radio Service Man, especially in the small town, must progress on the recommendation of his customers and repeat business. I don't think it's worth making that little fifteen cents extra profit to take a chance on turning out an unsatisfactory job and producing a dissatisfied customer."

Gus has found it unnecessary to work at night or extra hours to build his repair business. He lets each customer know that the shop closes at six o'clock and that there are no night service calls. By impressing this on the public, when there is some special program on at night that a set owner especially wants to hear, he makes certain, ahead of time, that the set is working properly.

Ruel McDaniel

## PIGTAILS

**M**ANY of the connections made in preliminary and experimental work are made with common bell wire or similar wire with light insulation. It is practical to provide an extra inch or so in a pigtail so that changes may be facilitated. The pigtail can be wound over any round object which may be handy. It is difficult, however, to remove the coil from some objects without damage to the insulation.



A mechanical pencil makes an ideal practical tool for making pigtails.

The point of an ordinary mechanical pencil makes an ideal practical gadget for this purpose. The wire easily slips from the tapered end and the smooth metal of the pencil does not injure the insulation.

Frank Bentley

# PRECISION TEST EQUIPMENT

## OFFERS *you* TRUE ECONOMY

Skill, craftsmanship and painstaking care are combined in the construction of every "PRECISION" test instrument . . . each tester being INDIVIDUALLY calibrated and checked against laboratory standards to maintain CLOSE ACCURACY. It is your insurance of "freedom from trouble." . . . It is your insurance that your instrument will "work" for you at maximum efficiency for a longer period of time. . . . Such stellar performance, from instruments that are popularly priced, is TRUE ECONOMY.



### SERIES 860

#### A.C.-D.C. VOLT-OHM-DECIBEL-MILLIAMMETER

A most popular feature of this laboratory model multi-range tester is its LARGE 9-INCH FULL VISION METER. You'll appreciate this large meter size as well as the fact that the selector unit is completely enclosed for remote control operation and can be instantly removed from the instrument panel for bench use.

#### SPECIFICATIONS

- ★ FIVE AC VOLTAGE RANGES at 1000 ohms per volt. 0-10/50/150/500/1500.
- ★ FIVE DC VOLTAGE RANGES at 1000 ohms per volt. 0-10/50/150/500/1500.
- ★ FOUR OHMMETER RANGES 0-400 (20 ohms center); first indication  $\frac{1}{4}$  of an ohm. 0-100,000 ohms (800 ohms center). 0-1 megohm (8,000 ohms center). 0-10 megohms (80,000 ohms center).
- All ohmmeter ranges are powered by self-contained battery supply incorporated inside of remote control unit.
- ★ SIX DC CURRENT RANGES 0-1ma/10ma/50ma/150ma/500ma/ and 10 amperes.
- ★ FIVE DECIBEL RANGES from -10 to +59DB. (0DB, +14DB, +23.5DB, +34DB, +44DB.)
- ★ FIVE RANGES FOR OUTPUT INDICATIONS (same as AC voltage ranges).

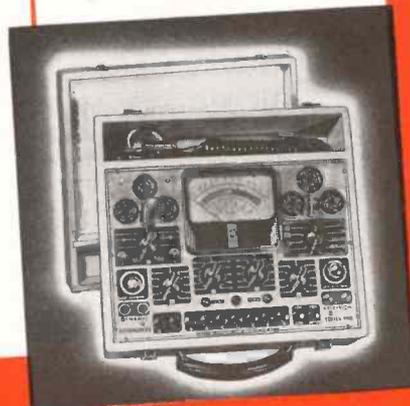
Size of remote control selector unit, 7x8x3 $\frac{1}{2}$ . Size of entire panel, 20x10 $\frac{1}{2}$ x4. Panel and control unit constructed of heavy gauge steel attractively finished in baked shivel black enamel. The panel is backed up with a steel dust cover housing, 4 inches in depth. Sold complete with batteries and test leads.

**SEE**

these testers, as well as any of the 12 popular "PRECISION" models, at your local Jobber. . . . Ask him to open any PRECISION unit and note the fine construction. . . . If there is no Jobber near you, write for catalog No. S-39.

### DYNAMIC ELECTRONOMETER SERIES 900

A MODERN "push-button" operated dynamic mutual conductance tube tester . . . combined with a 25 multi-range A.C. and D.C. volt-ohm-decibel-milliammeter . . . plus a 10 ampere range for complete point to point set analysis . . . includes ballast test facilities. . . . Ability to accommodate FUTURE tube releases . . . telephone cabling . . . wire wound shunts and matched metallized multipliers of 1% accuracy. . . . Though the price of this tester is surprisingly low . . . every fine tube analyzer feature, every advanced and tested refinement is incorporated. Attractive in design . . . solid in construction . . . it reflects the very best in modern tube and set analyzer design. See October issue of "Service," page 17.



EXPORT DIVISION - CABLE ADDRESS: MORHANEX - 458 BROADWAY - NEW YORK, N. Y. U. S. A.

# PRECISION APPARATUS CO.

821 EAST NEW YORK AVENUE

BROOKLYN, NEW YORK

## INTERMITTENT RECEPTION

ONE fading receiver may easily upset an entire day's output in a shop that does an appreciable amount of business. There is, therefore, a definite value in dollars and cents in any instrument that can test a set all day long if necessary without requiring the constant surveillance on the part of the benchman. Such a gadget is shown in the accompanying illustration.

Briefly, it rings a bell when the receiver fades, thus enabling you to go on with your usual repair jobs and at the same time, test the toughest one in the lot. If the bell rings, the other work may be left temporarily and the fading set tested further to determine the source of the trouble. If the bell fails to ring, the customer may be informed that his set was tested thoroughly and developed no trouble.

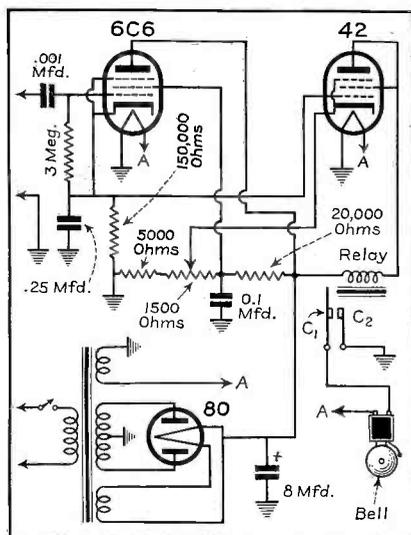
The relay in the plate circuit of the output stage is not formidable. Any high impedance telephone relay, that will handle a normal flow of about 10 ma and that will close when this flow increases to 12 ma, can be used. In the absence of such, a dynamic speaker field (with a resistance approximately 2500 ohms) from an old 5-in speaker and a pair of discarded auto-radio vibrator contacts, can be used to construct a substitute. After removing the housing that supports the outer edge of the cone the contact  $C_1$  may be mounted across the pole piece and insulated therefrom. The contact  $C_2$  is mounted on the pole piece. When current through the field winding increases from 10 ma to 12 ma,  $C_1$  is grounded to  $C_2$  and the bell is energized.

### OPERATION

Apparently then, if we can cause a 2 ma increase in plate current of a 42 tube when a radio fades, we can cause the bell to ring. The function of the 6C6 tube is to alter the effective grid bias on the 42 in the proper direction with a decrease in signal strength at the input terminals of the instrument. Obviously, the bell ringer should test the entire receiver under observation so that any fade from antenna to speaker will be indicated.

To accomplish this a modulated signal generator is fed into the antenna post of the receiver, with the r-f adjusted to approximately 600 kc. This frequency is chosen for two reasons: (1) The local oscillator in the receiver will tend to stop at the lower frequencies, (thus, if the fade happens to be the result of cessation of oscillation we are giving it every opportunity to act up). (2) At the lower frequencies the condenser gang is almost completely closed, and therefore, any trouble from rubbing plates is more likely to show up.

With the modulated signal being fed into the receiver, the speaker voice coil is disconnected and the voice coil terminals of the output transformer are connected to the bell ringer. Next comes the process of adjusting the cathode voltage of the 42 tube by means of the 1500-ohm potentiometer located in the voltage divider. It is best to start with the highest possible positive cathode potential. This means that the arm should be at the extreme right-hand position, while closely observing contact  $C_1$ . The arm is then slowly moved to the left until  $C_1$  and  $C_2$  are on the verge of closing. The bell ringer is now properly adjusted and any decrease in signal output should energize the bell. To as-



Circuit diagram of a device which will cause a bell to ring when a set fades.

certain if the set-up is correct, turn down the volume control on the receiver and the bell should ring. Even touching any r-f or i-f grid should make the bell ring.

While the receiver is being minutely tested for fade we cannot even hear it in operation—a highly desirable condition, especially when four or five other sets are blasting in the same room.

The normal operating bias of the 6C6 is obtained through the 3-megohm grid resistor. With no signal input the tube has no bias, since the grid is returned directly to the cathode. As the signal strength increases the grid bias on the 6C6 increases and the plate current decreases. The cathode voltage (above ground) will become less as a result. The grid of the 42 tube, which is connected directly to the cathode of the 6C6, varies with it. Since the latter is dependent upon signal strength, the 42 grid is responsive to input signal strength and the relay current will vary inversely to this signal.

The bell ringer is intended for use in such cases where the set cannot be made to fade under normal procedure.

John W. Nicholls

## CHRISTMAS BUSINESS

CHRISTMAS volume lurks in the lowly radio tube, in overhauling or general service, and the most humble parts for the enterprising Service Man and service shop tuning-in to the times and filling Santa's pack with specialties, sets of tubes prettily boxed, replacement accessories decoratively packaged, gadgets in which you deal, and even the complete going over of a set that needs considerable repair.

How do you attract Santa's attention? By modern merchandising methods; by featuring sets of tubes as Christmas gifts *de luxe*; by selling the "Gift Certificate" that means gift service, or service and improvement of a set for a beloved Listener-in, a friend or member of the family. Sister's or daughter's own individual set in her bedroom may need repair—and the "Gift Certificate" of the enterprising service shop is the answer to that maiden's requirements.

There are so many gifts that may be secured for Santa's sack and the various stockings hung at the mantelpiece that Santa himself may well be a radio repair specialist in this Radio Age of ours. A wide diversity of gifts—even if they are parts, novelties, accessories, or orders for special services, depending on the shop's presentation and sales promotional plans, may be held out to competition that usually gets the business to view with envy, when the shop proprietor takes time by the forelock and introduces his radio goods and services as timely Christmas wares—or "Last Minute Gift Suggestions" under the aegis of aggressive advertising.

In capitalizing on Christmas the Service Man selects items in stock, such as new tubes and the like, his major specialty of repair, and everything in fact that may be transformed by the magic and spirit of the season into a fine Christmas gift. He finds, moreover, that most of his articles can be converted into practical presents—the year's best Christmas gifts.

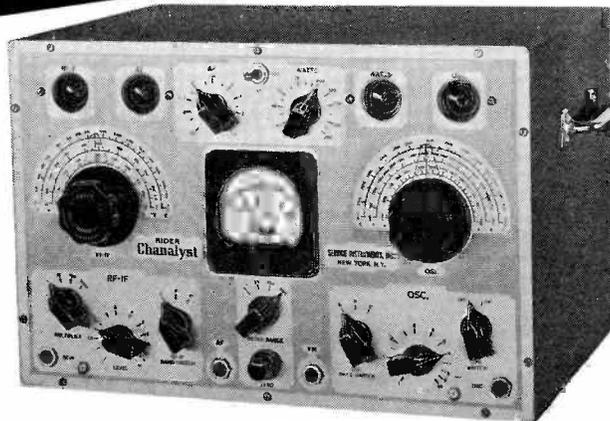
His merchandise must be "all wrapped up" in Christmas and his Christmas Certificates or "Serviticates" gay with ornamentation of the Yuletide, such as Three Wise Men or Magi, Star of Bethlehem, and the like. This is Nine Points of Allure. The homeliest gadget when covered with such gift glamor makes a charming and most welcome gift.

Through formulation of an intelligent selling plan he may raise December volume to that of a Thirteenth Month of the year, as business is borne to him on the wings of Christmas where these ABC's of alluring it are carried through impressively to an XYZ conclusion.

C. M. Litteljohn.

**Don't Take Our Word For It!**

*See  
The*



Net \$107.50

# RIDER Chanalyst

## IN ACTUAL OPERATION

See why servicemen everywhere say it provides the fastest method of trouble-shooting yet devised. The Chanalyst employs probes and eliminates adaptors and plugs. Any point in a receiver is checked merely by placing the proper probe to the points under test, AND you 'move' through the set as fast as you change the probes! The Chanalyst enables you to trace the signal from the antenna to the speaker—shows where it becomes distorted, takes on hum, weakens or dies. The Chanalyst involves no new principles of radio; it is a fundamental servicing instrument. In effect, it separates a receiver into five basic sections and enables you to perform tests heretofore impossible with a single servicing instrument. The Chanalyst has 'licked' the problem of intermittents, once and for all. It provides a fool-proof method of testing.



JOHN F. RIDER

in whose Successful Servicing Laboratories this revolutionary instrument was developed.

# Read

what these  
**SERVICEMEN**  
say . . . .

COATESVILLE, PA. "It's the easiest thing to use in my shop . . . does away with all guesswork and speeds up our service work. . . . I put it to work as soon as I got it and have been using it every day since, on large and small jobs."—M. Godschall.

PADUCAH, KY. "I have had better results with the Electronic Voltmeter (in the Chanalyst) than any other output indicator I have tried. I have found the Chanalyst very useful checking intermediate frequency and in finding troubles which would have been hard to find otherwise, such as intermediate transformers that show resistance on the Ohmmeter but are still bad."—Emmet Helm.

PHILLIPSBURG, N. J. "I have been in service work 12 years and bought a lot of test instruments. The Chanalyst is the best I ever bought. For intermittents and distortion it has cut my service time 90%, and for coupling condensers, you can test them quicker than you can pick up a soldering iron."—Carl B. Williams, Radio Service Laboratory.

HAZLETON, PA. "I now find it indispensable . . . The Chanalyst enables you to actually travel through a receiver, everything seems to open up before you."—Residential Radio Sales and Service.

DRYDEN, N. Y. "The Watt Indicator in the Chanalyst, alone, saved me a lot of trouble and time on three sets where the power transformer had been subjected to a heavy overload and was burnt bad. The Chanalyst takes all the GUESS WORK out of servicing."—E. M. Little.

HURON, S. D. "The Chanalyst has changed headache jobs into a pleasure! The one we have has been busy almost continually since we bought it."—Arndt's Radio Service.

**Don't Take Our Word For It . . .**

**GET A  
DEMONSTRATION!**

**"There's only ONE  
Rider Chanalyst"**

# Associations

## RADIO SERVICEMEN OF AMERICA

**S**HORTLY after the first of the year, RSA, in conjunction with the regular local chapter meetings, will sponsor special business subjects. These subjects have been built into the regular program design with the purpose of making RSA members better business men.

In the current issue RSA presents figures on the Service Man's cost of doing business. These figures are the result of an actual cross-sectional survey conducted among the members. The directors believe that these figures will form the basis of a cost accounting system for the Service Man.

RSA has affiliated during the past several weeks, the Lehigh Valley Radio Service Association of Allentown, Pa., with T. W. Reichard, president; J. A. Muthart, treasurer; H. H. Fillman, secretary; the Hartford Institute of Radio Technicians, Gerald Miller, chairman; James H. Smith, Jr., secretary; Kenneth G. Anderson, treasurer. These two groups represent two of the oldest established local associations in the country and have always done good work in aiding their members and in improving their local service industry. In addition, the Washington, D. C., Chapter has been established under the direction of J. B. Austin, Jr., chairman; Pat Hendrican, secretary; Bill Carrick, treasurer.

### Boston

Boston Chapter heard Director Saunders, 20th District, explain the workings of the oscilloscope in detail. On October 24 a discussion was held on the Chanalyst.

The Boston Chapter is looking forward in the near future to having other interesting meetings—these meetings are under the direction of William Wells, chairman, and Hyman Leve, chairman, program committee. Ingvar Paulson, secretary, is still on duty after all these years.

### Buffalo

The annual banquet of the Buffalo Chapter of RSA is planned for November 16. We understand chicken is to be served and

The latest time saving methods of dynamic analysis with the cathode-ray oscilloscope were demonstrated by Harold Justice, technician for the Lukko Sales Corp., Chicago, before a special meeting of more than 100 Service Men. The meeting was held under Lukko auspices at the Clough-Brengle plant.

something piping hot in the way of entertainment is promised. The annual bowling party was held November 8. While no scores are available at this time, it is rumored that several of the bowlers are of ABC tournament caliber.

### Chicago

At the Oct. 12 meeting of the Chicago Chapter, an engineer from Bendix Radio Corp. discussed, in detail, the service and maintenance of airplane receivers.

Neal Austin, chairman of the Barter and Exchange Committee, is rapidly acquiring a knowledge of the numerous things that Service Men want to get rid of. Lew Evans, shops standards committee, went very thoroughly into the costs of doing radio servicing, at a recent meeting. This is the first one of a series of such meetings.

### Cleveland

Cleveland Chapter of RSA had Mr. Trammell and Mr. Kendall give a Service Man's discussion of Rider's Chanalyst. These two men developed the uses and applications of the Chanalyst in ordinary service work.

### Danville

The Danville Chapter participated in the publicity program attendant upon the new station WDAN. The local charter of the chapter was presented by Joe Marty, Jr., executive secretary of RSA, at a recent meeting. A. G. Mohaupt gave an interesting lecture on the "Uses of the Signal Generator in Service Work." Considerable membership activity is planned for the near future.

### Decatur

An extended publicity and advertising program has been launched by the Decatur Chapter, to acquaint the general public with the type of work rendered by RSA members.

At the Nov. 1 meeting A. G. Mohaupt lectured on test equipment.

### District Nine

A combined meeting of all the chapters in the Ninth District was held in Pontiac, Mich., on November 1. Fifty men representing the officers and executive heads of committees were present. Much business was transacted. The speaker of the evening was Joe Marty, Jr., executive secretary of the RSA, who outlined the progress of RSA to date and gave some idea as to future plans. At the conclusion of the talk local charters were presented to Flint, Detroit and Pontiac, the three Michigan Chapters.

### Fremont

Fremont Chapter, on October 24, heard Mr. Scott of Clough Brengle give the complete story on Dynamic Testing with an interesting demonstration.

### Green Bay

All efforts of the Green Bay Chapter will be spent for a shindig, to be held during the Christmas season, for the members, their wives and guests. A. J. Nejedlo was elected chairman to make the necessary arrangements.

### Minneapolis

Minneapolis Chapter was host to over 150 Service Men, including the RSA group from St. Paul, at a recent meeting when John Potts gave the complete story of Rider's Chanalyst. Many other interesting meetings are planned for the near future by the Minneapolis group.

### New York

The Metropolitan New York Chapter heard Bruce Burlingame speak on the "Use of Meters in Service Work," at a recent meeting. At a subsequent meeting, J. J. Drummond of National Union Radio Corp., conducted a forum on new tubes and their applications.

At the meeting to be held Dec. 12, at the Hotel Capitol, 51st Street and 8th Avenue, John F. Rider will give a complete explanation and demonstration of his Chanalyst. The application of the instrument in locating causes of fading, noise, distortion, hum, loss of signal strength, voltage fluctuation, frequency drift, etc., will be stressed.

### Newark

A concentrated membership drive, under the direction of Harry Miller is under way in Newark, N. J. As an important point in the drive, the chapter is having advertisements inserted in local newspapers throughout the state which stress the advisability of using RSA Service Men.

### Ogden

The Ogden Chapter has embarked on a publicity campaign to acquaint the public with the value of good radio service.

At a recent meeting Lamont Boothe and Ted Olson of the local chapter demonstrated the Philco Mystery Control.

### Peoria

The Peoria Chapter, in conjunction with the Klaus Radio Co., sponsored RCA Victor engineers, who presented the out-

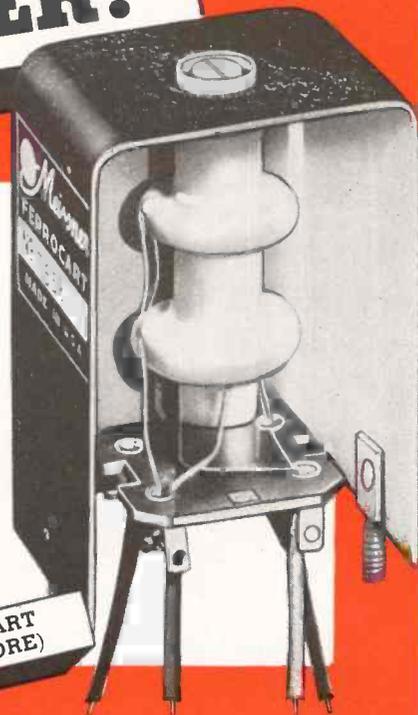
(Continued on page 42)



Replacements that Make the Receiver  
**"BETTER THAN EVER!"**

**"UNIVERSAL—ADJUSTABLE"  
 Antenna—R. F.—Oscillator Coils**

IT IS no longer necessary to order hard-to-get exact duplicates when an Antenna, R. F. or Oscillator coil needs replacing. These new adjustable-inductance Ferrocart (Iron Core) coils will replace the Broadcast Band coils in practically any receiver! The Oscillator coil is also designed to provide complete adjustment for receivers having intermediate frequencies from 175 to 520 kc, and may be used in either cut-plate tuning condenser or padding condenser circuits.

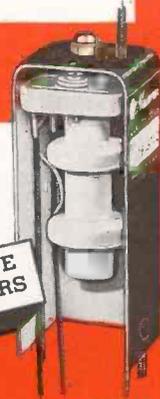


**Band Expanding I. F. Transformers . . .**

These Ferrocart (Iron Core) Band Expanding I. F. Transformers meet all requirements for variable selectivity—razor-sharp, medium width or broad band for high fidelity reception. Band width is electrically variable by means of a switch.

**Double-Tuned I. F. Transformers**

This is the ideal replacement transformer for Servicemen and Experimenters who demand the utmost in I. F. transformer performance at low cost. Available factory-peaked at 175, 262, 370, 456, 1500 or 3000 kc.



**Ferrocart Antenna & R. F. Coils**

These (Iron Core) coils are designed to cover the broadcast band (540 to 1600 kc) with a 365 mmf condenser. Will work with any of the standard types of tubes, including metal and the battery-operated 2-volt series.

*Meissner*

MT. CARMEL  
 ILLINOIS  
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**"A FAMOUS NAME FOR TWO DECADES"**

**QUALITY TESTERS  
at LOWEST PRICES**



Positively  
Checks Radio  
Receiving  
Tubes According  
to Latest Recom-  
mendations of Tube  
Engineers

New  
Model 432

**TUBE TESTER Only \$21.60**

- Separate Plate Tests on Diodes and Rectifiers
- Neon Short and Leakage Tests
- Ballast Tube Continuity Test
- Uses Attractive Trip-lett Direct Reading Instrument, 3" Size. (GOOD - BAD) Scale
- Line Voltage Adjustment
- New Improved Low Loss Switch

Complete in attractive, sturdy, quartered-oak case; suitable for counter or portable use. Sloping etched panel of silver and black.

**ALSO AVAILABLE**

**MODEL 431 ..... \$15.90**

Checks all receiving tubes. (No ballast test.) Tester uses dependable Readrite Meter. Quartered-oak case same as for Model 432.

**FREE POINT TESTER AND  
VOLT-OHM-MILLIAMMETER**



Readrite - Ranger Combination Testers are undoubtedly the best buy in precision testers. Besides the above, combinations may be had as follows:

- Model 442-540—Tube Tester and Signal Generator ..... Dealer Price, \$36.90
- Model 442-740—Tube Tester and Volt-Ohm-Milliammeter... Dealer Price, \$36.90
- Model 540-740—Signal Generator and Volt-Ohm-Milliammeter... Dealer Price, \$37.50

Model  
640-740  
only  
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Name \_\_\_\_\_  
 Address \_\_\_\_\_  
 City \_\_\_\_\_ State \_\_\_\_\_

**ASSOCIATIONS**

(Continued from page 40)

standing features of the new RCA line at the Oct. 27 meeting. Peoria will have Russ Lund of Clough-Brengle on Dynamic Testing in the near future.

**Quincy**

The Quincy Chapter heard Russ Lund of Clough-Brengle talk on Dynamic Testing recently. A large group from Quincy and the surrounding neighborhood were present. At the same meeting Joe Marty presented the local chapter with its charter.

**Staten Island**

Staten Island Chapter held its annual picnic recently and were hosts to 177 persons. Motion pictures were shown and refreshments served throughout the day and evening. This picnic is probably unique because there were so many prizes that a few had to be returned to the donors.

**INDEPENDENT GROUPS**

**California**

Frank Jallu discussed and demonstrated Philco Mystery Tuning at the Nov. 7 meeting of the Radio Service Association of California, Inc. When Frank was finished the mystery was plumb dispelled.

G. E.'s electric tuning was discussed by Harlan Eastman, who brought along a chassis or two to show the operation and servicing of the new homing type of motor tuning.

That ought to be a right satisfying shot of technicality for one sitting. Good idea, sez we. Sort of prevents that sunken feeling when you first encounter one of these new contrivances on a service job.

We sorta missed out on our meeting a coupla weeks ago, but we went and heard Walter Jones and that was something. We learned how to treat rectifiers and what makes power tubes tired and guzzled a sandwich or two and a bottla pop (sissy) all at the expense of Messrs. Brill and Brown. Thankee, gents!

**Philadelphia**

The Philadelphia Radio Service Men's Association held two enthusiastic meetings last month.

The first was the RCA meeting on Oct. 11, in the Inquirer Auditorium, with M. M. Brisbin serving up a technical discussion and demonstration of Facsimile and Television.

Then on Oct. 18 Century sent along John Rider to the Architects Building with one of the most absorbingly interesting meetings we've ever heard. Seems as if that "Chanalyst" of his will do about everything but put the soldering iron on the joints. All real serviceman's stuff—properly served!

Stan Myers and Little Schmitt had a big Doughnut Dunking Contest—and everybody lost count after the second hour! Papa Flood and his son didn't lose any time, either.

We've a winner on our list! Congratulations to Art Joseph who won a prize in the big contest on tube selling ideas. Art is a protege of another PRSMA booster, J. C. Van Horn.

Whatsamatter with Littlepage—somebody takes his card out of the box?

Glad to see a lot of good old faces last month... Al Haas, Paul Keller and Ed Ward.

PRSMA News

**REPLACEMENTS  
IN A FLASH  
IN THE**

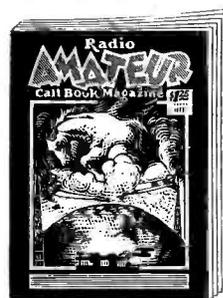
**THORDARSON  
REPLACEMENT  
TRANSFORMER  
ENCYCLOPEDIA**

**LISTS TRANSFORMER  
REPLACEMENTS FOR  
SETS COVERED IN  
RIDER'S 8 VOLUMES**

**FREE**

**From your parts distributor  
or direct from factory**

**THORDARSON  
ELECTRIC MFG. CO.  
500 W. HURON ST., CHICAGO, ILL.**



**SERVICEMEN  
who are  
RADIO AMATEURS  
buy a fresh copy today of the  
RADIO AMATEUR  
CALL BOOK**

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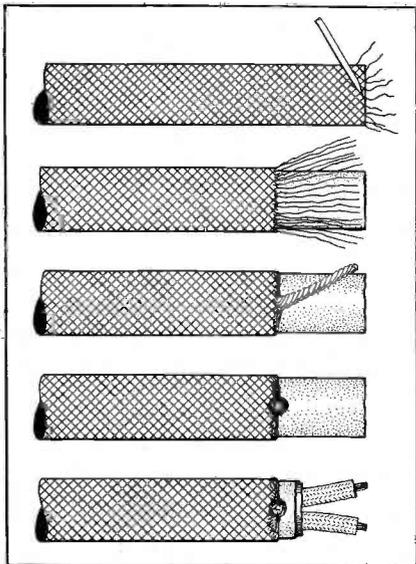
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## HANDLING SHIELDED WIRE

WHILE the usual method of dealing with shielded wire indicates an optimism and spirit of adventure on the part of the Service Man that is to be highly praised these days, it nevertheless results in an untidy looking job.

Some Service Men possessing less audacity but being more imbued with the aura of scientific precision do not stop when they have pressed the loose shielding together with their fingers. They have learned from sad experience (or better still, through reading SERVICE magazine) that a little solder applied to the shielding where it was cut prevents the strands from misbehaving. Alas, a few of the strands of shielding invariably avoid the soldering process and



Finishing shielded wire.

then the fun, or rather, lack of it, begins again.

The author finally evolved the technique shown in the accompanying sketch.

Insert a scribe, or other pointed tool, under the first few strands of the braided shielding as indicated in the illustration and pull the scribe toward the end of the wire, thereby unbraiding these few strands. Give the wire a quarter turn and repeat the operation. Continue loosening a few strands at a time each time the wire is given a quarter turn until the desired amount of shielding has been loosened.

One precaution must be observed if trouble is to be avoided. Under the braided shield there lies a braided cloth which helps to insulate the shielding from the remainder of the structure. Each time the scribe is inserted under the wire strands comprising the shield braid great care should be taken that the point of the scribe does not penetrate this cloth covering. If the scribe should

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The S-15A audio amplifier is an ideal medium power amplifier for P. A. and modulator service, delivering 15 watts of audio power. The power supply and audio amplifier are combined on one compact chassis. High gain, sufficient for crystal microphone operation, is effected through proper choice of tubes, including 6V6G tubes in the output stage. High impedance dual input is provided for either low or high gain, using standard jacks. A universal output plug is supplied at the back of the unit. A tone control is mounted on the common etched panel which sets off the modern beauty of the slate-gray crinkle chassis. The tubes required are one 6J7, one 6C5, two 6V6G's and one 83. This kit is supplied completely mounted ready to wire, less dust cover and tubes, including all components, accessories, etched plate, etc. Size 17" long x 7" wide x 8" high. Weight 23 lbs. **\$24.00**

Net price

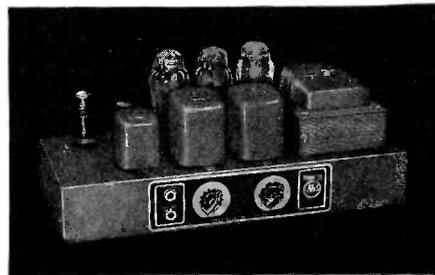
● If kit is desired with Special Series universal modulation transformer, use amplifier kit No. S-15M. Net Price **\$24.00**

● If kit is desired with 2A3 output tubes and additional stage of amplification, line and voice coil output, use Kit No. S-10A. Net price **\$25.20**

● 2A3 kit as above, but universal driver output transformer, use Kit No. S-10D. Net price **\$25.20**

● Tubes for S-10A and S-10D are one 6V7, one 6F8G, two 2A3's, one 83.

● Dust cover for above amplifiers, type S-15D. Net Price **\$1.50**



The appearance of the S-25A is the same as the S-15A.

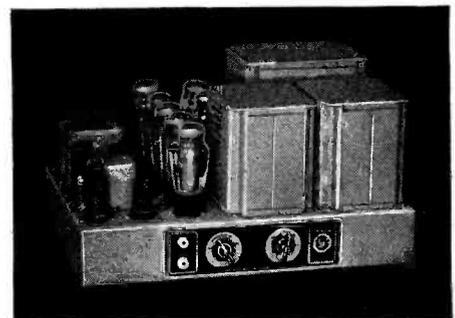
## ● S-25A

The S-25A audio amplifier has been designed specifically for the high power P. A. and modulator field. This unit employs 6L6 tubes in the output stage to obtain 25 watts of undistorted power. The circuit is simple but highly efficient, effecting sufficient gain in three stages to operate from crystal or similar microphones. The tone and volume controls are mounted with the dual high impedance, high and low gain input jacks on one etched panel. A universal output plug is provided on the back of the chassis. The power supply is unusually rugged and employs a two-section filter for optimum regulation and hum reduction. The kit is normally supplied with universal voice coil output impedances. The tubes required are one 6J7, one 6C5, two 6L6's and one 83. The S-25A kit is supplied completely mounted, ready to wire, less tubes, including all components, accessories, dust cover, etched plate, etc. Size 17" long x 7" wide x 9 1/4" high. Weight 32 lbs. Net price **\$30.00**

● If kit is desired with Special Series universal modulation transformer, use amplifier kit No. S-25M. Net price **\$30.00**

## ● S-100

The S-100 audio amplifier is an ideal inexpensive unit for amateur use. Four highly efficient stages are employed, permitting crystal, microphone input and 100 watt undistorted output. Four 6L6 tubes are employed in the output stage for maximum tube economy and minimum plate potential. Fixed bias is employed on the output stage, permitting peak power handling ability appreciably over the normal rating. A modern etched panel sets off the attractive appearance of the gray crinkle cabinet, which is similar to that of the SX-80 and SX-200 transmitter kits. Tone and volume controls are provided. High impedance, high or low gain, dual input is arranged using standard jacks. A Special Series universal modulation transformer is employed to effect maximum flexibility for matching any RF stage. Tubes required are one 6J7, one 6C5, two 6F6's, four 6L6's, three 83's. The kit is supplied completely mounted, ready to wire, less tubes and dust cover, including all components, accessories, etched plate, etc. Size, less cabinet, 17" long x 12" wide x 9 1/4" high; with cabinet, 18" long x 13" wide x 12 1/2" high. Weight 59 lbs. Net price **\$52.50**



This is the appearance of the S-100.

● If this kit is desired with a P. A. output transformer for universal voice coil impedances, order by No. S-100PA. Net price **\$55.00**

● Cabinet for above. Net price **\$3.75**

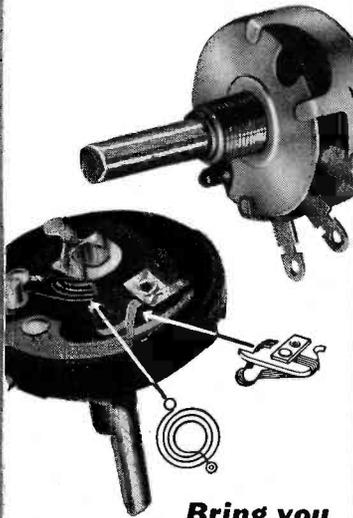
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penetrate the cloth covering the cloth threads would also be unraveled together with the shield wires. This is undesirable since the fine cloth threads can be separated from the braid wires only with difficulty. If, however, the cloth threads should become intermixed with the shield wires apply a flame. This will burn the threads up but it will also cause the braid wires to become oxidized. Scrape this oxidation off carefully.

Pull all the loose wires together and, starting at the base, twist them tightly together. A drop of solder may be applied at the base in order to prevent any possibility of unraveling. The operation can, if desired, be stopped at this point, the twisted shield wire being connected to ground.

If the operation is not stopped at this stage, no solder should be applied at the base of the wire. Instead, the twisted strands are clipped off close to the base. A bit of solder is applied to the slightly projecting stump, thus preventing the wires from becoming loose. This completes the manipulation of the shielded wire to prevent fraying. Clipping off the cloth insulation and the filler threads follows conventional lines.

D. Bee

### WELLS-GARDNER C6-A

*Dial drive cord replacement:* To replace the dial drive cord in this auto-radio model, remove the celluloid dial scale. Open the clamps on the back of the dial pointer in order to remove the old drive cord.

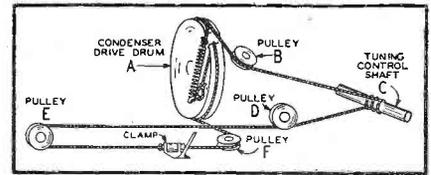
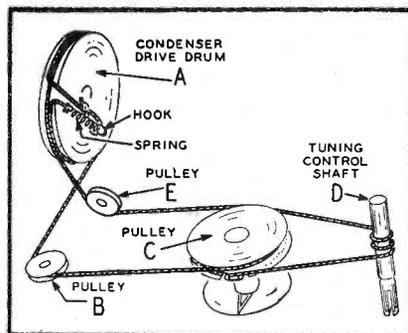
It is not necessary to remove the dial and drive bracket assembly to replace the drive cord.

Tie a knot with a small loop at one end of the new drive cord. Slide a  $\frac{1}{2}$  inch length of fabric tubing on the cord. Tie the free end of the drive cord to the tension spring. The distance between knots should be 28 $\frac{3}{8}$  inches.

Turn the gang condenser to full open position.

Place the looped end of the drive cord over the hook on condenser drive drum A (see accompanying illustration).

### Wells-Gardner C6-B dial drive cord replacement.



Wells-Gardner C6-A dial drive cord replacement.

Bring the cord up through the slot in the drum rim.

Turn the drive drum to the position shown in the illustration.

Wind one turn down and around drive drum A and around pulley B as shown. Wind  $3\frac{1}{2}$  turns on tuning control shaft C, progressing from a point midway between the two bracket arms toward the chassis. Bring cord under pulley D and around pulleys E and F as shown. See that the fabric tubing is now between pulleys E and F. Bring the drive cord to the rear around drive drum A and through the slot in the drum rim as shown.

Turn the gang condenser to full open position and place the free end of the tension spring over the hook on drive drum A.

*Dial pointer adjustment:* Mount the celluloid dial scale on the dial bracket. Tune in a signal of known frequency near one end of the dial scale. Move the pointer assembly to this frequency on the dial scale and tighten the clamps with long nose pliers.

### WELLS-GARDNER C6-B

*Dial drive cord replacement:* To replace the dial drive cord in this model, tie a knot with a small loop at one end of the new drive cord. The free end of the drive cord is tied to the tension spring. The distance between knots should be 23 1-16 inches.

Turn the gang condenser to full open position.

Place the looped end of the drive cord over the hook on condenser drive drum A (see accompanying illustration). (Shown with gang condenser half open). Bring the cord up through the slot in the drum rim and wind one-half turn to the rear (from front of chassis) around the drive drum. Pass cord around the pulley B as shown. Wind one turn clockwise (from front of chassis) around pointer disc pulley C. Loop cord through the notches on the outside rim of the pointer disc pulley as shown. Wind  $2\frac{1}{2}$  turns clockwise, progressing from a point midway between the bracket arms toward the chassis, on tuning control shaft D. Bring cord to the left under pointer disc pulley C and around pulley E as shown. Pass cord to top of drive drum A and wind one turn to the rear around the drum rim.

Pass the remaining drive cord and

ension spring through the slot in the drum rim. Place free end of spring over the hook on the condenser drive drum.

*Setting pointer disc:* Tune in an 800-kc signal. Hold the tuning shaft and turn the pointer disc until the pointer is at the correct position when the chassis front cover is put back in place.

#### ARVIN 6

*Backlash in variator control:* Remove the front case cover, by removing the 9 screws in its edge, the control and push-button knobs, and the escutcheon plate.

Tighten the set screw in the variator shaft collar and secure with the lock nut. Replace front and knobs and make sure that the variator shaft knob fits securely against the rubber grommet.

*Inability to tune to 550 kc:* Remove the front cover as directed above. Loosen the variator shaft, set screw and then turn the variator screw one full turn clock-wise. Retighten the variator shaft, set screw and lock nut.

*Elimination of case rattles:* Rattles in these models may usually be eliminated through the following procedure:

(1) Cut a piece of cardboard  $5\frac{1}{2}$  in by 6 in and after removal of the chassis from the case place this piece of cardboard in the rear of the set housing in such a manner that it will separate the back of the case from the rear of the chassis.

(2) Place a strip of Scotch tape on either side of the radio chassis along the bottom edge.

(3) Place a band of Scotch tape around the vibrator-grounding spring cup.

(4) See that the four pieces of tape which hold the speaker cloth in place securely adhere to the cloth. When reinserting the chassis in the case, make certain that this tape does not roll up against the speaker cone.

*Oscillation between 1100 and 1500 kc:* Model 6 Arvins bearing serial Nos. 85001 to 86001 may oscillate between 1100 and 1500 kc.

This condition may be corrected by connecting a 20,000-ohm,  $\frac{1}{4}$ -watt resistor in series with the B lead to the oscillator coil.

A 0.002-mfd mica condenser should then be connected from the B lug of the oscillator coil to ground to adequately by-pass this circuit.

Walter E. Peak

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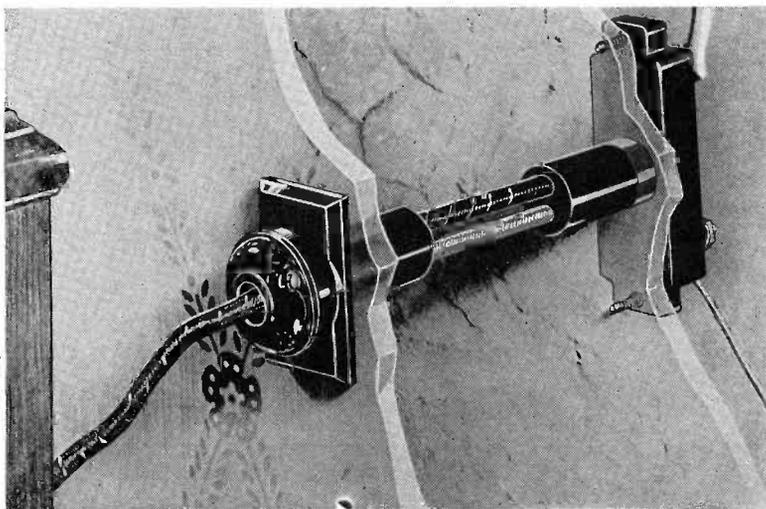


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## AIRLINE REMOTE CONTROL

(Continued from page 18)

Remove the push-button escutcheon plate and unscrew all six station-setting screws all the way out (counterclockwise). Remove whatever tubes may interfere with the installation. (Two or three in most models). Remove the cover plate on the top of the chassis by taking out four screws. Fig. 3 is a view of the 7-tube chassis showing the cover plate and four tubes removed. The magnet assembly is ready to be mounted over the hole in the chassis.

The magnet assembly is mounted on top of the chassis over a rectangular hole which is covered with a removable cover plate. The purpose of this unit is to electrically operate the automatic push-buttons on the front of the set, from a remote location. The relay assembly is mounted by means of two wood screws to the underside of the chassis shelf (on mantel models it should be mounted alongside the chassis). The purpose of this unit is to control the magnet assembly.

Before placing the magnet assembly in position, put the four screws which were used to hold the cover plate to the chassis into the mounting holes of the frame of the magnet assembly. Four thin fibre washers are supplied which are used to hold the mounting screws in the mounting holes until the magnet assembly is lowered into position. This is shown in Fig. 4D.

Referring to Fig. 3, place the magnet assembly in position so that the slots in the armatures are directly over the plungers. Carefully lower the magnet assembly so that the plungers enter the slots in the armatures. A screwdriver will be helpful in aligning any armature which may not be directly over the plungers. The armatures must slip over

the plungers between the latch bar and the shoulder of the plunger (see Fig. 4).

Rest the magnet assembly on the chassis base and move it slightly toward the back of the set until the locating pins (see Fig. 1) on each side of the magnet assembly frame slip into the locating holes on both sides of the opening in the chassis base (see Fig. 3).

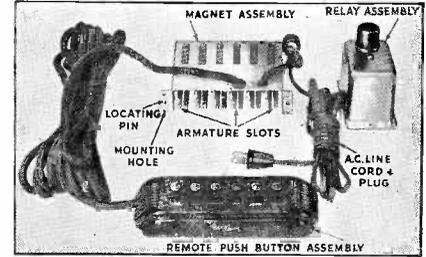
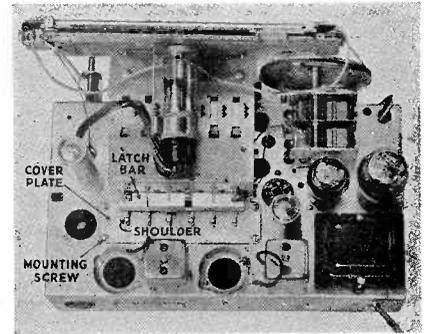


Fig. 1. Airline remote control attachment for use on the current line of Ward receivers. The push-button, magnet and relay assemblies are shown. Selection of any one of six preset stations is possible from a remote point.

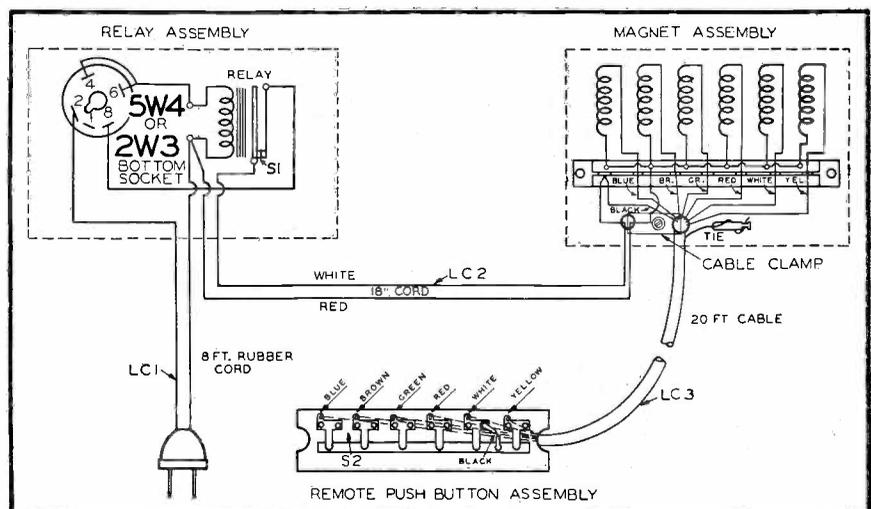
Fig. 2. The 7-tube Ward Airline (Models 62-370, 62-470, 62-700) receiver showing the position for mounting the magnet assembly and the associated receiver links.



Hold the assembly in place and fasten it securely to the chassis base by means of the four screws.

Mount the relay to the underside of

Fig. 5. Airline remote control circuit. The rectifier tube is used to obtain the necessary d-c to operate the relay and magnet assembly.



the chassis shelf using the two wood screws and spacer washers supplied. On mantel models mount the relay alongside the chassis. Arrange the wire connector cables to the magnet and relay assemblies around the tube socket base and replace the tubes that were removed to facilitate the installation.

Reset the automatic push buttons by

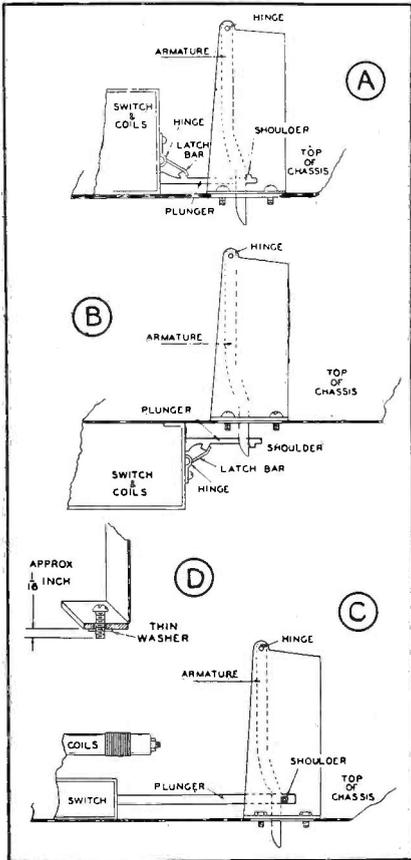


Fig. 4. Details for mounting the Airliner remote control magnet assembly.

means of the station setting screws on the front of the set.

In the Model 62-403, precaution should be taken when placing the magnet assembly to prevent scratching of the movie dial.

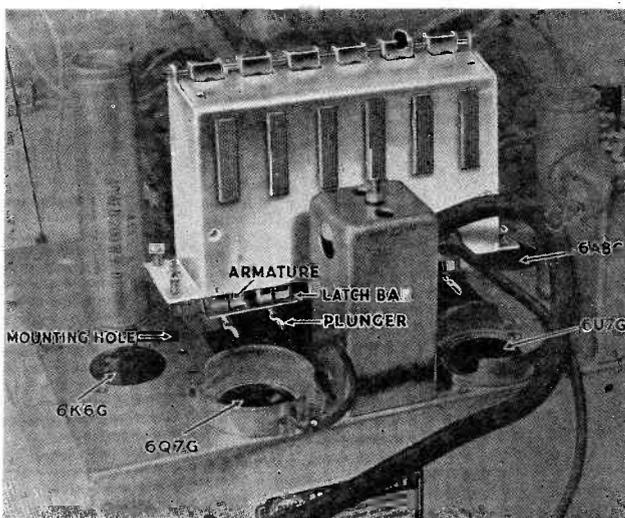


Fig. 3. A view of the 7-tube chassis (Models 62-370, 62-470, 62-700) with the cover plate removed and the magnet assembly almost in place. Four tubes have been temporarily removed to facilitate the installation.

After the remote control units are completely installed and the receiver placed in operation, stations can be selected automatically by pressing any one of the buttons of the remote assembly. The stations, of course, must first be set up by adjusting the setting screws on the front of the receiver.

#### CRYSTAL MICROPHONES

The new Astatic Model MU-2 and MU-4 crystal microphones are wide-range, multi-unit, pressure-operated devices of modern design, having an output level of -56 db. The MU-2 is constructed with two double-diaphragm, yoke-driven crystal units using four diaphragms. The MU-4 assembly employs four units using eight diaphragms and is characterized by smoother response. Extremely small losses in level are said to be encountered when long cables are used, with no frequency discrimination being encountered. For further information write to *Astatic Microphone Lab., Inc.*, 830 Market St., Youngstown, Ohio.

#### CLAROSTAT RESISTORS

Clarostat announces a line of adjustable wire-wound power resistors. The coating is an inorganic cement solidified with very low heat treatment. The unit may be operated at red heat without blistering, cracking or deteriorating, it is said. Units are available in 10-, 25-, 40-, 60-, 80-, 100-, 160- and 200-watt ratings, and in any resistance value from 1 to 100,000 ohms.

Additional information may be obtained from *Clarostat Mfg. Co., Inc.*, 285 N. 6 St., Brooklyn, N. Y.

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With the introduction of its series S Pincor Silver Band dynamotors, Pioneer Gen-E-Motor Corporation now offers a complete line of B power-supply equipment for sound systems, police units and broadcast service. The new Pincor Silver Band dynamotors, according to the manufacturers, are not affected by vibration.

Data sheets giving capacities, performance characteristics and other information may be obtained from *Pioneer Gen-E-Motor Corporation*, 466 West Superior Street, Chicago, Ill.



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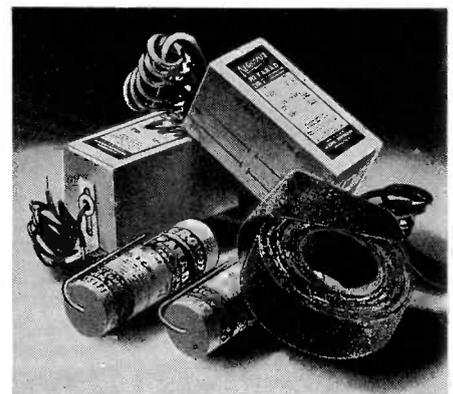
● AEROVOX offers the outstanding line of exact-duplicate replacement condensers *positively matched* to initial equipment. Such units *fit right, look right, work right*. They restore any set to original *new* condition. It's the only sensible way to service a set for a fussy owner, or to make a trade-in salable at a fair price. And remember, AEROVOX exact-duplicate replacements usually cost less than a batch of general-utility condensers for same purpose.

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## Book Reviews

**ELECTROLYTIC CAPACITORS**, by P. M. Deeley, published by the Cornell-Dubilier Electric Corp., South Plainfield, N. J., 276 pages, price \$3.00.

The development of electrolytic condensers has occurred with such rapidity that workers in this field have hitherto apparently lacked the time to write about them. The investigation of any phase of these condensers required a long and arduous search to find the widely scattered references.

Such laborious search of the literature is no longer necessary, thanks to the appearance of "Electrolytic Capacitors" for this book gathers together under one cover all that any Service Man needs to know about the subject.

About half of the book is devoted to the fabrication of electrolytic condensers and will probably prove to be of interest only to the specialist. The other half, however, is so filled with interesting and useful material as to warrant its being read by anyone who uses electrolytic condensers.

D. B.

**MATHEMATICS FOR RADIO AND COMMUNICATION, Book I, Arithmetic, Algebra, Geometry**, by G. F. Maedel, published by Prentice-Hall, Inc., 70 Fifth Avenue, New York City, 1938. 314 pages, price \$3.75.

Those Service Men who either lack a formal training in or who have forgotten their elementary mathematics are acutely aware of the many good radio articles that they must pass over for want of the necessary mathematical knowledge. No longer need he regret his inability to manipulate mathematical symbols, for a little time spent with "Mathematics for Radio and Communication" will eliminate his present incapacity.

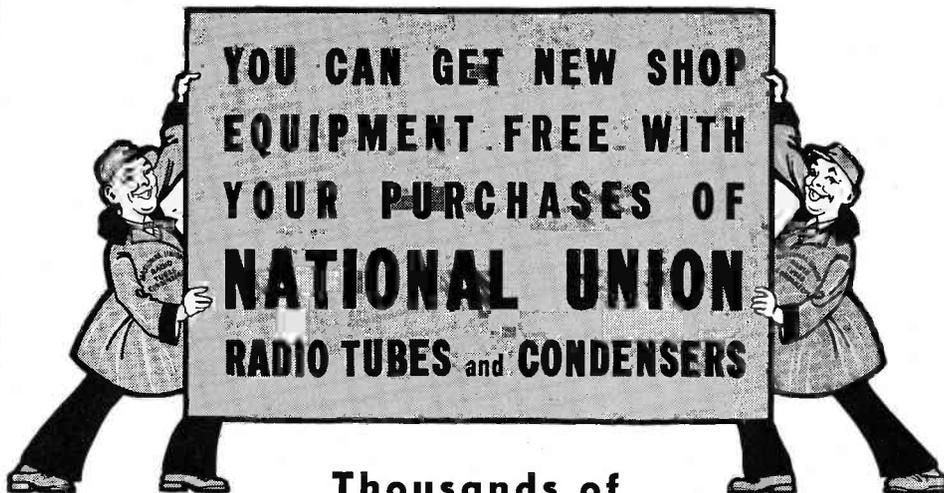
This book presents the fundamental principles and operations of arithmetic, algebra and geometry in a remarkably clear manner. It makes no attempt to completely cover these three branches of mathematics, but confines itself to those portions of greatest practical utility. The Service Man is therefore enabled to master the important essentials in a minimum of time.

The illustrative examples, as well as the problems to be solved by the reader, are mainly chosen from the field of radio, thereby extending the Service Man's knowledge of radio simultaneously with his acquisition of mathematical skill. Answers to all problems are given at the back of the book. This makes the book ideal for self-study for it enables the student to check the answers he has himself obtained, thereby giving him a feeling of confidence that he is performing the operations correctly.

R. L.

**RADIO LABORATORY HANDBOOK**, by M. G. Scroggie, published by The Wireless World, Iliffe and Sons, Ltd., Dorset House, Stamford Street, London, S. E. 1, England, 1938. 384 pages, price 8/6 net, by post 9/-.

"Though the most gifted writer may fail to interest all of the people all of the time, it is the present author's hope that he may succeed in interesting some of the people (i. e., all those who experiment in radio, on however small or large a scale) some of the time." Thus remarks the author in his preface. The present reviewer feels



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NEWARK, N. J.

S-1138

that Mr. Scroggie is much too modest in his statement, and that this book will not merely interest but rather will irresistibly fascinate all of its readers all of the time.

Radio Laboratory Handbook covers the entire field of radio measurements, from audio frequencies to the ultra high frequencies. Various types of measuring equipment, home-made as well as manufactured, are analyzed as to their utility, precision, and cost.

The author constantly keeps the question of price in the foreground, for he realizes that the readers of his book must obtain maximum utility for minimum outlay in the measuring equipment which they purchase. It should not be thought, however, that the author advocates only very

low-priced equipment. On the contrary, he points out that precision and convenience are directly related to price.

Despite the fact that this book is almost completely non-mathematical in nature, the author clearly explains the techniques involved in measuring radio apparatus, from the lowly resistor to the complete radio receiver. This is undoubtedly one of the most practical books that has ever been written on radio measurements. Even the engineer engaged in making precision measurements could encounter many valuable suggestions.

Radio Laboratory Handbook is unqualifiedly recommended to every Service Man who has occasion to make audio or radio frequency measurements.

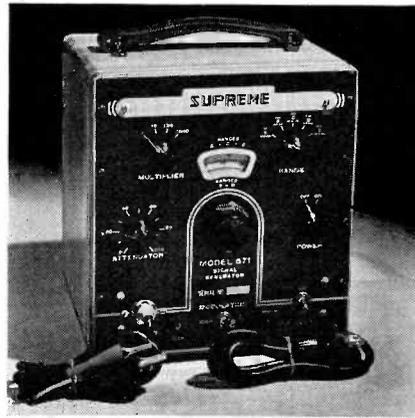
D. B.

# Manufacturers

## SUPREME SIGNAL GENERATOR

The latest Supreme signal generator, Model 571, has a frequency range from 65 kc to 20.5 mc on fundamentals. Two levels of 400-cycle modulation, 30% and 75%, are provided. The output is approximately 0.1 volt.

Additional information and prices can be obtained directly from *Supreme Instruments Corp.*, Greenwood, Miss.



Supreme signal generator.

## NOGGLE ADD-A-BIN

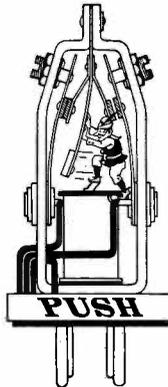
Noggle Products Co. have introduced a system of unit bins for storing small parts. The bins are sold separately and can be assembled into a single unit by the user. The system is called Add-a-bin and is obtainable in various sizes.

Additional information on this and other Noggle products may be obtained from *Noggle Products Co.*, Ann Arbor, Mich.

## PAULEY-JAMES VIBRATORS

Pauley-James Corp. announce a complete line of synchronous vibrators. The new line incorporates all of the mechanical and electrical features of the Pauley-James non-synchronous Vibrapower unit as well as a push-pull coil circuit.

Replacement charts, listing all types, are available directly from *Pauley-James Corp.*, 4619 Ravenswood Ave., Chicago.



Pauley-James vibrator.

## COAXIAL CABLE KITS

A convenient kit containing all the necessary components for the construction of 1/2-in. diameter coaxial cable has been made available for amateurs, experimenters and engineers. These kits include inner conductor, insulators, outer shieldings, clips, screws, nuts, eyelets and instructions for the assembly of the cable.

The trade name of the product is CO-X concentric cable. Complete details and technical information is available from *Transducer Corp.*, 30 Rockefeller Plaza, New York City.

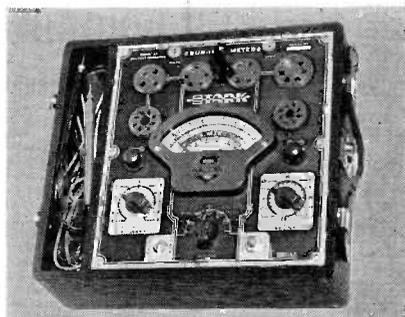
## BELL SCHOOL SYSTEM

Bell Sound Systems, Inc., have introduced a desk type panel sound system for use in schools having thirty rooms or less. The equipment includes a radio tuner, talk-back features for intercommunication, 24-watt amplifier, audible monitor and provision for phonograph attachment.

Additional information can be obtained directly from *Bell Sound Systems, Inc.*, 1183 Essex Ave., Columbus, Ohio.

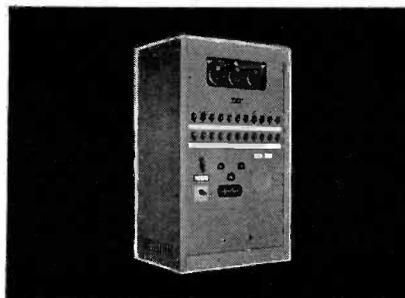
## CLAROSTAT BALLAST TESTER

Clarostat Model 160 tester is a means for testing resistor tubes with any type of base or for testing line cords of any resistance value. Additional information on this and other Clarostat products may be obtained from *Clarostat Mfg. Co., Inc.*, 285 N. 6th St., Brooklyn, N. Y.



Stark Rural meter.

Bell school system.



## "SINGLE-ENDED" TUBES

Four new RCA "single-ended" metal receiving tubes have recently been announced to radio equipment manufacturers as follows: RCA-6SF5, high-mu triode; RCA-6SJ7, triple-grid detector amplifier; RCA-6SK7, triple-grid super-control amplifier; RCA-6SQ7, duplex-diode high-mu triode.

These new single-ended tubes, in which all electrodes including the control grid terminate at base pins, employ a radically new construction with interlead shielding. As a result of this new construction made possible by modern methods of tube manufacture, the r-f amplifier pentodes 6SJ7 and 6SK7 not only have the same grid-plate capacitance as similar capped types, but also have lower values of input and output capacitance. Similarly, the a-f types 6SF5 and 6SQ7 offer the same mechanical advantages as the r-f amplifiers.

In addition to the single-ended types, RCA has made available through transmitting-tube distributors two new voltage regulator tubes designated as the RCA-VR105-30 and RCA-VR150-30.

Complete information may be secured from *RCA Radiotron Division, RCA Manufacturing Co., Inc.*, Harrison, N. J.

## HALSON DWARF

Halsen have announced their Model A-5S, a 5-tube super in the Dwarf cabinet. Additional information and prices may be obtained from *Halsen Radio & Television, Inc.*, Cambridge and Tremont Sts., Meriden, Conn.

## RURAL METER

The "Rural Meter" is a new battery-operated tube tester and analyzer. A large fan type meter indicates "poor—weak—good." A circuit arrangement permits the testing of self-contained batteries directly on meter. Three d-c voltage ranges are from 0-10-100-300 volts; resistance ranges from 0-1,000-100,000-1,000,000 ohms. Complete specifications may be secured from *Stark Electrical Instruments*, 418 South Wells St., Chicago.

## ARCTURUS TUBES

Arcturus have announced the addition of 14 tube types to their line. Ten of these are ballast. The other four are a 6J8G, triode-heptode converter; 6K8G, triode-hexode converter; 6P5G, triode amplifier-detector and the 6F5GT high-mu triode midjet.

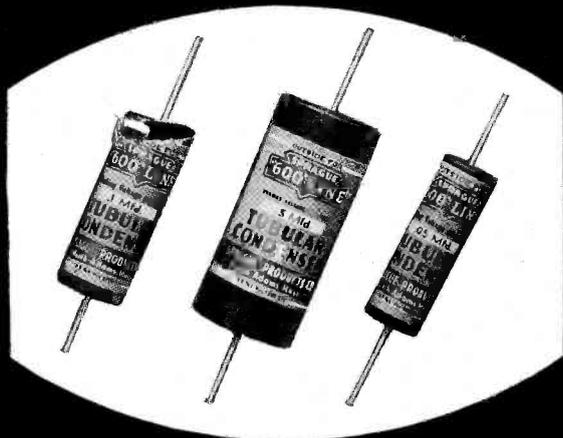
Additional information on these and other Arcturus tubes may be obtained from *Arcturus Radio Tube Co.*, Newark, N. J.

## BERNARD MAXIMETER

One of the 31 ranges of the Bernard Maximeter is an output meter with a full scale deflection of 150 millivolts. This range will give a deflection before the avc starts to work.

Additional information on this and other Bernard instruments can be obtained from *H. J. Bernard*, 319 Third Ave., Brooklyn, N. Y.

(Continued on page 56)



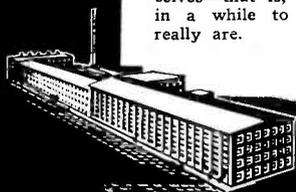
Maybe we should have told you **LONG AGO . . .**

**S** AID the sales manager to the man who writes these ads: "Hy, do you realize there are 60 million Americans who have no direct knowledge of the World War? Either they were not yet born, or were less than 6 years old when the War ended. Time marches on! That's why you ought to say something about TC Tubulars soon. Maybe there are newcomers in Radio who don't know all about the most famous condensers that ever came down the pike."

So here goes: Since first Sprague TC Paper Tubulars started to make famous the slogan "Not a Failure in a Million!" there have been many developments, many imitations, many attempts to beat Sprague quality—But still TC's remain the fastest selling tubulars on the market, and certainly the most reliable.

Just ask the best technical men you know. Go to the fellows who don't buy their condensers because of advertising claims, but who buy them on the strength of hard-boiled engineering tests. What they tell you about TC's will prove more convincing than any pretty adjectives we might print here. They'll tell you a lot about construction, non-inductiveness, moisture-proofing, safety factor, etc. that might make pretty dry reading but that makes a mighty convincing demonstration against any competition you care to name.

Maybe we should have written this ad long ago. But sometimes it's hard to realize that maybe even the world's most famous condensers won't walk out and sell themselves—that is, unless we tip folks off once in a while to investigate how good they really are.



**SPRAGUE**  
GOOD CONDENSERS—EXPERTLY ENGINEERED—  
COMPETENTLY PRODUCED

SPRAGUE PRODUCTS CO., NORTH ADAMS, MASS.

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Address .....

City ..... State .....

Service man   
Dealer

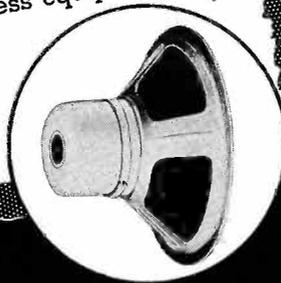
Experimenter   
Amateur

Name of Jobber.....

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What engineers like about Cinaudagraph Speakers is the even, high quality of tone and dependability of construction. Furthermore Cinaudagraph offers this fine quality in a complete line of permanent magnet and electro-dynamic speakers from 5" to 18". Investigate the new profit possibilities of comparatively priced Cinaudagraph speakers used so extensively by the country's foremost manufacturers of radio and Public Address equipment.

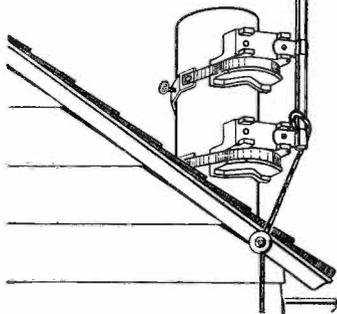
Write to Cinaudagraph Corp.,  
Stamford, Conn., for new  
descriptive catalog today.



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- Can be sold to replacement market as well as with new sets.
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- Easy to mount to soil pipe, or against chimney, window frame, garage, etc.

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WARD BUILDING CLEVELAND, OHIO

#### CLINTON 247

*Dial rim alive:* If the set owner experiences a shock when touching the dial rim, the condition may be rectified by sliding the chassis back so that the rim does not contact the chassis.

Willard Moody

#### PHILCO 37-11

*Inoperative:* If this model is dead because of a defective 6K5, a 6Q7G may be substituted in its place. The high-mu triode section of the latter is identical to the 6K5. The diode plates in the 6Q7G will not be used in this instance. They do not interfere with the normal operation of the receiver, however, because the 6K5 socket has no wiring connected to the diode terminals.

Willard Moody

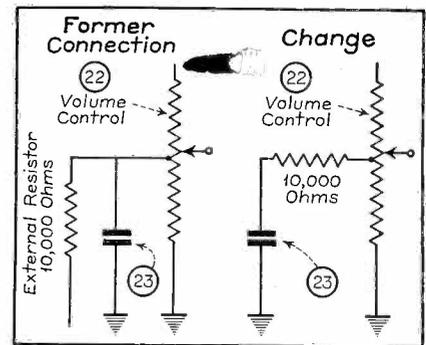
#### PHILCO 37-675

*Inoperative: No voltage on 6A8G anode grid:* This may often be traced to a shorted 0.05-mfd. condenser located near the front section of the range switch in the centralized tuning unit. The 4,000-ohm carbon resistor connected from the low voltage point of the filter choke should be replaced whenever the short has caused it to change its value.

Willard Moody

#### PHILCO 39-25

*No highs at low volume setting:* A few of the early production sets of this model had the base compensation con-



Philco 39-25 circuit change.

denser improperly wired. The accompanying sketch shows the proper connection.

Philco Serviceman

#### TRIUMPH 420, 430 TUBE TESTERS

*To accommodate 6SQ7 tubes:* To enable the Triumph tube testers of the above models to accommodate the new single ended tubes, terminal No. 1 of the special octal socket should be connected to terminal No. 1 of the standard octal socket and terminal No. 2 of the special socket should be connected to terminal No. 8 of the regular octal socket. This additional wiring brings either of the two models up to date. Model 430 with serial numbers above 1056 are factory wired to accommodate the 6SQ7 tubes. New tube index charts are available from Triumph.

J. P. Kennedy  
TRIUMPH MFG. CO.

#### PRECISION E-100 SIGNAL GENERATOR

(Continued from page 24)

##### CIRCUIT

The triode section of the 6K8 is used in an oscillator circuit, electron coupled within the tube envelope to the hexode section, used as a buffer amplifier. Modulation of the r-f amplifier is accomplished by a 6C5, 400-cycle sine-wave audio oscillator. The r-f output is fed through a constant impedance four step ladder attenuator and a continuously variable input attenuator both controlled at the front of the instrument panel. A two wire shielded output cable provides at one lead, the r-f voltage directly from the constant impedance attenuator and at the other lead through the self contained dummy antenna, designed according to IRE specifications.

The percentage modulation of the r-f signal is variable from 0 to 100 percent.

**STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUGUST 24, 1912, AND MARCH 3, 1933**

Of SERVICE—A Monthly Digest of Radio and Allied Maintenance published monthly at New York, N. Y., for October 1, 1938.

County of New York, } ss.:  
State of New York, }

Before me, a Notary Public, in and for the State and county aforesaid, personally appeared B. S. Davis, who, having been duly sworn according to law, deposes and says that he is the Business Manager of SERVICE—A Monthly Digest of Radio and Allied Maintenance, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business manager are: Publisher, Bryan Davis Publishing Co., Inc., 19 East 47th Street, New York, N. Y.; Editor, Robert G. Herzog, New York, N. Y.; Managing Editor, None; Business Manager, B. S. Davis, Ghent, N. Y.

2. That the owners are: Bryan Davis Publishing Co., Inc., 19 E. 47th St., New York, N. Y.; B. S. Davis, Ghent, N. Y.; J. C. Munn, Union City, Pa.; J. A. Walker, St. Albans, L. I., N. Y.; A. B. Goodenough, New Rochelle, N. Y.; S. R. Cowan, Brooklyn, N. Y.; P. S. Weil, Brooklyn, N. Y.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: None.

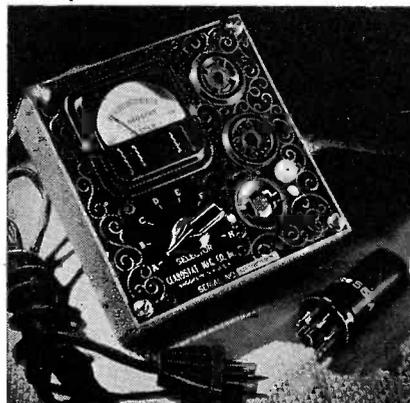
4. That the two paragraphs next above, giving the names of the owners, stockholders and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock, and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

(Signed) B. S. DAVIS, Business Manager.

Sworn to and subscribed before me, this 27th day of September, 1938. (Seal) J. A. WALKER, Notary Public.

Queens Co. Clk's No. 2034; Reg. No. 5634. New York Co. Clk's No. 433, Reg. No. 9-W-299. Commission expires March 30, 1939.

**PLUG-IN RESISTOR Tester**



Extremely compact. 5 3/4 x 5 3/4 x 2 1/2".

Self-contained. Just plug into any outlet.

Handsome black and silver etched panel. Frosted gray case.

Takes UX or octal base units.

Meter indicates good or bad resistors.

Reference wall chart with each tester.

Only \$7.45 dealer's net cost.

• Your servicemen asked for it. So here it is—a convenient, simple, positive means of testing plug-in resistors and line cord resistors for "opens" and other defects. Indispensable. • Write for descriptive folder. • See one at local CLAROSTAT jobber.

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Common r-f and i-f alignment frequencies are listed for rapid reference and give needle positions (on the 0 to 100 scale) to an accuracy of 1/2 percent.

All resistors, by-pass and blocking condensers associated with the oscillator circuit are mounted directly on

the switch assembly with the coils and the 6K8 oscillator tube. Six bands are employed to cover the range from 100 kc to 15.0 mc. The sixth band is so designed that it generates even order harmonics that are of sufficient strength to provide signals (with sufficient ac-

curacy) for two additional bands which cover the ranges from 14.0 mc to 60 mc.

**A-F GENERATOR**

The 6C5 audio oscillator provides 400-cycle modulation of adjustable intensity up to 25.0 volts for amplifier and speaker testing. Audio and r-f (modulated or unmodulated) are available independently of one another. This is accomplished through the use of a specially constructed three winding output transformer in the oscillator circuit. Inverse feedback is also used to assure pure sine-wave form.

**G. E. MM-1 MULTIMETER**

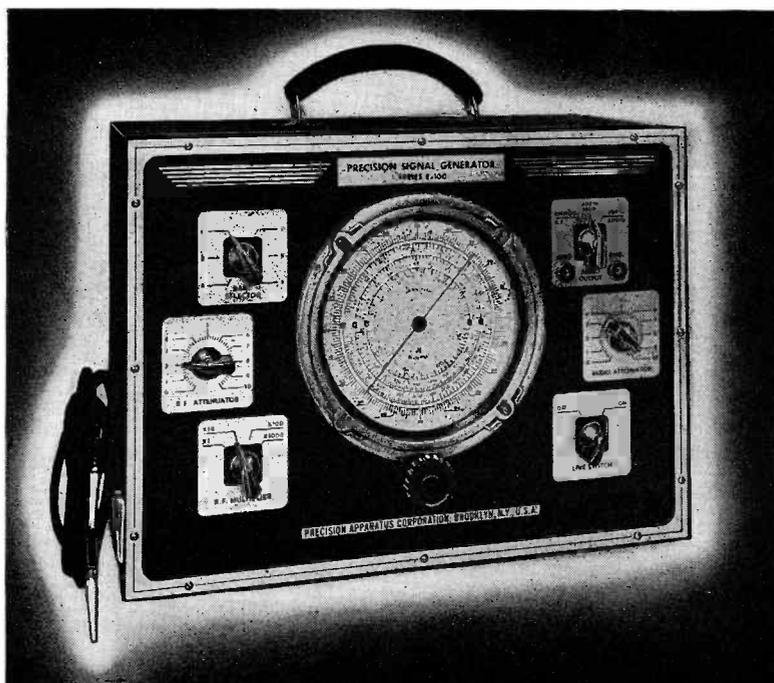
THE General Electric Model MM-1 multimeter is a general purpose meter with functions and arrangements so chosen to give a maximum of usefulness to the Service Man.

**FUNCTIONS**

The instrument provides for the measurement of a-c and d-c voltages, and d-c milliamperes commonly encountered in radio receivers with the scale calibrated directly for all the ranges provided.

Four ranges are provided for the measurement of d-c resistance. The scale is calibrated to read from 0.5 ohms to 4,000 ohms, with a center reading of 40 ohms. For the 40,000, the 4-meg,

Precision E-100 signal generator.



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I am enclosing \$2.00 National Yearly Dues. (Nominal Local Chapter Dues not included.)

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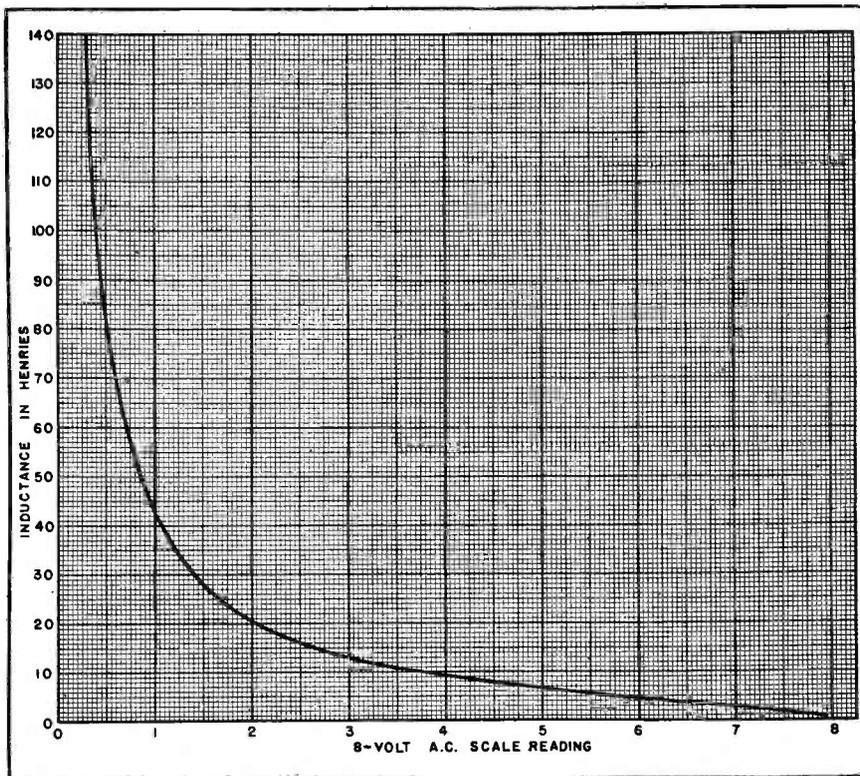
RSA has pioneered and established these benefits for you. Join now — so you can get them: ★ Membership in the only Independent Servicemen's Organization in the Industry. ★ Advanced Service Courses for Members. ★ Technical advice and assistance for members asking it. ★ Recognition by and representation in the entire servicing business. ★ RSA is as important to you as your job or your business. Don't wait—send your application in *today!*

The Best \$2.00  
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**RADIO SERVICEMEN OF AMERICA, INC.**

Joe Marty, Jr., Executive Sec'y, 304 S. Dearborn Street, Chicago

To measure inductance with the MM-1, the function switch is set to capacity and the meter connected to the a-c line. The graph translates the 8-volt a-c scale to inductance values. With the range switch in the C X 100 position the graph may be read directly. In the C X 1 position the readings obtained should be multiplied by 100.



and 20-meg ranges this scale should be multiplied by 10, 1,000 and 5,000 respectively to obtain the correct value. For readings on the 20-meg range it is necessary to use a 90 volt external battery. Suitable connecting leads are provided inside the instrument for this battery.

The two capacity ranges provided function in connection with the a-c power line. The first range is read directly from 0.0005 to 0.1 mfd; these readings are multiplied by 100 to obtain values on the other range. On 50-cycle lines the readings should be multiplied by 1.2 and on 25-cycle lines by 2.4 to obtain the proper values.

To measure inductance with the MM-1, the function switch is set to capacity and the meter connected to the a-c line. The accompanying graph will translate the 8-volt a-c scale to inductance values. With the range switch in the C X 100 position the graph may be read directly. With the switch in the C X 1 position the readings so obtained should be multiplied by 100.

The decibel scale is calibrated to read power in db in any circuit of 500-ohms impedance. Zero level is taken at 0.006 watts in a 500-ohm circuit. When the meter is used in circuits of other than 500-ohms impedance, a correction of  $10 \log (500/R)$  should be added to the reading. In plotting response curves



## MANUFACTURERS

(Continued from page 50)

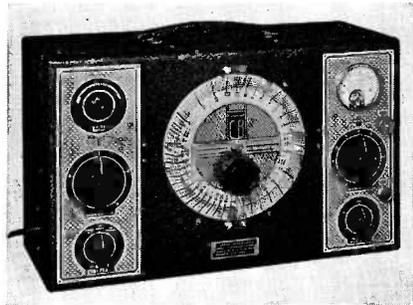
### G. E. APARTMENT ANTENNA

An answer to the apartment house antenna problem is offered by General Electric in a new all-wave multicoupler system. The antenna can be used to serve as many as 20 radios.

Additional information can be obtained from the *General Electric Co.*, Construction and Materials Division, Bridgeport, Conn.

### CLOUGH-BRENGLE MICROVOLTER

Clough-Brengle Co. have introduced a cali-

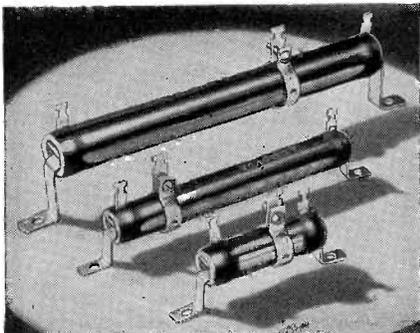


brated microvolter with frequencies from 100 kc to 30 mc and output calibrated from 1/2 to 100,000 microvolts.

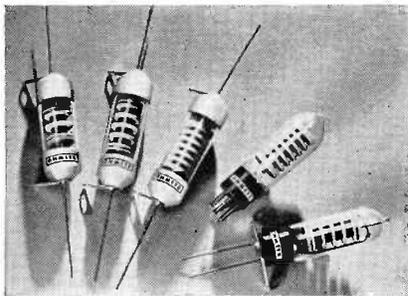
Additional information on this and other Clough-Brengle test instruments can be obtained directly from *Clough-Brengle Co.*, 2817 W. 19th St., Chicago.

### WIRE-WOUND RESISTORS

Further refinements are featured in the new Pyrohm Jr. wire-wound vitreous-enameled resistors just announced by Aerovox. Special resistance wire of low temperature coefficient of resistivity is wound on refractory tubing. This assembly, in-



cluding terminal connections, is coated with powdered glassy enamel and fired at red heat. The result is a resistor covered with vitreous enamel tightly fused to the wire, terminal connections and tubing. Connections can be made either to the soldering lugs or to 2" bare pigtailed. Units come in the popular 10 and 20-watt sizes, and in widest range of resistance values. The same refinements are reflected in the new Slideohm adjustable resistors available in 25, 50, 75, 100 and 200-watt ratings. One slider band is supplied with each unit, but additional bands may be had at slightly added cost. *Aerovox Corporation*, 70 Washington St., Brooklyn, N. Y.



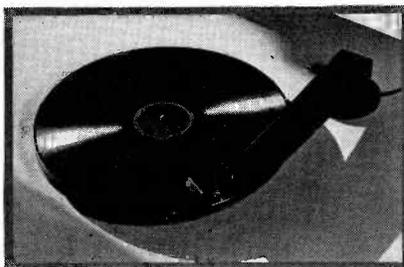
### HERMETICALLY SEALED RESISTORS

Ohmite Mfg. Co. are introducing a commercial series of hermetically sealed glass bulb precision resistors. The units are coiled, non-inductively pie wound, on porcelain in 2, 4, 6 or 8 sections and enclosed in hermetically sealed glass tubes. They are obtainable in 1-watt rating from 0.1 ohm to 2 meg.

Additional information may be obtained from *Ohmite Mfg. Co.*, 4835 Flournoy St., Chicago, Ill.

### MOVING-COIL PICKUP

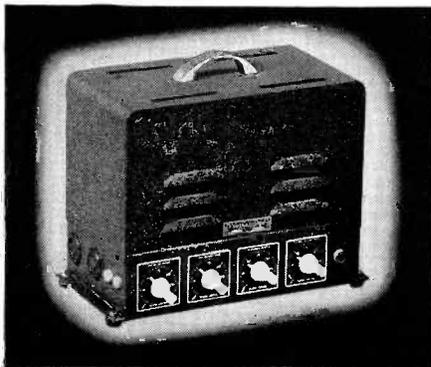
In the new Lansing moving-coil pickup Model 100 LR, for lateral recordings, the generated voltage is said to be directly proportionate to needle point velocity from 30



to 10,000 cycles without distortion. Low needle-point impedance and light weight (6 to 30 grams) on record permit 500 playings without damage to record, it is said. Complete information may be secured from *Lansing Manufacturing Co.*, 6900 McKinley Ave., Los Angeles, Calif.

### MILLION AMPLIFIERS

Million announce a line of amplifiers and p-a systems with power outputs of 5, 10, 17 and 35 watts. Additional information and prices may be obtained from the *Million Radio & Television Labs.*, 685 W. Ohio St., Chicago.

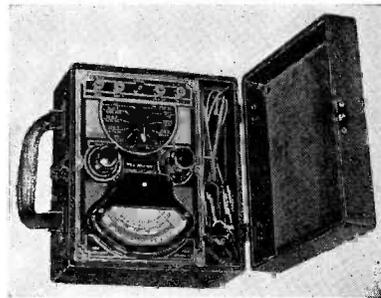


### TRIAD BANTAMS

Triad, busily engaged in producing the bantam or GT series of tubes, announce the following types are available: 6A8GT, 6K7GT, 6J7GT, 6Q7GT, 6R7GT, 25L6GT, and 25Z6GT. Additional information may be obtained from *Triad Mfg. Co., Inc.*, Pawtucket, R. I.

### RADIO CITY MULTITESTER

A new universal multitester, Model 409A, has been developed by Radio City Products Co., Inc. This model is to supersede the Model 409 an additional range up to 10 meg. is included. The current range has also been extended to 10 amp. Additional information can be obtained from the *Radio*



*City Products Co., Inc.*, 88 Park Pl., New York City.

### DYNAMIC MICROPHONE

The new Turner Model 99 dynamic microphone is shown in the accompanying illustration. It is said that the nickel alloy magnet in this unit is not affected by jars. The output of the microphone is said to be flat within plus or minus 4 db from 60 to 9,000 cycles. Output is -59 db. An adjustable saddle gives directional or non-directional operation. Complete information may be secured by writing to *The Turner Company*, Cedar Rapids, Iowa, for Bulletin 40.



### RAYTHEON TUBES

Raytheon Production Corp. have announced a new series of tubes of the single ended type. The series includes a 6SJ7, 6SQ7, 6SK7, 6SF5. In addition several other tubes have been announced. These include a 1A7G, pentagrid converter; an RK-63, power amplifier-oscillator; an RK-28A, an r-f power amplifier-oscillator; an RK-62 gas triode detector thyatron and a 6W7G, pentode detector-amplifier. Additional information and characteristics of these and other Raytheon tubes may be obtained from the *Raytheon Production Corp.*, 420 Lexington Ave., New York City.

**JUST 8 MODELS**  
**for 90% OF ALL RADIO**  
**SERVICE CALLS**  
*Including...*



**Both Power and Audio Transformers**

● For \$17.76 a service dealer can stock 8 models of Halldorson Transformers that will answer 90% of all radio service calls covering both power and audio requirements.



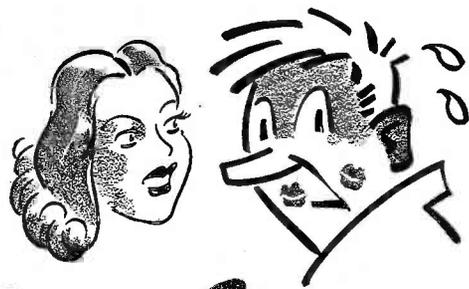
And remember, the design of each transformer covers the requirements of all the makes of sets for which it is intended. When the investment is so low, why not be prepared to give prompt transformer service with the outstanding Vacuum Sealed Transformer line.

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*Vacuum Sealed* **Transformers**

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Your work must stand up if you expect to make prompt collections. The sure way is to use dependable Ward Leonard Replacement Parts. They are made right and are conservatively rated. Send for the Servicemen's Data Sheet and Price List.

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Please send me Price List Circular 507.

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Address .....

City..... State.....

Jobber's Name.....

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 Owensboro, Kentucky

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- Copper Clips
- Insulated Clips
- Wee-Pee-Wee Clips
- 300 Ampere Clips
- Insulated Grid Clips

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**UNIDIRECTIONAL DYNAMIC D9T**

BACK—NO PICKUP  
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D9T, List \$37.50, High Imp., 25' Cable  
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Manufacturers' full line dynamic, crystal and carbon microphones and stands.

**AMERICAN MICROPHONE CO., INC.**  
 1915 S. Western Ave. Los Angeles, Calif.

B9 CRYSTAL LIST \$22.50

D5T DYNAMIC LIST \$32.50

# Highlights

## NATIONAL UNION DISPLAY

A new window center piece, 4 ft. high and 2 ft. wide, lithographed in six colors and mounted to heavy board backed by double wing easel, was released by National Union Radio Corp., Newark, N. J. Additional information may be obtained directly from National Union.

## MUELLER CLIP

Mueller Electric Co. have introduced an insulated grid clip assembly for test purposes. The assembly consists of a Pee-Wee Clip with a rubber insulator, 10 inches of flexible rubber covered wire and a phone tip. A bulletin illustrating and describing the clip, Form No. 790, can be obtained from the Mueller Electric Co., 1583 E. 31st St., Cleveland, Ohio.

## WARD LEONARD TERRITORY

Ward Leonard Electric Co., Mt. Vernon, N. Y., announces an extension of the territory covered by their radio products representative Charles D. Southern to take in Ohio, Kentucky and Indiana.

Mr. Southern's office is located at 116 W. Rudsill Boulevard, Fort Wayne, Ind.

## ATLAS SOUND CATALOG

Atlas Sound Corp., 1447 39th St., Brooklyn, N. Y., have released catalog No. W-38. The catalog contains a description of p-a speakers, parabolic baffles, trumpets, mike stands, carrying cases and marine horns. Copies may be obtained directly from Atlas.

## RADIO CITY PRODUCTS APPOINTMENT

Radio City Products Co., Inc., manufacturers of tube-testing equipment, announces the appointment of Mr. George W. Hudson. Mr. Hudson will represent the R.C.P. equipment line in Virginia, North Carolina and South Carolina. His headquarters will be at 3303 East Broad Street, Richmond, Va.

## AUDAK BROCHURE

Audak Co., 500 Fifth Avenue, New York City, have issued a descriptive and illustrative brochure showing their complete line of pickups and cutting heads. Copies may be obtained directly from Audak.

## N. U. MANUAL

National Union Radio Corporation, 57 State St., Newark, N. J., provided its distributors and distributor salesmen this month with a new 102-page sales manual for the 1938-39 selling season. Contents include illustrations and descriptions of instruments made by leading instrument manufacturers of the country with details as to how they can be obtained free on National Union equipment offers. Pages are also devoted to executives of the National Union Sales organization, National Union products including radio tubes, condensers, photo-electric cells, exciter lamps, radio panel lamps, automobile head lamps, electrolytic and paper condensers.

## GENERAL INDUSTRIES BULLETIN

Electric phonograph motors, automatic record changers, and single record assemblies are covered in a bulletin which is available from The General Industries Co., Elyria, Ohio. Specifications are given for the various units. Write to the above organization.

## HAMMARLUND CATALOG

The Hammarlund "39" Catalog is now available. It covers condensers, coils, coil forms, sockets, chokes, transformers, communication receivers, etc. Descriptions and technical data are given. Write to Hammarlund Manufacturing Co., Inc., 424-438 West 33 St., New York City.



H. J. Bernard, managing editor of Radio World for 14 years, has entered the test equipment manufacturing field.

## RIDER'S VOLUME IX

The 1,672 page Rider Volume IX Trouble Shooter's Manual with a 36 page "How It Works" section and a revised 156 page index will be off the press by November 19.

Additional information on this and other Rider manuals can be obtained directly from John F. Rider, Publisher, 404 Fourth Ave., New York City.

## DRAKE DISPLAY

Drake Mfg. Co. have released a counter display for 15 different types of dial



Drake pilot light assembly display.

and jewel light assemblies. Complete details can be obtained from Drake Mfg. Co., 1713 W. Hubbard St., Chicago.

## USE BULLETINS

United Sound Engineering Co., 2233 University Ave., St. Paul, Minn., have just issued three bulletins giving descriptions and specifications on the Type CR-6 beat-frequency standard signal generator, the Type CR-3 cathode-ray oscillograph and the Type CR-4 beat-frequency audio oscillator. Copies may be secured by writing to the above organization.

## BURSTEIN-APPLEBEE CATALOG

Burstein-Applebee Co., 1012-14 McGee Street, Kansas City, Mo., have just issued their 1939 Wholesale Buyers' Guide, Catalog No. 55. This 164-page catalog covers testing equipment, tubes, batteries, sound systems, motors, amplifiers, recording and reproducing equipment, microphones, speakers, switches, transformers, condensers, resistors, radio receivers, receiving antennas, wire, transmitting equipment, etc., of the leading manufacturers. Copies may be secured from the above organization.

## TERMINAL MIDTOWN STORE

On December 1st, 1938, the Terminal Radio Corporation opens another radio supply house at 68 West 45 Street, New York City. Terminal's downtown store, at 80 Cortlandt Street, is near the Hudson Terminal, and the new store at 68 West 45 Street is just a short distance from midtown Times Square. Both stores are completely stocked and include full facilities for demonstrating all amateur communications receivers and complete sound systems.

The second issue of the Terminal Radiogram is off the press. Copies may be obtained from Terminal Radio Corp.

## ICA CATALOG

Catalog 200 has just been announced by the Insuline Corp. of America, 23 Park Place, New York City. Their complete line of radio and electrical equipment is illustrated and described. A copy will be mailed free upon addressing the manufacturers.

## MEISSNER SERVICE

The Meissner Manufacturing Co. of Mt. Carmel, Ill., announces a coil repair and rewinding service. Such a service will eliminate the handling of a large stock of slow-moving "exact duplicate" replacement coils on the part of the radio jobber as well as the coil manufacturer.

Speedy delivery at a reasonable price are essential qualities of such a set-up and these are promised by Meissner. A flat rate is made to the old coil wherever possible, but if this is impractical, a new coil will be made at the same price.

In all cases the defective coil must be sent in, accompanied by as much pertinent information as possible in order to facilitate turning out the job with minimum delay.

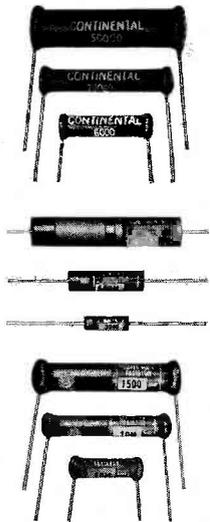
## ELECTRONIC LABS. LITERATURE

Electronic Laboratories, Inc., 124 W. New York St., Indianapolis, Indiana, have recently issued a catalog on converters and a data sheet on heavy duty vibrators. Complete descriptions are given. Copies are available from the above organization.

## PRECISION TUBE CHARTS

Owners of Precision Electronometers Models 500, 500A, 600 and 700 may obtain the latest tube chart (Form 7138) by writing to the Precision Apparatus Co., 821 E. New York Ave., Brooklyn, N. Y.

# ULTRAWATT



Startlingly new! Ultrawatt resistors are wire wound with low temperature coefficient wire; cement insulation.

W20,  $\pm 5\%$ , 20-watt, list price.....\$0.65  
 W10,  $\pm 5\%$ , 10-watt, list price.....\$0.40  
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Bakelite Type M insulated carbon resistors are now the choice of service engineers for compact jobs.

M3, 10%, 3-watt, list price.....\$0.30  
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 M $\frac{1}{2}$ , 10%,  $\frac{1}{2}$ -watt, list price.....\$0.17

Ceramic Type D insulated carbon resistors are still the favorite of servicemen after 5 years' trial.

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CONTINENTAL CARBON products are distinguished for their uniformly high quality. Specify CONTINENTAL when you order

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## How Do You Do It?

How do you solve the many servicing problems with which you have to contend . . . what special kinks have you worked out which help you in servicing receivers . . . have you developed shortcut schemes for testing, or built test devices that do the work better and faster?

No matter what the scheme or the device, there are many, many Service Men who would like to know the how's and why's—just as you would like to know about the schemes and devices employed by others.

## SERVICE WANTS TO KNOW!

If you have clever ideas and clever devices, we want to know about 'em as much as do our readers. Regular space rates are paid for all material accepted for publication.

All you have to do is give us the outstanding points, and a rough pencil sketch of the device if it happens to be such—and we will do the rest.

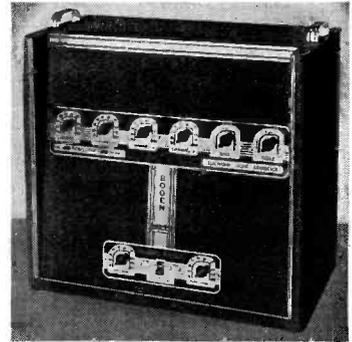
Come on, now, and kick in. Write up those ideas now and send them in to the . . .

## ON THE JOB DEPARTMENT

# BOGEN MODEL DX70 BINAURAL AMPLIFIER

70 WATTS  
 (PEAK POWER 100 WATTS)

- ★ ELECTRONIC TONE CORRECTION
- ★ PROVISION FOR REMOTE CONTROL
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Model DX70 also available if specified with low impedance inputs of 50, 125, 250 and 500 ohms.

The NEW MODEL DX70 is a further refinement of the famous Bogen CX70 acclaimed as the finest high power amplifier on the market! The DX70 features every worth while development in modern Sound Engineering and meets the requirements of the most exacting Engineers in the country. Built to Broadcast Station Specifications. For details on the many advantages and quality of this and other Bogen units, see your dealer at once or send for descriptive Bulletin.

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With the flip of a finger you can now (1) lower or raise the response of the microphone. . . (2) adjust the microphone for most desirable response for close talking or distant pickup. . . (3) adjust the system to any "taste", room condition, or equipment.

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**NEW! MODEL RSHk (hi-imp):** RBSk (200 ohms) Frequency range 60 to 8000 C.P.S. Output -68db. . . Chrome or Gunmetal . . . . . \$32.00 LIST

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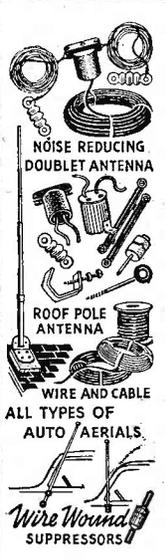
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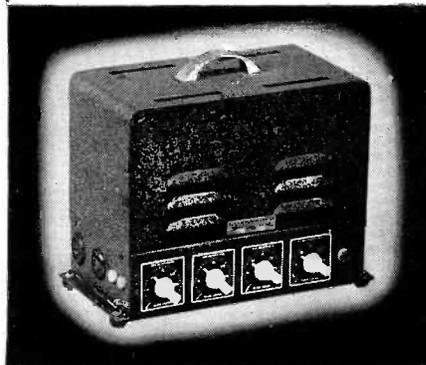
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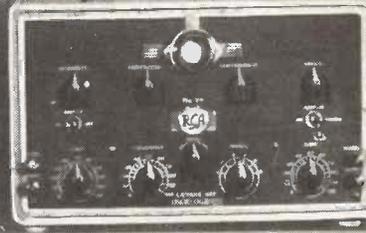
RCA Oscillograph No. 155 . . . \$63.95



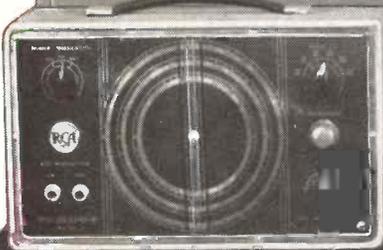
RCA Oscillograph No. 151-2 . . . \$49.95



RCA Oscillograph No. 151 . . . \$39.95



RCA Test Oscillator No. 153 . . . \$29.95



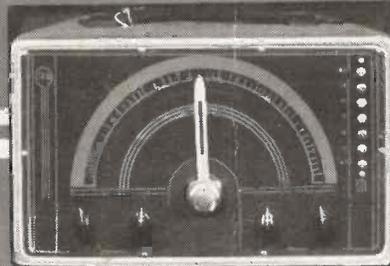
RCA Tube Tester No. 156-A . . . \$37.95



RCA Test Oscillator No. 150 . . . \$64.50



RCA Audio Oscillator No. 154 . . . \$49.95



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Here, in one display, is a complete new line of RCA Test Equipment. With it, every service job you do will be a *better* service job. Your efficiency will increase, your time will be saved. You can do more work, better work—and make more money. See this equipment at your RCA Parts Distributor's!

Ask him—or write to the address at right—for your free copy of the new RCA Parts Catalog.

Over 325 million RCA radio tubes have been purchased by radio users . . . In tubes, as in parts and test equipment, it pays to go RCA All the Way. Listen to the Magic Key Sundays, 2-3 p. m., E. S. T., on NBC Blue Network



# Test Equipment

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