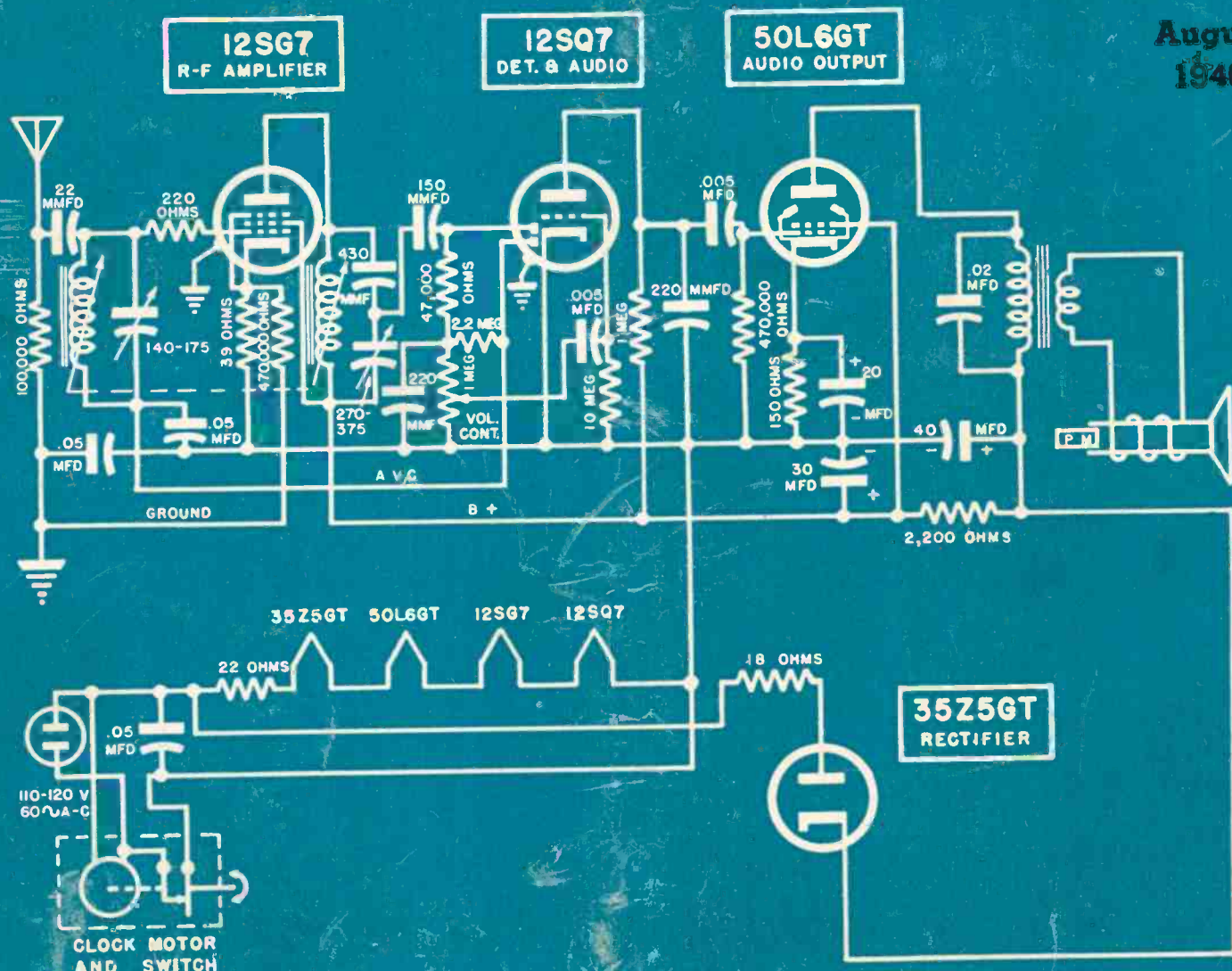


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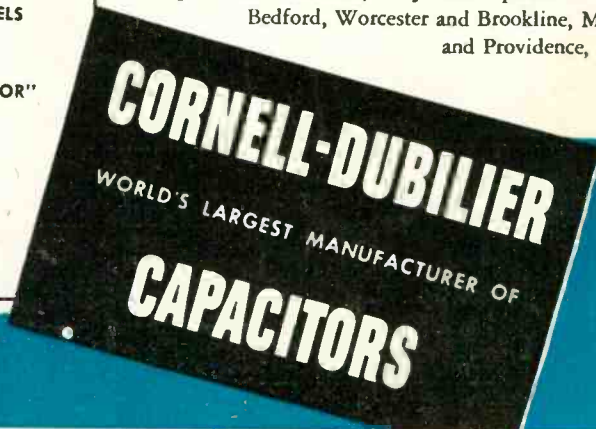


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EDITORIAL

RADICAL CHANGES IN RECEIVER COMPONENT design and application, based on wartime research, are soon to make their appearance.

Of particular interest at the present are two developments of miniature items — self-supporting baseless tubes and dry-disc rectifiers. Most receivers will use these miniature type tubes, which will be for 6- and 12-volt applications. Large tubes, with bases, are expected to be used only in larger-type receivers where additional power is required. In such instances, high heat dissipation is involved and bases and larger tube envelopes are necessary.

The dry discs are expected to replace tube rectifiers in many types of receivers. New developments in barrier construction now permit operation of the discs to as high as 50 volts per disc. Heretofore it was only possible to go as high as only 20 volts per disc. The dry-type rectifiers also have the unlimited life advantage, provided, of course, they are not overloaded.

The miniature sizes of these components have already resulted in many unique circuit and layout applications, affording production of extremely small receivers with unusually high efficiency factors.

In view of the importance of these developments, a series of articles discussing their design and application have been prepared for early presentation in *SERVICE*. Watch for this series!

BRITISH MANUFACTURERS have adopted television training programs for Service Men on a large scale. The courses, which run from one to three weeks, are quite comprehensive. In one ten-day course, a manufacturer is offering a discussion of the fundamental principles of television; block diagrams of typical receivers; analyses of cathode-ray tubes, power packs, video amplifiers, scanning generators, sync separation, time constants, integration and differentiation, antennas, feeders, and matching systems. Circuits of all available types of television receivers are also discussed and chassis of new receivers carefully analyzed.

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RADIO TELEVISION ELECTRONIC SERVICE

Reg. U. S. Patent Office

Vol. 15, No. 8

August, 1946

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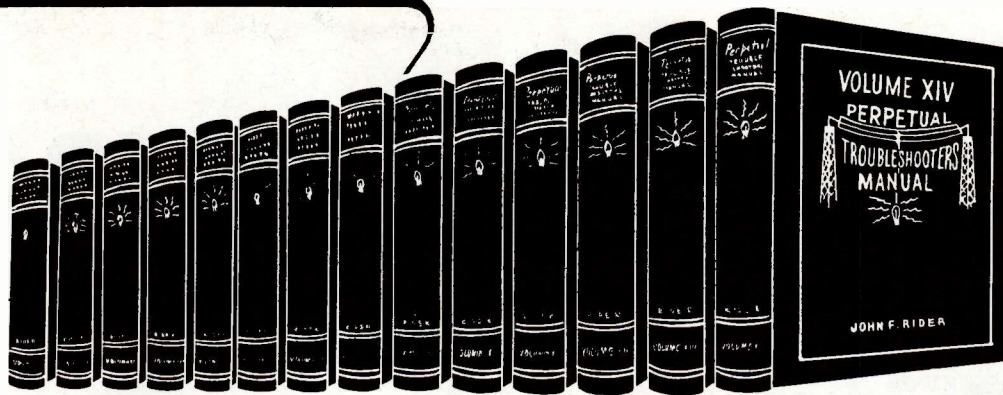
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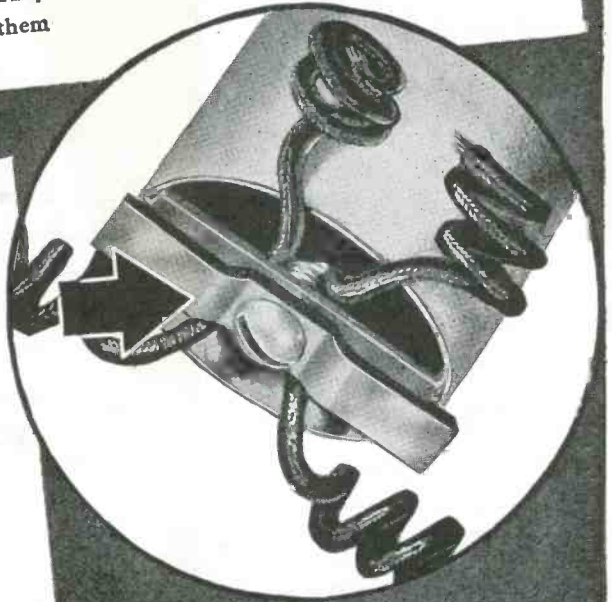
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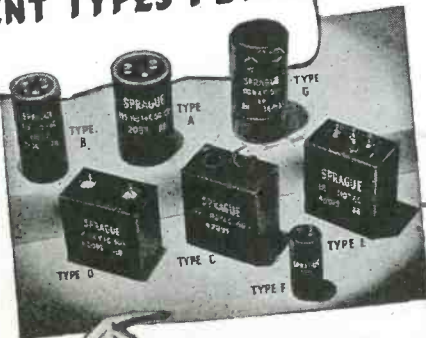


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by
FRANK FAX

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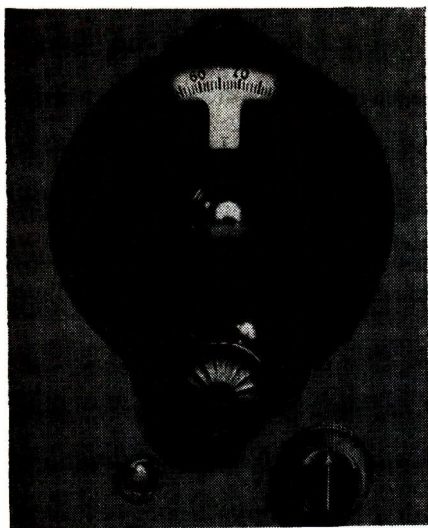


Fig. 1. Front view of converter.

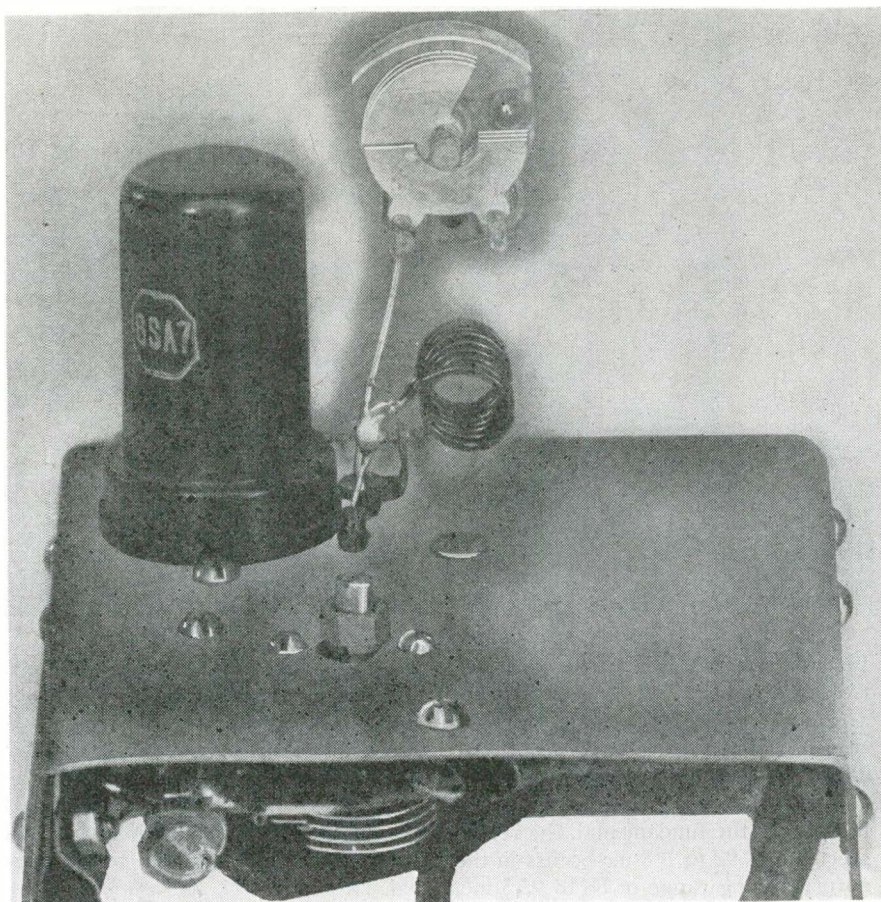


Fig. 2. Rear view of converter.

A 88 to 108-Mc CONVERTER For The New F-M Band

WITH THE SHIFT OF THE F-M BAND to 88 to 108 mc, the lower frequency f-m receivers faced obsolescence unless they could be converted to cover the new v-h-f ranges. One type converter that provides such coverage is discussed in this article. This model is easy to align, uses no special high frequency tubes or parts, and is reasonably selective and sensitive.

The converter uses a single 6SA7 pentagrid converter, which secures its power from the old f-m set. The lower-frequency f-m model is also used as a fixed i-f tuned to 43 mc. The converter does all the tuning. Alignment is ac-

by **SAMUEL SABAROFF**
Transmitter Engineer, WCAU

complished by using the old f-m set as a frequency meter.

The 6SA7 tube acts as both oscillator and mixer. It might be asked how this tube can be used for service at 100 mc when its characteristics are generally described for the lower frequencies only. The reason lies in the fact that the oscillator frequency is 43 mc below r-f range. Thus for the 88 to 108-mc band the oscillator tuning range is 45-65 mc, a range at which the 6SA7 readily oscillates. The con-

version efficiency, however, is not as high as at the lower frequencies.

It will be noted that the lowest oscillator frequency of 45 mc is 2 mc higher than the i-f of 43 mc. This is more than sufficient to prevent any interaction.

Harmonics and Their Cure

The use of this frequency arrangement does result in a partial repeat spectrum in the normal r-f range due to conversion taking place by means of the oscillator third harmonic. When the oscillator is tuned from 45 to 65 mc, the third harmonic will vary from

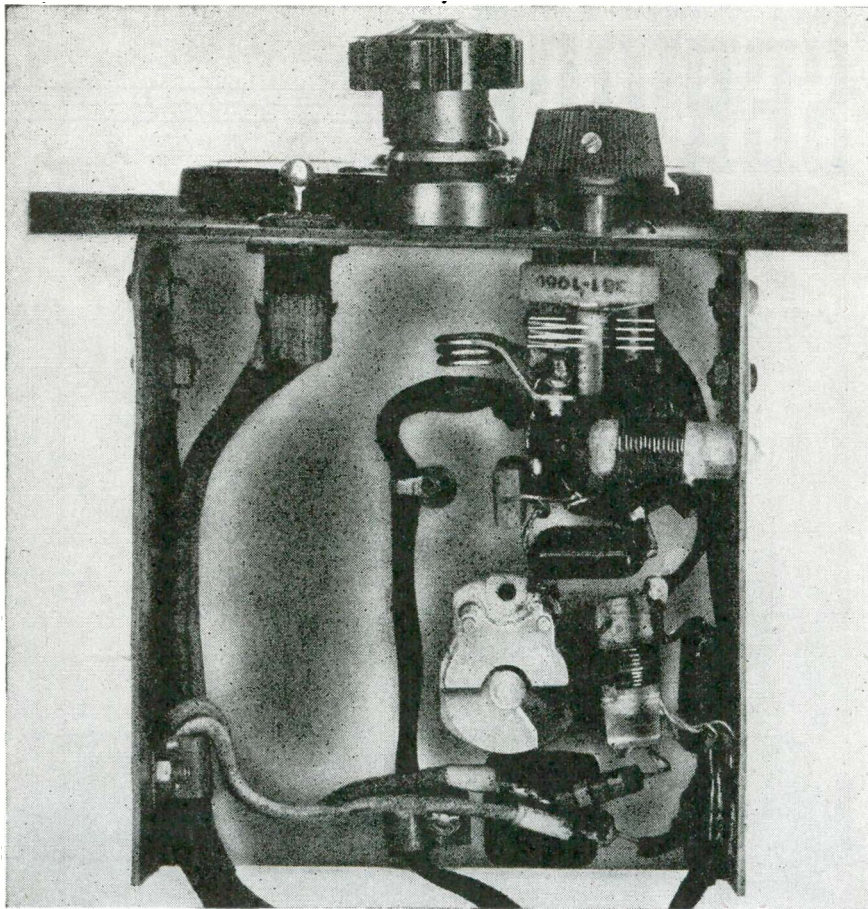


Fig. 3. Bottom view of converter.

135 to 195 mc. The difference between this and the 43-mc i-f results in a response range of 92 to 152 mc. The response, due to the oscillator fundamental, is simultaneously 88 to 108 mc.

Since the third harmonic varies faster than the fundamental, the repeat spectrum of 92 to 108 mc occurs in the normal tuning range of 88 to 93.3 mc. Sufficient preselection would minimize such harmonic conversion, but this is out of the question in a simple converter. Fortunately, the third harmonic conversion efficiency is considerably less than that at the fundamental. When interference does take place, it is possible to shift the i-f somewhat, until a desired station is received without interference. Reducing the antenna coupling will also help.

When the converter is tuned to near minimum oscillator capacity, it may be possible to hear another repeat spectrum. This is outside the normal range of the converter and thus creates no problem. This repeat spectrum is due to conversion by means of the oscillator second harmonic. When the fundamental varies from 65.5 to 75.5 mc, the second harmonic will vary from 131 to 151 mc. The difference between this and the 43-mc i-f affords coverage of the 88 to 108 mc bands.

Circuit Features

For simplicity, the r-f section and

the oscillator were tuned separately. This is no great disadvantage since for most signals, the r-f tuning is broad and is used as a *touch up* after a station is selected by means of the oscillator tuning. On weak signals however, the r-f tuning may bring a station up from no signal to full signal.

The converter, Figure 4, is essentially the same as that used at the lower frequencies. It will be noticed, however, that the heater is supplied through an r-f choke, and through the cathode tap on the oscillator coil. It is here assumed that one side of the heater is grounded. If this is not true, then a choke will have to be placed in each heater lead and a six-conductor cable used for power instead of the five-conductor cable that is shown.

The physical construction of the converter may be varied to suit the individual taste of the constructor. The photographs illustrate a model for application to the side of the cabinet of an a-m receiver. The old f-m chassis was also placed in the cabinet, and the audio system of the a-m set was switched to the f-m unit as desired.

Constructional Details

The converter chassis measures 4"x4" and was bent up from 1/16" aluminum. Side folds were added to increase stiffness. The panel, also 1/16"

aluminum was made 7" high and 6" wide so that a National type B dial, used for oscillator tuning, and the r-f tuning knob and a-c switch could be comfortably placed thereon.

The general construction of the converter was *tight*. That is, all components were placed and mounted closely around the socket. The socket is of the wafer type having a metal rim with lugs to which grounds may be soldered. The suppressor grid, screen bypass capacitor and the ground side of the r-f coil were soldered directly to this metal rim. All other grounds were attached to the chassis wherever they fell.

The socket was so mounted and oriented that the lead from the grid terminal to the r-f tuning capacitor was less than 3/4" in length. The r-f coil was connected from the r-f tuning capacitor to the socket rim in such a manner that the antenna coil could be conveniently coupled to it.

The filament choke was mounted so that the lead to the filament terminal was less than 1" in length.

The lead from the plate terminal to the primary of the i-f transformer was about 1", as is the lead from the transformer to the i-f padder. A three lug terminal strip made a convenient mounting for the i-f transformer, with the coil leads soldered to the outermost lugs.

The rotors of the r-f and oscillator tuning capacitors, and the i-f padder were directly connected to the chassis by their mountings.

The oscillator coil was mounted on top of the chassis with the ground end soldered to an inserted brass machine screw. The cathode tap and the lead from the oscillator grid capacitor was brought through the chassis by means of an insulated #16 wire. The grid lead was then continued from the coil to the oscillator tuning capacitor. These leads must be as short and direct as possible.

The r-f and i-f transmission lines were of the rubber insulated type that was used in an all wave type of installation. Ordinary lamp cord works about as well. The i-f line was of sufficient length to connect to the antenna terminals of the old f-m set. The r-f line was made about 2' long and then spliced to the regular antenna line after the converter was installed. The r-f line leads were connected together at the converter, shaped into two turns about 3/8" in diameter and

Fig. 4. Circuit of converter.

L_1 , r-f grid coil, air wound, 3 turns, $\frac{1}{8}$ " diameter, #16 enameled or bare wire, (total wire length 5", turns spaced approximately wire diameter); L_{11} , r-f antenna coil, air wound, 2 turns, $\frac{1}{8}$ " diameter, continuation of antenna line, adjustable coupling to ground side of L_1 ; L_2 , oscillator coil, air wound, 9 turns, $\frac{1}{8}$ " diameter, #16 enameled wire, tapped at 2 turns, (total length of wire $13\frac{1}{4}$ ", coil length adjusted to correct frequency); L_3 , filament choke, close wound on $\frac{1}{8}$ " diameter bakelite rod or tubing, 15 turns, #20 enameled wire; L_4 , i-f coil primary, close wound on $\frac{1}{8}$ " diameter bakelite rod or tubing, 7 turns, #20 enameled wire; L_{44} , i-f coil secondary, 2 turns of #24 d-c-c wire wound adjacent to the ground side of L_4 . The 25-mmfd variable is an air padder too. The .001-mfd. capacitors are mica postage stamp-type for bypass. The 50-mmfd fixed capacitor is also a mica postage-stamp type. The 20,000-ohm grid leak is a $\frac{1}{2}$ -watt type; 20,000-ohm screen-dropping resistor is a 1-watt type; 1,000-ohm resistor, for isolation, is a $\frac{1}{2}$ -watt type.

closely coupled to the ground side of the r-f coil.

Converter Operation

The converter will operate satisfactorily with a plate voltage of 100 to 250 volts. This can be picked up from either the screen or plate supply in the old f-m chassis.

The converter is aligned by means of the old f-m set used as a frequency meter. It is assumed that its calibration is reasonably accurate.

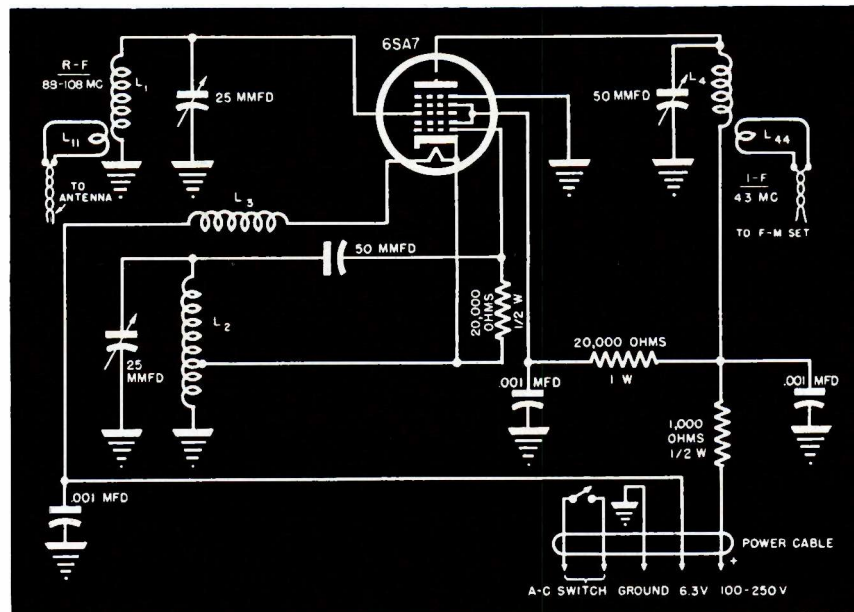
To place in operation, power is first applied to the converter and the old f-m set. The i-f line is not connected to the old f-m set, nor is the r-f line connected to the antenna transmission line. In other words, the only connections to the converter and the old f-m set are the power cable and the a-c line.

Setting I-F Padder

Now the i-f padder is tuned to maximum capacity so as to tune it out of range of the oscillator. The old f-m set is then tuned to 47 mc, with the gain turned up so that the noise is appreciable. The converter oscillator is set to maximum capacity and then slowly decreased until the noise in the old f-m set disappears, showing that a signal from the converter oscillator is being received. Taking maximum capacity as zero on the oscillator dial, the signal may be received when the oscillator dial reads about 20. Now we decrease the frequency of the old f-m set at the same time, increasing the capacity of the oscillator so that the signal stays in tune, until the f-m set is tuned to 45 mc. The converter oscillator coil is then *stretched* or *squeezed* until the 45-mc signal occurs with the oscillator dial reading between 5 and 10. This completes the oscillator converter calibration.

I-F Transmission Line

The i-f transmission line is now connected to the antenna terminals of the old f-m set which is tuned to 43 mc. The converter oscillator is stopped from oscillating by placing a finger on the oscillator capacitor. The i-f padder capacity is then slowly decreased until there is a definite increase in the noise coming from the old f-m set. This will occur when the padder plates are



meshed about one third. The padder should be rotated back and forth around this point and padded to the point of maximum noise. The finger may now be removed from the oscillator capacitor, thus completing the converter alignment. Connection of the r-f leads to the antenna transmission line is all that remains to place the converter in a condition to receive signals.

A typical calibration curve is shown in Figure 5. The f-m band of 88-108 mc is contained in the dial range of 8 to 85. This will vary somewhat depending on differences in distributed capacity and lead lengths.

In tuning, the oscillator is varied slowly until a signal is heard, and then the r-f and oscillator tuning varied for

best response. The r-f tuning range is more than sufficient for the f-m band but exact calibration is impossible because of the effects of the transmission line. The converter tuning will drift somewhat for the first few minutes of operation until it has reached normal operating temperature.

Antennas

A simple antenna that will suffice for most locations is a piece of brass, copper or aluminum tubing about $4\frac{1}{2}$ ' in length and of more than $\frac{1}{4}$ " in diameter. For outdoors, the center of this tubing is fastened to a wood or metal pole which may then be installed in the best possible location. It is not
(Continued on page 28)

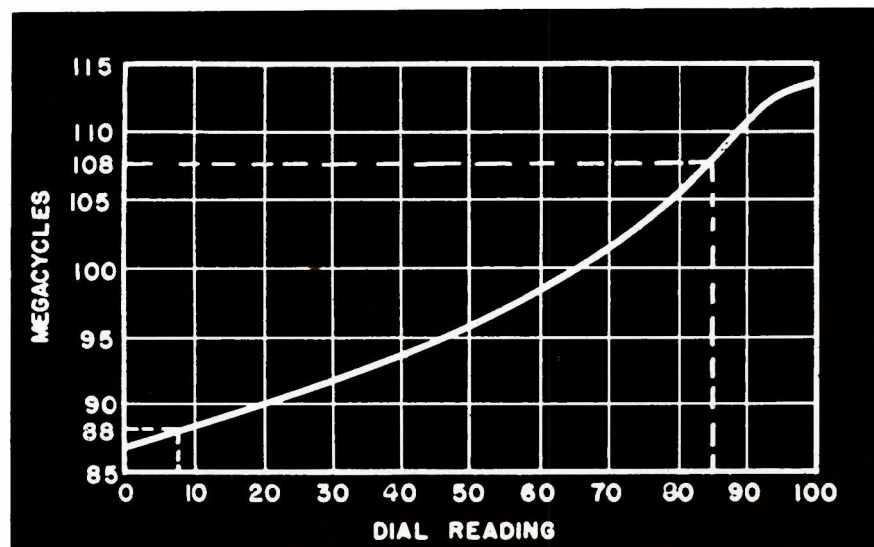


Fig. 5. Typical converter calibration.

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Trends in Sound*

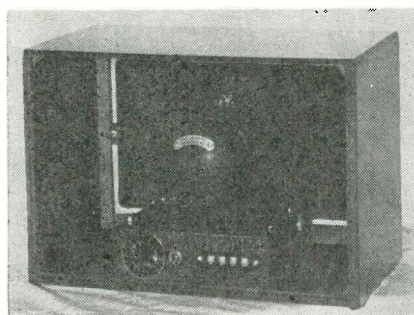
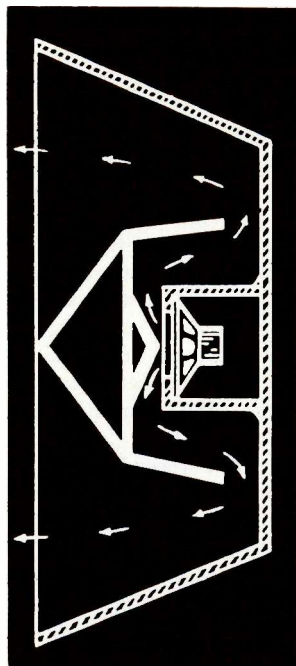
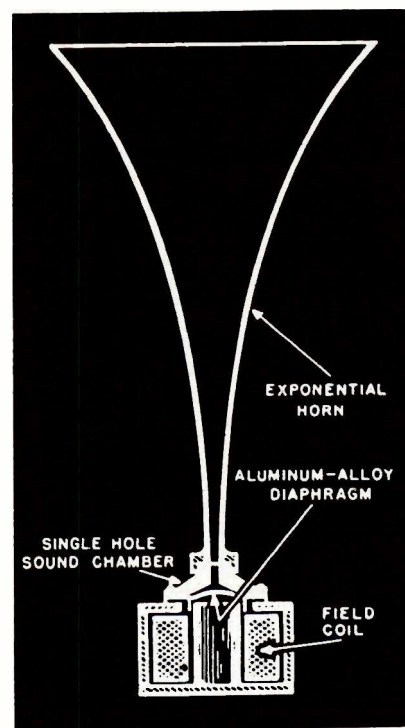


Fig. 1. Rear view of tweeter in cabinet. (Courtesy Atlas Sound)

Fig. 2 (left). Center section of typical large re-entrant woofer horn.

Fig. 3. Pre-war type trumpet horn tweeter.



LOUDSPEAKERS

by S. J. ARTHUR

[Part II]

THERE ARE VARIOUS TYPES of woofers. It is possible to use a cone (at least 12") on a large flat baffle, but this is too cumbersome for commercial application. Those used include large cones (12" to 18" diameter) in *infinite* baffles of large volume in bass reflex baffles, and in large re-entrant wood horns.

Tweeters

There are also various types of tweeters. The early models were very small units with short trumpet horns. Another type utilized a direct radiator cone or diaphragm, but it gave rather poor spatial distribution of high-frequency sound. Later models carried more power and gave more uniform distribution of high-frequency sounds over a wide angle in front of the horn. These utilized large driver units with light metal diaphragms and special sound chambers built in the unit. These units are screwed or bolted on cellular horns. The cells are designed

to distribute the sound uniformly. Several of these tweeters can be used with one woofer, if desired.

Cellular-Horn Tweeters

Cellular-horn tweeters are relatively expensive and are primarily used for theatre or other large, comparatively high-power installations. This has been recognized by one manufacturer who has developed a smaller, less expensive, individual tweeter horn and unit. It will have ample efficiency and power capacity to be used effectively with an efficient woofer cone in a suitable baffle, to effect flat response from the cut-off of the woofer to about 14,000 cycles. Fig. 1 illustrates a produc-

*See July, 1946, SERVICE for series of "Trends in Sound" articles on loudspeakers, amplifiers, microphones and new developments.

tion model of this tweeter in a cabinet which includes a dividing network equipped to connect to an 8-ohm amplifier and an 8-ohm woofer. A tweeter such as this, when available, will permit the conversion of a 12" to 15" cone speaker to a woofer providing a wide-range dual-channel loudspeaker system.

An interesting application of cellular horn tweeters, of the type cutting off at about 300 cycles, appears in speech systems in reverberant churches and halls. If the expense is warranted, this makes an excellent solution to this usually difficult problem.

The anticipated high-quality, wide-range program material which f-m and television sound channels are expected to furnish, has resulted in the development of the single-unit dual-channel wide-range speaker. Several types are available or will be in the near future. They are designed to fit into the same position in a radio cabinet as the regular cone speaker. One

(Continued on page 29)

Trends in Sound

PHONO PICKUPS

by B. K. MARTINSON

A PHONO PICKUP IS A DEVICE for converting mechanical motion into electrical impulses. The accepted source for this mechanical motion is a revolving wax record of either the *lateral-cut* or the *hill-and-dale* types.

Audio voltage impulses are converted by the recording-head needle into lateral, or side-to-side vibrations. This motion, in turn, cuts a groove into the record which varies laterally. In the hill-and-dale type of recording the needle motion provides a variation of the groove depth. Most popular-types records are cut laterally, hill and dale recordings being used almost exclusively in broadcast transcriptions.

In the lateral-cut record, the amplitude of an audio signal is interpreted in terms of the width of the side-to-side motion, while the frequency determines the number of side-to-side motions per second. It is the function of the reproducing pickup to reconvert these motions to electrical energy.

Record Limitations

Since fidelity of reproduction is the ultimate goal, it is important to know what limits are imposed by the record itself. Since the record turns at a constant rate, 78 rpm, for most recordings, and since the outer groove is longer in length than the inner one, the rate

of travel of the needle is highest in the outside groove, and slowest for the inner one. For high audio frequencies the greater the distance that the needle covers per second, the better will be the fidelity. Therefore, the limiting factor for high frequencies is the length of the inside groove, which, in turn, is a function of its distance from the center of the record.

For low frequencies, the limiting factor is the damping imposed on the recording head needle. In addition, because of technical difficulties in the mechanics of recording, frequencies below 250 cps are recorded at constant amplitude, which results in a decreasing loss in power with frequency when reproduced.

The upper amplitude limit is a function of the lateral needle movement, which is itself limited by the width of the record groove and the distance between grooves. The lower amplitude limit is a function of the needle scratch level. Therefore, in recording, the input level to the recording head needle is so regulated that it never falls below the needle scratch level, nor ever causes the needle to swing beyond its maximum permissible movement. Thus,

amplitude distortion is introduced into the recording; this can be compensated for by the use of an expander circuit in the associated amplifier.

In addition, the frequency response is limited, as previously noted, by the speed of needle travel in the groove. Another factor affecting frequency fidelity is record wear, which not only causes both amplitude and frequency distortion, but also increases scratch level.

Since the record is not a perfect medium for audio transcription, the pickup must not necessarily have a wide-frequency response.

The approximate frequency range of an average recording is 100 to 5500 cps. Better type recordings may extend from 50 to 8,500 cps, with studio transcriptions going to 10,000 cps.

Pickup Construction

When phono pickups were first introduced, the general construction followed that of the first loudspeakers. That is, the pickup head, known as the magnetic type, consisted of a needle holder attached to a vane floating between two poles of a magnet on which coils were wound. Variations in the movement of the vane varied the magnetic field and induced a voltage in the

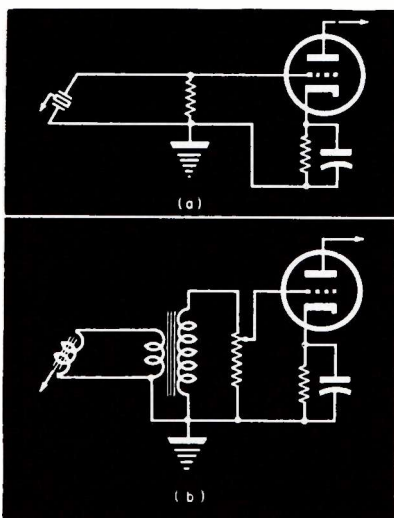


Fig. 1 (left). Crystal pickups, which are high impedance devices, may be connected directly to the grid of a tube as in (a). Magnetic type pickups, which are low impedance devices, require the use of a matching transformer as shown in (b).

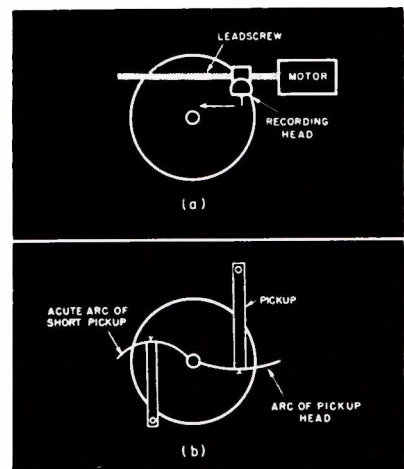


Fig. 2. In (a) is shown a typical recording system. The recording head travels along a lead screw in a straight line, cutting grooves in the record. In (b) we see how the length of the pickup arm influences the tracking error. Since the pickup acts from a pivot, some error will be introduced. However, the longer the pickup arm, the less the tracking error.

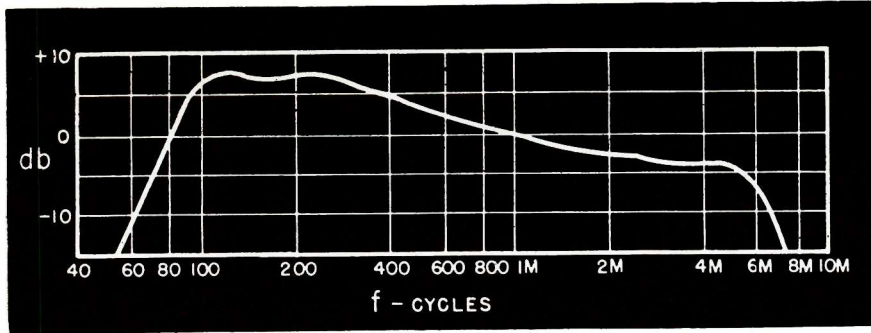


Fig. 3. A typical response curve for a crystal pickup. Note how sharply the response drops at both ends of the audio spectrum. The usable portion of the response curve lies along and above the -10 db line.

coils in terms of the frequency of vibration.

Most modern pickups are of the crystal type. These crystal pickups consist of a Rochelle salt unit so attached to the needle holder that the vibrations of the needle set up stresses and strains in the crystal structure. These stresses and strains, in turn, create a voltage across the face of the crystal, at very low power. Since the crystal is a high-impedance device, it may be coupled directly into the grid of a tube. Magnetic type pickups, on the other hand, are low impedance devices which necessitate the use of matching transformers. Fig. 1 shows two typical input circuits for both types.

At the reproducing end, there are further influences on fidelity of reproduction. When recordings are made, the cutting head travels on a leadscrew, so that the cutting needle with respect to the groove always cuts at a right angle. However, the arm of the reproducing pickup must be centered at some point outside the perimeter of the phono motor. This causes the pickup head to describe an arc as it moves across the record; these two motions are demonstrated in Fig. 2. The arc creates a non-uniformity in needle pressure in the groove, with the needle dragging against the side wall of the groove at some points. This action causes distortion, wear on the record, and mechanical noise as well as increased scratch.

From Fig. 2, it will be noted that the longer the pickup arm, the flatter the arc, and consequently the better the reproduction. Other methods of reducing tracking error are to offset the pickup unit and curve the arm. Longer arms are needed for wider records. This is why transcription type pickup units, operating on 16" records, are longer. The mounting centers for most pickups are usually at least 7", measuring from turntable center, with greater distances giving better results. Of course, this distance is a function of

the length of the pickup arm.

Frequently distortion may be traced to mechanical resonance in the pickup arm, pickup head, or both. It is therefore essential that the entire pickup arm structure be properly damped. Damping is usually accomplished by rubber mounting both pickup head and pickup arm. Another method takes advantage of this condition by constructing the pickup arm so

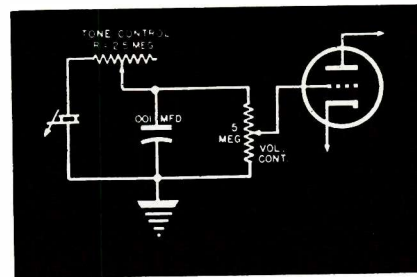


Fig. 4. Volume and tone control circuits for use in conjunction with a crystal pickup. The 2.5-megohm tone control will vary the upper frequency response, thereby controlling the amount of scratch noise, which varies from record to record.

that it resonates at the low frequencies, thereby improving the response at this end of the audio spectrum. Some resonance must be tolerated since excessive damping would cause additional wear of the record by restricting arm movement.

The weight of the pickup head on the record has three important aspects. First, the greater the weight, the more the record will wear. Again, a heavy
(Continued on page 16)

Western Electric

Type	Voltage Output	Impedance (1,000 cps)	Needle Pressure	Frequency Range (cps)	Needle
AJ2	.5 to .7	.2 meg.	1.5 ounces	50- 4,000	optional
C2	2.0 to 2.5	.2 meg.	2.5 ounces	40- 5,000	optional
C3	2.0 to 2.5	.2 meg.	2.5 ounces	40- 5,000	optional
C4	2.0 to 2.5	.2 meg.	2.5 ounces	40- 5,000	optional
C5	.5 to .7	.2 meg.	1.5 ounces	40- 5,000	optional
C6	3.0	.2 meg.	2.5 ounces	40- 5,000	optional
D2	2.0 to 2.5	.08 meg.	2.5 ounces	40- 5,000	optional
D3	.5 to .7	.08 meg.	1.25 ounces	40- 6,000	optional
D4	.7 to .9	.08 meg.	1.25 ounces	40- 5,000	optional
D5	.7 to .9	.08 meg.	1.25 ounces	40- 6,000	sapphire
E4	1.5 to 2.0	.2 meg.	2.5 ounces	40- 5,000	sapphire
E9	.5 to .7	.08 meg.	1.25 ounces	40- 6,000	sapphire
N2	.9 to 1.1	.08 meg.	1.25 ounces	40- 5,000	sapphire
N3	.7 to .9	.2 meg.	1.25 ounces	40- 5,000	sapphire
N4	1.0 to 1.25	.2 meg.	1.5 ounces	40- 5,000	sapphire
N5	.7 to .9	.2 meg.	1.25 ounces	40- 6,000	sapphire
T1	2.0 to 2.5	.08 meg.	2.5 ounces	40- 5,000	sapphire
T2	2.0 to 2.5	.08 meg.	2.5 ounces	40- 5,000	sapphire

Shure

97A	1.4	.5 meg.	1 1/8 ounces	70- 6,000	optional
97AN	1.4	.5 meg.	1 1/8 ounces	70- 6,000	sapphire
95A	3	.5 meg.	2 ounces	70- 6,000	optional

Astatic

LP21	.85	.5 meg.	1 ounce	30- 7,000	sapphire
LP23	.65	.5 meg.	1 ounce	30-10,000	sapphire
L25	1.25	.5 meg.	2.0 ounces	30- 6,500	optional
L70	1.0	.5 meg.	1.25 ounces	30- 4,000	optional
L71	1.0	.5 meg.	1.0 ounce	30- 8,000	optional
L72	3.5	.5 meg.	1.25 ounces	30- 4,000	optional
L75	.75	.5 meg.	1.25 ounces	30- 6,000	optional
L76	1.0	.5 meg.	1.25 ounces	30- 3,000	optional
MLP	1.0	.5 meg.	1.0 ounce	30-10,000	sapphire

Table 1
Highlights of some types of crystal pickups

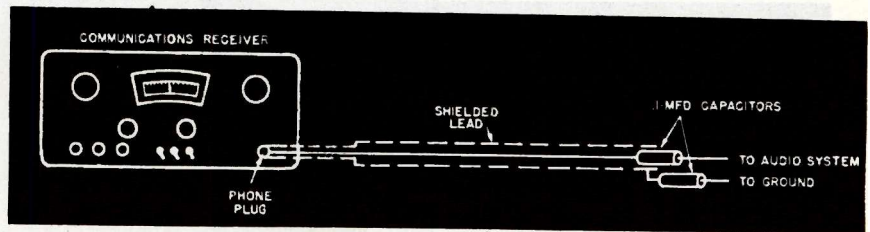
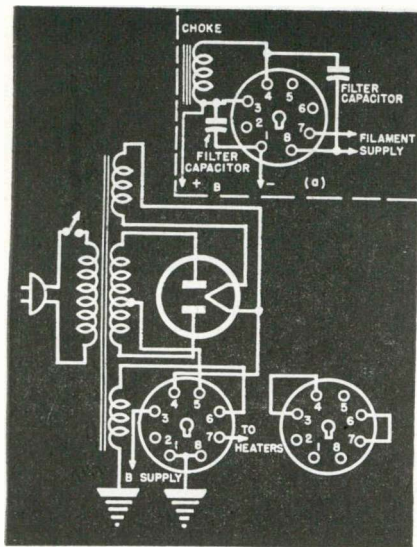


Fig. 1. By attaching a shielded probe to the headphone jack on the communications receiver, the prod may be used for checking audio systems.

Fig. 2 (left). Shorting plug system used in the Hallicrafters S-40. A unit consisting of a plug, choke, and two filter capacitors, wired as shown in *a*, permits the use of this receiver's power supply system for external applications.

Communications Receivers as SERVICE INSTRUMENTS

CONTINUING OUR DISCUSSION of the use of communications receivers as service instruments, it is possible to attach an exploring coil to the antenna posts of the communications receiver to check the operation of oscillator sections in receivers under test. The receiver under test is set to some frequency at the high end of the dial, say 1,600 kc. The oscillator of the receiver should then be oscillating at a frequency of 1,600 kc, plus the i-f frequency. To check for oscillation, the b-f-o of the communications receiver is turned on, and the dial rotated in the vicinity of the expected oscillator frequency. A beat note should be heard.

Use as Audio Oscillator

The communications receiver may also be used as an audio oscillator, by using the signal generator in conjunction with the b-f-o. The generator is set at some free point in the spectrum where no signals are present. The b-f-o is turned on, and the frequency of the resultant note may be varied within audio range. The signal may be conveniently removed at the phone jack.

Use of Phono Jack

The phone jack is also a convenient point for removing an audio signal for checking the audio system of a re-

by

THOMAS T. DONALD

[Part II]*

ceiver, Fig. 1. A shielded lead and a phone plug are used for this purpose. At the end of the lead, a .1-mfd capacitor is inserted. The communications receiver is then tuned to some local station. The lead prod may then be applied to various points in the receiver under test to check for gain or distortion. The shield of the prod should be grounded to the receiver under test through a .1-mfd capacitor.

Battery Conversion

Most communications receivers feature a plug for conversion to battery operation. One such system, used in the Hallicrafters S-40, is shown in Fig. 2. A shorting plug is inserted in the receptacle for a-c operation. By removing this shorting plug, the B and filament supply to the receiver is cut

off. This power supply is then available for use outside the receiver. To adapt the receiver's power supply for external use, a separate unit can be constructed. This can consist of a filter choke, two filter capacitors and a plug, which may be inserted into the receiver. The use of this unit would permit the checking of receivers whose own power supply is defective. This circuit is shown in Fig. 2a.

Locating Stations

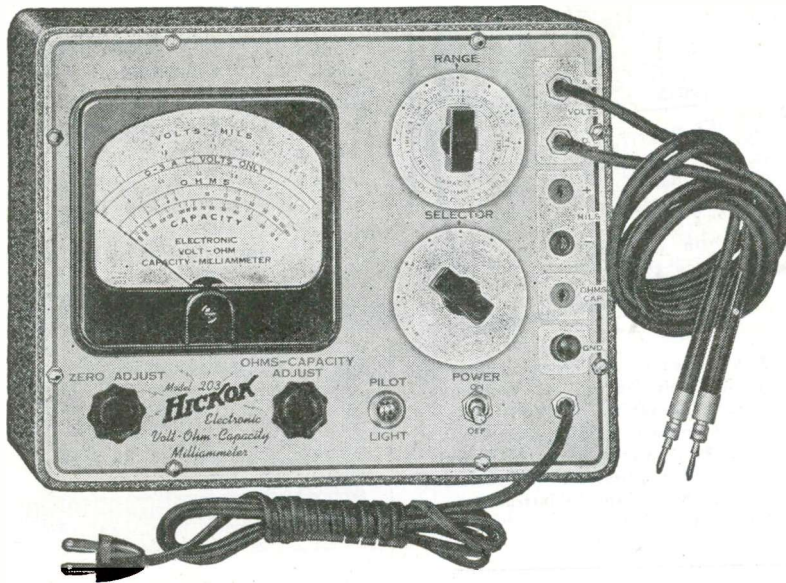
The most obvious use for the communications receiver is in locating broadcast stations on the dial. Quite often, in checking midget receivers, it is possible to pick up a signal whose frequency is uncertain, either because the dial pointer has been removed or because the set is misaligned. The quickest way to check is to determine which station is being received by checking the program against another receiver. In addition, when push buttons are being adjusted, stations are quickly aligned by having another receiver handy.

*Part I appeared in the June, 1946, issue of SERVICE; pages 9 and 40.

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 - b. Volts, D-C: 0-3, 12, 30, 120, 300, 1200
 - c. Mils (D-C): 0-3, 12, 30, 120, 300, 1200
 - d. Cap: 0-10,000 mmf in 2 ranges
0-1000 mf in 5 ranges
Ind: 50 mh-100 henries (use conversion chart)
 - e. Ohms: 1.0 ohm to 10,000 megohms in 7 ranges
4. Frequency: A-C up to approximately 5 megacycles.
5. Input Impedance:
 - a. Volts D-C: 15 megohms
 - b. Volts A-C: 12 megohms
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 - 1 6SJ7 cathode follower
 - 1 6SN7GT vacuum tube volt-meter
 - 1 0D3/VR150 voltage regulator

Dimensions: 9" x 11½" x 7"

Weight: 13 lbs.

Meter: Model S44A

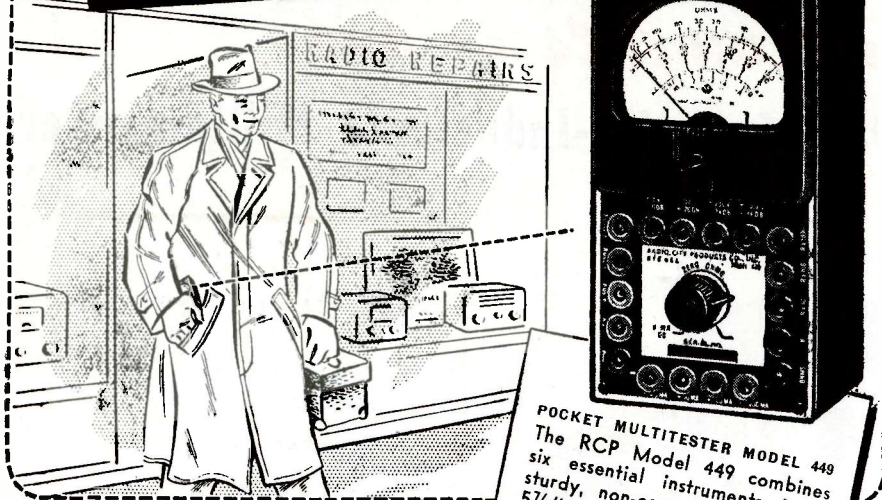
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PHONO PICKUPS

(Continued from page 13)

pickup will not respond as well to high frequencies as will a light one. Third, a heavy pickup increases the needle scratch, both mechanical and electrical. To overcome pickup weight, all pickup arms are counterbalanced, so that the actual weight of the pickup on the record is 3 ounces or less.

Crystal Pickups

Crystal pickups are the most common type in use today. The maximum

response of a typical crystal pickup (Fig. 3), without the addition of compensating networks is usually between 100 and 400 cycles, with sharply falling characteristics at 50 and 7,000 cps. Fig. 4 shows a typical compensating input network for a crystal pickup used to reduce the needle scratch of the record. The salient characteristics of crystal pickups manufactured by Astatic, Shure, and Webster, are presented in Table 1.

Pickup heads marked *sapphire* in the

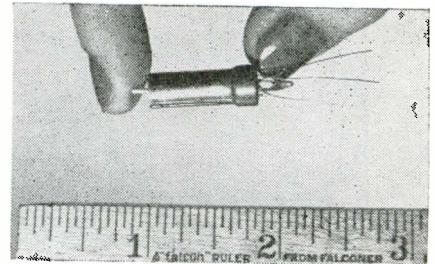
needle column have a needle permanently attached to the unit.

Crystal pickups must never be installed in locations where the temperature is in excess of 125° F. Moisture also affects them adversely. A crystal type pickup will also fracture easily if abused in any way. For these reasons, the pickup must be handled gently.

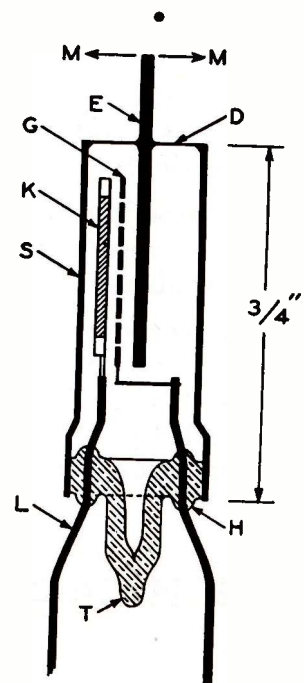
To test crystal pickup activity the needle can be rubbed gently across the fingertip. Continuity tests should show infinite resistance. Sometimes the crystal unit will give a better response if the needle is rubbed in one direction than when it is rubbed in the other. This is indicative of a cracked crystal and will cause serious distortion or even spotty reproduction. The pickup should never be allowed to fall on the record since this is usually the cause of broken crystals.

New Pickup Types

Two new types of pickup units have



Above, view of vibrotron. Below, schematic of vibrotron. Motion of movable electrode (E) in direction MM is transferred through a thin metal diaphragm (D) to affect the electron flow of triode consisting of electrodes (K) cathode, (G) grid, and (E) movable anode. Motion of the movable anode in direction MM produces a proportionate change in the electron flow. The triode is contained within a metal envelope (S) and has its leads (L) brought out through a vacuum-tight glass header (H) with exhaust tip (T).

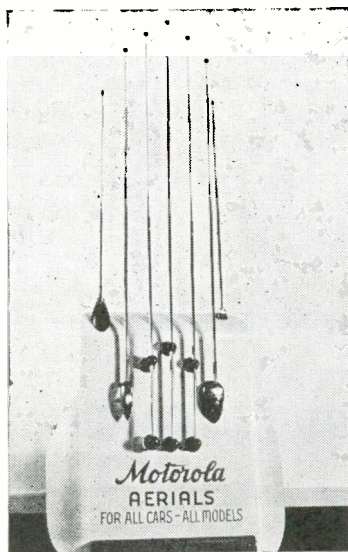


recently made their appearance. One is the Zenith cobra head; the name refers to the shape of the pickup arm. In this unit, a pickup coil attached to the needle holder is part of the inductance in an oscillator circuit. By varying a vane, similar to the method used in magnetic type pickups, the coupling of the oscillator coil is varied, producing an amplitude-modulated effect in the oscillator output. The output of the oscillator is then passed through a detector to remove the r-f component. This unit is also constructed in a push-pull system to further remove noise components and second harmonic distortion. It has a high-frequency cutoff characteristic at 4000 cps, which is said to be desirable for high signal-to-noise ratio. The mechanical impedance of this device is so low, that a weight of but 14 grams is necessary for proper tracking. The low impedance of the pickup coil, which is an inductance of 20 microhenries, permits the use of unshielded leads.

Another new type of pickup, developed by RCA, is called the *vibrotron*. This is a tiny metal electron tube with a movable electrode extending through a flexible metal diaphragm at the top of the tube, which serves as an external lever. The tube is, in effect, a triode with a moveable plate.

As the plate moves away from the cathode, the electron flow is decreased and vice versa. The entire unit weighs 1/15 of an ounce, is about 1" in length and 1/4" diameter. The frequency characteristic of the unit is quite wide, and since it is a tube, it may be considered as a part of the audio amplifier system, with corresponding high output.

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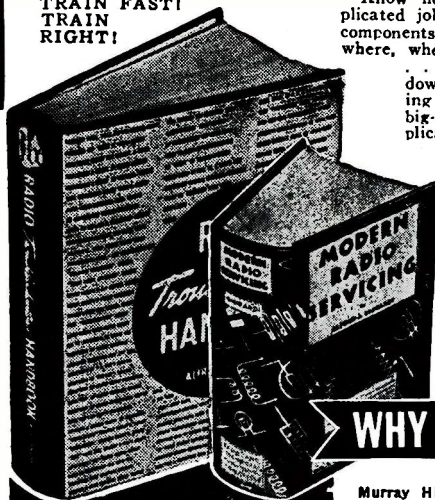
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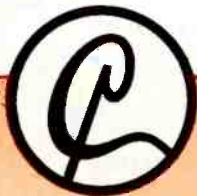
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TOOLS And ACCESSORIES

For the NEW SERVICE SHOP

ONLY the *basic* tools considered to be essential in the average Service Shop have thus far been discussed in this series. For the small shop this basic tool equipment can well serve as a starter, to be added to as the necessity for additional tools arises.

To the experienced Service Man concerned with being able to do all sorts of jobs on a wide variety of makes and models of receivers in the least time and with the least effort, this limited list admittedly leaves much to be desired. Radio equipment design has become complicated and varied, with the result that there are quite a few additional supplementary and *special-purpose* radio tools which are very handy to have around. Some are not frequently needed, but they are somewhat difficult to do without when they are wanted. They should be considered by the Service Man who will probably wish to add to his *basic* tool kit from time to time, expanding it on the theory that while a good Service Man can do a creditable job of servicing with a limited tool equipment, it

*Part III appeared in June, 1946, SERVICE.

by **ALFRED A. GHIRARDI**

Advisory Editor

[Part IV . . . *Supplementary and Special-Purpose Tools*]*

is a fact that he will do a better job with more, well-chosen equipment.

Most of the supplementary and special-purpose tools described in this installment are available from your radio jobber, from the larger radio mail order houses and from your local hardware dealer.

Supplementary and Special-Purpose Tools

Bench grinder
Electric drill stand
Breast drill
Hacksaw and blades
Files:

- One 1/4", and one 3/8", tapered round machinists' file.
- One 1/2" tapered triangular machinists' file.
- One, 8" long, half-round machinists' file.
- One, 8" long, flat-wood file (not a rasp).
- One, 6" long, second cut or smooth-tapered flat-mill file.

One handle for each file.

File card

Pliers:

- One 6" straight fine needle-nose.
- One 5 1/2" curved needle-nose.
- One 6" slip-joint (adjustable) combination type.
- One plastic long-nose.

Screwdrivers:

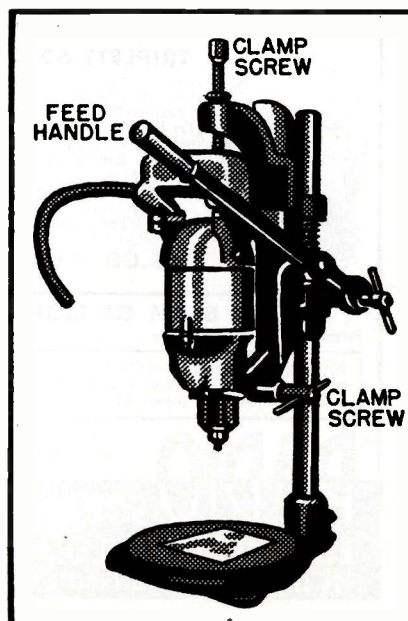
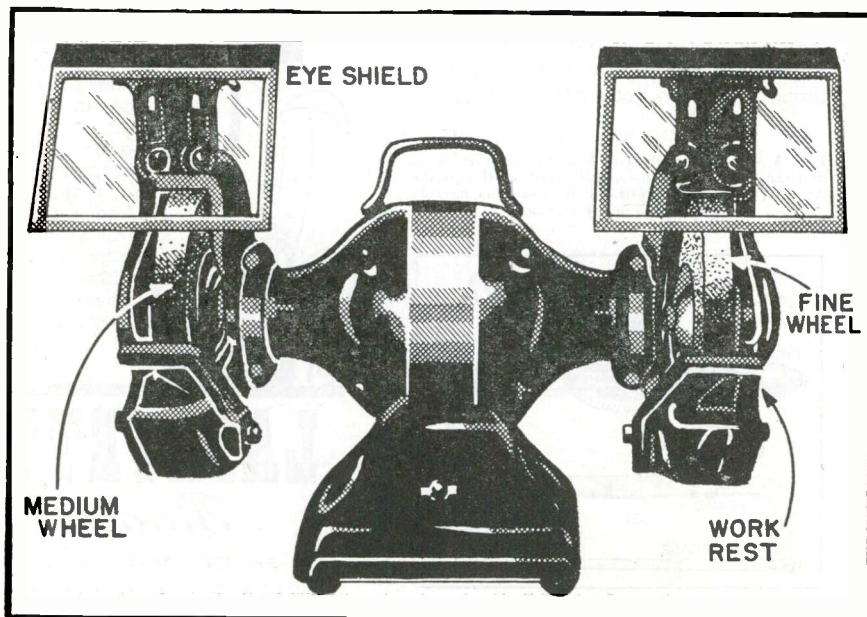
- One 1/4" x 1 1/4" short, stubby blade.
- One 3/8" x 10", square blade.
- One 3/16" x 10", round blade.
- One flexible-shaft type.
- One 6", insulated-shaft type.
- One screw-holding type.
- Two offset types (One 2 1/2" long, and one 4 1/2" long.)
- One Phillips (for screws up to No. 4).
- One Phillips (for No. 5 to No. 9 screw sizes).

Wrenches:

- One Bristol No. 6 set-screw type.
- Two offset socket wrenches for No. 6 and No. 8 screw size hex nuts.
- Two flexible-shank socket wrenches

(Continued on page 20)

Fig. 1. Typical small electric bench grinder equipped with tool rests, wheel guards and eye shields. Fig. 2. Stand which converts the portable electric drill into a drill press for the shop.



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TOOLS

(Continued from page 19)

for No. 6 and No. 8 screw size hex nuts.

One adjustable knurled-nut type.
One kit of Allen hex key wrenches.
One vise-grip parallel-jaw wrench.

Reamers:

One tapered for hole size from 1/8" to 1/2".
One tapered for hole size from 3/8" to 7/8".
One, tapered for hole size from 5/16" to 1 1/2".
One hand (Reamawl) type.

Countersinks:

One round shank type.

Large hole cutters:

One set of screw-type chassis punches for hole sizes required.
One fly-cutter for holes from 7/8" to 4" diameter.

Stock and dies:

Die stock.
Dies for 4-36, 6-32, 8-32 and 10-32 machine screw threads.

Twist drill case (with or without set of twist drills)

Twist drill gauge

Rules and scales

One 6' flexible steel push rule.
One 2' folding rule with caliper.
One combination measuring tool.

Dividers:

6" size.

Trimming knife:

With set of removable blades.

Working tools:

One medium size crosscut saw.
One medium size rip saw.
One claw hammer.
One carpenters' brace (ratchet type).
Wood bits 1/4", 3/8", 7/16", 1/2".
One expansion bit, 1/2" size.
One wood chisel, 1/2".
One combination oil stone (medium-fine).

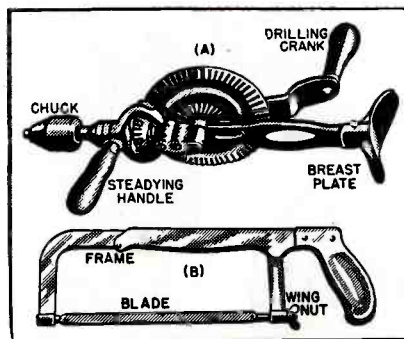
Lights:

Goose-neck bench light.
Flashlight (3 cell).
Trouble lamp (60 watt bulb).

Bench Grinder

A bench grinder equipped with a suitable assortment of abrasive wheels, wire brush wheel, and buffing and polishing wheels is extremely handy for dozens of uses in the shop, even though you can get by without one if

Fig. 3. At (a), a breast drill for heavier hand drilling work than the small hand drill can do. At (b), an adjustable-frame hacksaw. (Courtesy Crescent Tool Company)



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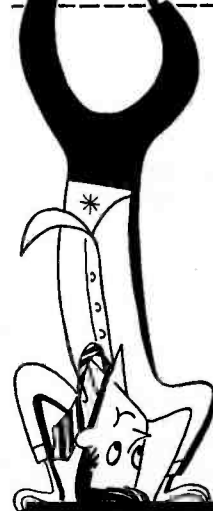


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necessary. The abrasive wheels can be used for sharpening drills, chisels, screw-drivers and other tools, shaping small parts, removing burrs, and all miscellaneous grinding operations. The wire brush wheel is useful for removing paint, cleaning metal, etc. The buffing wheel can be used to polish plated parts, etc.

The grinder may be the inexpensive hand-crank type, or preferably one of the common small electrically-driven bench units, such as is illustrated in Fig. 1, which contains a coarse abrasive wheel on one end and a fine wheel on the other end of an electric motor. The wheels are removable so that wire brushes, polishing or buffing wheels may be substituted for them. Abrasive wheels for grinders may be obtained in a variety of shapes, grades and sizes. For average shop purposes, 4" or 6" wheels, about 1" thick are satisfactory.

If the grinder is not equipped with a glass eye-protecting shield, a pair of goggles should be purchased and always worn to protect the eyes from flying particles of steel and abrasive. The electric grinder should have wheel guards; *it is unsafe ever to use a grinder without them.*

Electric Drill Stand

A drill stand makes a regular bench-type power drill press out of your portable electric drill. A common type is illustrated in Fig. 2. The feed handle provided on the stand enables the operator to feed the entire electric-drill assembly (with twist drill) down to the work to be drilled, which is placed on the flat table of the drill stand. The portable electric drill is held in place on the stand by means of easily-adjusted clamps, and can be removed quickly when it is to be used without the stand. The drill stand is invaluable for accurate drilling work, since it enables all holes to be drilled accurately at right angles to the work's surface, or to some other angle if the work is clamped to the table accordingly. Of course, its use is limited to those jobs where the work can conveniently be brought to the drill. For other jobs such as auto-radio installation work, etc., the drill must be brought to the work. For this work, the portable drill is used without the stand.

If you plan to buy a drill stand, keep it in mind when you purchase your portable electric drill. You should be

(Continued on page 24)

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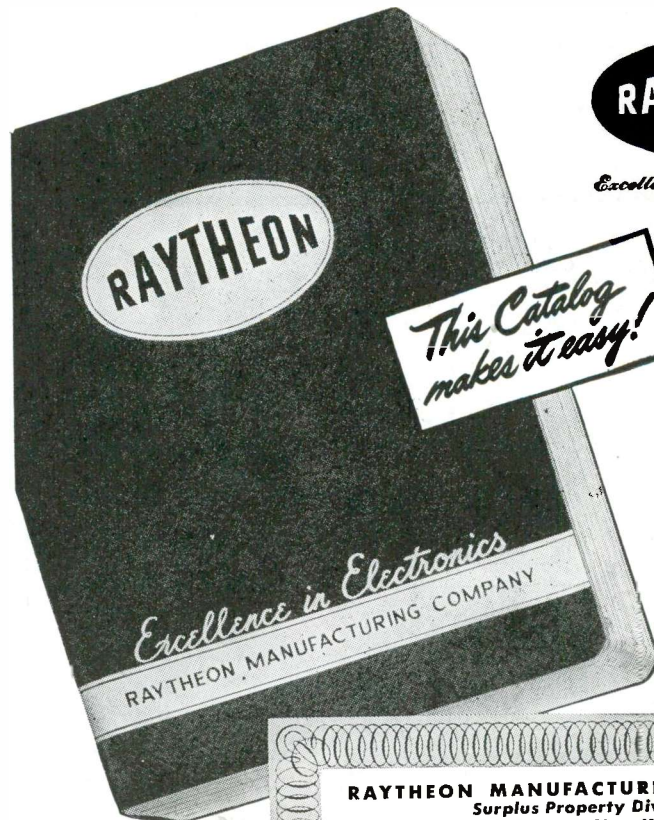
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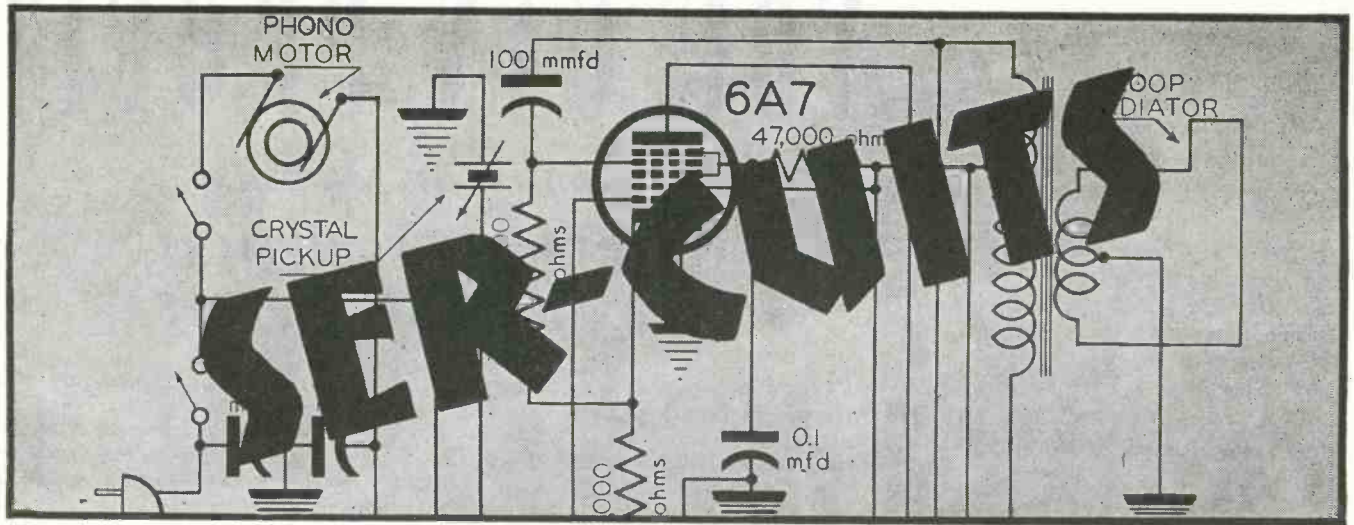


TABLE MODELS USING IRON-CORE i-f transformers, phono combinations, phono-amplifiers and battery receivers are discussed in our ser-cuits analyses this month.

Radiola 61-1, 2 and 3

Radiola models 61-1, 61-2 and 61-3, with an iron-core i-f input transformer, are represented in Fig. 1. These models use a 12SG7 converter tube driven by a separate 12J5 oscillator with cathode-to-cathode coupling through 3300 ohms bypassed by a .01-mfd capacitor. The 3300 ohms is

by HENRY HOWARD

used for supplemental bias of the converter (in addition to avc bias). The oscillator uses a capacitor winding instead of a conventional grid capacitor. The converted plate and screen supply contains a decoupling filter of 1,500 ohms and a .01-mfd capacitor, the capacitor being returned to the (hot) cathode instead of B-. The input i-f

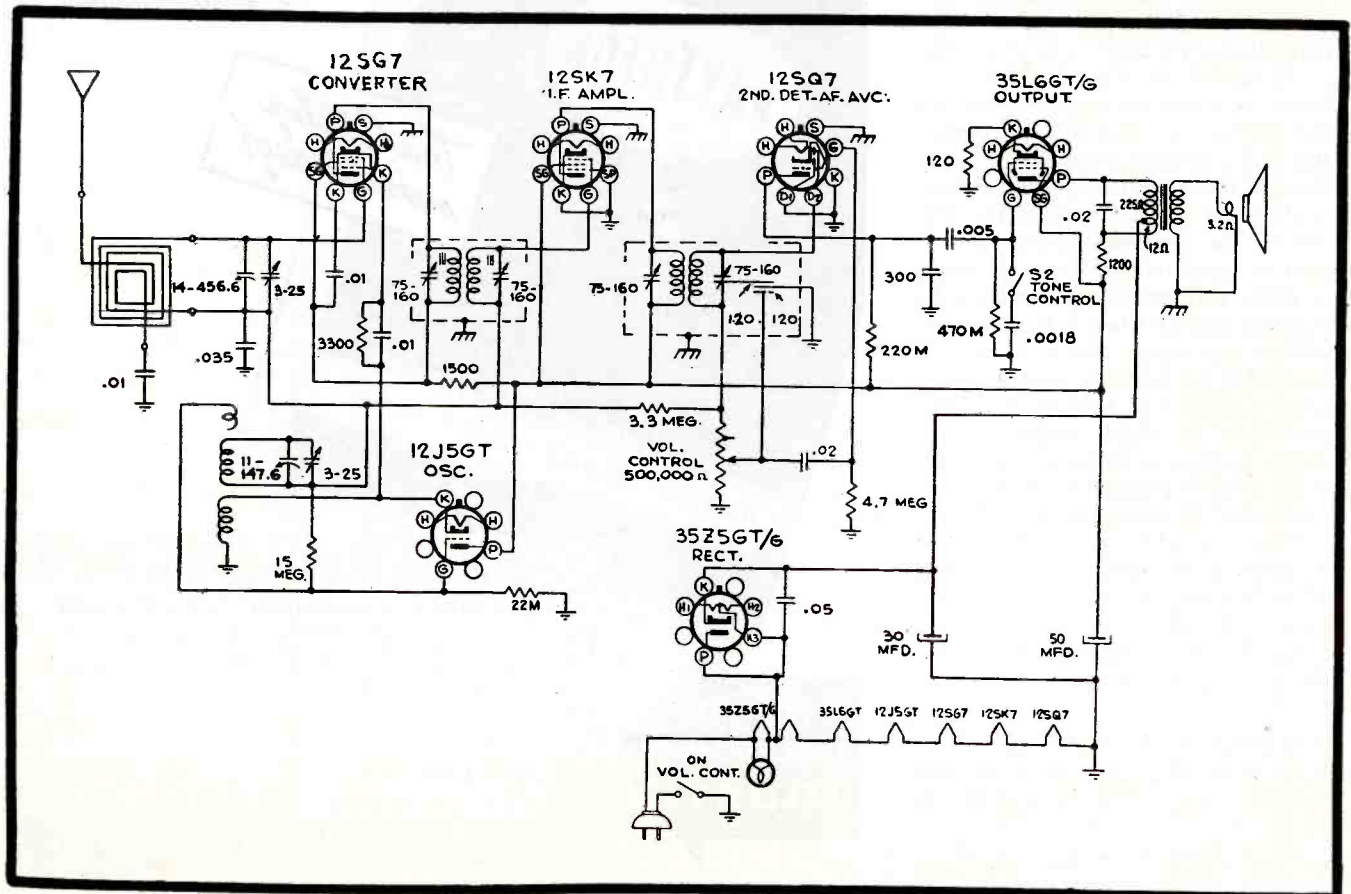
Fig. 1. Radiola 61-1, 2 and 3, using a 12SG7 converter driven by a separate 12J5 oscillator with cathode-to-cathode coupling.

transformer contains an iron core. A .0018-mfd capacitor is shunted across the power tube's input for tone control. The primary of the output transformer is tapped for hum bucking, a system recently described in these columns.

RCA Victor 55U, 55AU

In Fig. 2 we have the RCA Victor Victrola 4-tube and rectifier phono-combination models, 55U, 55AU, equipped with an automatic changer. A 12SA7 is used in a cathode-tickler

(Continued on page 26)



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HOWARD W. **SAMS** & CO., INC. **RADIO PHOTOFACT SERVICE**

TOOLS

(Continued from page 21)

sure to purchase a drill for which a properly fitting stand is available.

Breast Drill

For those who do not care to buy the electric drill listed as optional equipment in the *basic* list of tools, a less expensive *breast drill* may be purchased for hand drilling of holes larger than about $\frac{1}{4}$ " or $\frac{3}{8}$ " diameter.

The breast drill is similar to the hand drill in construction, with the exception that besides being larger and more sturdy a breast plate is substituted for the handle and an additional handle is provided near the chuck to steady the drill, as shown at (a) of Fig. 3. Breast drills that have a continuous ratchet feature can be used in tight places. Some even have a crank of adjustable length, and two or three-speed adjustments, for drilling holes of various sizes and materials of various hardness. The breast drill is equipped with a 3-jaw chuck designed to take round shank twist drills. It is really a big brother to the smaller hand drill, and is used for heavier work than the hand drill is capable of handling.

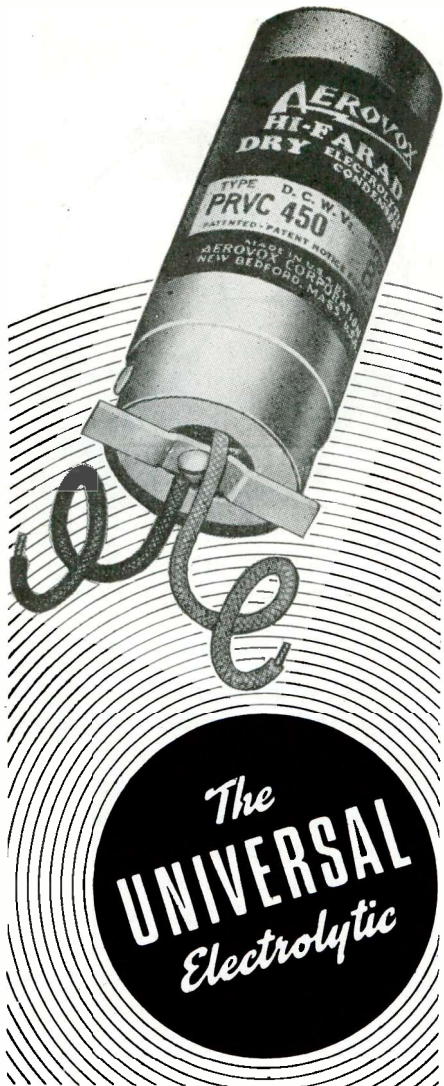
Hacksaw

Although the small keyhole hacksaw, listed in the *basic* list of tools, will suffice for many light metal-sawing jobs, and in fact is indispensable for work in cramped quarters, sawing out rectangular holes, etc., a full-size hacksaw having a frame adjustable to take either 10" to 12" blades is handy to have; (b) of Fig. 3. If a less expensive type is desired, a fixed-frame type designed to take a 10" blade will suffice.

Examination of the two-pin spindles that hold the blade under tension, will reveal that they may be turned to various positions in the frame. This permits the blade to be turned at right angles to the frame when necessary to do so for some sawing jobs.

Hacksaw Blades

The replaceable hacksaw blades are made of high grade tool steel hardened and tempered. They are made in two general types: those hardened all over, and those having only the teeth or cutting edge hardened. The former type is used mostly for sawing stock of large cross-section. In the latter type the teeth can be left harder in manufacture, and therefore superior



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cutting qualities and greater flexibility result. They are preferable for radio shop uses.

Hacksaw blades are made with a varying number of cutting teeth per inch ranging from 14 to 32. Selection should be based on the material to be cut. The following will serve as a guide:

(a) Use a blade with 14 teeth per inch on machine steel, or cold rolled steel. This coarse pitch makes the saw free and fast cutting.

(b) Use a blade 18 teeth per inch on solid stock, aluminum, bakelite, tool steel, high speed steel, cast iron and structural shapes. This pitch is recommended for general all-round service.

(c) Use a blade with 24 teeth per inch on tubing, tin, brass, copper, light angles and ornamental iron, channel iron, pipe and electrical conduit, and sheet metal over 18 gauge. If a coarser pitch is used, the thin stock will tend to strip the teeth out of the blade and make it difficult to push the saw. The saw should be held so that two or more teeth are always in contact with the work.

(d) Use a blade with 32 teeth per inch on thin-walled tubing and conduit and on sheet metal thinner than 18 gauge.

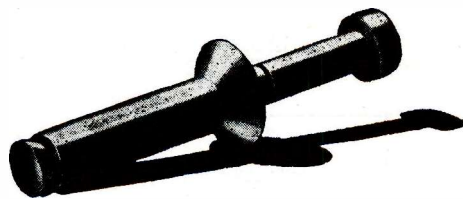
Blades having 18 teeth per inch are best for general all-around use in the Service Shop, so at least a dozen of them should be stocked. However, a few 24 and 32-teeth blades should also be kept on hand for possible use.

(To Be Continued)

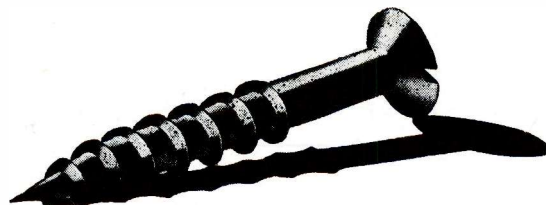
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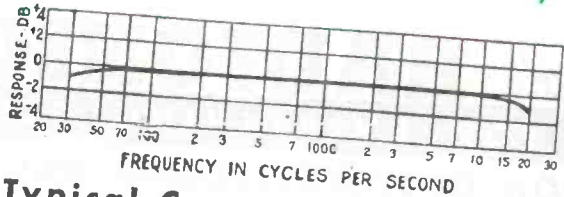
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LS-10X	As above	As above	50,000 ohms	+14 DB	-92 DB	5 MA	\$28.10
LS-21	Single plate to push pull grids:	8,000 to 15,000 ohms	135,000 ohms; turn ratio 1.5:1 each side. Split Pri. and Sec.	+14 DB	-74 DB	0 MA	\$21.25
LS-30	Mixing, low impedance mike, pickup, or multiple line to multiple line	50, 125, 200, 250 333, 500 ohms	50, 125, 200, 250, 333, 500 ohms	+17 DB	-74 DB	5 MA	\$22.50
LS-30X	As above	As above	As above	+15 DB	-92 DB	3 MA	\$28.10
LS-50	Single plate to multiple line	8,000 to 15,000 ohms	50, 125, 200, 250, 333, 500 ohms	+17 DB	-74 DB	1 MA	\$21.25
LS-55	Push pull 2A3's, 6A5G's, 300A's, 275A's, 6A3's	5,000 ohms plate to plate and 3,000 ohms plate to plate	500, 333, 250, 200, 125, 50, 30, 20, 15, 10, 7.5, 5, 2.5, 1.2	+36 DB			\$25.00
LS-57	Same as above	5,000 ohms plate to plate and 3,000 ohms plate to plate	30, 20, 15, 10, 7.5, 5, 2.5, 1.2	+36 DB			\$17.50

The above listing includes only a few of the many units of the LS Series. For complete listing — write for catalogue.



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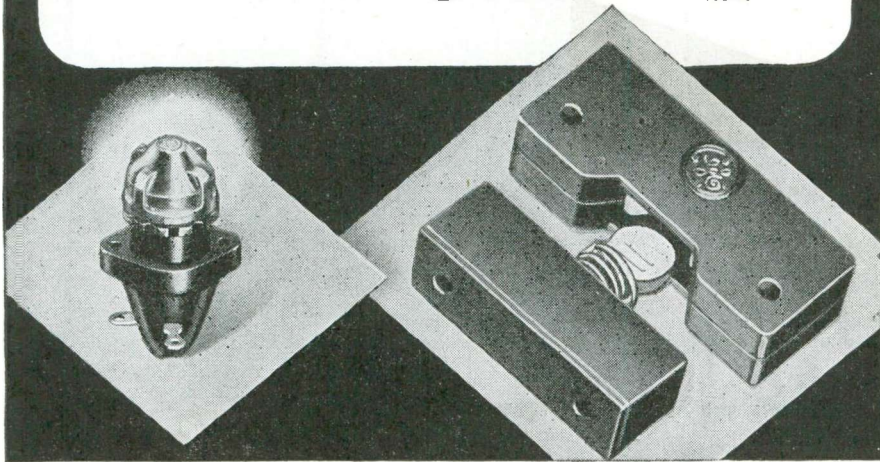
Safety first for personnel is of the utmost importance.

This protection can be guaranteed through the use of G-E Interlock Switches on radio transmitters, X-ray and therapeutic machines, burglar alarms, and signal controls for fire doors.

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Electron Signal Tracer.....	\$87.71	Adjustable Ground Pipe Clamps. Lots of 50	2.55
Vomax Vacuum Tube Voltmeter.....	59.85	Standard Brands 20-20 mfd.—150 Volt Con-	.58
Supreme 546 Oscilloscope.....	87.70	densers	
Weston 779 Analyzer.....	75.00	Hook Up Wire—Solid Double Cotton Cov-	
Weston 697 Volt-Ohm Milliammeter.....	28.00	ered, Color Coded Braid—Moisture Proof	.69
Chancellor Phono-Player (attachable to any		100 Ft. "ASP" 50 mmfd. Air Padding Condenser	.27
Radio) List \$17.95, dealer net.....	11.58	with 1/2" Shaft.....	
Chancellor Record Player (Three Tube with			
Alligator Case) List \$2.07, net.....	30.95	AUTO ANTENNAS	
Record Changer Case, \$13.95 ea.; 22 1/2" L.	12.50	Side Cowl—No. 2031—3 Sec. 26"-66"	1.80
x 13 1/2" W. x 10 1/2" H. Lots of 3.....		low loss lead.....	
Record Player Case, 19" L. x 13 1/2" W. x	8.95	Cowl Underhood—No. 244VJ 4 sec.—100"	3.18
7 1/2" H.....		"Poly" low-loss leads.....	
Rub-R-Lite Flashlight (less Batteries) List	13.35	E-L Vibrators—Models 1703-2041-2088 (Auto	2.09
\$1.85. Per Dozen.....	11.00	Radios)	
Rider Manuals—VI.....	15.00	E-L Vibrators—Model 2089 (Auto Radios	3.50
IX-XI-XIII-XIV.....		and Farm Radios)	
Rabin Converter—Input DC: 110V 3.3			
Amps.; Output AC: 110V 2.27 Amp., 60	29.50	CHANCELLOR TUBES	
eye; 100 P. Fact, 3600 RPM—Excellent		IR5.....	.88
Value.....	7.15	IS4.....	.88
Inverter—110 DC to 110 AC—25 Watt.....	3.25	IS5.....	.88
8" PM Speakers.....		IT4.....	.70
Stanor Power Transformer.....	2.65	2B7.....	.70
P-6010, 4-5 Tube, 40 Mill.....	3.38	3A4.....	.88
P-6011, 6-7 Tube, 70 Mill.....	3.82	3Q4.....	.88
P-6012, 8-9 Tube, 90 Mill.....	4.20	3Q5GT.....	.36
P-6013, 11-13 Tube, 120 Mill.....		5Y3GT/G.....	.75
Standard Make Universal 6 Watt Output	1.20	6B8G.....	1.35
Transformer.....	2.44	6C7.....	.89
Trim Dependable 2000 Ohm Headphones.....	1.82	6C8G.....	.55
Acme De Luxe 2000 Ohm Headphones.....		6D6.....	.89
48" Kinkless Rubber Leads with 2-4"	.49	6I8G.....	.89
Probe—Phone TIP.....	.10	6S8G.....	.77
1 Meg Auto Volume Control, less Switch.....	2.55	6SA7GT/G.....	.62
Black Lead-In Straps. Lots of 50.....		6SK7GT/G.....	.75
		6SN7GT.....	.62
		6SQ7GT/G.....	.55
		6U7G.....	.75
		6V7G.....	.75
		7A7.....	1.16
		7H7.....	.75
		12SA7GT/G.....	.75
		12S17GT.....	.82
		12S17GT.....	.89
		12S17GT.....	.75
		12SN7GT.....	.36
		27.....	.55
		39/44.....	.43
		56.....	.49
		77.....	.49
		117Z3.....	.89

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F-M CONVERTERS

(Continued from page 9)

necessary for the support to be insulated from the antenna.

The transmission line should be of the parallel or twisted pair type, connected to the antenna about 8" each side of center. These connections should be soldered or clamped tightly so that weathering and vibration will not loosen them. The transmission line comes down in the form of a V to about 10" from the antenna.

An outside antenna may be mounted out of a window at the end of a flag pole, or on a pole mounted on a roof. It should be oriented so that reception is best. This occurs usually (not necessarily) when the antenna is horizontal and broadside to an incoming signal. A high antenna is generally best, but this advantage may be nullified by the loss in a long transmission line necessary to bring the signal to the point of utilization. This tends to explain those situations in which a high antenna does not seem to work better than one not so high.

For receivers close to the transmitter and with few line of sight obstructions, it may be possible to use an indoor antenna. A curtain rod (with curtain) has made a satisfactory antenna, but this arrangement was necessarily abandoned for one inserted in the wall molding. The best antenna position will depend in great part on the piping and wiring proximity. Sometimes, reception will vary with moving persons. It is best to select a spot for the antenna in which such effects are a minimum.

Other Converter Models

Several different versions of this simple converter have been built. One converter was made to receive a single station for monitoring purposes. Since it was fixed tuned, necessitating no dial, it was made very compact and small so that it could be mounted inside the old f-m set. The r-f, i-f and oscillator circuits were adjusted by means of mica trimmers.

In another version the r-f and oscillator tuning capacitors were ganged. This necessitated the addition of series and parallel trimmers and careful attention to coil values. This was also made with a built in a-c/d-c power supply.

A deluxe model with a regulated power supply and a stage of r-f was also made. A convenient feature was the addition of an i-f calibrating arrangement whereby the oscillator could be modulated and switched to the i-f

(Continued on page 29)

LOUDSPEAKERS

(Continued from page 11)

of these types that has been on the market longest simply has the small direct radiator type of tweeter mounted in the center of the woofer cone cavity. The later types, which are quite efficient and give wide-angle distribution of the high frequencies, have a

(Continued on page 30)

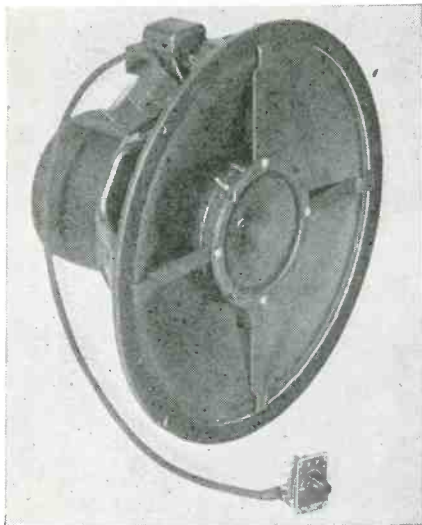
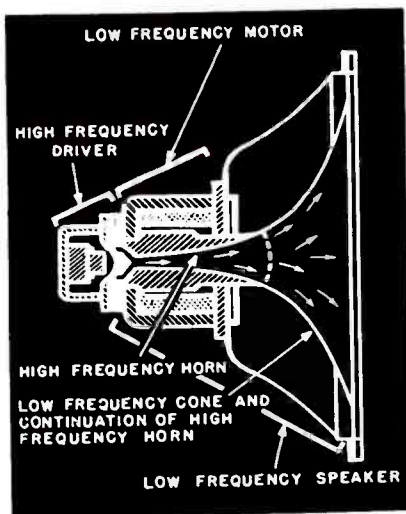


Fig. 4. Coaxial woofer-tweeter unit; type J. (Courtesy Jensen)

Fig. 5. Cross-section of coaxial speaker; type H. (Courtesy Jensen)

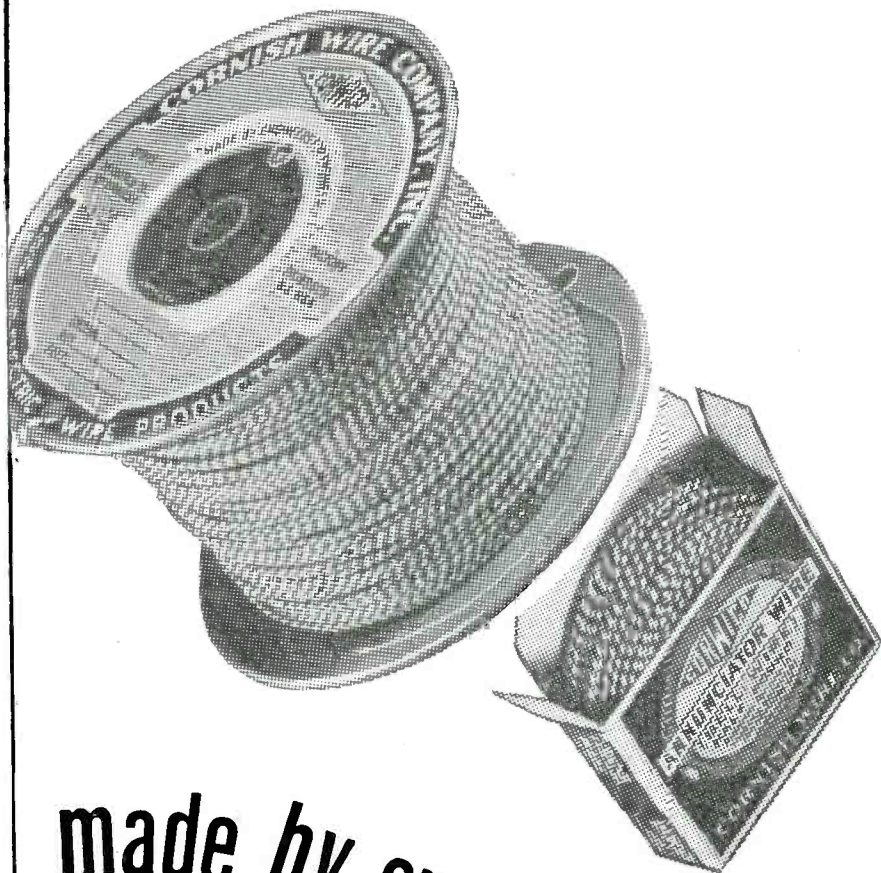


F-M CONVERTERS

(Continued from page 28)

frequency. With this model, the old f-m model was tuned to maximum response to this i-f signal, thus peaking it to the proper i-f frequency. This feature was especially useful when the converter was used with those sets in which the same dial assembly was used for both a-m and f-m reception.

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LOUDSPEAKERS

(Continued from page 29)

tweeter driver unit of the diaphragm type mounted on the rear of the woofer-cone driver. The high-frequency sound is fed through a passage in the center of the woofer pole. One design uses a small cellular horn to radiate this high-frequency sound. Another kind utilizes a woofer cone of a special shape to act more or less as a high-

frequency horn, thus dispensing with the separate cellular horn.

Air Horns

There are many special types of speakers available too. One is the air horn. This is an entirely different kind of loudspeaker for it consists of an electrically operated valve, which modulates a stream of air. It has two chief advantages: (1) it produces very high sound pressures with relatively low electrical amplifier power and (2) the driver required is only a fraction

(Continued on page 31)



Fig. 6. Type H coaxial speaker. (Courtesy Jensen)

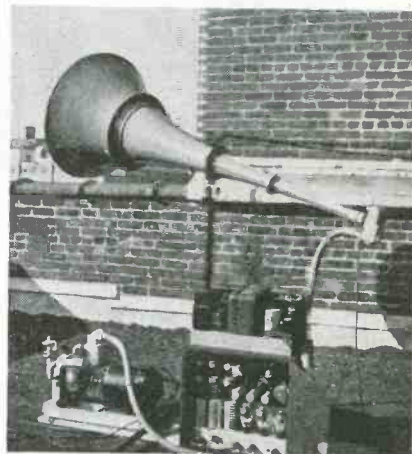
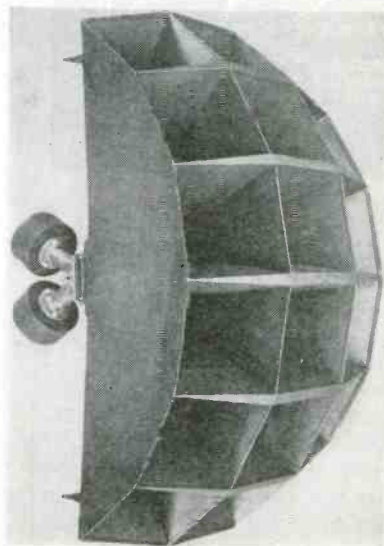


Fig. 7. Air horn assembly.

Fig. 8. Cellular type horn with tweeters. (Courtesy Altec Lansing)



of the size of a conventional type which would produce the same high output solely from electrical power input. However, as the power must be supplied somehow, it must come from the air stream. Hence, a unit consisting of an air compressor, pressure regulators, filters, and either electric motor or internal combustion motor, is a necessary adjunct to the air horn. The overall efficiency therefore, is not necessarily greater than that of a conventional loudspeaker. It has many maintenance problems, and the equipment cannot be adjusted or repaired by the average Service Man. As it is subject inherently to distortion, its frequency response is limited, and it produces a constant hiss due to the air stream. Its use is limited to high-intensity speech coverage over comparatively great distances and high interfering noise levels.

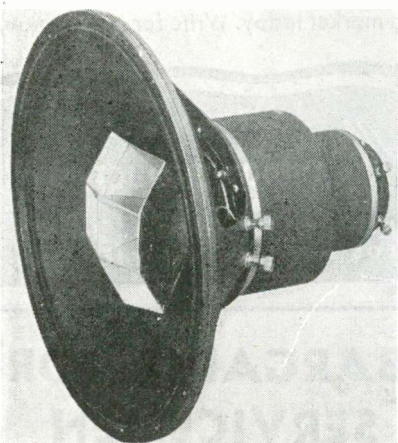
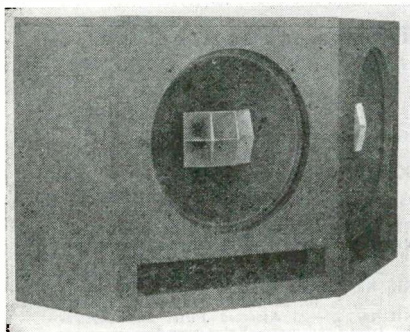


Fig. 9. Duplex speaker with woofer-tweeter. (Courtesy Altec Lansing)

Fig. 10. Multicellular horn with two h-f units. (Courtesy Altec Lansing)



Correction

In the discussion of velocity microphones, in the July issue of SERVICE, the metal ribbons should have been called loosely-stretched ribbons with a natural period below the audio range; output impedance is very low, with a mike-to line transformer to increase impedance.



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FINGER-TIP CONTROL. Hundreds of exact frequencies instantly selected. No confused dial to read. No band switch. I.F., Broadcast, Shortwave, and Ultra Hi Frequencies with or without 400 cycle note.

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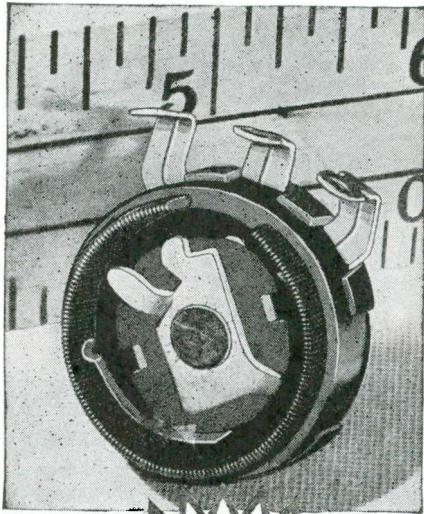
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SER-CUITS

(Continued from page 26)

limiting the load on the detector. The radio-phono switch opens the B circuit to the 12SA7 and 12SK7 i-f amplifier to prevent radio interference and provide a little more audio output through an increased plate voltage. A .002-mfd capacitor across the first audio output is switched in on radio and phono for low tone position. Again, we have hum bucking in the output transformer. Some models use 4" x 6" elliptical speakers, others standard 5" p-ms.

RCA Victor 55F

Fig. 3 shows the RCA Victor, model 55F, battery powered, wood-cased farm receiver, with a 1N5 r-f amplifier and untuned first detector. A standard antenna transformer is used in conjunction with an external antenna for maximum pick-up. The r-f amplifier is coupled to the 1A7 detector by a 5600-ohm plate load resistor, through a 7-ohm choke and 120-mmfd capacitor. An i-f wavetrap is placed in parallel with the detector.

A high gain 1N5 i-f amplifier uses two iron-core transformers, the output transformer being tapped for screen grid feedback. The detector load consists of 47,000 ohms in series with a 1-megohm control.

A 2-deck power switch cuts in a B series resistor (680 ohms) in addition to the usual bias resistor (390 ohms) to overbias the 3Q5 output tube for more economical operation. Distortion is increased and power reduced as a sacrifice.

Line-Powered Supply

The set draws 14 ma in the maximum output position and 10 ma in the battery saver position. The 1.5 volt A drain is 300 ma. Provision is made for connecting a line-powered supply unit, known as the CV-42 Electrifier, Fig. 4.

A 35Z5 supplies both A and B power with the filaments connected in series. A ballast tube takes care of the 35 volts needed for the rectifier. This tube has a 2300-ohm element to limit the A current to about 50 ma.

A 3-unit A filter electrolytic contains 50 mfd 150 volts; 30 mfd 150 volts; and 250 mfd 10 volts. The B series element is a 2700-ohm resistor.

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... BUT BETTER
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Kits for Servicemen

Kit No. 200—200 resistors ranging from 50 ohm to 5 Meg.—1/4, 1/2 and 1 Watt. 5.95
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Kit No. 100—100 Assorted By-pass and Buffer Condensers—Regular dealer's cost over \$2—our price to you. 6.95
Kit. No. 45—45 Assorted Wire wound Resistors, 5, 10, 20 and 50 Watt. 5.95
Kit No. 25—25 Assorted Filter and Electrolytic Condensers—Value over \$9. 3.95

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NEWS

PHILCO LICENSES RCA

Philco Corporation has licensed RCA to use the Philco advanced f-m system and approximately 600 other Philco patents.

* * *

E. G. BROWN JOINS BROWNE AGENCY

E. G. Brown, former advertising manager for the Hallicrafters Co., has joined Burton Browne Advertising, Chicago, Ill.



* * *

CENTRALAB TO ISSUE TEMPORARY BULLETINS

Because of changing conditions in the industry at present, temporary bulletins will be issued by Centralab, division of Globe-Union Inc., 900 East Keefe Avenue, Milwaukee 1, Wisconsin. The information contained in these bulletins will be incorporated later into permanent catalogs.

The first of these bulletins, 933, covers bypass and coupling capacitors. This bulletin includes values, tolerances, working voltages, power factor limits, leakage resistance, color code and dimensions.

* * *

WADDELOW WINS WALSCO HOLLYWOOD TRIP

F. S. Waddelow, owner of the Radio Doctor, Champaign, Illinois, was the winner of the trip to Hollywood at the recent Chicago parts show drawing held by the Walter L. Schott Company, Beverly Hills, Calif.



Left to right: Donald J. Terwilliger, sales manager of Walter L. Schott Company; H. W. Clough, vice president of Belden; Mr. Waddelow, and Walter L. Schott.

* * *

SHERWOOD NAMED TO PARTS SHOW BOARD

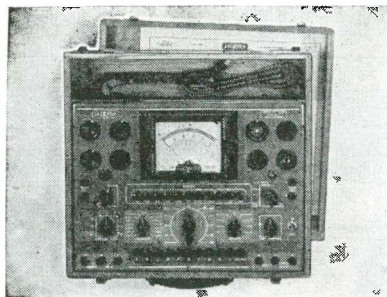
Rollie Sherwood, sales manager of Hallicrafters, has been appointed to the board of directors of Radio Parts and Electronic Equipment Shows, Inc. He will serve as a representative of the Association of Electronic Parts and

(Continued on page 34)

ALL IN ONE PACKAGE



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Full Range Filament Selection—from 3/4 V. up to and including 115 V. . . Filament selector marked directly in volts at each position.

Tests All Tubes—all of the popular receiving types and television amplifiers, including Bantams — Miniatures — Loctals — Single Ended — and High-Voltage Filament Types. Provision for many more. Two spare socket positions are provided on panel.

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400,000 (3,000 ohms center); 0 to 4 megohms
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NEWS

(Continued from page 33)

Equipment Manufacturers for a term of
two years, 1947 and 1948.

J. A. Berman, Shure Brothers, has
been reelected to the board, to represent
the parts and equipment manufacturers.

ZUCKERMAN JOINS RADIO

Walt Zuckerman has joined Sun Radio
& Electronics Co., Inc., 122-124 Duane
St., New York City, as head of the ama-
teur sales and technical department.

ELLEFSON NAMED DIRECTOR OF SYLVANIA CENTRAL ENGINEERING LAB

Dr. Bennett S. Ellefson has been ap-
pointed directed of the Central Engineer-
ing Laboratories of Sylvania Electric
Products Inc.



HALLICRAFTERS SETS UP SERVICE CENTERS

Six centers have been set up through-
out the country for the checking, repair-

ing, and servicing of Hallicrafters equip-
ment by the Hallicrafters Company,
Chicago.

The six centers are in New York City,
Los Angeles, Seattle, Pittsburgh, Chi-
cago and Butler, Missouri.

HARADEN PRATT REELECTED RTPB CHAIRMAN

Haraden Pratt, Mackay Radio and
Telegraph Co., has been reelected chair-
man of the Radio Technical Planning
Board, 1 East 79th Street, New York 21,
N. Y.

J. L. Middlebrooks, NAB engineering
director, has been named vice chairman.

WALTER M. NORTON BECOMES PRESIDENT OF RCA VICTOR DISTRIBUTING CORP.

Walter M. Norton has been named
president of the RCA Victor Distribut-
ing Corporation. Mr. Norton will con-
tinue as director of the recently organized
distribution department of RCA Victor.

ELLINWOOD BUYS RADIOTONE

Ellinwood Industries, Los Angeles,
Calif., have purchased the assets of
Radiotone, Inc.

Included in present production are two
portable recorders, the RA-116 and the
R-116, and the D-116, the latter a dub-
bing table.

The RA-116 is a 16" dual-speed re-
corder. The amplifier incorporates phase
inversion, inverse feedback and tone
equalization.

The R-116 is a 16" dual-speed recorder

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my set please." That's the cus-
tomer specifying "Raytheon"—a
name he knows to be synonymous
with quality and dependability.
Stock Raytheon tubes to keep
your customers happy; to keep
your business growing.

without the amplifier or speaker, but incorporating the same recording mechanisms as that used in the RA-116.

The D-116 dubbing table has a 16" turn table.

* * *

FINDLAY NOW LITTELFUSE AD AND SALES PROMOTION MANAGER

John Findlay has been named advertising and sales promotion manager of Littelfuse Incorporated, 4757 N. Ravenswood Ave., Chicago. Mr. Findlay was recently managing editor of *Industrial Marketing*.

* * *

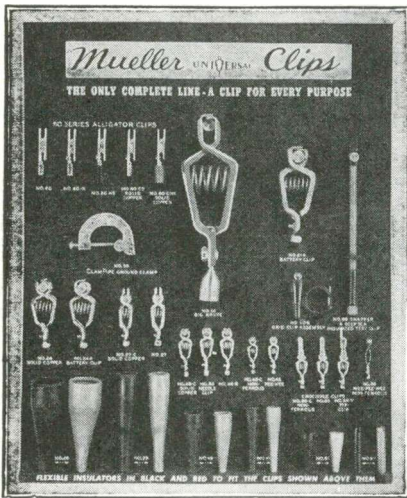
C-D CAPACITOR CATALOG

A 24-page catalog describing dry electrolytics, tubular papers, shell paper capacitors, auto radio capacitors, micas for transmitting and receiving, test instruments and instrument filters, has been issued by Cornell-Dubilier Electric Corporation, New Bedford, Mass.

* * *

MUELLER DISPLAY BOARD

A 17" by 21" display board, No. 122, showing clips, 12 insulators for clips and three other items, has been released by the Mueller Electric Co., 1583 East 31st Street, Cleveland 14, Ohio. Identifying code numbers are printed under each item, corresponding sizes of clips and insulators are matched and samples are detachable.



* * *

GUARDIAN RELAY BULLETIN

A 4-page bulletin describing series-200 Guardian relays with interchangeable coil and contact assemblies, and kit of series-200 switch parts, has been released by Guardian Electric Mfg. Co., 1606 West Walnut Street, Chicago 12, Ill.

Assortments consist of four coils in 6, 12, 24 and 115 volts a-c and five coils in 6, 12, 24, 32 and 110 volts d-c, each interchangeable with one single-pole double-throw and one double-throw double-pole contact assembly.

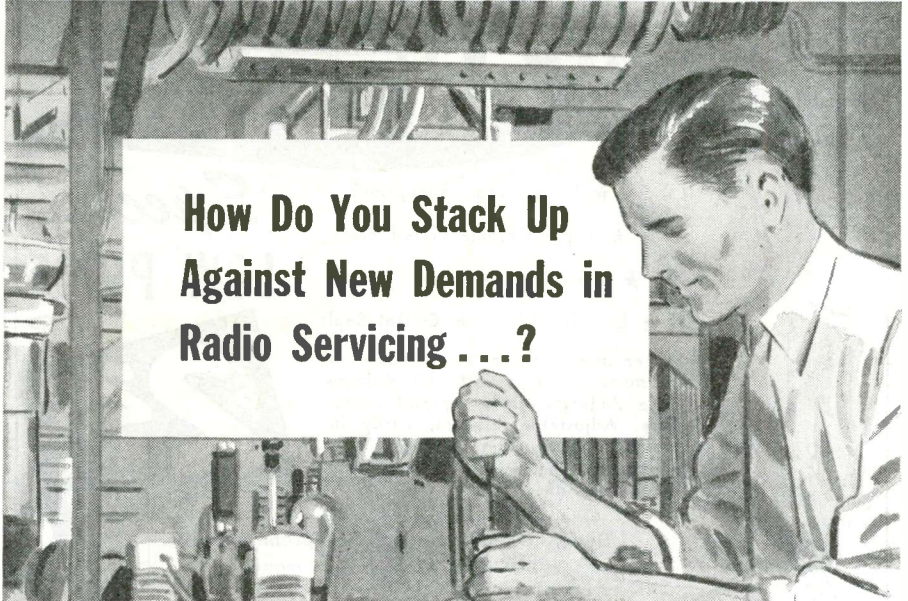
* * *

SHALLCROSS RESISTOR WALL CHART

Fifty-four resistor types are illustrated and described in a wall chart prepared by the Shallcross Manufacturing Company, Collingdale, Penna. Chart offers dimension data, mounting specifications, minimum and maximum resistance values, tolerance, temperature charts, temperature coefficient data, etc.

A copy of the chart is available free of cost; ask for the Shallcross Akra-Ohm resistor engineering data chart.

CAPITOL RADIO ENGINEERING INSTITUTE—Where Professional Radiomen Study



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Soon—Television, UHF, FM Units and other Electronic Equipment Will, or Can, Be Coming to YOU for Servicing . . .

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While lots of fellows always agree with good advice, somewhere within them there is an apparent *resistance* to it, that keeps them from *acting*, soon enough. Don't be one of those chaps. *Action* today for Radiomen means the acquiring of all knowledge, experience and training you possibly can in the new developments in Radio-Electronics.

E. H. Rietzke
President of CREI

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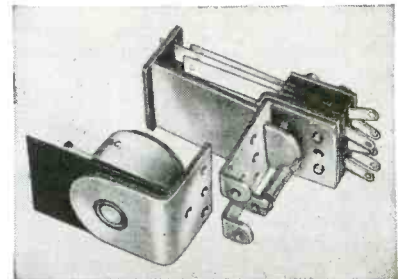
NEW PRODUCTS

GUARDIAN INTERCHANGEABLE RELAY COILS AND CONTACT ASSEMBLIES

Relays, series 200, which feature an interchangeable coil and operate on any standard voltage or current, have been developed by Guardian Electric Manufacturing Company, 1606 West Walnut Street, Chicago 12, Illinois.

Relay consists of two basic parts, a coil assembly and a contact assembly. Held together with two screws and lock-washers.

Series-200 assortment permits separate relay combinations by making different connections on the switch blade terminals and putting together any of nine standard a-c or d-c coils with either of two switch assemblies, single-throw double-pole or double-pole double-throw. An extra kit containing contact switch parts permits making contact combinations up to four-pole double-throw.

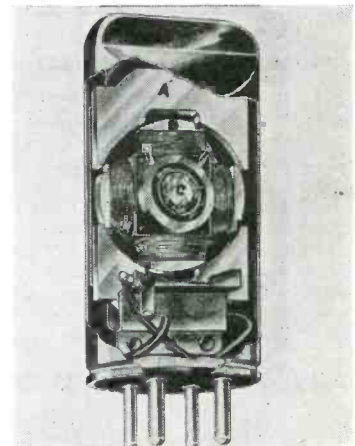


DYNECTRON ROTARY CONVERTER

A plug-in type rotary converter, the dynectron, has been developed by Ohio Tool Company, Cleveland, Ohio.

In this converter the current-interrupting action is rotary, in comparison to the vibrating action of the vibrator.


The making and breaking of the current occurs in a steel enclosed glass cell, containing tungsten-tipped electrodes which alternately make contact with a small pool of mercury, all sealed in a vacuum.



Cross-sectional view of the converter. Rotary action of converter is the result of attraction and repulsion of the electrically energized magnets, B, to the permanent Alnico magnets, A.

AEROVOX UNIVERSAL CLEAT-MOUNTING CANNED ELECTROLYTICS

General-purpose cleat-mounting electrolytic capacitors in aluminum cans, type

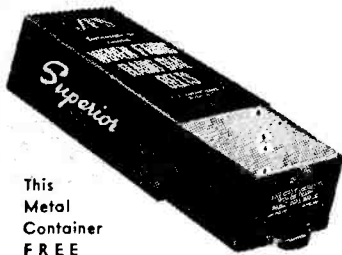


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ITS ROUGHNESS ASSURES SMOOTH PERFORMANCE

Made of buna S rubber (#3 thin single) with smooth rubber cover on outside and rough finish on inside. Standard equipment with set manufacturers — resistant to atmospheric changes — more pliable and rougher — insuring positive grip on shafts and pulleys. Its popularity has made it the largest selling Radio Dial Belt in the U.S.A.



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4111 FT. HAMILTON PARKWAY · BROOKLYN 19, N. Y.

PRVC, have been developed by Aerovox Corporation, New Bedford, Mass.

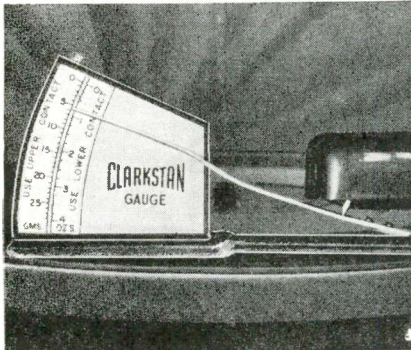
Electrolytics have insulated positive and negative wire leads, color-coded for polarity. Multiple-section units have concentrically-wound sections with common negative lead. Available in popular ratings and capacitances.



* * *

CLARKSTAN PHONO NEEDLE PRESSURE GAUGE

A gauge to check the weights of tone arms and pickups, the Clarkstan Corporation, 11927 West Pico Boulevard, Los Angeles 34, Calif., have developed a needle pressure gauge.



* * *

FTR HOOK-UP WIRE

A thermoplastic insulated radio hook-up wire, tested to underwriters standards, has been announced by Federal Telephone and Radio Corporation, Newark, N. J.

Features include free stripping, high resistance to flame, abrasion resistance and resistance to oxidation. Wire is available in solid or stranded types ranging in size from 24 to 14 for high or low voltage needs and comes in 14 colors.

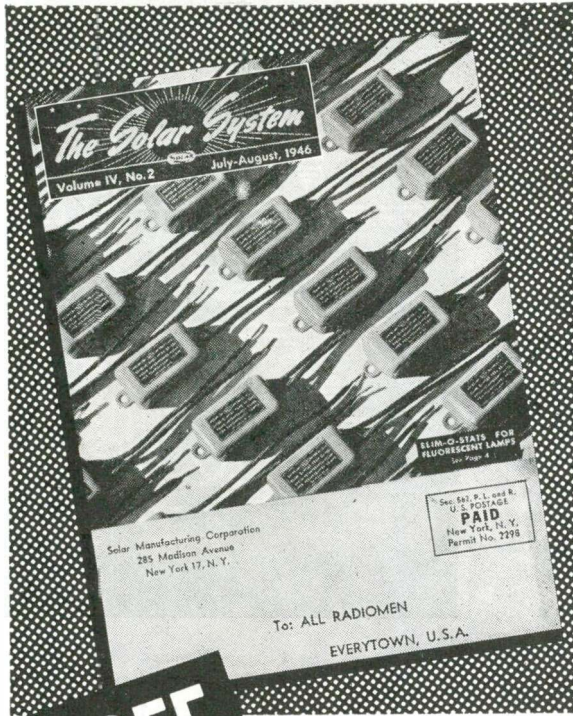
* * *

FEILER SIGNAL-TRACING ANALYZER

A signal-tracing analyzer, TS-2, has been produced by the Feiler Engineering Co., 803 Milwaukee Ave., Chicago.

Has built-in high impedance isolation network; permits connection directly across high impedance circuits with minimum effect.

Has r-f vacuum-tube voltmeter circuit to permit visual indication of r-f voltages. Has provision for output meter



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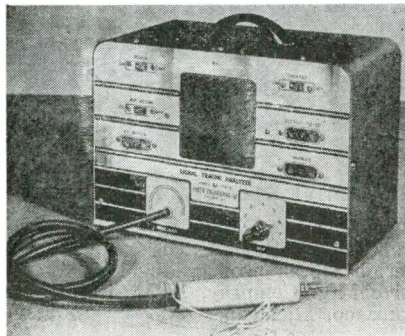
Name.....

Address.....

City.....Zone No.....State.....

for silent tracing. Equipped with headphone connection.

Uses two 1T4S and one 3O4; built-in



5" p-m speaker. Bakelite probe houses miniature tube, isolating network, and associated circuits for detector-amplifier.

* * *

ELECTRO-VOICE CARDYNE CAROID DYNAMICS

Single-head cardioid dynamic microphones, Cardyne-type, have been announced by Electro-Voice, Inc., 1239 South Bend Ave., South Bend 24, Indiana.

Utilizing the Electro-Voice mechano-phase principle, the Cardyne is said to provide cardioid unidirectivity, high output, wide-angle pick-up at front of microphone, but dead at rear. Sound at

(Continued on page 38)

SERVICING HELPS

by FRANK C. KEENE

IN SERVICING a Silvertone 1709, I found it necessary to replace a 37 with a 76, and noted rather odd results. With the 37 in the socket, it was impossible to get any plate voltage reading. However, in taking the 37 or 76 out of the socket, with the voltmeter leads still connected to the 37-socket prongs, the voltage rose to 200. The same results appeared with either tube. Installation of a coupling capacitor between the 37 plate and the 45 grid did not cure the voltage rise. Can you offer an analysis?—Carl E. Chapman.

To determine the source of trouble an ohmmeter check should be made from the socket lug to ground, with the tube in the socket. It is very possible that this particular lug is being grounded out when the tube is inserted. The only other possibility is that the plate resistor is opening up under load. This

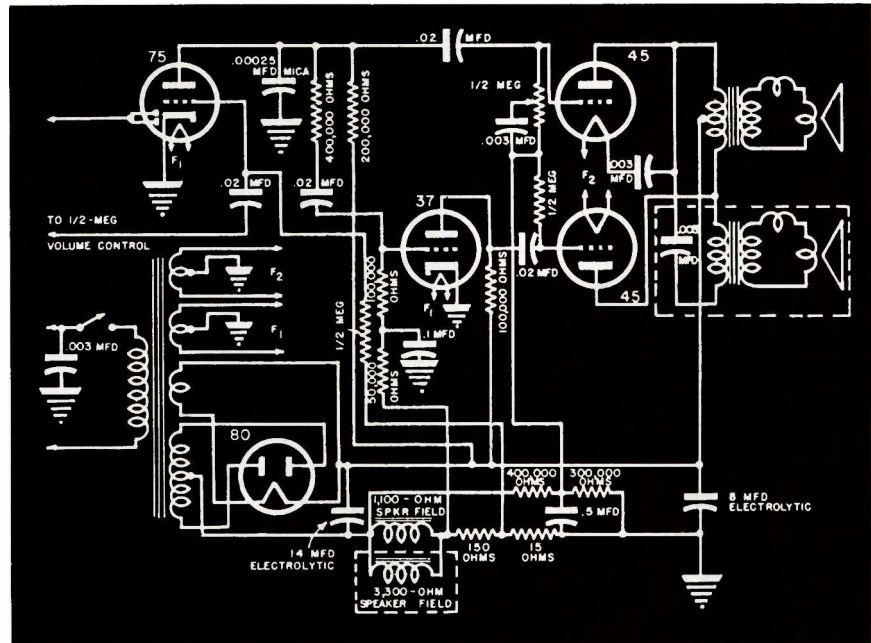


Fig. 1 (Chapman query). Circuit of the Silvertone 1709.

is a remote possibility, and can be checked quickly by putting another resistor in series with it to ground, with the tube both in and out of the socket.

According to the circuit, Fig. 1, the plate voltage on the 37 should read 145,

with a plate current of .9 ma. Therefore, the drop across the load resistor (100,000 ohms) should be 90 volts. If the voltage across the resistor is 235 volts; this is an indication that the plate socket lug is grounded.

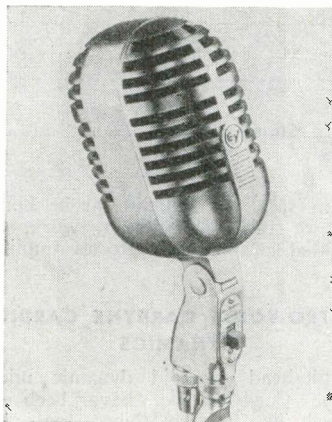
NEW PRODUCTS

(Continued from page 37)

rear dead zone cancels out and is not reproduced.

Output level (high impedance 25,000 ohms), 53 db below 1 volt/dyne/cm², open circuit. Stand coupler thread, 5/8"-27. Equipped with 20' shielded cable. Available in 50, 250, 500 ohms, or high impedance (direct-to-grid, 25,000 ohms). Low impedances balanced to ground.

Made in two models: the Cardyne II, model 731, 30-12,000 cps; the Cardyne I, model 726, 40-10,000 cps.



RADOLEK TRACER

A signal trace test unit, model 200, has been announced by the Radolek Company, 601 West Randolph Street, Chi-

cago 6, Illinois. Has a polystyrene tipped probe, and low capacity coupling.

ELECTRONIC LABS VIBRATOR INVERTER

A vibrator inverter, designed to permit operation of a-c phonographs with d-c, has been developed by Electronic Laboratories, Inc., Indianapolis, Ind.

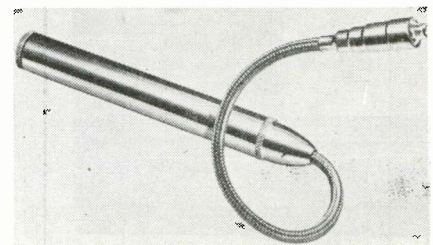
Unit measures 4 1/2" x 4" x 2 1/4" and weighs 14 ounces. With an input of 115 volts d-c, the inverter's output is 110 volts, 60-cycle a-c, providing a maximum load capacity of 25 watts.



AERO-MOTIVE FLEXIBLE FLASHLIGHT

A flexible flashlight, Zoo Flex-Lite, with a long flexible extension bulb retainer, has been produced by the Aero-Motive Mfg. Company, 1803 Alcott St., Kalamazoo, Michigan.

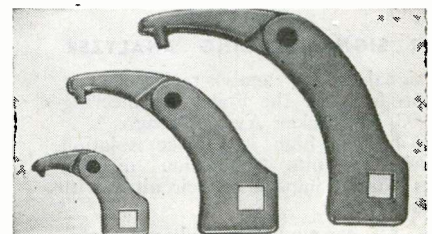
Made of polished aluminum. Uses two standard size AA batteries. Light is said to be waterproof.



JO MFG. CO. SPANNER WRENCH SETS

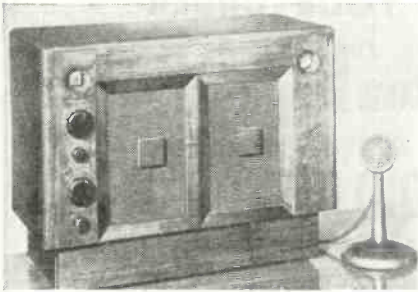
Adjustable spanner wrench sets have been added to the line of tools manufactured by JO Manufacturing Company, South Gate, California. Made in three sizes for 3/4" to 2", 1 1/4" to 4", and 3 1/2" to 6" diameters.

Each wrench set is of forged steel, heat-treated and cadmium plated. Set consists of a handle, removable screw, a key arm, and three pin arms in graduated sizes.

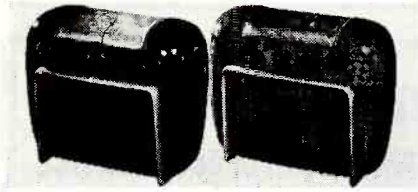


(Continued on page 40)

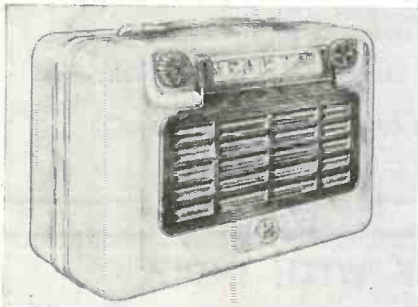
NEW MODELS



Jefferson-Travis film tape recorder, model HR2, that is said to have a recording time of 120 minutes.



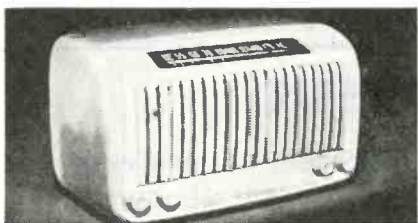
Crosley 4-tube single band a-c/d-c end table receiver, models 56TD, TE and TF. Has enclosed loop antenna and 4" pm speaker.



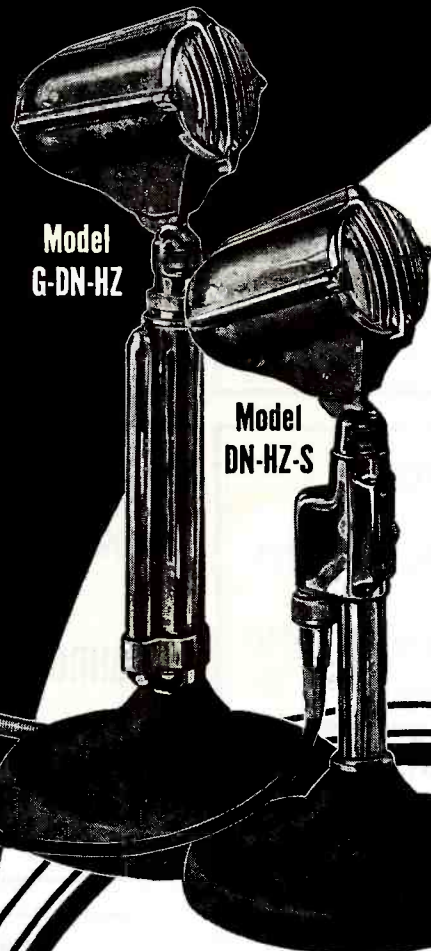
Hoffman Radio A-700 portable battery set featuring a permeability tuned r-f amplifier stage. Supplied with an *Antenna Dor* that permits lowering of loop antenna to increase antenna pickup.



Above, Olympic 6-tube portable, operating on a-c/d-c and batteries, designed by Olympic Radio & Television (model 6-606). Below, two-band 6-tube a-c Olympic receiver, using one stage of r-f and a single turn skirtwave loop (model 6-601).



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Model
G-DN-HZ

Model
DN-HZ-S

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of different output impedances, are available: DN-50, DN-200, DN-500 and DN-HZ.

Any one of these models is available with the Type G, Grip-to-Talk Desk Stand. Only one model, however, DN-HZ-S, high impedance, is available with the Type S On-Off Switch. Astatic Dynamic Microphones are semi-directional in character, incorporate a unitary moving coil system and carefully proportioned acoustic circuit to highly damp the natural resonance of the moving parts and provide a response substantially flat from 50 to 7,000 cycles. All DN-Series Microphones are sturdy and dependable, relatively low in cost, smartly streamlined, attractively finished in opalescent gray with bright chrome grille, and sure to give long, satisfactory service.

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RCP 802-N tube & set tester..... 59.50	SIMPSON 240 "Hammetor"..... 26.50
APPROVED R.F. sig. gen..... 49.50	TRIPLETT 2413 tube tester..... 49.50
WATERMAN 2" oesilloscope..... 55.00	TRIPLETT 2432 slg. gen..... 88.50
TRIPLETT 625-N v.o.m..... 45.00	TRIPLETT 666-H v.o.m..... 20.00

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For the Man Who Takes Pride in His Work

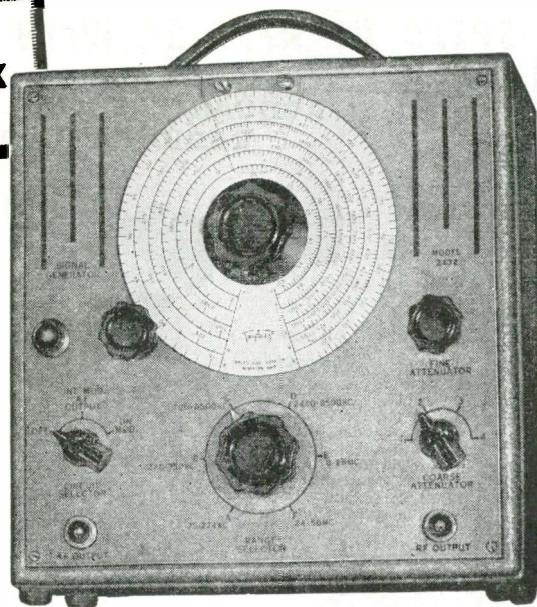
MODEL 2432 SIGNAL GENERATOR

Another member of the Triplett Square Line of matched units this signal generator embodies features normally found only in "custom priced" laboratory models.

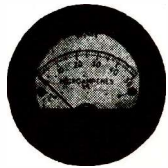
FREQUENCY COVERAGE—Continuous and overlapping 75 KC to 50 MC. Six bands. All fundamentals. **TURRET TYPE COIL ASSEMBLY**—Six-position turret type coil switching with complete shielding. Coil assembly rotates inside a copper-plated steel shield. **ATTENUATION**—Individually shielded and adjustable, by fine and coarse controls, to zero for all practical purposes. **STABILITY**—Greatly increased by use of air trimmer capacitors, electron coupled oscillator circuit and permeability adjusted coils. **INTERNAL MODULATION**—Approximately 30% at 400 cycles. **POWER SUPPLY**—115 volts, 50-60 cycles A.C. Voltage regulated for increased oscillator stability.

CASE—Heavy metal with tan and brown hammered enamel finish.

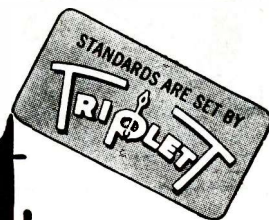
There are many other features in this beautiful model of equal interest to the man who takes pride in his work.



*Precision first
...to last*



Triplett



ELECTRICAL INSTRUMENT CO. BLUFFTON, OHIO

4-TUBE A-C CLOCK-CONTROL RECEIVER

(See Front Cover)

A FOUR 150-MIL TUBE T-R-F RECEIVER, that can be preset for *on* operation by a clock, is shown on the cover this month. The G.E. 50, this model operates off the 105-125/60-cycle lines with series filaments.

A 2-gang permeability tuned unit tunes the input and output circuits of a 12SG7 r-f amplifier for a high gain. An unusual feature is the use of a diode detector with a standard avc system. A 12SQ7 first audio is followed by a conventional 50L6 and p-m.

The external antenna is resistance coupled to the r-f grid across 100,000

ohms through a 22-mmfd capacitor. A 220-ohm grid suppressor is used to discourage oscillation at the high-frequency end of the band. A 39-ohm cathode bias resistor without bypass is also used to limit regeneration. The cathode is connected to the chassis through 470,000 ohms, and a .05 bypass is connected from chassis to *B* line. A capacity-voltage divider, or impedance-matching system, is used to couple the r-f output to the diode detector with somewhat more than half of the resonant circuit voltage being fed to the 150-mmfd coupling capaci-



G.E. clock-radio receiver with an alarm selector control. Clock turns on radio at pre-determined hour.

tor. The divider consists of a 430-mmfd capacitor and an adjustable 270 to 325-mmfd unit, the output being taken across the latter.

To minimize detector loading of the tuned circuit, 47,000 ohms are used ahead of the 1-megohm volume control and 220-mmfd detector capacitor. A 2.2 megohm resistor is also used for the avc circuit to shunt this detector load. The second 12SQ7 diode is tied to the avc bus for initial bias. The detector load is also made lighter by using a 10-megohm leak for the first a-f. The triode's load resistor is high, 1 megohm, to obtain maximum gain. The 50L6 grid leak is 470,000 ohms, as high as permissible. The

(Continued on page 42)

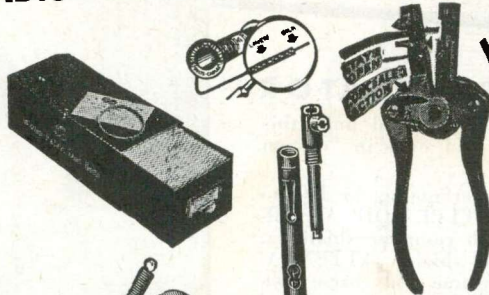
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Dial Cables, Dial Belts,
Packaged Hardware,
Cabinet Repair Kits

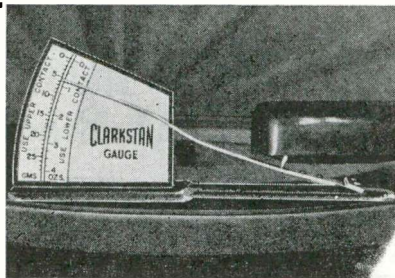
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ROCKFORD, ILLINOIS

CLARKSTAN Phono Needle GAUGE



Has Calibrated Dial readable to one-gram.

ACCURATELY indicates phonograph needle pressure. Quickly reveals overweight or unbalanced pick-up tone-arms that cause damaging record wear and surface noise. Easily convinces customers of need for change to a new lightweight tone-arm. Every radio serviceman, technician, engineer, manufacturer and salesman will find a Clarkstan Gauge helpful and profitable in adjusting tone-arms. See your jobber or write for Bulletin No. 109.

CLARKSTAN CORP., 11927 West Pico Boulevard, Los Angeles 34, Calif.



OLD TIMER'S CORNER

by **SERVICER**

A FEW WEEKS AGO, Jack had asked me to do him a favor. While it seemed simple enough, I soon found myself facing a tough, but really tough problem. He had opened his business many years ago and, like so many of us, had expanded and expanded until it turned out to be a large store with some ten helpers and a lot of stock and everything. In short, it was *big*

business with a couple of capital B's. Of course the war had taken its toll and he had lost a lot of his good sales personnel; and after the great fracas was over, he had tried to get them back. For the most part, however, the boys who went had decided they were not coming back. One had gone in for further schooling under the GI Bill of Rights, another had married and gone into business with his father-in-law, and so on. Out of the group, only two had come back, the janitor and the office manager. Jack had had to hire a whole new staff and he was very unhappy about it all.

"Darn it all," he told me, "I've hired bright young salesmen with lots of personality and loads of zip and push. We got the merchandise and we have the prettiest store in the country. We have the customers and we make it exceptionally easy for them to buy. Yet sales are falling off at an alarming rate while those of my nearest competitor are rising in the same ratio. I'm puzzled. Perhaps you can stay around a few days and discover what is the trouble," he concluded.

So I hied myself over to his store at odd hours and watched the sales personnel work. And I came to some very definite conclusions. But it was not easy to tell Jack that his salesmen just weren't—salesmen! Nice guys, sure. But salesmen? No! And, what's more, I hated to tell Jack what I had found out because he was so inordinately proud of his ability to pick salesmen. So I compromised.

When time came to tell Jack, I said: "About what I discovered, Jack, it will do no good to tell you what I found out. Suppose though I tell you what is required of a salesman. Then you can, with your native intelligence, figure what to do yourself. Okay?"

Jack said it was, and here is what I told him about salesmanship:

There are five golden rules of salesmanship and every salesperson should know them all. Even if he or she does not know them by name, he should follow them. Here is the list, which I have called the *Lifeblood of Sales*.

(1) *Know what you are selling.* This does not mean just to know that a radio set is a Philco or an RCA with 8 or 10 tubes. One must know more about it. What is the nearest cheaper set, and the next more expensive? What is the advantage of the particular set over its competitor? What are the other types of sets on the market, who sells them and at what price? How are the chances of getting replacements for tubes or parts? Will it function where the customer wants to use it, or will it need a special installation? These are but a few points that a salesperson must know. There are many, many others.

(2) *Know your customer.* It is not enough to know his name or his family. Try to find out how he thinks, what business he is in, what his interests are, why he wants to buy, and what his wife thinks of the idea. The more you learn about a customer, the easier it is to reach him and get him to buy. That does not mean that you should hire only salespersons who are familiar with every person in the neighborhood. Rather, you should use salesmen who have the knack of making customers feel that they have known the salesman for years and years, even if they have only just met him. While this is not too important in small sales, it becomes increasingly important as the unit dollar volume goes up.

(3) *Be honest.* That's a hard one to talk about; no one will admit that he or she is a dishonest salesman. Such people, and there are many, are those who knock a competitor's product when in fact they are only repeating rumors. Dishonest salesmen make promises which neither they nor the house for which they work have any intention of keeping. They then

(Continued on page 43)

COVER DIAGRAM

(Continued from page 41)

screen grid is run at a lower voltage than the plate which increases the voltage gain at the expense of output power.

The power filter uses an 18-ohm surge limiting resistor, 40 and 30 mfd capacitor and 2,200 ohms. A 20-mfd bypass is used across the 150-ohm cathode resistor.

OLD TIMER'S CORNER

(Continued from page 42)

expect to crawl out of these promises by saying that the manufacturer held them up. Dishonest salespersons are those who will make a general statement which can be applied to a given set of facts only in one instance. For example, the salesman who says "F-m is better than a-m." This is true only if there is an unusual amount of static or interference in the locality of the customer. F-m is *not* better than a-m if both have clear channels and the a-m station is on a par with the f-m station in the matter of frequency transmission. If both transmit frequencies up to, say, 10,000 kc audio-wise, and there is no static and the signals are equally strong, there is no difference between them. It would be wiser to state under *what* conditions f-m is better than a-m, or vice versa. The customer will appreciate it.

A dishonest salesman will deal in fancies and gossip in the same manner as he will with facts, intermixing them to make up a logical story. That is wrong. Without honesty, there can be no real salesmanship. Honesty will always build good will, too, that indefinable something which brings customers back again and again to your store. So do not destroy it—build it up with honesty.

(4) *Get the order but get it at a reasonable profit.* Too many salesmen take unfair advantage of the customers. They will know the resale value of a set the customer wants to turn in, and yet to get an order, they will allow that particular customer more than what is fair. That amounts to a discount and when the house complains, the salesman usually takes the difference out of his own pocket. This means that one customer is treated differently from another with the same set to trade but handled by a different salesman. The test of good salesmanship is certainly to get the order, but to get it at a profit to the house and to the salesman.

There are others who think it smart to get an order and at the same time allow the customer far below a fair market price for the turn-in. These salesmen operate on the basis the customer should know the price he wants. They point out that this is a good way to get the order and make a bigger profit. But in the long run, the customer will find out he was bilked and will tell others. Thus what was a profit will turn into a loss of general business because of the distrust which has been generated.

(5) The last Golden Rule is a lot of rules thrown together. Watch your conduct (inside the business as well as outside). Be loyal to the house that you represent, and above all, be on your toes. There is not much that need be written or said about this rule since it is well understood. But too often that is *all* that is required of a salesperson and the other Golden Rules which are the *Lifblood of Sales* are forgotten or glossed over.

When I had finished, Jack looked up and said, "I guess I see what you mean and I think I can fix it. It seems that I need some good salesmen. I'll hire them and give them a transfusion of your *Lifblood of Sales*. That ought to help!"

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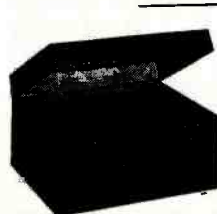
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JOTS AND FLASHES

MANY UNUSUAL PLANS are being made to demonstrate television receivers this Fall. Special rooms with cozy home settings have been designed by leading decorators and television-room specialists. While some of the rooms are of a rather luxurious nature, many are of the average type that will be found in most homes. Receivers will be placed so that it will be possible to see just how much room light can be tolerated during viewing . . . Harry W. Rubinstein, Thomas B. Hunter and Milton Ehlers, formerly with Centralab, have formed a ceramic capacitor manufacturing company, the Herlec Corporation, 442 N. 5th St., Milwaukee, Wisc. . . . Recent estimates indicate that there are over 200 manufacturers now licensed by RCA to make receivers . . . J. R. Little is now manager of the RCA theatre equipment section . . . J. F. D. Mfg. Company, 4117 Ft. Hamilton Parkway, Brooklyn 19, N. Y. is now shipping all distributor orders of \$50 or more net freight prepaid . . . Henry D. Sarkis has been named eastern sales representative of the Vokar Corp of Dexter, Michigan; Precision Parts Co. of Ann Arbor, Michigan and its Chicago subsidiary, Carter Radio. The New York office is at 43 Water Street . . . Harry S. Jones has become assistant chief engineer, in charge of research and development, for Lear, Inc., Grand Rapids, Michigan. He was formerly chief engineer of the instruments division of Thomas A. Edison, Inc. . . . The second issue of the "Olson News" has been published by the Olson Radio Warehouse, 73 E. Mill Street, Akron 8, Ohio . . . A three-story engineering and administration building is now under construction for the Weston Electrical Instrument Corp., Newark, N. J. . . . F. R. Ellinger has succeeded T. B. Hunter as Centralab representative in Chicago. Mr. Hunter will also cover the territory of Roland Moeller (Wisconsin-Illinois-Iowa-Nebraska) who recently resigned because of ill health . . . Additional space in the General Motors diesel equipment plant at Grand Rapids, Michigan has been leased by Lear, Inc. . . . Don G. Mitchell, president of Sylvania, recently received the American Marketing Association Meritorious Service Citation from Secretary of Commerce, Henry A. Wallace, at a banquet in New York . . . Two Hallicrafters mobile shortwave communications units have been purchased by the State of Illinois for disaster control. The units used are the SCR299, which were used by the U. S. Army Signal Corps during the war . . . The recent issue of *Sylvania News* contained a complete retail price list of receiving tubes . . . J. F. D. have purchased a factory site at 16th Avenue and 61st Street, Brooklyn, where they plan to build their sixth plant . . . DX Radio Products Co., Inc., Chicago, will move to a new plant at 2310 W. Armitage Avenue, where speakers, crystals, coils and loop antennas will be produced. . . . A miniature selenium rectifier, 1 1/4" x 1 1/4" x 11/16", is described in a folder recently released by Federal Telephone & Radio Corp. Circuit diagrams and application data are offered in this folder.

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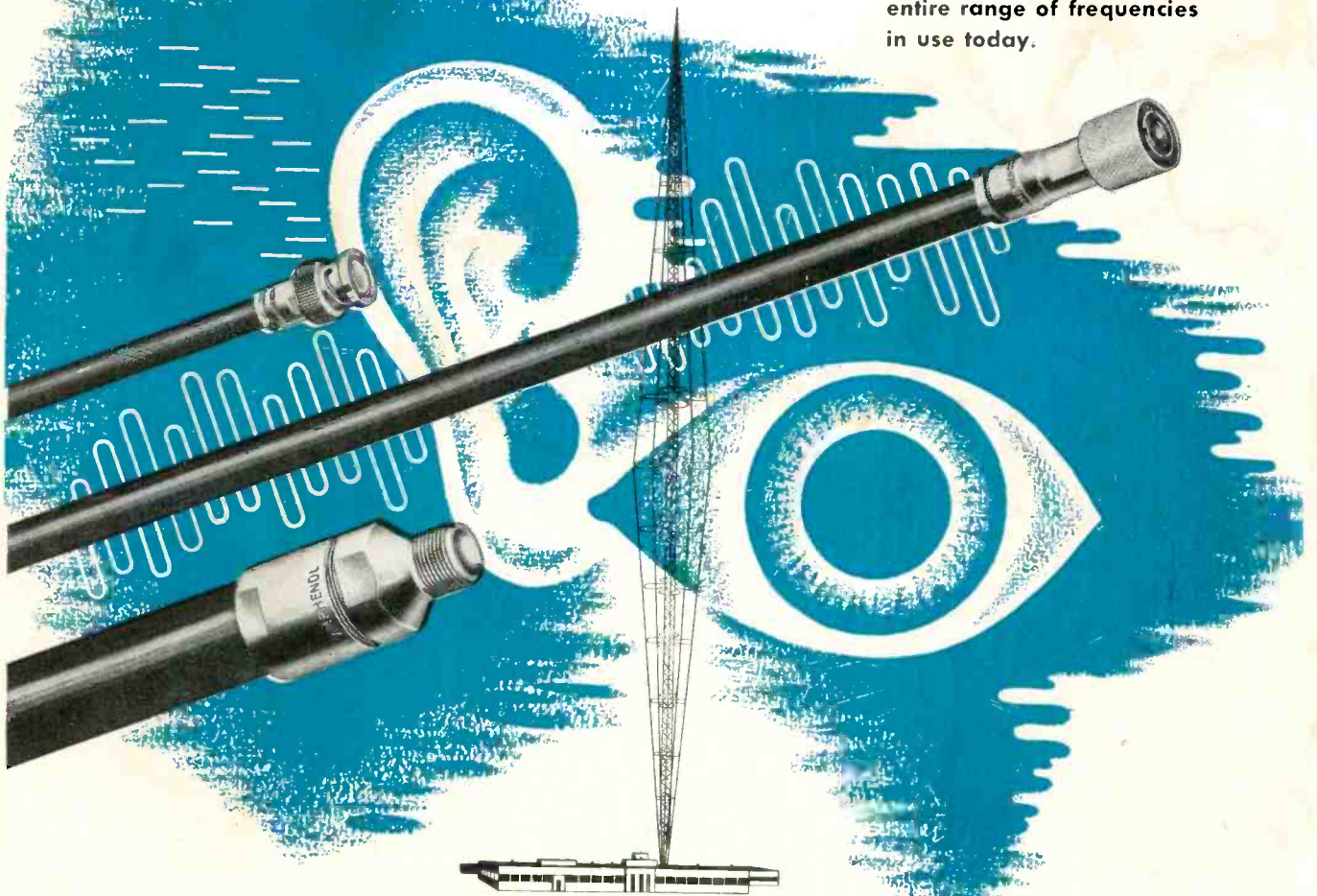
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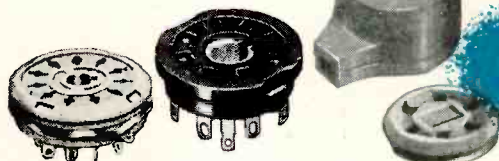
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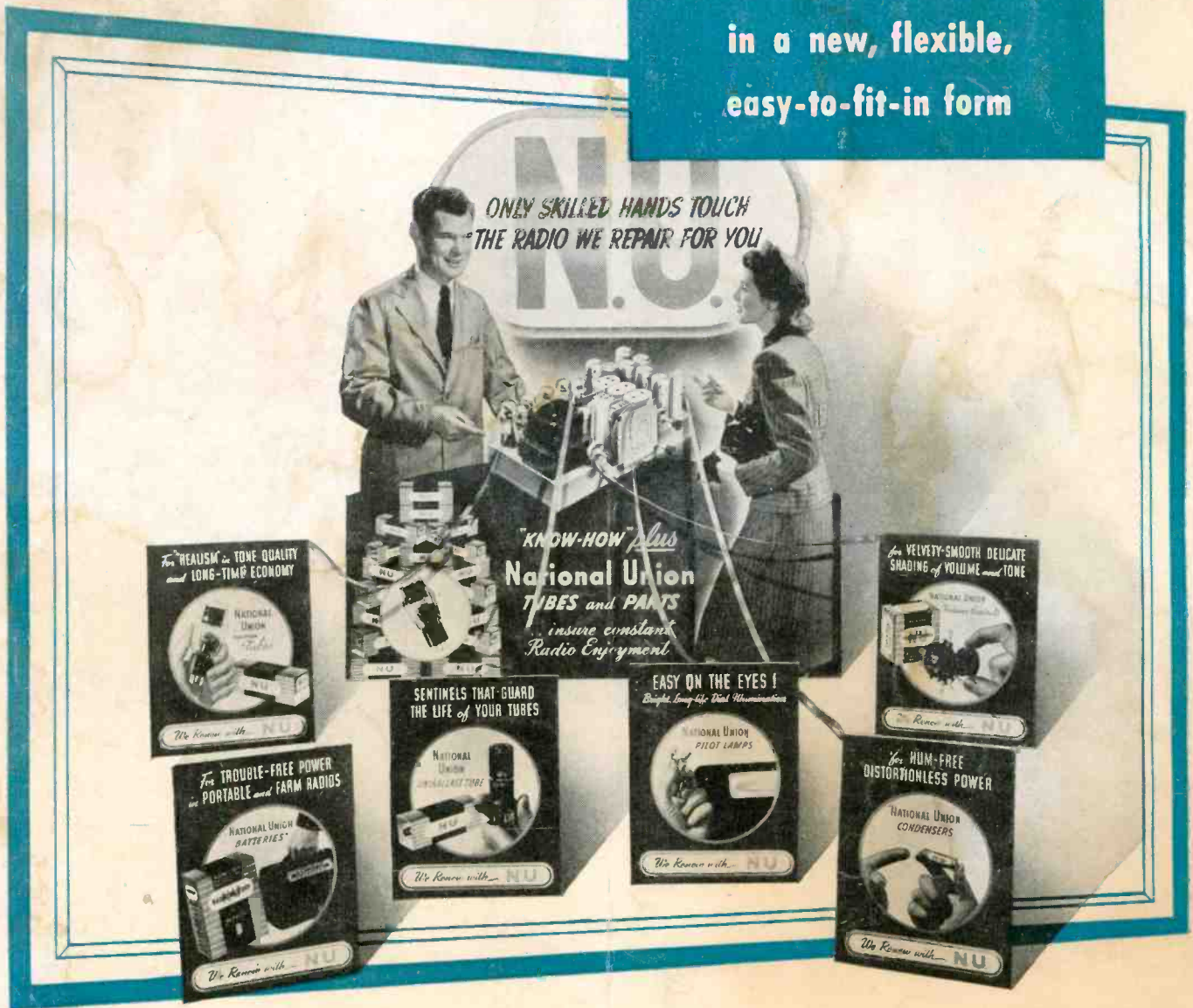


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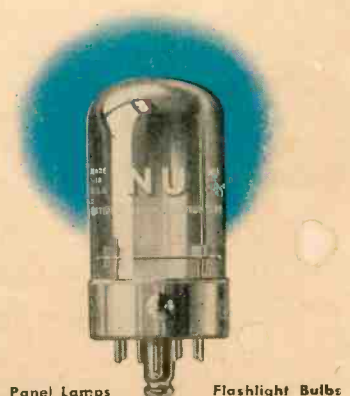
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