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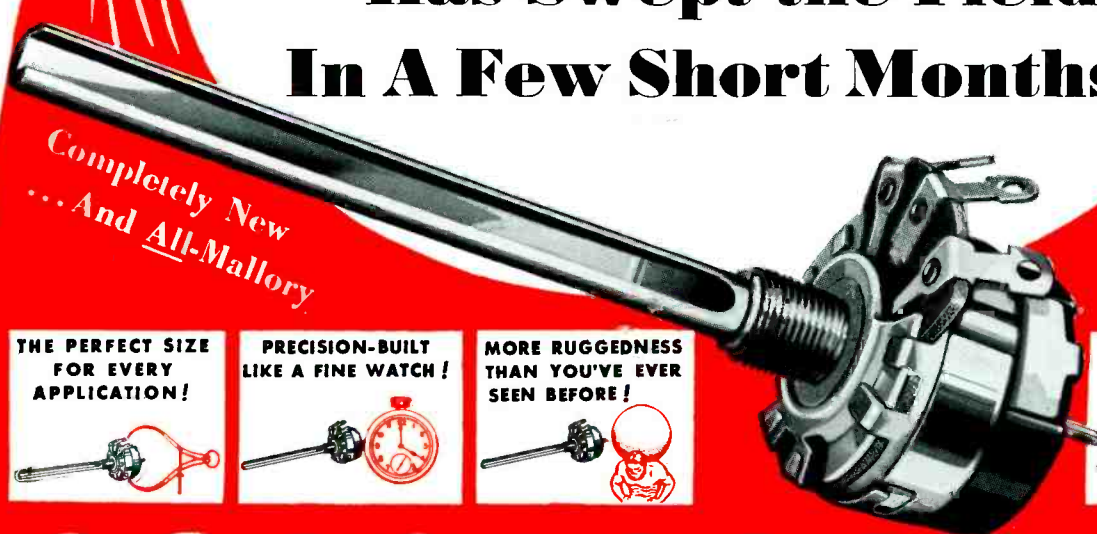
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ASITUATION which might be called "personnel priorities" exists in the radio servicing industry. By this we mean that the government has called upon Service Men to serve their country, not only in the armed forces, but also as technicians and in other capacities in connection with defense production. Because of the operation of the civil service system many of these latter men have naturally been taken from among the best that we have to offer. In general, they are the ones who owned quite an assortment of meters and service equipment before they answered Uncle Sam's call.

Do you suppose that any of these men sold their prized test equipment before they entered government service? You can bet your bottom dollar they didn't! From what we know of Service Men, they would rather sell their mother-in-law before they'd part with a single shunt—even at fancy prices.

Let's view the picture from a different angle. Curtailment of receiver production will definitely result in more service work. Men remaining in the servicing industry will require more and more equipment in order to do the extra work. Graduate students and others coming into the field will certainly need new apparatus. Because those Service Men who have temporarily left the industry are not inclined to sell their equipment, any survey of existing service equipment does not expose the crying need. If priorities are permitted to curtail production of service test equipment, how will this urgent need be met? Without proper equipment how will Service Men be able to maintain present receivers?

To cope with this situation, SERVICE believes that the production of test equipment, used for the repair of radio receivers, should be given a highly preferred priority rating.

ALTHOUGH iron-core coils have been in use for some time, they assume new importance in view of the present shortages of vital materials. Many manufacturers have already included models in which these coils eliminate the familiar aluminum tuning condenser. Others are planning to use these units in newer models. Because of this shift, you should make it a point to become thoroughly familiar with iron-core coils and their applications. On page 3 of this issue we present our feature article, "Permeability Tuning," by H. I. Danziger, with this thought in mind.

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PERMEABILITY TUNING

By H. I. DANZIGER

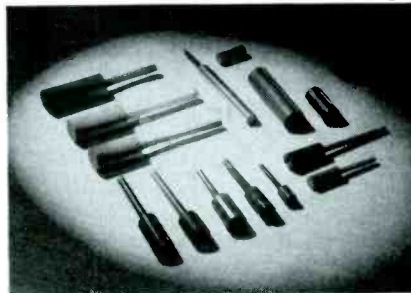
HENRY L. CROWLEY & COMPANY

SET DESIGNERS are depending more and more on high-frequency iron cores in meeting the present aluminum shortage. New types of cores serve to eliminate the usual aluminum shields for coils, while permeability tuners are taking the place of aluminum tuning condensers.

As far back as 1892 and probably as early as 1878, iron filings imbedded in shellac or resin were used for high-frequency applications. This led to the development of progressively smaller particles so that the art became largely a matter of degree and of the availability of productive methods for producing finer powder and holding and molding same into solid masses and shapes.

Antenna-Coil Cores

The first general use in radio of powdered iron cores was in the antenna coil,



Crolite high-frequency iron cores for permeability tuners are provided with screw insert for fixed insertion in coils.

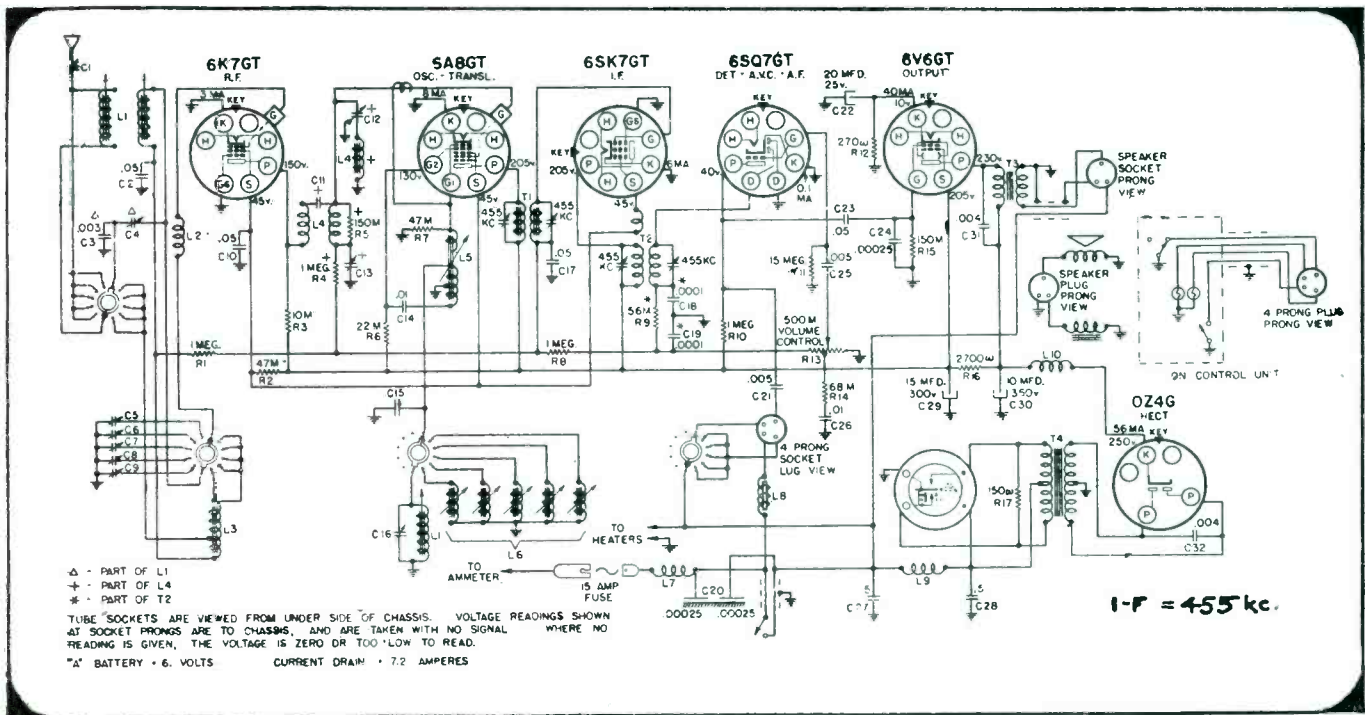
The Silvertone Model 667 auto-radio receiver (below) employs a three-gang permeability tuner as well as permeability tuned push-button rotary station selector.

especially for auto-radio set production. This purpose requires maximum Q; the permeability isn't too important. It has become almost an axiom that the higher the resultant Q the better the coil, which also means decreased background noise and the minimizing of other problems, both by increasing the gain and sharpening the tuning of the antenna circuit.

In the quest for higher Qs, the core was changed from the earlier 3/8" od by 1/2" long, to 3/4" by 1" lengths, while the winding changed from universal to a cross between bank and universal, and in some cases straight bank-wound. In special instances a completely closed core was used.

I-F Coil Cores

When the use of the iron core was extended to i-f coils, the requirements



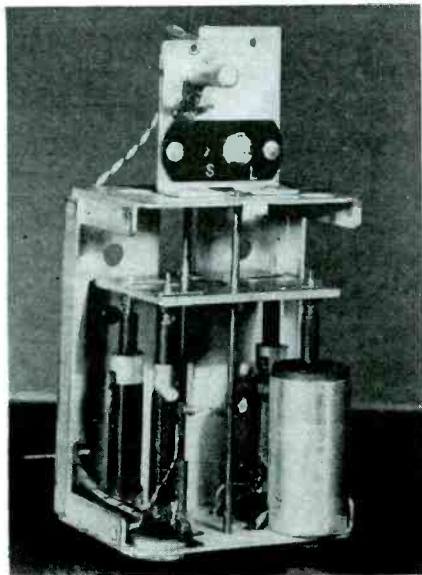


Crolite powdered iron core and shield, with coil inserted. The core at front slips into center of coil and shield. Slots in the shields accommodate the coil connections.

were quite different. Permeability began to play a far more important part, especially where the i-f peak was less than 465 kc. For this use it was necessary to develop a material with considerably better permeability. Losses naturally are not so great at these frequencies, hence Q is less important, and the most effective coil results from the use of a core with higher permeability.

The initial attempts to lower the cost of the i-f core led to the selection of various inexpensive materials. These materials were low in permeability and possessed other poor characteristics. In use these materials tended to change in chemical composition, and even more serious, have a permeability characteristic that increased with applied voltage. This naturally caused a change in inductance with increasing signal strength, and hence a definite frequency shift. This shift has been as much as 2 kc from a weak signal to a normal strong or local signal strength. In fact, the general use of permeability or ad-

This tuner has an r-f stage on all bands and covers the broadcast, 9, 11 and 15 mc spread bands. It is used by the Colonial Radio Corp. for a farm set.



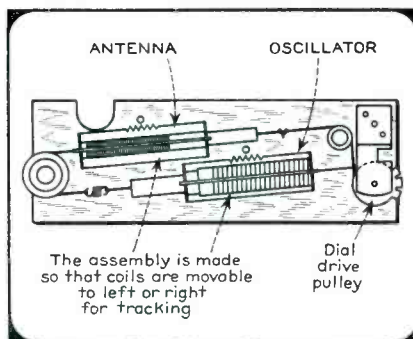
justable i-f transformers was delayed due to this shift.

Engineers did considerable work on the subject and were able to produce reasonably cheap core materials without the objectionable frequency shift. With the advent of these improved materials, the stability and freedom from drift of permeability-tuned units became especially good. The use is spreading quite rapidly and in many cases has permitted, in combination with other core-loaded units, the elimination of automatic frequency control in push-button operated receivers.

Smaller I-F Cores

Recently considerable work has been, and is being done, with regard to reducing the size of cores, especially the diameter. Early cores were $\frac{3}{8}$ " od and this size was probably selected because it happened to be the usual air-core coil size. With cores having $\frac{5}{16}$ " and $\frac{1}{4}$ " and even down to 0.2" diameters, and lengths of $\frac{5}{8}$ " to $\frac{3}{16}$ " and less, low

Simple means for the group movement of permeability tuned cores. A string extends from an eyelet, at either end of the core, and passes over small pulleys. String is also looped over main or drive pulley connected to the tuning-dial shaft.



cost high-quality core materials are available.

General Uses

The use of cores has spread rapidly. They have gone into oscillators, wave-traps, antenna couplers and the like. Cores are now used not only for increasing Q and sharpening the tuning, but also for stability and for widening bandpass. Couplings intended to pass all frequencies without critical points or great variations in the degree of coupling are possible by means of special core materials which are now available and in general use. The use of completely closed cores of the proper material is especially favorable for this purpose.

In the short-wave field it is fre-

quently desirable to have a coil core that will not materially reduce the Q of the coil. This type of core is particularly desirable for permeability tuning or vernier adjustment. For very high frequencies (50 to 300 mc) cores made with conventional binders sometimes burn up. For such applications special binders have been developed that will withstand the heat produced by losses at those frequencies.

In many instances it has been desirable that the Q of coils remain practically the same with or without the core. This permits the designing of a circuit providing for any change introduced by station selection at one or the other end of the band; in other words, with the core all the way in or out.

In other circuits it may be desirable to have a distinctly different condition so that the selectivity is increased as you go towards one or the other end of the band. In fact, both these conditions are sometimes met in different circuits. The expanding of the band with higher frequencies is another requirement in some circuits. Materials have been developed for these various purposes.

Incidentally, at high frequencies where high Q is desirable, this objective can be obtained by proper proportioning of the space between the core and the coil. It is a fairly good rule that the higher the frequency with ordinary coils, the greater the space between the outside diameter of the core and its inside diameter, and the less the weight of material that should be used.

Push-Button Tuning

A use which has become of prime interest recently is that of push-button station selection by means of coils with adjustable cores. There are several major advantages gained with this method. One is maximum stability over a long period of time, regardless of temperature and service conditions, as well as severe mechanical jolting. There is also the advantage that the set user or Service Man can select the station at will, or change from one station to another on a given push-button, without requiring great skill or instruments.

The first and simplest method of using cores in two-stage tuning is to have two separate cores, each with a screw molded therein, moving in coils adjacent and parallel to each other, one the oscillator and the other the antenna, connected by means of a pressed metal yoke to which is attached a screw that comes forward through the panel and underneath the proper push-button. The usual push-button switch is used so that when the button is pressed the two coils

are connected across their corresponding portion of the circuit.

In the normal production routine of tracking a set at any usual frequency within the band, the push-buttons are depressed successively and the two corresponding cores moved separately until they track. This brings the antenna and oscillator coils in track one with the other, and then the Service Man may adjust both together by means of a screw fastened to the yoke. Other mechanical methods could, of course, be used to bring about the same end.

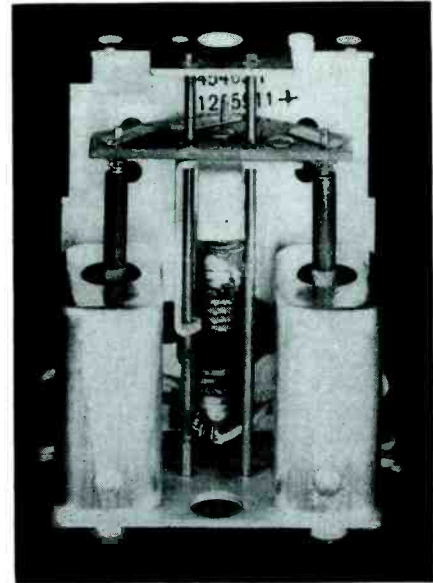
Another method is to mount both cores on one shaft, such as a brass rod or strip of bamboo, and slip this com-

binations with the same physical dimensions are used to arrive at the same results.

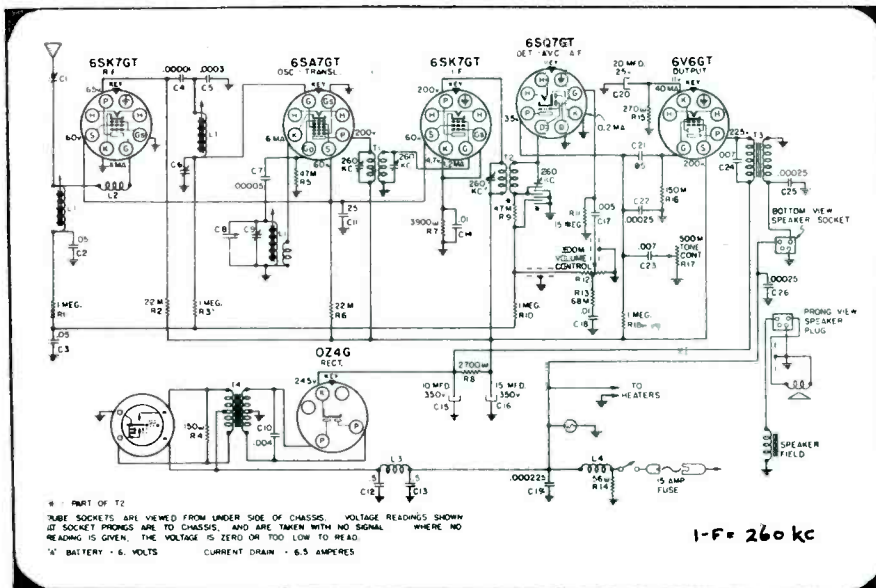
Permeability Tuning

The most recent development is permeability tuning. This is similar to the push-button technique in that a set of cores is used to replace the variable tuning condenser.

Generally, permeability tuning is accomplished by a quite heavy or high permeability core from $1\frac{1}{2}$ " to $1\frac{7}{8}$ " long, placed in the axis of a long solenoid, and moved back and forth by mechanical means. Frequently a sleeve is placed around the coil to increase the tuning range and to improve shield-



This three-gang permeability tuner employs a preselector circuit. It is used by the Colonial Radio Corp. for a Pontiac auto set.



ination through the center of the tube carrying the oscillator and antenna coils. The coils are tracked, one with the other by sliding either one of the cores on the shaft or by sliding the coil on the tube. Then the whole assembly can be tuned by the slot in the end of the long screw, or by adjusting the bamboo strip, as the case may be. In other words, to pick up any given frequency, the rod with both cores is moved in or out of the coil tube as may be required.

Even simpler methods are possible. For instance, some manufacturers use solid cores separated by wooden dowels, with a spring at one end and a screw bearing against the dowel at the other end, all in the coil tube.

In order to track the oscillator with the antenna coil by the same movement, the oscillator coil can be either wound differently in shape or size from the antenna coil, or the iron core can be made shorter. A more expensive way is to shape the iron core. In some special instances two cores of different permea-

Silvertone Model 666 auto-radio receiver employs a simple three-gang tuner (above) with movable iron-core coils. Condensers C6, C8 and C9 are trimmers which are usually mounted on the coil assembly as shown in the accompanying illustrations.

ing—even dispensing with aluminum shields in view of the present aluminum shortage. It is also feasible to place coils above and below the chassis, with respect to each other, as a further shielding means. Each of the coils represents a stage of tuning, so that for three-stage tuning there would be three separate coils and three separate cores.

As for the group movement of the cores, a simple means is to have a string extending from an eyelet at either end of the core and passing over small pulleys and again looped over the main or driving pulley on the dial shaft. Thus as the dial is rotated it automatically draws the core back and forth in the coils, thereby changing the inductance. Such a tuning unit replaces the usual variable tuning condenser and coils. Engineers claim such advantages

as lower cost, more accurate tuning, better tracking, high average output and, therefore, more faithful reproduction.

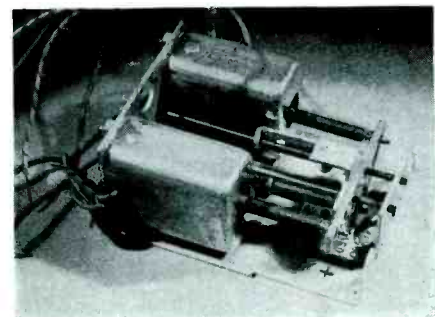
Permeability tuning promises to be one of the outstanding developments of the day, particularly in meeting the growing aluminum shortage facing set designers and manufacturers. Coupled with push-button tuning, this permeability tuning presents many desirable qualities.

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Save your aluminum scrap for national defense. Every little bit helps. See your local Boy Scout or American Legion Commander.

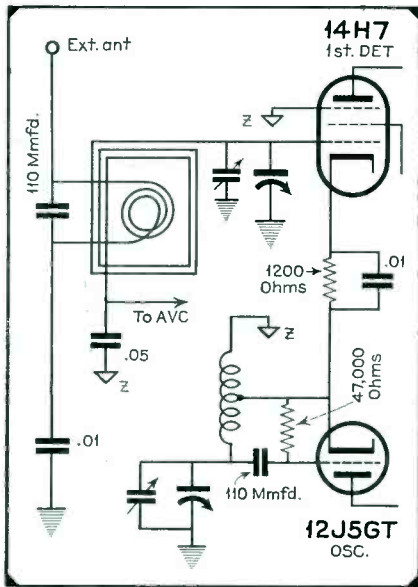
Photo shows a typical three-gang permeability tuner with two of the coils shielded. Note the trimmer condensers at the front.



CIRCUITS

See Front Cover

By HENRY HOWARD



THE SPARTON Model 672-6X (see front cover circuit) is a six-tube, six-band, push-pull receiver and is designed for operation from either a six-volt d-c source or

ceiver. The battery cable terminates in a pair of battery clips and the power line cable has the usual two-prong plug. Each cable has an octal plug at the set end.

Fig. 4. (Left) Stewart-Warner 206B-206C Series.

from 110 to 240-volt a-c supply lines. Two cables are supplied with the re-

Switching from one power supply to the other is accomplished by simply plugging in the appropriate cable. The same power transformer, rectifier tube and filter network serve equally well

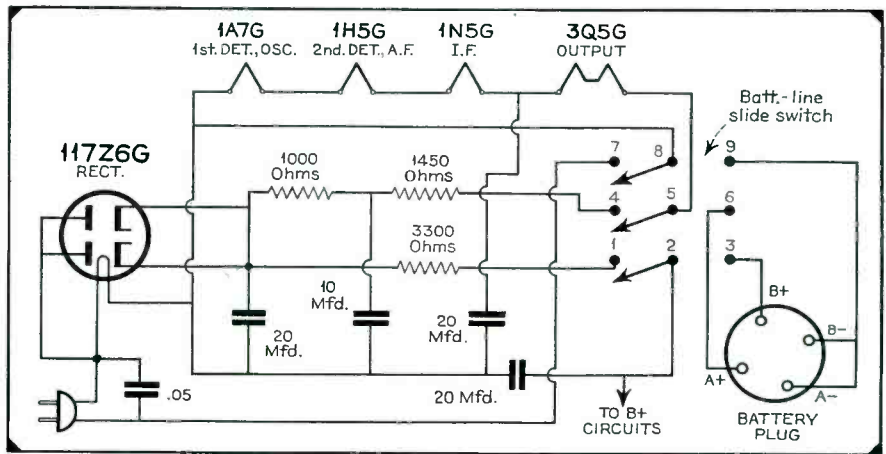
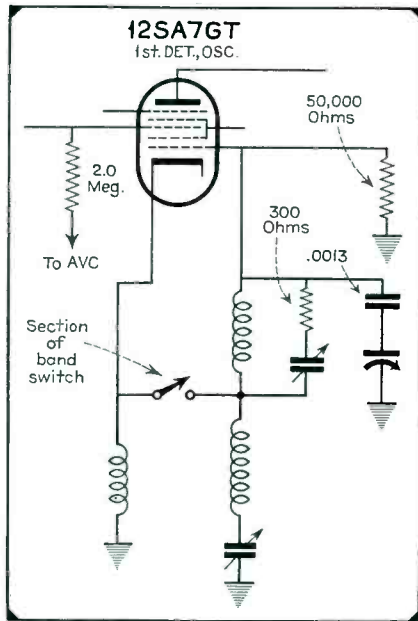


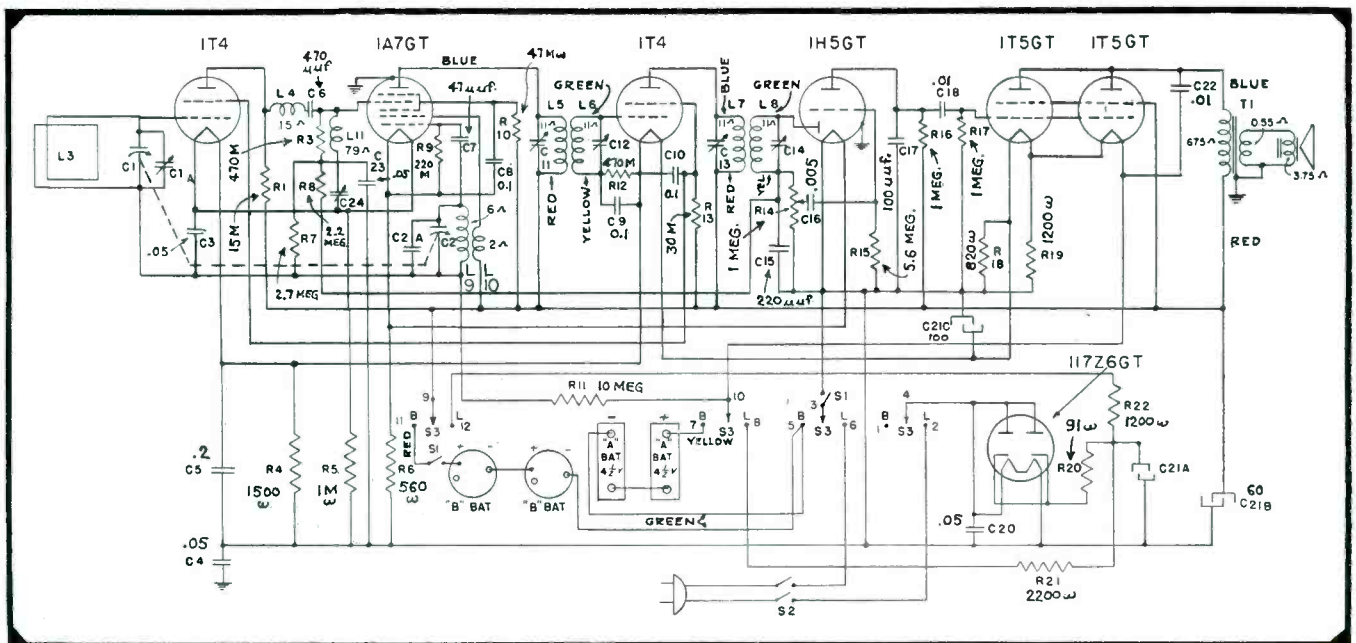
Fig. 3. (Above) Philco 42PT87, 42PT88.

Fig. 5. (Left) Fada 137.

Fig. 2. (Below) G.E. LB700, LB701, LB702, LB703.

with either voltage supply. For a-c line operation, a 240-volt primary tapped at 110, 125, 150 and 210 volts should meet all possibilities

The rather extensive frequency range covered in this receiver includes long



• PHILCO MODELS 42-355, 42-390 F-M, A-M RECEIVER •

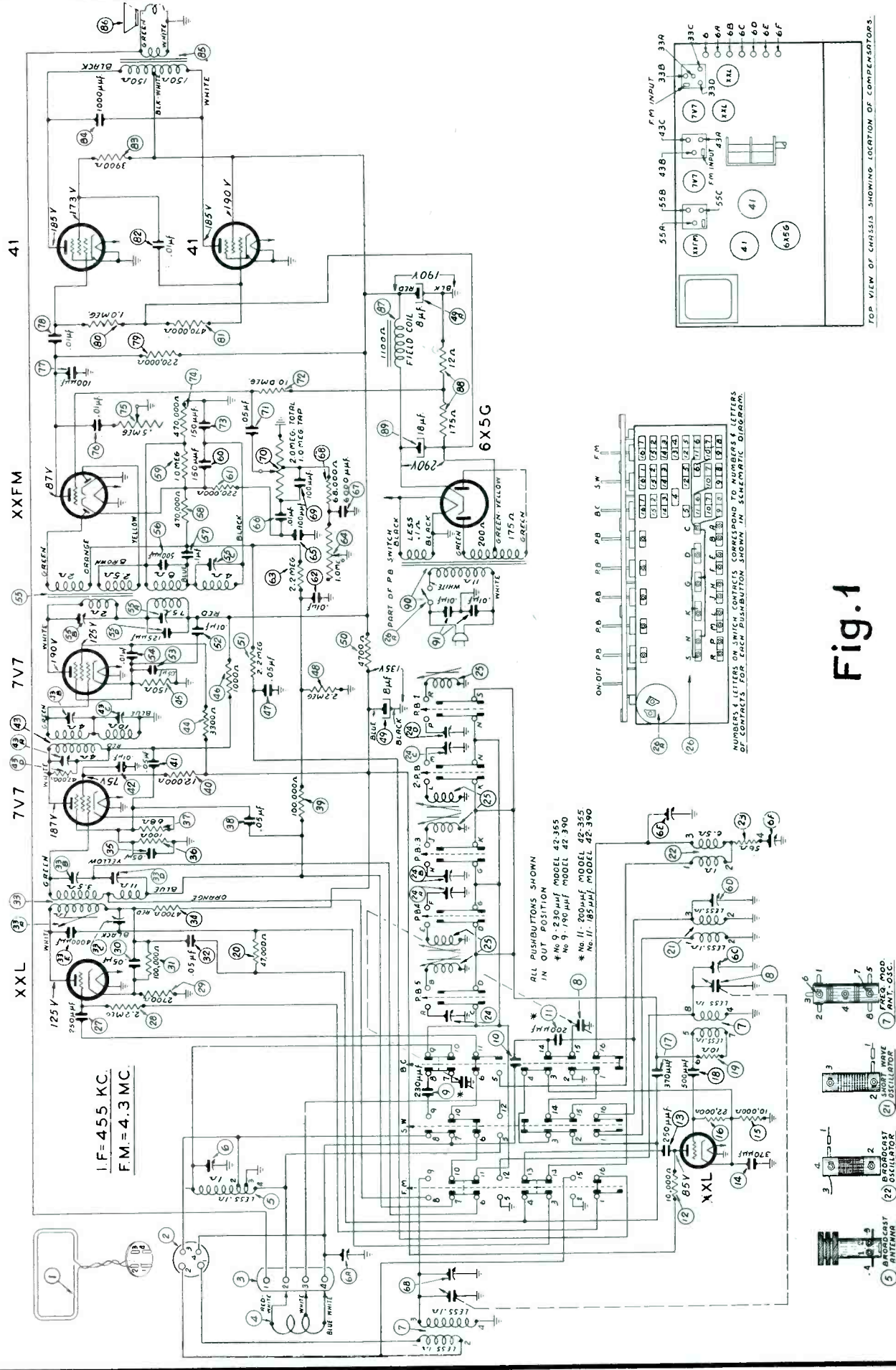


Fig. 1

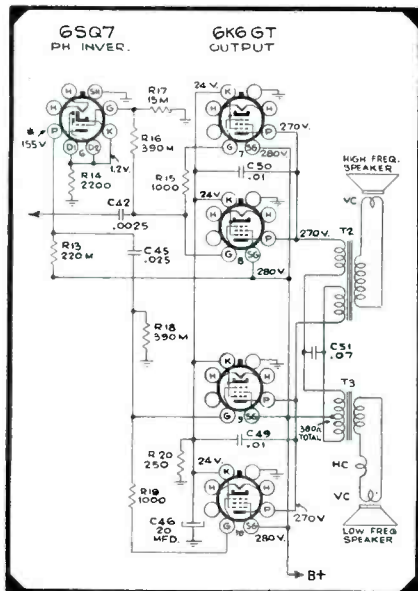


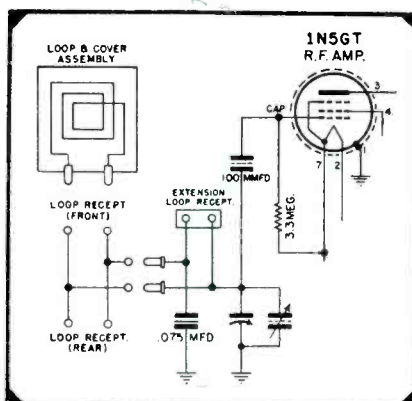
Fig. 7. (Above) RCA 211K (Chassis RC571).

waves, broadcast and 32 to 110 meters on the one hand, and three band-spread ranges: 25 to 30, 20 to 25 and 13 to 16 meters as a special feature. A single antenna primary winding serves for all band-spread ranges. The oscillator frequency is set below the signal frequency in these three ranges, whereas it is set above the signal frequency in the other bands. A series-type trap, tuned to the i-f peak, is connected in series with the antenna circuit.

The power transformer has the following windings: a 240-volt a-c primary tapped at 110, 125, 150 and 210 volts; a 6-volt, push-pull vibrator pri-

mary; a 6-volt filament winding and a center-tapped, high-voltage secondary. The transformer is also provided with an electrostatic shield. On battery operation one side of the a-c primary is grounded and the filament winding disconnected from the receiver circuits. The battery is connected to the filaments and pilot lamps and to the center tap of the vibrator primary through a hash filter choke. On line operation the vibrator is disconnected by opening the aforementioned center tap connection, the lamps and filaments are switched to the filament winding and the a-c line is connected to the voltage selector

Fig. 8. Motorola 62L11, 62L12 (below).



switch. All these connections are accomplished by suitable wiring on the

Fig. 9. (Right) Zenith 6D612, 6D612W (Chassis 6B04).

plug and socket connections for the power supply cables.

Screen grid inversion is used—the second power tube deriving out-of-phase grid voltage from the screen of the first tube; no phase inverter tube being required. A high impedance p-m speaker is used.

Philco 42-355, 42-390

The Philco Models 42-355 and 42-390 are combination a-m and f-m receivers with built-in loops for broadcast, short wave and f-m. Nine electric push buttons are provided, five of which are for station selection and the others for switching operations, including band selection. A plug is provided for the f-m loop. Where a dipole antenna is used instead of the loop, for better reception, the end of the transmission line is plugged in instead of the loop. The set uses a novel balanced detector with a type XXFM dual diode-triode. No limiter is used. Other features include screen-grid inversion, bass compensa-

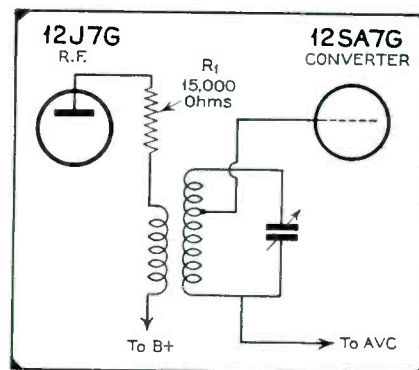
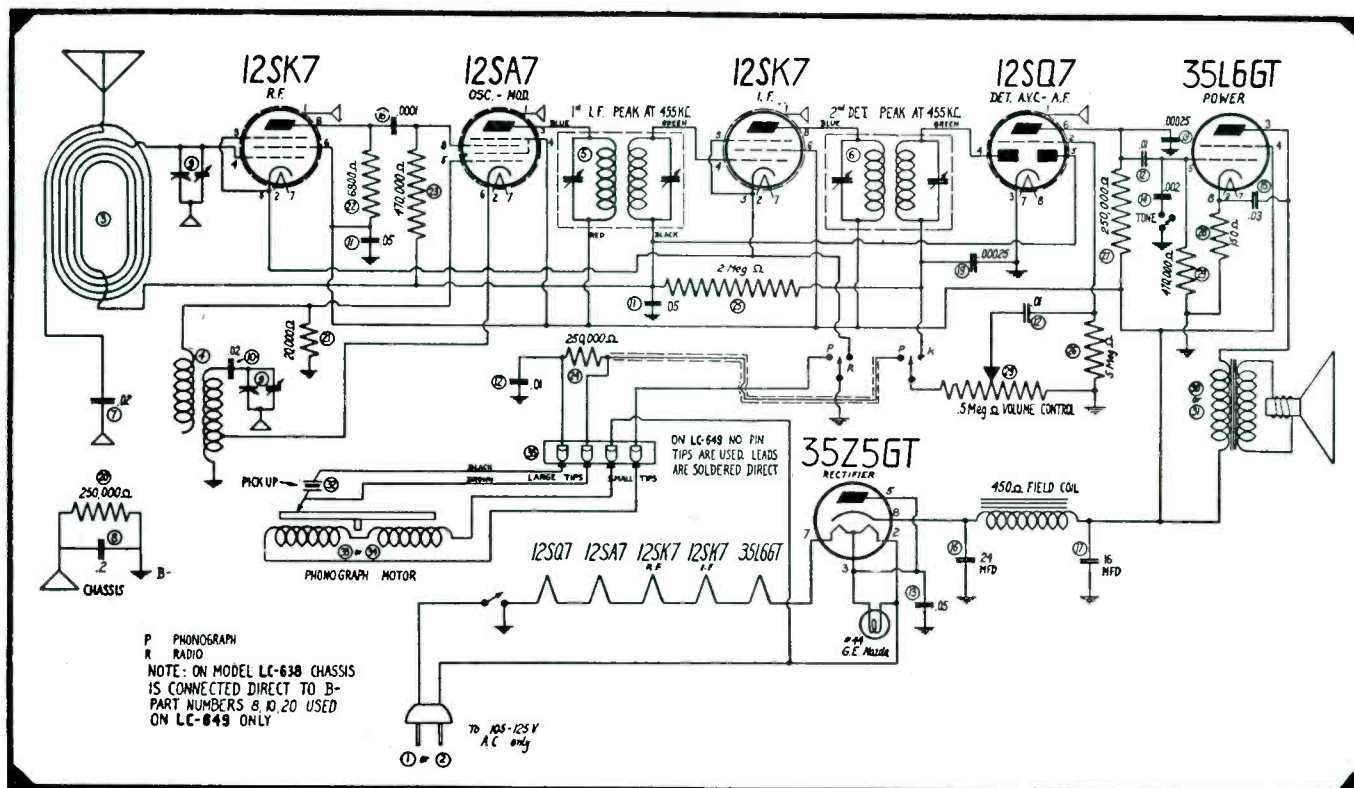


Fig. 6. (Below) G. E. LC638, LC649.



tion and treble and bass tone controls. See Fig. 1.

Philco 42-122T, 42-123F

Philco battery Models 42-122T and 42-123F, code 121, are 5-tube, battery receivers featuring push-pull output. The tubes are loctals and, for economy, screen grid phase inversion is employed.

G. E. LB700, LB701, LB702, LB703

G. E. a-c, d-c battery portable model LB700 series are 7-tube, single-band jobs with a tuned loop r-f stage, untuned mixer or converter stage and a pair of 1T5s in parallel for output. The tubes are mixed; some are the standard portable GT types and others are from

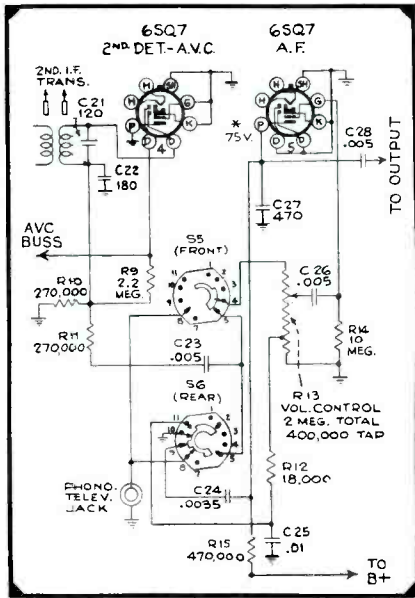


Fig. 10. (Above) RCA 27K (Chassis RC567).

the miniature series. The parallel 1T5s allow more output than a 1C5 for the same filament drain. In order to get a little gain from the r-f stage, an equalizer network is used for the untuned coupling system from r-f to mixer. See Fig. 2.

Philco 42PT87, 42PT88

In this series of articles, we have found many types of battery-to-line switching in portables. Here is a set using a 5-pole double-throw slide switch—Philco's Models 42PT87 and 42PT88, shown in Fig. 3. Pin jacks are provided on the side of the cabinet for attaching an auxiliary plug-in loop for better reception in shielded or difficult locations.

Stewart Warner 206 Series

Stewart-Warner uses a new 150-ma loctal converter tube designed for low conversion noise; the purpose is similar to Philco's XXL triodes. This is the 14H7. A separate oscillator tube is

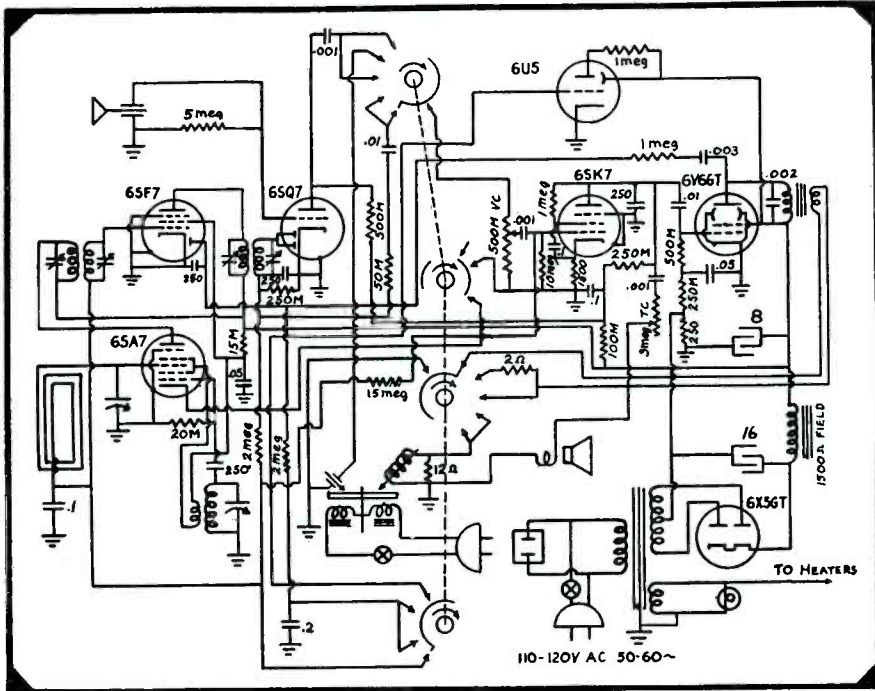
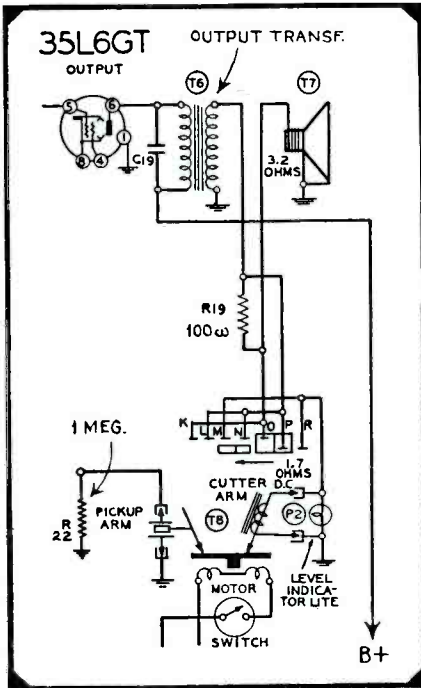


Fig. 13. (Above) Packard Bell 67B. Fig. 11. (Below) Airline 14BR629A.

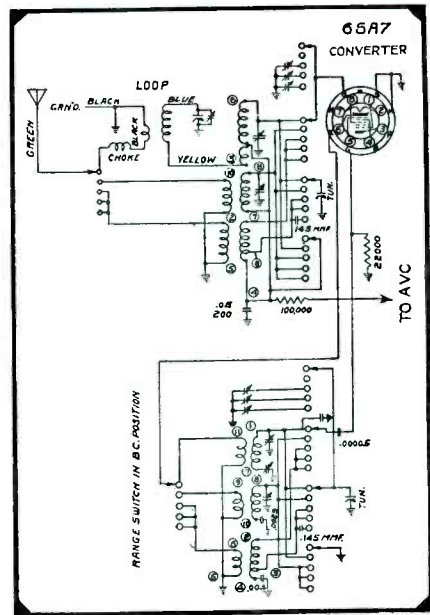


is shunted across only part of the antenna coil on the short-wave band. Instead of switching to an entirely new coil in the oscillator circuit for short-wave, the cathode feedback coil is connected in parallel with part of the inductor causing a great decrease in overall inductance while retaining sufficient feedback for proper oscillation. See Fig. 5.

G. E. LC638, LC649

G. E. Models LC638 and LC649 are single-band a-c phonograph combinations with a loop r-f stage. On phono position, the signal is eradicated by opening the r-f and i-f cathodes from negative B. This not only prevents any

Fig. 12. (Below) Truetone D1175.



used which, in Models 206 series, is a 12J5GT. The method of oscillator injection consists of connecting the oscillator cathode to the converter cathode through a network consisting of a 1,200-ohm resistor shunted by a 0.01-mfd by-pass condenser. (See Fig. 4.)

Fada 137

Fada's Model 137 is a two-band, 5-tube a-c, d-c loop receiver which uses the loop in the usual manner for broadcast and uses either an external antenna or the loop with one end open for short wave. The tuning condenser

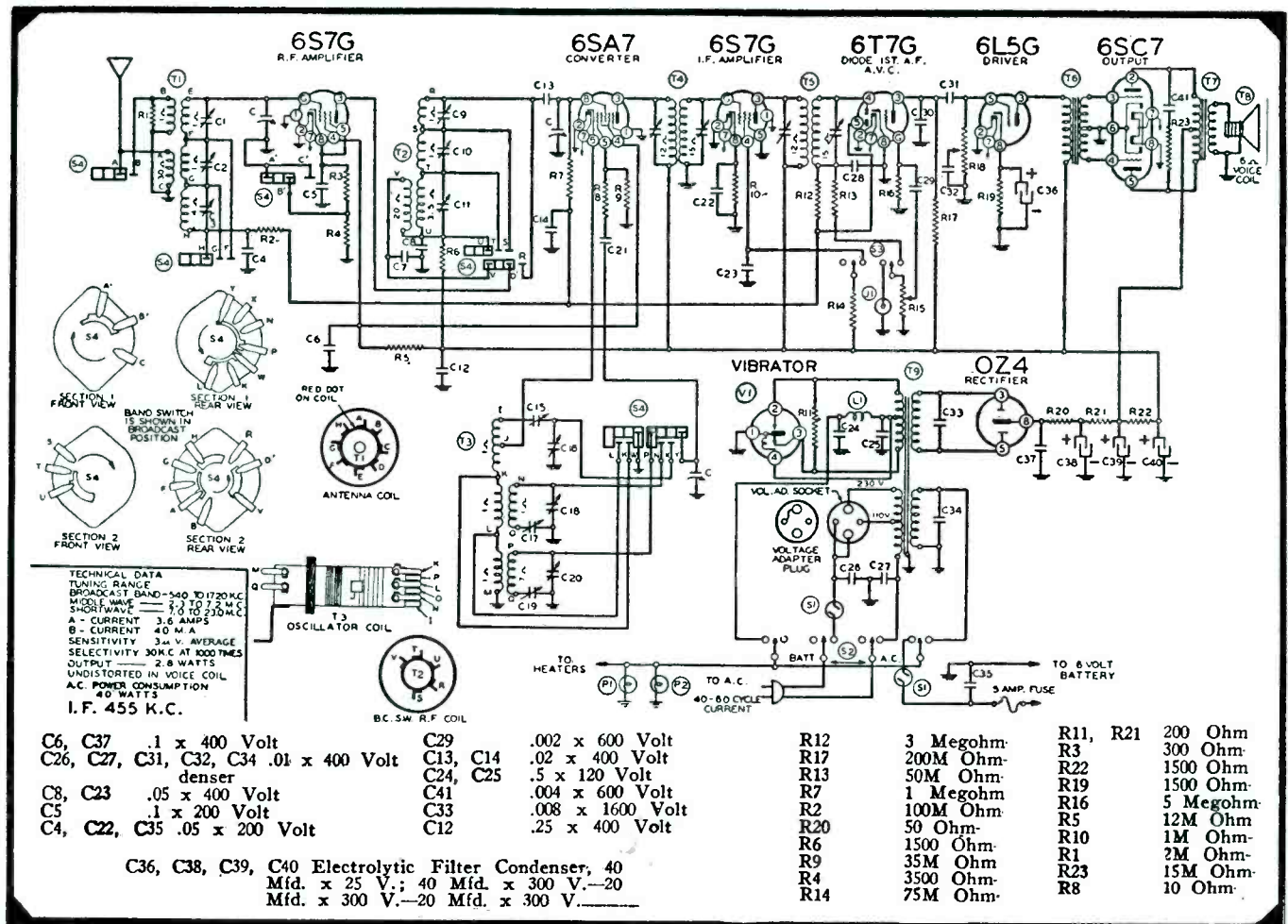


Fig. 14. Airtone 14BR742A.

reception, but cuts the B drain 20 ma, hereby increasing the plate voltage by about 15 volts. On these transformerless models this 15-volt gain is a decidedly important factor in getting more power from the output stage for phonograph record reproduction. In Model 638, a 4-pin plug is provided for easy servicing. This plug removes the pickup and phonograph motor. See Fig. 6.

RCA 211K (Chassis RC571)

RCA Victor Model 211K is an elaborate 11 tuber with broadcast and three s-w bands, one being a spread band. Two speakers are used; the low-frequency job is a 12-inch electro, while the high-frequency tweeter is a 5-inch p-m. Four 6K6GTs are used in parallel-push-pull with two separate output transformers which are connected in series. The audio power is properly apportioned by shunting the push-pull primary of the low-frequency output transformer with a 0.07-mfd capacity to by-pass the highs. Because of the phasing of the two separate primary windings in the high-frequency output transformer, this condenser has no shunting effect, but serves rather as a high frequency by-pass condenser and

the highs are retained. Note Fig. 7.

Motorola 62L11, 62L12

A plug-in loop which may be plugged in to either the front or rear of the set is the novel feature of Motorola's Models 62L11 and 62L12. The untuned coupling between r-f and mixer is also novel, consisting of a combination of magnetic coupling through an untuned transformer and resistance-capacitance coupling via a gimmic. (Fig. 8.)

Zenith 6D612, 6D612W (Chassis 6B04)

Fig. 9 shows an honest-to-goodness 3-gang set which has an interesting r-f-to-mixer coupling circuit even though its tuned (Zenith 6D612, 6D612W, Chassis 6B04). A 15,000-ohm resistor is connected in series with a low-impedance primary. The resistor prevents the coupling from rising too high at the high-frequency end. The grid of the mixer is tapped down on the secondary, thus reducing the minimum capacity. This allows greater selectivity and a smaller variable condenser (the latter being a patriotic move in these hard-to-get-metal days). Of course, some gain must be sacrificed, but there is plenty of gain to spare in a 3-gang job

anyhow. Note that the gang condenser has its frame connected to the avc bus instead of ground. This makes the circuit more stable, there being no condenser in series with the tuning condenser and coil.

RA 27K (Chassis RC567)

RCA Victor Model 27K combines the radio and phonograph tone controls on one knob through the use of a gang switch. Rotating the knob clockwise, we have three-tone positions for radio, bass to speech, and then two positions for phonograph, bass and full. Bass compensation is also provided. (See Fig. 10.)

Airtone 14BR629A

Ward's Airtone Model 14BR629A phono-recorder combination has a novel recording indicator in the form of a 60-ma pilot lamp. The pilot lamp shunts the low-impedance magnetic type cutter as shown in Fig. 11. Under normal operating conditions, the lamp glows dull red during most of the recording period. An occasional bright flicker should be seen only on strong passages. Prolonged brightness means overloading. The receiver uses an antenna plate instead of a loop, permeability tuning and

(Continued on page 23)

VOLUME EXPANDERS

By ROBERT G. HERZOG

EDITOR

VOLUME EXPANSION has dropped from the limelight of late . . . there are few, if any, phonograph combinations in the 1942 lines which offer this feature. However, because of the increasing interest now shown in phonographs and records these circuits merit additional attention.

Volume expansion serves a definite purpose. During recording for phonograph reproduction, as well as in the pickup for radio broadcasting, the audio level is continuously "monitored" and "compressed." In other words, the volume of sound is decreased during extremely loud passages and is increased or boosted during low ones.

In the making of records this compression is necessary because the ratio of maximum to minimum amplitudes, that it is feasible to record, is not sufficient to take care of very large volume changes, such as those produced by a symphony orchestra, for example. If these passages were permitted to reach the cutting head they would cause adjacent grooves to run into one another.

At the broadcast studio, the operator cuts down the high volume passages to prevent over-modulation and to insure

Fig. 3. An early expander circuit (right) employed by RCA in their Model MI4288 p-a amplifier. It is the expander part of the circuit shown in Fig. 2, below.

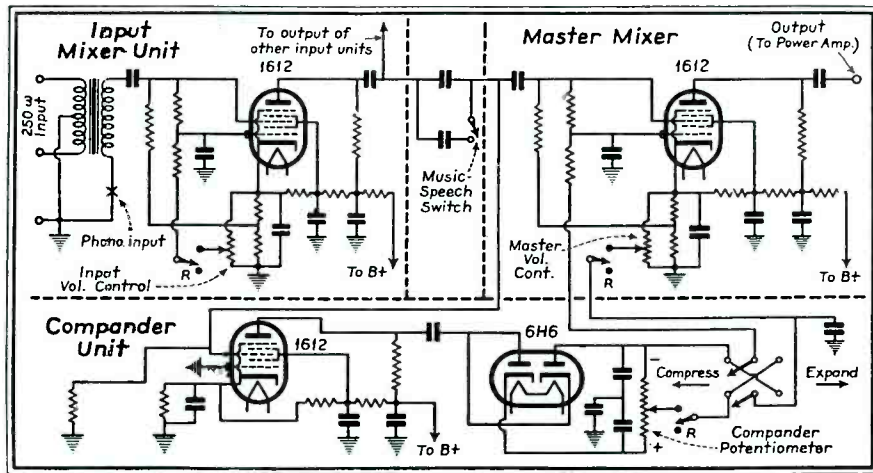
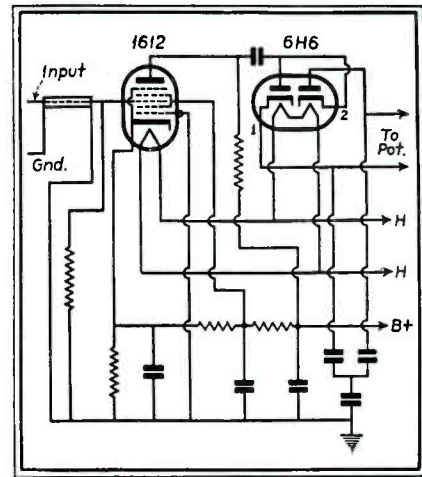


Fig. 2. (Above) A combination compressor and expander circuit, called the "Componder".

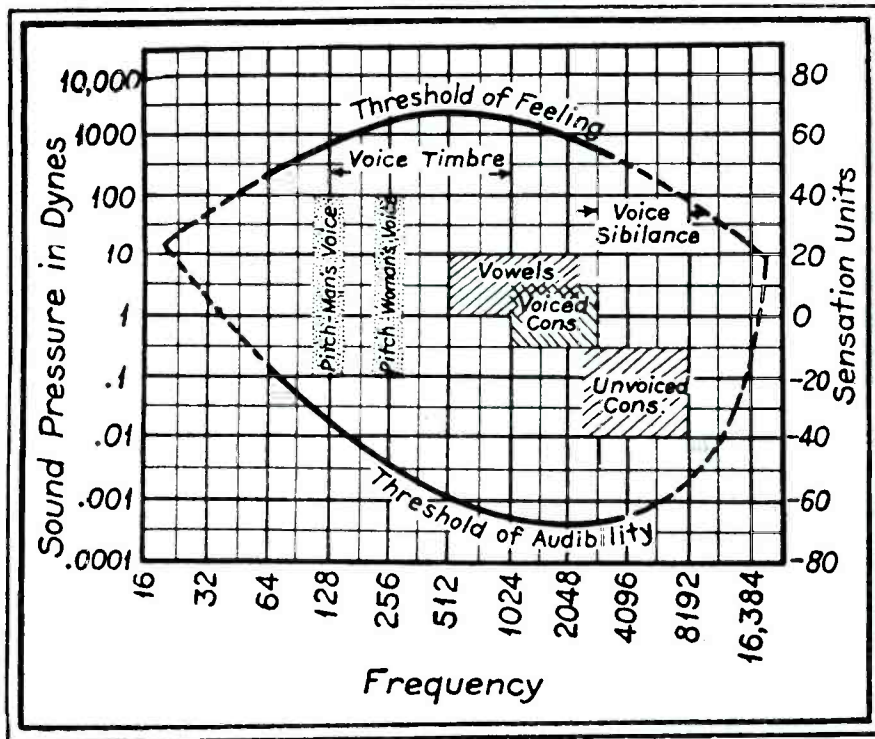
Fig. 9. (Below) Insofar as the human ear is concerned, the bass tones fall below audibility before the middle tones. For this reason most volume expanders employ circuit filters to prevent the attenuation of these frequencies on weak signals.

efficiency of transmission. On the other hand, when the average level of the audio signal is low, he must raise the gain to enable the signal to override the noise and hum of the carrier. This obviously reduces the volume range of the program.

In receivers and amplifiers that have no provision to compensate for the compression, passages are distorted in the sense that they are not reproduced with full volume range. If full compensation is desired, it is necessary to provide the audio amplifier with some means for increasing the amplification of loud passages in the same proportion that they were compressed. Several circuits, which have been used in the past to accomplish this purpose, are discussed below.

RCA Volume Expanders

Probably the earliest volume expander circuit that found its way into receiver and low-power amplifier construction was one which used the 6L7 tube in an arrangement such as that of Fig. 1. The particular circuit shown is for the RCA Hi-Fidelity phonograph amplifier Model R99. The same circuit, with very slight modification, was also used in the Model D22. Other receivers and public-address amplifiers of the same era, that boasted of volume expansion



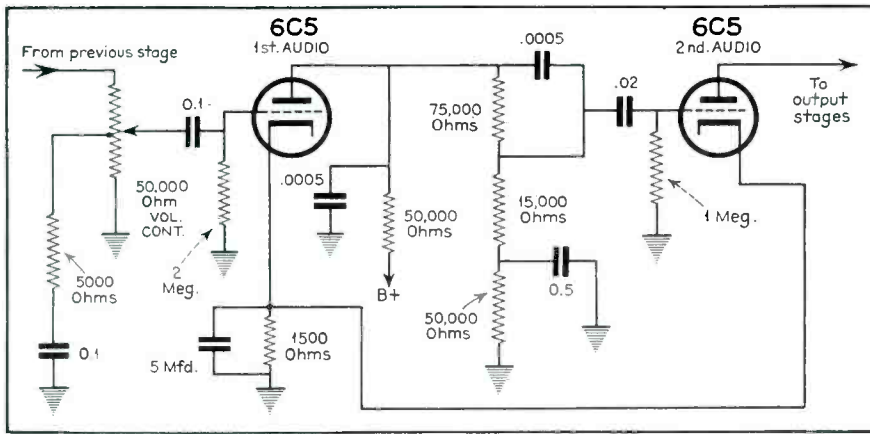


Fig. 8. Emerson Symphonizer in the off position. (See Fig. 5.)

sion, also utilized this circuit arrangement.

The characteristics of the 6L7 permit its adaptation to a comparatively simple volume-expander. The tube has two control grids. The first (G_1) has a remote cut-off characteristic and the second (G_2) has a sharp cut-off characteristic. Of the three remaining grids, two are screens and one is a suppressor.

The signal to be expanded is fed to the remote cut-off grid (G_1) of the 6L7 and also to the input of a 6C5 (see Fig. 1). The output of the 6C5 is rectified by a 6H6; the positive terminal of the rectified output connects to the sharp cut-off grid (G_2) of the 6L7. The no-signal bias of this grid is such that the G_1 -plate transconductance of the 6L7 is low (under 50 micromhos). When a signal is applied, the rectified voltage fed to G_2 increases the transconductance, and hence the gain, of the 6L7. This increase in gain is approximately proportional to rectified diode

voltage and hence to signal amplitude.

The time constant of the circuit generating the control voltage is so adjusted that changes in this voltage occur only for comparatively slow changes in the signal amplitude. If the time constant is too short speech will sound particularly unnatural. If the time constant is too long there will be an objectional lag. A time constant between 0.25 and

expander and compressor, or "com-pander" as the manufacturer terms the device. The particular circuit shown is that used in the RCA Model MI4288 public-address amplifier. The expander circuit is shown alone in Fig. 3 and is basically the same as that shown in Fig. 1.

In operation the input to the amplifier is fed to the remote cut-off grid of two 1612 type tubes (specially constructed 6L7s). The first is used as the voltage amplifier. The output of the second is rectified in a 6H6, connected as a voltage doubler. Here again the rectified d-c will vary directly in proportion to the strength of the input signal. This d-c voltage is used as a supplementary bias on the sharp cut-off grid of the first 1612 tube.

If the voltage is connected so that the gain of the 1612 varies directly with the signal (positive terminal to grid return of 1612 tube), the circuit acts as a volume expander. If the polarity of the voltage is reversed (negative terminal to the grid return of the 1612 tube), the circuit acts as a compressor. A simple two-circuit, two-position switch is used

Fig. 3. Crosley Auto Expressionator uses lamp bulbs for expansion.

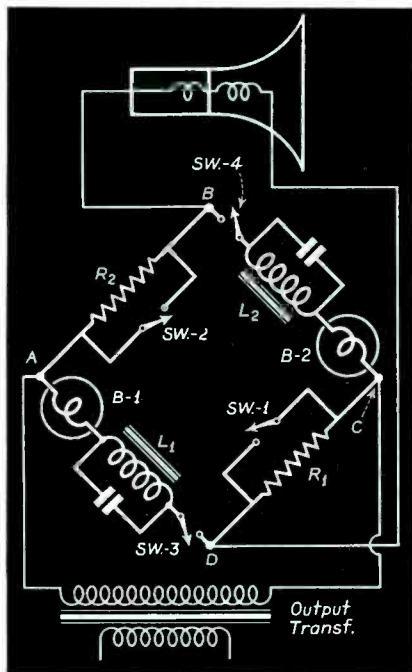
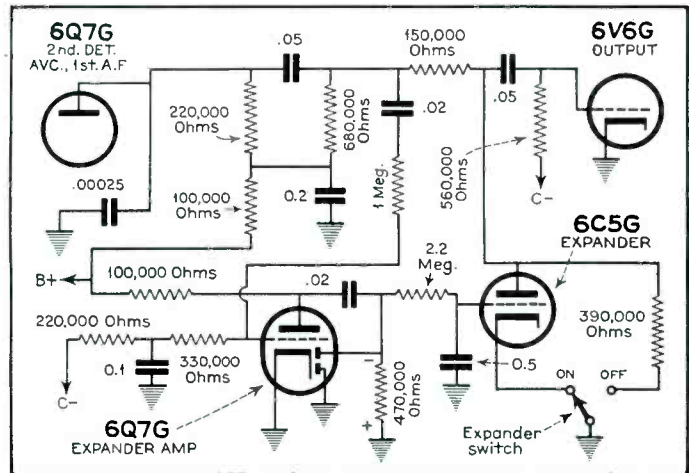


Fig. 5. The output stage receives slightly less than two-thirds of the signal fed from the plate circuit of the 6Q7G first audio stage. During operation of the expander this amount varies directly with the amplitude of the signal applied to the detector load.



0.5 seconds is generally regarded as a satisfactory choice.

Distortion of the signal due to the characteristics of the remote cut-off grid (G_1) is appreciable for large signals. Therefore, the maximum signal input to G_1 should be 1 volt peak, which is of the same order as that obtainable from the usual magnetic phonograph pickup. Higher values of signal should be attenuated.

The plate current value of the 6L7 serves as a good measure of the degree of expansion. It is suggested that the initial bias on G_2 be adjusted for a no-signal plate current of approximately 0.15 ma by means of the "expander bias control." This control should require no further adjustment unless the tube is changed.

RCA Com-pander

Fig. 2 gives the circuit of a volume

to accomplish the changeover from one function to the other. The degree of either compression or expansion is controlled by the amount of this voltage which is applied to the grid return.

Crosley Auto Expressionator

In an effort to simplify the volume-expander circuit Crosley introduced the arrangement shown in Fig. 4 in their Model 1155 receiver. The circuit, known as the auto-expressionator, may be described as a device with two paths through which the a-f currents may flow. The loudspeaker is connected in the circuit of one of these paths, and the Auto-Expressionator—consisting of two lamps the size of those used in flashlights—is in the other path.

Referring to the circuit in Fig. 4, the component parts of the Expressionator are arranged to form a Wheatstone

bridge circuit. At most frequencies the impedance of L_1 and L_2 is so low that for purposes of explanation they may be considered short circuited. The two Expressionator lamps, B_1 and B_2 , because of their special thermal characteristics, cause an increase in the current through the R_1 and R_2 branches of the bridge as the volume increases. This effects a much greater increase in the loudspeaker output.

When the Auto-Expressionator knob is in the off position SW_1 and SW_2 are closed and SW_3 and SW_4 are open. In this position R_1 and R_2 are shorted and the output transformer is connected directly to the voice coil of the loud-

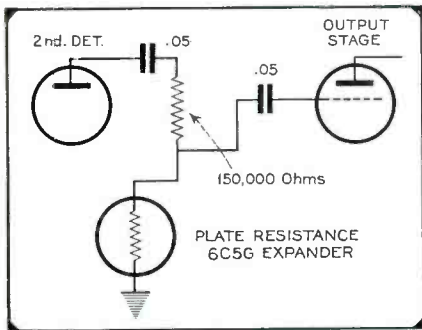


Fig. 6. Sparton's volume expander uses a 6C5G in a special circuit.

speaker. When the control knob is in the on position, SW_1 and SW_2 are opened and SW_3 and SW_4 are closed. With this connection the output transformer currents must flow through the bridge circuit before they can reach the voice coil. The resistance value of R_1 and R_2 are slightly less than the cold resistance of the lamps so that the bridge is out of balance by a slight amount. As the signal from the output transformer increases the resistance of the Expressionator lamps increases quite rapidly due to their change in temperature. This increases the off-balance condition of the bridge circuit. The effect is accumulative, and a greater and greater portion of the total signal will be heard in the loudspeaker.

In order to make expression smooth and pleasing, a definite amount of time lag in the heating and cooling of the lamps is necessary. If heating and cooling is too rapid the corresponding resistance change and upset in the bridge balance condition may take place within a low-frequency cycle. This will introduce distortion predominately of the odd-harmonic type. If the filament time lag is within the range from 0.1 to 0.2 seconds, however, this distortion is eliminated. It is also desirable to have a slight amount of time lag to prevent harsh and abrupt expansion. The thermal inertia of the lamps governs this time lag.

As music becomes softer and softer

the lowest frequencies drop below the range of audibility before the middle and higher frequency tones (See Fig. 9). To counteract this effect the Auto Expressionator incorporates an automatic bass compensator which does not permit the volume suppression of extremely low frequency tones. As the volume level increases the compensation gradually disappears so that there is always a pleasing balance between the low and high-frequency tones.

Referring to L_1 and L_2 (Fig. 4) and their respective shunt condensers, it will be seen that their purpose is to provide permanent unbalance of the bridge circuit independent of the Expressionator lamp temperature at frequencies below 40 cycles. The result is that when the Auto-Expressionator is switched into the circuit there is a decided boosting of the extreme bass at low volume levels.

Sparton Volume Expander

During the latter part of 1937 and early 1938, when volume expanders were the vogue, Sparton included the circuit shown in Fig. 5 in the larger models of their line. The particular arrangement and parts values are for the Model 968.

Examination of the circuit will show that the grid of the 6V6G output tube is connected to the junction between the 150,000-ohm and the 390,000-ohm (R_{23}) resistors (through the 0.05-mfd coupling condenser) when the expander switch is in the off position. During such operation his grid will, therefore, receive a little less than two-thirds of the signal fed to it from the plate of the 6Q7G first a-f stage.

The operation of the expander can best be understood by reference to the simplified circuit shown in Fig. 6. When the expander switch is in the on

Fig. 5. Emerson's Symphonizer also employs a tube in a voltage divider network to accomplish volume expansion.

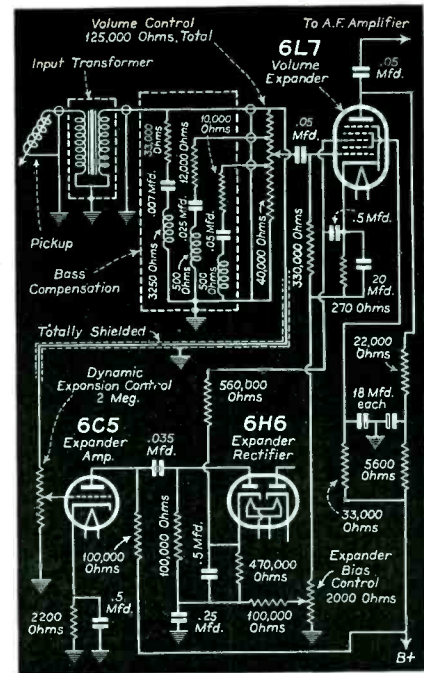
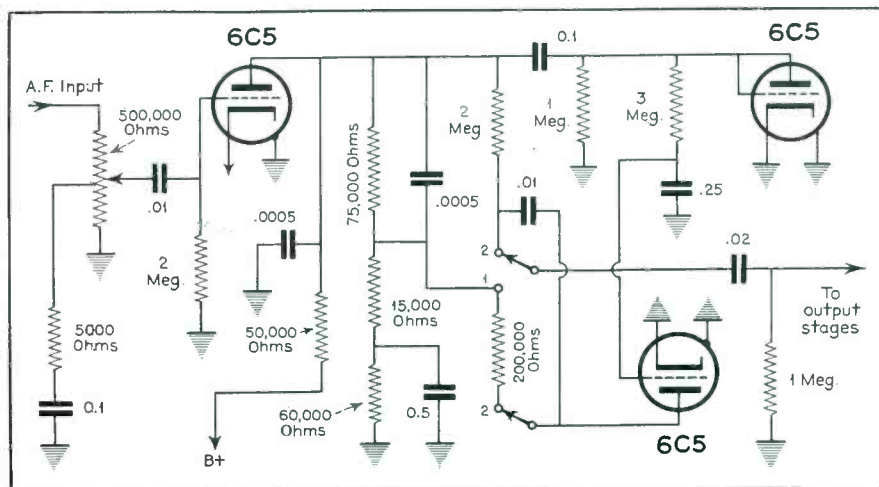
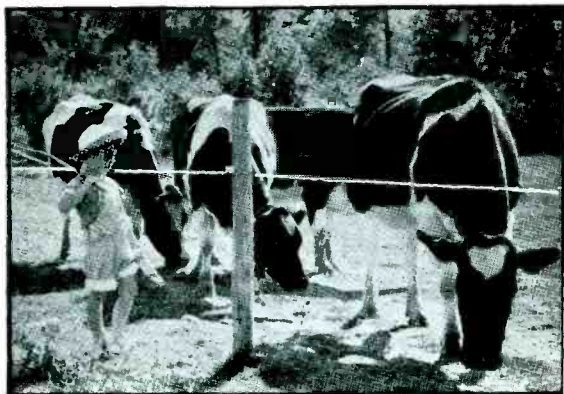


Fig. 1. The characteristics of the 6L7 permit its application in a simple expander circuit.

position the internal plate to cathode resistance of a 6C5G tube is substituted for the 390,000-ohm resistance (R_{23}) in the expander plate circuit. During such operation, however, the portion of the signal fed to the output tube grid will depend upon the plate resistance of the 6C5G expander tube. This resistance, in turn, will depend upon the bias applied to the tube.

To obtain the bias for the expander tube, a portion of the input signal is fed to the 6Q7G expander amplifier. This portion is amplified in the triode section and rectified in the diode section. The rectified d-c, varying directly in proportion to the average signal level, is used for the 6C5G expander tube bias. Thus the plate resistance of this latter tube will vary directly in proportion to the average signal level, as will the

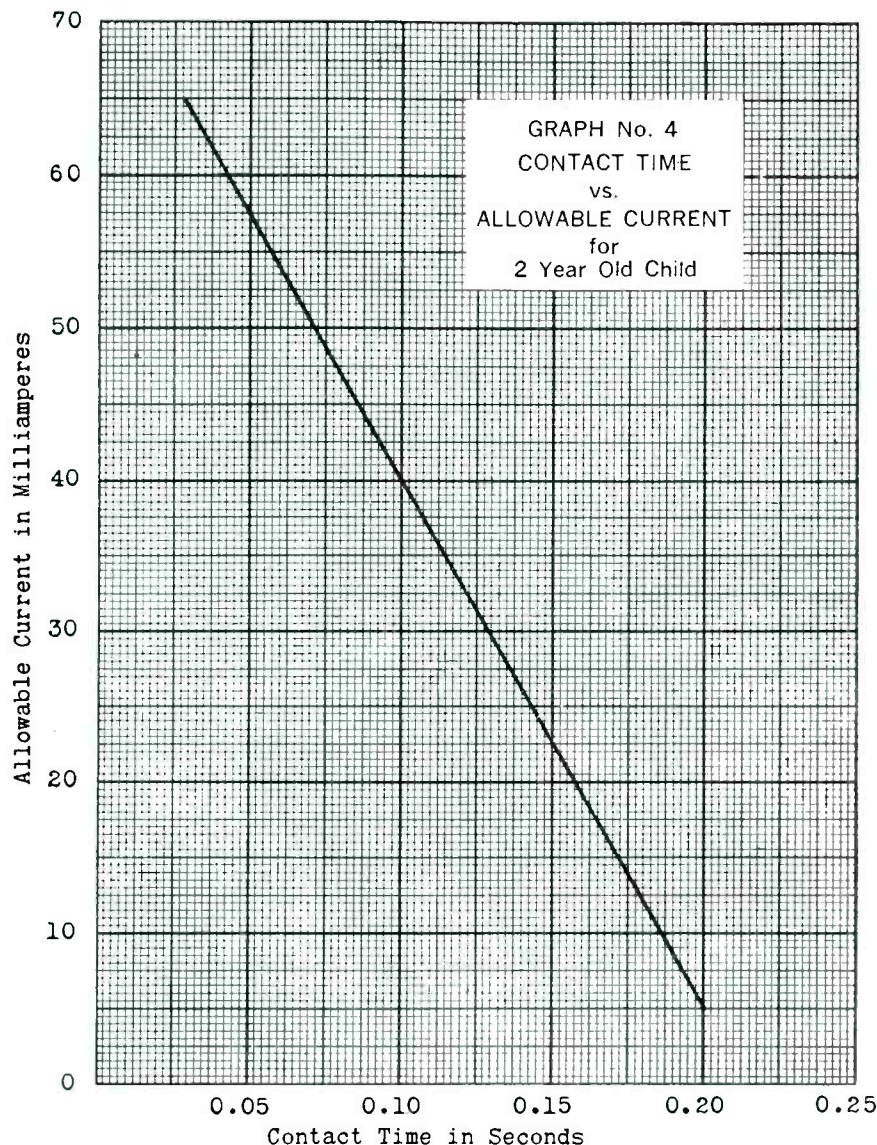
(Continued on page 26)



FENCE CONTROLLERS

By JAY ALLEN

Illustration courtesy Underwriters' Laboratories, Inc.



ONE of the most recent and novel applications of electricity in the rural areas is the electric fence. Physically, the electric fence differs from the conventional type of barbed-wire or woven-wire fence in that it is of simpler construction (usually having one wire) and does not require the mechanical strength or stability of the older types. Functionally, it is different in that it controls the animals by means of fear rather than by strength or by causing pain. Electric fence

manufacturers claim that this type is more economical, portable, and, in some cases, more effective than the ordinary fence.¹

The electric fence is composed of two distinct parts, namely, the insulated fence wire and the electric controller which supplies the electric energy to the fence wire. This article is an attempt to give information on the latter device. Several units are discussed, for operation on 6-volts d-c and for operation from the power supply lines. Un-

Fig. 6. (Left) In making recommendations, the Underwriters' Laboratories considers their allowable current vs. contact time relationship on the basis of a two-year-old child.

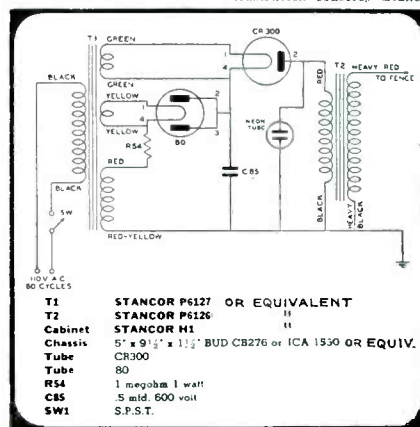
derwriter's Laboratory recommendations are also given.

The operating principle of the electric fence is that the animal, in attempting to go through the fence, establishes an electrical circuit through its body to the ground. In this position the animal receives the electrical shock supplied by the fence controller. After receiving a number of these shocks the psychology of the animal is such that it is inclined to avoid further contact with the fence wire, having learned that the fence is the source of an unpleasant sensation.¹

The earliest types of fence controllers were of the alternating current transformer types. These consisted essentially of a transformer and a current interrupter which permitted the transformer to be energized at regular intervals. The current interruption was provided by means of a mercury tube switch mounted at the end of a revolving shaft which was propelled through a gear train by means of a small motor. The current interrupting means was provided in the secondary side of the transformer. One side of the trans-

Fig. 2. (Below) A modern fence controller uses a discharge tube to obtain the proper interruptions of the electric fence circuit.

Illustration courtesy Stancor



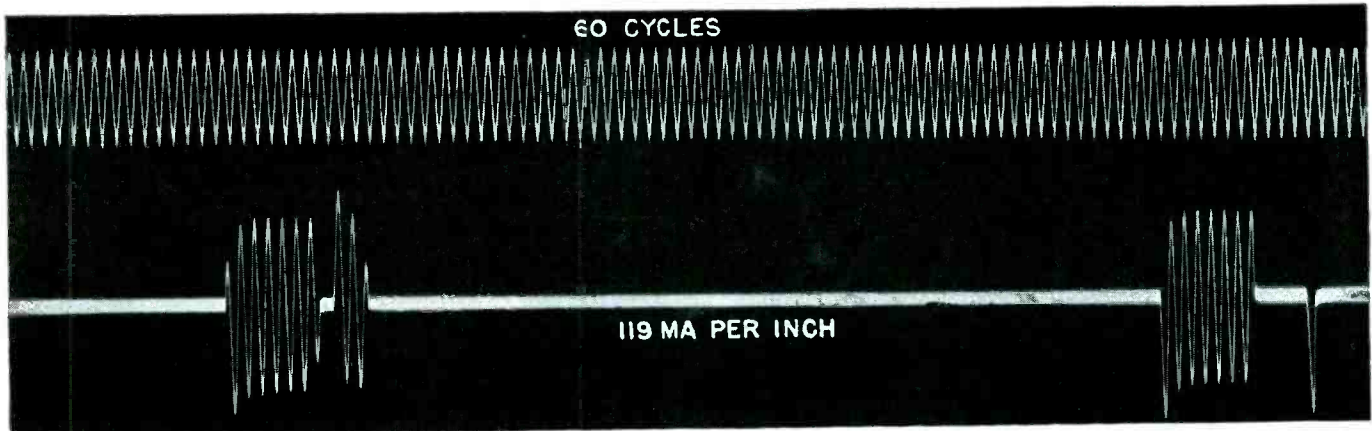


Illustration courtesy Underwriters' Laboratories, Inc.

Fig. 1. The lower wave train shows the pulse delivered to the fence during discharge across a load with circuit elements similar to those of a fence and live subject.

former was intended for direct connection to ground and the other, through a high series resistance, to a one-strand barbed-wire fence.¹ An oscillogram of such a unit is shown in Fig. 1.

Electronic Type Circuit

A modern unit,² using more familiar tube circuits, is shown in Fig. 2. An idea of the parts layout can be obtained by reference to Fig. 3. Parts for the device are generally obtainable from radio parts jobbers.

Operation of the circuit is simple. Rectified voltage is applied to the condenser (C85) through the series resistor (R54). After charging, the condenser is then discharged through the primary of the transformer T by the Cetron tube. The ensuing surge builds up a relatively high secondary voltage which is in turn applied to the fence.

The entire process is repeated at a rate predetermined by values of R54 and C85. The discharge rate varies inversely with the value of R54. For example, the 1 megohm resistor produces approximately 55 discharges per minute. If this were changed to 2 megohms, the rate would be approximately 28 per minute.

In application one side of trans-

Fig. 3. (Below) The modern a-c controller can be constructed on a 9½ by 5 by 1½ inch chassis. The parts are standard.

Illustration courtesy Stancor



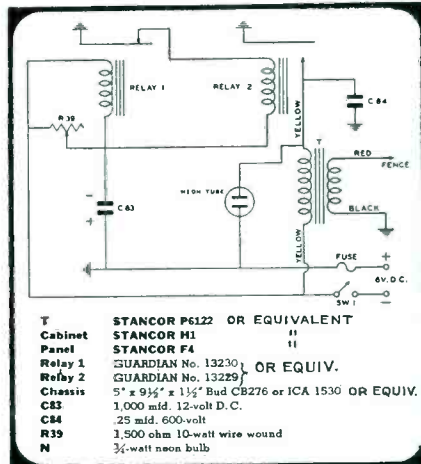
former (T2) secondary normally goes to the single fence wire insulated from ground. The other goes to a ground in the unit proper. This controller delivers a very hot penetrating shock when touched. In actual practice it was found that cattle will give it a wide berth after one contact.

Six-Volt Circuit

A circuit³ designed for operation from a three-cell storage battery or similar six-volt source is shown in Fig. 4. The layout is pictured in Fig. 5. The device operates in the following manner: Closing switch SW1 causes a current to flow through resistor R39 and Relay 1, thereby charging condenser C83. The charging current through Re-

Fig. 4 (below) and Fig. 5 (right). A simple unit with a pair of relays will charge the electric fence from a six-volt d-c source.

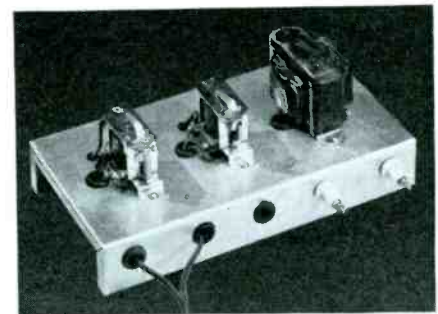
Illustration courtesy Stancor



lay 1 causes the contacts to remain open until it falls to a value too low to hold Relay 1. When the contacts on Relay 1 close, a circuit through C83 and Relay 2 is completed, causing contacts on Relay 2 to close. Condenser C83, then discharges almost immediately through Relay 2, but during the brief interval the contacts are closed, transformer T is energized by the six-volt circuit, a high voltage is induced in the secondary of T. The timing of the discharge is in-

duced in the secondary of T. The timing of the discharge intervals is predetermined by the parallel resistance value of R39 and relay coil together with condenser C83. Sliding the tap along the variable resistor, decreasing the value of R39, will increase the number of shocks delivered to the fence per minute.

The "hot" or ungrounded side of the output is connected to the fence to be controlled and the grounded side (chassis and battery) must be connected to a good ground such as a well casing. If



the ground is poor the fence will not have much "kick."

Due to operating characteristics of the relays, a novel method of chassis layout is used in the battery operated unit. This method permits the relays to operate in the correct position, with armature hinge down. It also provides sturdy support for all components.

The photographs (Figs. 3 and 5) show the arrangement of the parts on a base 9½" x 5" x 1½" deep, although the layout may be changed to suit individual requirements. Grommets should be used to protect all leads where they pass through the chassis.

Battery leads, neon indicator and output terminals extend through the front of the panel for cabinet mounting or may be arranged through holes drilled in the lower apron of the chassis.

Precautions

Electric fences are high-voltage devices. Proper precautions and safe-

(Continued on page 35)

YOUR EQUIPMENT

By ROBERT G. HERZOG

EDITOR

The conversation presented below, with only slight editing, was overheard in a local radio shop within the last month. Fictitious names have been substituted for the characters.

The Time: Early afternoon.

The Place: Williamson's Radio Shop.

The Occasion: Mrs. Lacey has come in to have her tubes tested. She approaches the counter behind which Bill Williamson stands. After suitable greetings from Bill she says:

"Would you please test these tubes and let me know if any are bad?"

"Why certainly. How long have you had them in your set?"

"Well, it must be two, er . . . no, three years or so. How long should they last?"

"Tubes will last two or three years under normal conditions, but they become weaker all the time. If you watch the meter on this tube checker you will see that all of your tubes read 'Weak.'"

"I'm glad to see that it's only the tubes. When the set stopped playing I thought it might be something serious."

"Although you should have new tubes, I don't think that weak tubes is the chief trouble with your set. If I were to put these tubes in another set they would work to some extent."

"Then why do I need new tubes. The set played all right before it had this trouble."

"Of course, the change in performance does not come about all of a sudden. As the tubes become weaker the volume drops gradually, month by month and . . ."

"But the set played plenty loud enough. If I turned the knob all the way up it would drive you out of the neighborhood."

"The actual loss in volume may not seem important, but as the ability of the set to produce drops, so does the quality of its output and what's more important, background noise gets louder and more annoying."

"There did seem to be a lot of noise. If I put new tubes in the set after it is fixed, do you think that it will be eliminated?"

"Perhaps, but I would have to check the set over with some of the instruments on that board before I would say for sure."

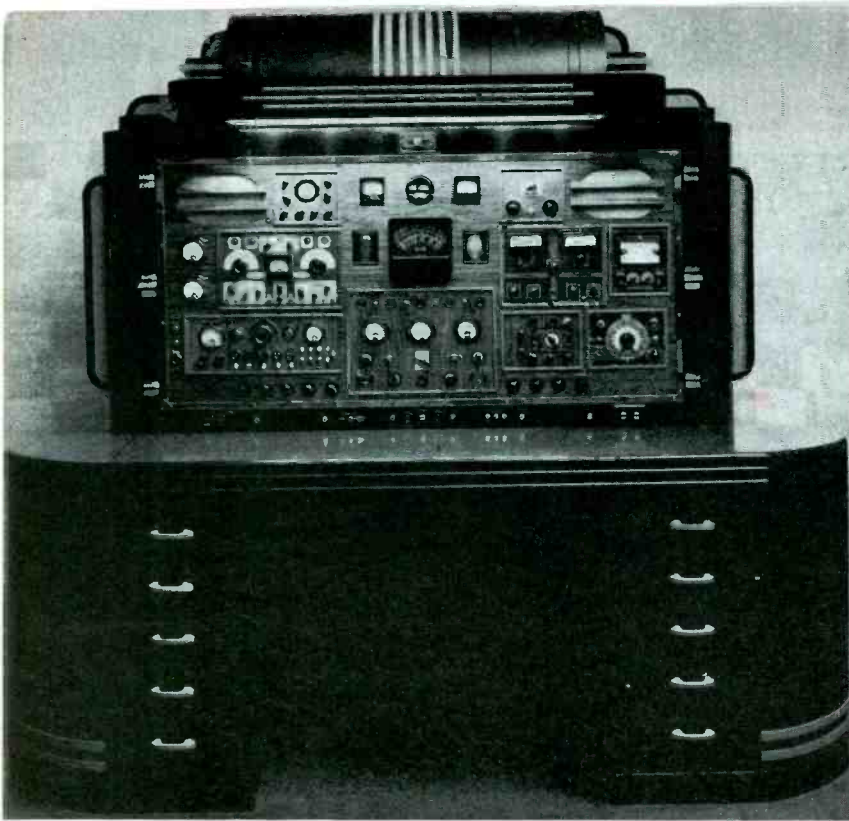
"I notice that you have quite a lot of meters and things. They sure look pretty, but do you really need all that stuff? I'll bet most of it's 'window dressing.'"

"All that stuff' is my stock-in-trade. There is hardly a day that I don't use every piece of equipment on that board to make checks during routine service jobs. Just as it is impossible for me to check your tubes without the tube tester, it is impossible to make the checks on your set without much of the equipment on that board. It is true that I could get along with a few pieces less, and make the others do their work. However, to save time and effort, for which I would have to charge my customers, I use this special equipment wherever possible."

"If you didn't need that flashy board you might be able to charge less for your work. I'm sure it must have cost a great deal of money."

"You can rest assured that my equipment represents a substantial investment. For that same reason you can

(Continued on page 34)



It has been said that elaborate layouts of equipment, such as shown above, are mere window dressing. Even if the equipment is needed, it was argued, the instruments could be kept neatly on a shelf. However, even the most casual layman can see that considerable time would be required to set up instruments for use in the shop below, whereas a Service Man could get right to work on the bench above.



Pictured below is a corner in the laboratory of Henry Howard, noted design engineer. Several pieces of equipment are set out to make a test on a new receiver design. Engineers use plenty of equipment to make sure that their circuits will stand up in normal use.



**FEWER INSTRUMENTS NEEDED...
LESS MONEY REQUIRED...
BIGGER PROFITS FOR YOU!**

THE 1, 2, 3, OF

RCP dependable TEST instruments

IN TIMES LIKE THESE much is expected of the radio serviceman. How well, how efficiently and faithfully he serves his community during the present national emergency, moreover, may determine radio servicing and the serviceman's future. Opportunity is knocking.

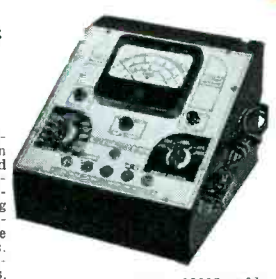
THE PUBLIC-SPIRITED patriotic serviceman is wise in turning to Radio City Products at this time. Accurate, fast and reliable, RCP test instruments are as impressive in operation as in appearance. This equipment is quality-built through and through. But what appeals to servicemen particularly—and especially now—is RCP engineering.

EVERY INSTRUMENT in this complete line is designed to do more work, more efficiently—at less cost to you. Which adds up to customer goodwill, more business and, of course, bigger profits. Five instruments in the latest, completest RCP line are described here. For news of the entire 1942 series, send for new RCP catalog.

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Ohms—0/1000/10,000/100,000/1 meg./100 meg./1000 meg.
Capacity—0/.001/.01/.1/1/10/100/1000 mfd.



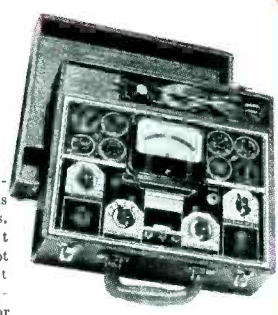
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**RCP803
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TUBE &
SET
TESTER
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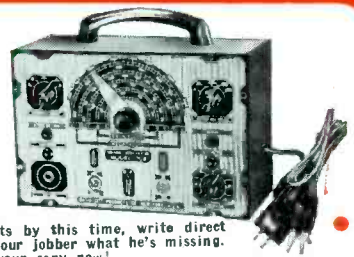
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RADIO CITY PRODUCTS CO., INC.
88 PARK PLACE • NEW YORK CITY

DO YOUR CUSTOMERS KNOW?†

By John F. Rider

PUBLISHER



IN THIS day of national emergency, radio is more than just a medium of entertainment and education. It is the only communication link of instantaneous action between the Federal Government and the people of this nation. It is the only means whereby with the flip of a switch, those who are responsible for the functions of this government and the proper protection of its people, may speak and convey their message to the entire population. Since we do not know what the future has in store—national preparedness requires that every radio receiver in the home—factory—automobile—or wherever it may be, function properly.

For many years past, manufacturers of radio receivers produced a new crop each year. Because of defense requirements, there will be a definite curtailment in the production of new receivers during the remainder of this year and next year. This means that the public at large will find it more and more difficult as time goes on, to procure new equipment to replace their old receivers. . . . Defects in radio receivers are, however, not controlled or determined by international policies, the declaration of war, or shortages of materials. . . . Radio receivers fail and will continue to fail because of the deteriorating actions of the electric currents which course through them—because of humidity—because of improper handling. . . . Since replacement of a defective receiver will become more difficult, it is inevitable that there should be an increase in the amount of radio servicing, therefore a closer association between the public and the radio repair industry.

Under the circumstances, it becomes valuable to the welfare of the people of this nation to know something about what radio repairing really means. . . . This does not require that Mr. and Mrs. America become technical people and make it their business to learn what is in a radio receiver. . . . What is necessary, however, is that people realize that the repair of a radio receiver is not as simple as many believe. . . . The modern radio receiver is a complicated affair. . . . There is no device with which the public comes in daily contact which is comparable in the nature of its complexities to the radio receiver. Strange as it may seem, about the only parallel is the human body. . . . The automobile, which so many people view with awe and consider a complicated device, is relatively simple when compared to a modern radio set.

The average listener becomes annoyed because a slight amount of noise, crackling or sputtering develops in his radio receiver. To all appearances, the receiver is perfect—except for that little noise. . . . After listening to the crackling for a week or so, a Service Man is called. . . .

As far as the public is concerned, this specific problem of repair is very simple. . . . It's just a matter of removing that crackling or sputtering. . . . What the

public fails to realize is that of all of the possible defects, and they are myriad, which may develop in a radio receiver—the most difficult of all to locate—is that of noise. . . . Every single part—every tube—every wire—every connection—in fact everything in the radio receiver is a possible source of this trouble. . . . It is true that once the defect has been located the actual operation of repair may be but a moment's work. . . . But the locating of that simple defect is an entirely different matter. . . . It may take hours and even consume days! . . . It may take many hours even in the finest equipped radio shops—operated by men who have spent years securing their technical education.

The locating of noise—that very slight crackling or sputtering—is in reality the most difficult problem which can face the Service Man. About the only parallel which can be found is an ache or pain in the human body. . . . As every man and woman well knows, many aches and pains which may appear to be centralized, are after much investigation and experiment found to be due to something far removed from the actual location of the pain. . . . Strangely enough, the public has become accustomed to accepting such conditions and to paying the doctor for each and every visit made—for each and every experiment, although, it may not be until after the fourth or fifth visit that the real root of the trouble is located and the remedy is effected.

But when working with the Service Man, the public, unfortunately, is not cognizant of the fact that the Service Man too, is working with invisible forces—electrical currents. . . . Because of the nature of the fault, few Service Men, if any are paid in full for all of the time they must spend to cure noise troubles in radio receivers. . . .

The public at large expects the Service Man to be able to diagnose a fault the moment he looks at or listens to a radio receiver. Just as a medical man often finds it impossible to arrive at a clear-cut diagnosis of an ailment by a superficial investigation in the home and requests that the patient go to his office for a more thorough analysis by means of proper apparatus, just so does the Service Man find it impossible in most instances to diagnose a defect properly in the customer's home. . . .

It is because of this and because the necessary equipment is located in the repairman's service shop, that it has become common practice to remove the radio receiver from the home to the shop. . . . It is only after critical examination in the repair shop that it is possible for the Service Man to render a decision as to the nature of the fault and the cost of its repair.

The public should appreciate that the Service Man is not a miracle worker—that he is just another human being, who can be trusted to do an honest job and render an honest bill for work done. . . . I say this with full realization that there have been times in the past when a Service Man practiced subterfuge. But to condemn the majority because of the occasional practices of a few is not right. The Service Men of America are honest people and serve the national requirements faithfully and justly. . . . The very growth of radio during the past twenty years is testimony to this fact.

It is of value to the public at large—for their own protection—for the protection of the investment that each and every person makes in his radio receiver, to understand that the repair of a radio receiver is not just the substitution of a defective part. . . . There occurs in a radio receiver, over a period of time, a gradual wearing away of the parts. This is similar to that found in the human body as people grow older. . . . Listening to a radio receiver day after day, it is indeed difficult to realize the changes taking place, for they occur little by little until that day arrives when the major defect develops. When such a receiver is sent to a radio shop for repair, replacing the defective part is not all that the Service Man must do.

After having put in a new part or parts as the case may be, and the receiver again is in an operative state, he then must check the entire receiver, for while it may be in an operating state, he still is not certain that the receiver is performing as it should. There is a great difference between a receiver which is in an operating state and a receiver which is performing as efficiently as it should and was intended by the set manufacturer. It is the obligation of every reliable radio Service Man to make certain that the receiver, before it leaves his shop is as close to perfection as it is possible to make it. An individual who is not familiar with radio would consider such a final check-up as being something superficial and unnecessary. This is absolutely incorrect, for we doubt if one receiver out of a thousand is in such condition when it is brought into a repair shop, that after repairing the fault the Service Man may return the receiver to the customer without any further checking.

Such supplementary and final checking consumes time, and while it is true that the customer may not have specifically asked for such a final test, he should look askance at the man who does not make it, rather than consider the Service Man who

(Continued on page 22)

†From an address over radio station WABC, New York, September 22, 1941, by John F. Rider.

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Radio Tubes

More Radio Service Dealers use National Union than any other make . . . there must be a good reason why.



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Complete line . . . Same Super Quality as found in N. U. Tubes. Just try them.



Sound Extra Tubes

. . . a line of heavy duty radio tubes for sound work . . . an exclusive N. U. development.



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The only line of Dry Batteries sold exclusively to the radio Trade . . . You can make more money.



Mr. Neil McKay

Stan McKay Radio Service
Oakland, California

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NATIONAL UNION invites . . .

All radio service dealers to enjoy the benefits of the N. U. Shop Equipment Plan. The latest in tube testers and test equipment are available to you, immediate delivery. More than 60,000 completed deals prove the success of this plan. Investigate now.

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Ready For Anything

Whether you are interested in Industrial Rectifiers from 1 volt to 250,000 volts and from 1 Ma. to 2,500 Amps. . .

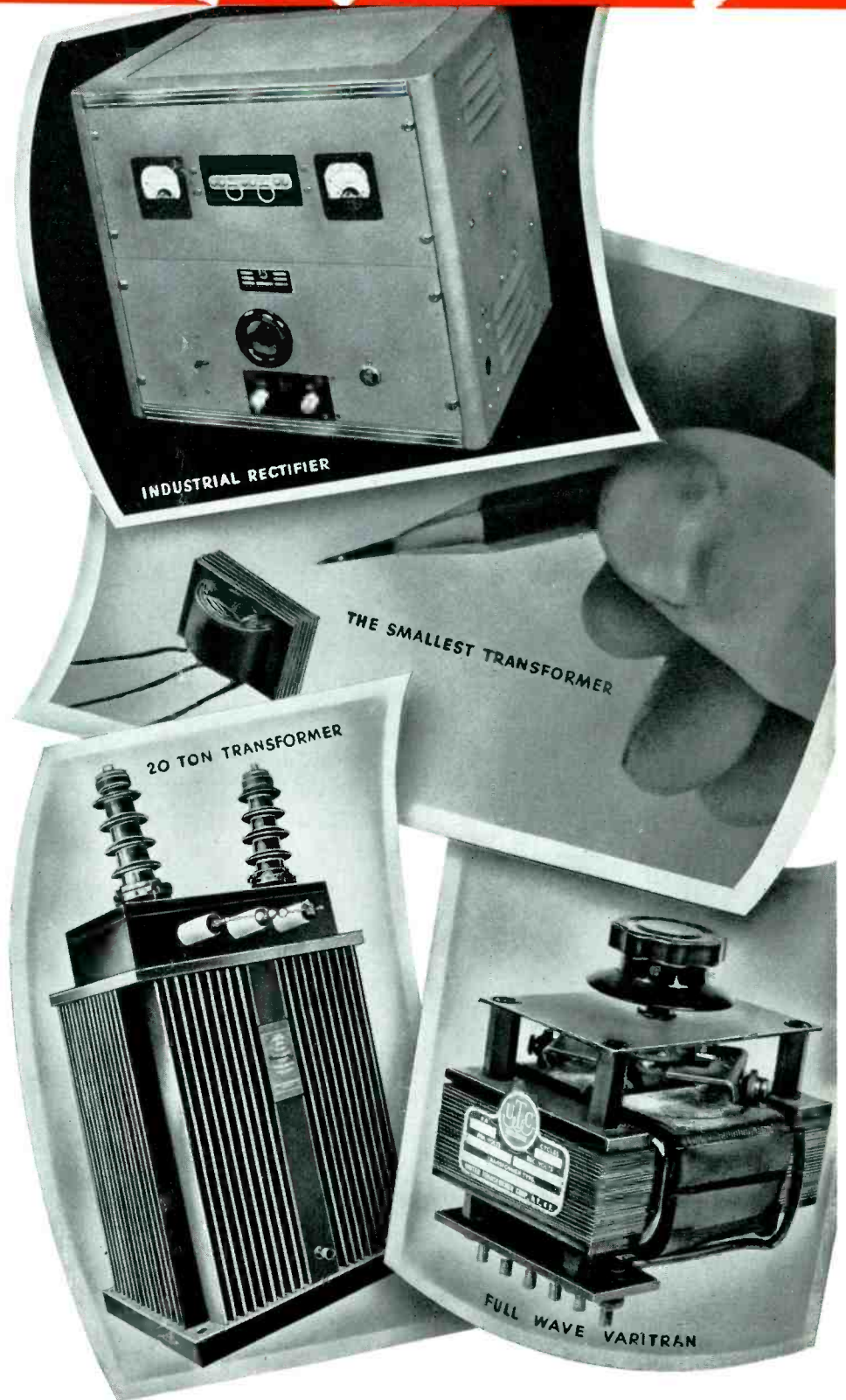
Or if you are interested in small transformers in our Ultra-Compact Ouncer or Sub-Ouncer types (our smallest units weigh only one-third ounce). . .

Or if you require high power transformer equipment for a 500 Kw. transmitter. . .

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ASSOCIATIONS

RADIO TECHNICIANS GUILD

Rochester, N. Y.

The Third Annual Info-Meet of the Rochester Radio Technicians' Guild will be held on Sunday, November 9, 1941. This date has been chosen to further co-operation with the IRE Rochester Fall Meeting, as was the case last year. The latter event will take place November 11, 12, and 13. Both the Info-Meet and the IRE Meeting are scheduled to be held at the Sagamore Hotel.

Plans for the Info-Meet have been completed by the various committees under the guidance of the following chairmen: Bertram L. Lewis, Info-Meet Committee; Horace Chapman, program; George Thompson, speakers and entertainment; Al Marsh, finance, and William E. Brewerton, publicity committee.

We have been assured that Walter R. Jones of Hygrade-Sylvania and other noted speakers from the IRE will be present. All indications lead us to believe that this meet will be bigger and better than ever.

The Info-Meet is open to any and every Service Men—it is not in any way a sales convention. Every reader of SERVICE should make an effort to attend.

William E. Brewerton, Publicity.

RADIO SERVICEMEN OF AMERICA

Cleveland, Ohio

The Eighth Annual Radio Industry Picnic, sponsored by the Cleveland, Ohio, Chapter of RSA, was held Sunday, August 31, at Brunswick Lake. From nine in the morning until all hours, games, contests, refreshments, dancing, etc., kept the many members, their families, and guests busy and entertained. We enjoyed the ball game between the jobbers and the RSA chassis jerkers. The decisions of the umpire were especially interesting. The tug-of-war, which ended in a spill for every one on a certain end of the rope, topped off the events of the day.

Ed George was general chairman of the picnic committee.

Don Bruns, Director District 12.

Danville, Ill.

The radio service business in Danville has really been good. Every shop is loaded and some are turning down jobs rather than take on more repairs than they can accomplish in a short time. We wonder if the "advertising" we received from the *Reader's Digest* helped do it?

The Danville Chapter RSA now has a bowling team. Boy, are they hot! They bowled last Wednesday night and lost, but it was a lot of fun just the same. Doc McKinney is captain of the team, which includes Robert Roesler, Harry Longer, Earl Drollinger, and Lyal Cummings. The season lasts thirty-five weeks and we just hope our men will last that long.

Edward C. Welch, Secretary.

Freemont Chapter

Robert J. Bay of the Warren Radio Co. loaned his RCA Dynamic Demonstrator

to our chapter for any tests we wished to make at our September 24 meeting. Bob Uhl checked the board with the 'scope and r-f oscillator, while Don Bruns used a Chanalyzer. Circuit faults were set up and the results observed. The meeting was conducted as a radio school in which the members could actually use the board and equipment for any tests they wished to make.

The secretary was instructed to congratulate Don Stover for the fine work on the *Reader's Digest* matter.

Robert M. Uhl, Secretary.

Interstate Chapter

Our September 9 meeting was held at O. W. Olson's home. In recognition of the goodness of Dr. Z. V. Harvalik of St. Ambrose College, Davenport, Iowa, in co-operating with the association on program activities, he was voted an honorary associate membership in the chapter. Dr. Harvalik is to address us again at our next meeting, which will be held at St. Ambrose College.

Oscar W. Olson, Secretary.

LaPorte Chapter

We have been organized for the past two years, but only recently have joined the RSA. We meet the second and fourth Wednesdays of each month. The first meeting is a business meeting and at the second we discuss our different service problems and pass along service kinks and hints which we encounter in our everyday work. We are very proud of the fact that every member is willing to cooperate with every other member at any time. We also notify each other concerning customers who lag in the payment of their bills.

We are now revising our by-laws to conform with the national RSA bylaws and are working on a coding system for marking chassis.

Stanley A. Kubit, Secretary.

Lehigh Valley

Our meeting of September 8 was a grand success. That boy Frank D. Langstroth of Hygrade Sylvania certainly is good. He talked on "Solving Modern Service-Problems."

On the 22nd, Sandy Gowan of Radio Service-Dealer talked about possible problems of this business of radio servicing. Members of the PRSMA of Philadelphia and RSA members from Reading were our guests.

LVRSA went on the air over WCBA on September 9 with our first full quarter-hour program. The subject matter was a rebuttal to the recent *Digest* item, with part of the script written by Dr. Orestes H. Caldwell of *Radio Today* magazine and the balance by our own boys. The speaker was ye scribe.

Ray E. P. Abbott, Secretary.

Pittsburgh, Pa.

At the regular meeting of this association on September 11, Henry Kaiser, Chief Engineer of WWSW and W47P, spoke on f-m and demonstrated many features. F-m station W47P broadcast a special pro-

gram especially for us. An f-m receiver was on hand for the demonstration.

Bill Irlam, Secretary.

Westchester, N. Y.

On Sunday, August 17, through the courtesy of our local jobber A. (Dave) Davis, who gave us the use of his large power boat, our members were able to enjoy a day's outing on Long Island Sound. With the exception of a couple of incurables, the men were glad to forget the subject of radio for at least one day. We really enjoyed ourselves with fishing, swimming, the contents of our picnic baskets, and, of course, the ride itself. Very many thanks, Dave. We wish there were more jobbers like you.

On Sunday, August 31, we really went to town with our annual clambake. Bob Jones ran the bake, assisted by Hinkelbein, Donaldson, Harris, Arrington, and (most important) Mrs. Jones. Grub! Brother, listen: All you could eat of clam chowder, clam broth, and clams—with a sauce the recipe for which Bob has a safe deposit box in his bank—and a half a chicken and a half pound of fish per person! Not to mention onions, potatoes, the usual condiments, rolls, soda, etc. Oh, yes! And for those addicted to the stuff, there was plenty of—must I say it? Well, all right—beer. Dancing, ball games, horse shoes, games and races with prizes—but why go on? Even if you weren't there, do you doubt we had a swell time?

We were pleased to have with us at our clambake Jimmy Walker of SERVICE Magazine, who was accompanied by his father-in-law. If friend Walker says he doesn't like clams and chicken after what we saw him put away, we are never going to believe anything we read in SERVICE any more. Selah!

But now winter is approaching, and our chapter is planning again to justify itself by giving a series of interesting lectures and many other services to its members. We plan to work with our neighboring chapters, so as to enable us to best serve the interests of the Service Man.

Henry M. Lutters, Director District 18.

New York, N. Y.

On Monday evening, September 29, John F. Rider, speaking to a group of over 300 New York Service Men at the Hotel Capitol, urged immediate and militant action among independent Service Men to combat certain forces which were aimed at their livelihood. Mr. Rider named and discussed these forces at some length and suggested that the Service Men organize into a powerful association to combat them. Many present indicated that they were ready to do so. Committees were immediately formed to get things under way.

On the same evening and on other evenings following, these committees have met and can report remarkable progress. Practically every group approached has signified that they would join the organization and would support it in every way. The parts jobbers, particularly, have indicated their support and at this writing have subscribed over \$500 toward that end.

From the enthusiasm shown, and the efforts spent by the preliminary committees, it would seem that we can say with certainty that there will exist in Metropolitan New York a very powerful and active service association bent on bettering the lot of the Service Man.

Robert G. Herzog, Acting Secretary.

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**PLUG-IN
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Type AEP-450—450 v. D.C.W.

Single-Section:

10, 20, 40 and 80 mfd. 1-5/32" dia.
x 2 1/2" and 4 1/4" tall.

Double-Section:

10-10 and 20-20 mfd. 1-5/32" dia.
x 2 1/2" and 3" tall.

Triple-Section:

10-10-10 mfd. 1-5/32" dia. x 2 1/2" tall.

Type AEP-45025
10 x 10 x 450 + 20 x 25.
1-5/32" dia. x 2 1/2" tall.

- Like to keep well ahead of the crowd? Well, here's a hot tip: Begin using these handy plug-in electrolytics for those radio, sound-system and electronic assemblies you're building or servicing regularly. They're the coming thing. They're smart—octal base fits standard octal socket; a cinch to test and replace; handle like another tube. Your customers will appreciate this up-to-the-minute touch.

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DO YOUR CUSTOMERS KNOW?

(Continued from page 18)

charges for such a final check-up, as making unnecessary charges.

The major portion of a charge made for a repair by a Service Man is mostly for work done other than the actual correction of the defect. It is for the time spent in pick-up and delivery of the receiver—for the time spent making the inspection—for the time spent making the actual diagnosis and locating the defect—for the cost of the new part or parts, some of which may be expensive—it is for the time involved in making the final overall check-up of the receiver. . . . Every service job must bear its share of the over-all expense of running the service shop—the rent, the light, power, advertising, cost of equipment and so on. . . . Failure to recognize this condition is due to no deliberate fault on the part of the public. . . . They just never have been told! . . . It is this that has made the public feel that oftentimes they were overcharged for a radio repair.

In connection with charges made for radio repair work, it may be of interest to people to know that of all of the technical classifications of employees in the United States, the Service Man is the lowest paid. . . . In fact, it is a very sad commentary upon the radio repair industry to note that the average net weekly income, as stated by the United States Department of Commerce, is between \$18.00 to \$20.00 per week. . . . This for a man who has spent much time securing a technical education. . . . Under the circumstances it is illogical for anyone to accuse the radio servicing industry at large as being a racket, for most certainly the remuneration received is not in line with the high incomes one would normally expect from a so-called racket. . . . The personnel of this industry—and there are 30,000 of them—are sort of forgotten men. . . . Most certainly it is hoped that in the future, a greater understanding will develop between the public at large and the American Radio Service Man, for he is entitled to as much consideration as everyone else who renders a service to the people of this nation.

Standard, nationally known parts and accessories are guaranteed for quality and performance. It pays to use them—and only them—in your work.

Book Reviews . . .

MATHEMATICS FOR ENGINEERS,
2nd EDITION, by Raymond W. Dull;
published by McGraw-Hill Book Co.,
New York, 780 pages, cloth binding, price:

The author states in his preface that this treatise has been prepared primarily for engineers, who want a quick and convenient reference; who have grown rusty in their mathematics; and who feel the need for a text for the study of mathematics. The author points out that two sources to which the engineer ordinarily turns for mathematical aid are the engineers' handbook and the mathematical text book. This

treatise is intended to remedy the situation.

The author has attempted to treat each subject completely without depending on a thorough knowledge of the preceding subject matter. The short cuts, methods of checking and graphical solutions are particularly apt. Of special interest to this reviewer was this chapter on empirical equations which is so seldom a part of the engineers' mathematical equipment just so useful in analytical work. The subject is well treated and presented in a logical and easily understandable manner.

This is an excellent reference book and well adapted for use in bringing out certain phases of mathematics. The treatment is clear and logical.

R. D. R.

PLASTICS IN INDUSTRY, by Plastes,
published by Chemical Publishing Co.,
Brooklyn, N. Y., 241 pages, cloth binding,
price \$5.00.

This book is intended to acquaint the reader with the essential facts regarding plastics, their origin, manufacture and uses. Plastics have been so much discussed in the press recently that many confused ideas relative to the industry is inevitable.

This treatise covers the subject in a thorough elementary style. The material is presented in logical and easily readable form. The book is well illustrated and is recommended.

R. D. R.

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Here is an AC-DC Volt-Ohm-Milliammeter with all the ranges you want . . . easily readable on the large 7" instrument with extra-long 6" scale, in a new up-to-the-minute three-tone case. DC Volts 0-10-50-250-500-1000 at 5000 Ohms per volt DC; 1000 ohms per volt AC. AC Volts 0-10-50-250-1000 at 400 ohms per volt; DC Ma. 0-1-10-100; Resistance ranges: 0-1500 Low Ohms; 0-150,000 Ohms and 0-7.5 and 0-15 Megohms. Maroon case with red and silver panel, attached handle.

Dealer Net Price, \$19.65

For Catalog Write — Section 1017, College Drive

READRITE METER WORKS, Bluffton, Ohio

CIRCUITS

(Continued from page 10)

a separate mike preamplifier stage.

Truetone D1175

Truetone Model D1175 phono combination features five bands including three with bandspread. Particular pains have been taken to do a complete job in switching and operating the short-wave bands. The full complement of condensers is provided, no cheap short cuts having been attempted. The result must be an efficient receiver. See Fig. 12.

Firestone No. S7399-1

Firestone No. S7399-1 has a self-shortening phono jack in the volume control circuit, eliminating the need for a switch. When the phono plug is inserted, it disconnects the detector. When removed, the detector circuit closes automatically.

Packard Bell 67B

In the Packard Bell 67B series of recorder combinations a 6SF7 pentode-diode serves as an i-f amplifier and rectifier for the cathode-ray eye which acts as a recording level indicator. (See Fig. 13.) In Fada's Model RE187 recorder, degeneration is applied to the volume control. The cold end of the control, instead of being grounded, is fed a small amount of audio voltage from a voltage divider across the voice coil. Grid leak contact potential bias is used in both the a-f amplifier and inverter, the value of the resistors being 4 megohms.

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

Airline 14BR742A

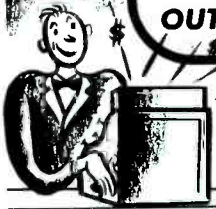
Before leaving battery sets, we should consider Ward's Airline Model 14BR742A designed for 6-volt storage battery or a-c operation from 115 or 230 volts. The tube lineup should be noted, as economy of operation seems to be the keynote. First, an OZ4 rectifier is used on both battery and line. Second, all 150-mil, 6-volt tubes are used except the 6SC7 twin triode power tube which draws 300 mls. Third, the use of this economical twin as a Class AB output stage. The vibrator takes only 2.4 amps, making the total drain for seven tubes only 3.6 amps. Switching from one line voltage to another is done by the adaptor plug which switches to the appropriate tap on the primary of the

Just what the Servicing Industry ordered!—

RIDER'S
"Automatic Record Changers and Recorders"

OUT NOVEMBER 20th. Approx. 700 Pages—\$6.00

Ring Out the Profits!



—and we don't mean *Wring* out the profits. For, automatic record changers and recorders are high-cost instruments on which you can make an adequate charge for repairs. There's a limit to servicing charges on "\$5.00 radios," regardless of how much time you spend on them. But, the owners of record changers and recorders are willing and able to pay you a profitable price to keep these expensive pieces in good working order. 800,000 record changers are providing an important source of profit for the wide-awake service shops of the country and creating a need for adequate and ready reference data to speed up trouble shooting and repair.

We anticipated this need and have been compiling material for the past 18 months. Now it's ready—just when you need it! Rider's "Automatic Record Changers and Recorders" is a bound volume of complete and valuable information which covers, by means of explanatory text, diagrams and drawings, and servicing data, *everything* you need to know on any automatic record changer or recorder coming to your shop. Place your order for delivery November 20th. Priced at \$6.00, it contains approximately 700 pages of the same size as Rider Manuals. And, speaking of Rider Manuals, do you have a complete set of all twelve—or are you missing any or all of the first five volumes? If you're, there's good news for you in the left hand column below.

JUST OUT — 1200 Pages — \$12.50
ABRIDGED RIDER MANUAL Vols. I to V

For those servicemen who have wanted a complete set of Rider Manuals, but felt they couldn't afford the early individual volumes, which sell for \$7.50 each, the Abridged Rider Manual Volumes I to V will prove an invaluable aid. Its 2000 pages cover the most widely distributed sets issued between 1930 and 1935. A real value—a time and money saver in your work on all the older sets. But you better get it (or any of the twelve volumes you are missing) NOW for—the prices of Rider Manuals and books will be increased December 15th!

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power transformer. A 3-section resistance capacity B filter is used as well as an r-f by-pass and buffer condenser for attenuating the r-f hash from the gas rectifier. (See Fig. 14.)

WELLS GARDNER 6D3-1

Oscillation: When an especially high gain i-f tube is used for replacement in some of the later production of this model, some trouble may be experienced with oscillation at the low-frequency end of the dial or in extreme cases over the entire dial. To eliminate this condition, a 170-ohm, 0.25-watt resistor should be connected between the cathode of the 12SK7 i-f tube and B—. Some late production models are factory equipped with this resistor.

Wells-Gardner & Co.

WELLS GARDNER 5D2-6

Production changes: In the circuit diagram the oscillator grid leak (R2) is shown as 50,000 ohms. To improve sensitivity, a 30,000-ohm grid resistor is used in some cases. Wells-Gardner & Co.

Standard, nationally known parts and accessories are guaranteed for quality and performance. It pays to use them—and only them—in your work.

Fig. 3. An individual Service Man's effort in a local newspaper (below).

Proven Right

By Readers Digest

TWO YEARS AGO SWANTZ DRAFTED THE FIRST RADIO ORDINANCE TO PROTECT THE PUBLIC.

One and one-half Years Ago Swantz Told Same Story to the Madison City Council With Graphs and Figures Showing the Enormous Toll Paid for Incompetence and Dishonesty.

This Spring Swantz had the ordinance strengthened and revised by the City Council to provide State Vocational Training, Examinations by a Radio Board and Revocation of License for dishonesty. Copies are available at the City Hall.

NOTE Organized servicemen offered to cut rates in proportion to the number of licenses through strict examination, but legal technicalities required a grandfather's clause and twice as many men were licensed (without examinations) as Madison can support. Yet organized workmen reduce their house calls from \$1.50 to \$1.00. The average net hourly wage is less than 65 cents and most men work only part-time. . . . too many men . . . too much duplication of shops and equipment. . . . The profit on tubes and repair parts does not begin to cover the overhead. Too many men . . . too much duplication of shops and equipment. One of our best technicians estimates 15 men can service all of Madison and suburbs—yet over 60 were licensed.

18 Years of Cheerful & Scientific Service

Write blue prints and instructions on almost every set made . . . specialized instruments to quickly locate any kind of trouble . . . published and recommended by John F. Rider, unanimously endorsed by radio manufacturers and engineers as the greater authority, compiler, and publisher of radio service information and procedure.

Written Estimates and Contracts Furnished.
10% Cash Discount on All Shop Repair Jobs

A. B. SWANTZ RADIO SERVICE
PHONE F. 7734

Low Overhead Location—402 S. Mills St.
Member of Radio Manufacturers Service — A.R.T.
L.U. 159 J.R.F.W.

"TURN ABOUT IS FAIR PLAY"

Some of the receiver manufacturers and service shops are taking advantage of the Reader's Digest radio repair man article to make its effect beneficial to the trade.

Fig. 1. Philco's placard for RMS members lists "Standard and Reasonable" prices for most repair jobs. Minimum charges are also indicated in larger type at the bottom of the listings.

Fig. 2. The first of three RCA advertisements in Collier's Weekly tells the public how to choose a radio Service Man. It appeared October 11.



WHAT YOU SHOULD KNOW ABOUT RADIO SERVICE

During the National Emergency

In this National Emergency, our radios become increasingly important to us all. They keep us in touch with our Government's Defense Program and other events of the utmost significance. They stand as safeguards to national unity and as aids to national defense. Thus, the desirability of keeping old radios operating efficiently becomes evident—and especially so in view of present limitations on the production of new receivers, caused by shortages of certain essential materials.

Actually, the average radio receiver requires little attention. What it does require, however, should not be neglected.

WHEN DOES A RADIO NEED SERVICE ?

It is seldom wise to wait for service until a radio stops operating entirely. As a rule, any receiver that has been in use for 18 months or more will benefit from a routine service check-up at a probable cost of not more than \$1.50 or \$2, depending on local rates. Most old receivers could be greatly improved, simply by the replacement of worn tubes. In other cases, the realignment of tuned circuits, the replacement of worn volume controls or other parts may make an amazing difference.

HAVE YOU A "RADIO EAR" ?

Deterioration in essential radio parts may result in noise, distortion, tuning difficulties, weak volume, poor tone and other annoying factors. Often, this

occurs so gradually you are not fully aware of it. Your ear comes to accept inferior reception as good reception, or you take poor operation for granted. With occasional attention from a competent technician, however, your radio should continue to perform satisfactorily for many years.

WHAT OF SERVICE CHARGES ?

The reliable technician—and you'll have no trouble locating such a man—is equipped for fast, economical service on any radio. He will charge on the basis of time required, plus standard prices for any tubes or parts used. For minor jobs, he will probably charge his advertised minimum service fee. This is sound business practice—for your protection as well as for his.

It is also sound practice for the service shop to have modern test instruments. RCA service equipment, for instance, permits testing along the lines followed in the RCA Laboratories, and in RCA radio manufacturing. Such equipment is conducive to better, faster and hence more economical work.

It is sound practice for a radio serviceman to explain just what is required to repair your radio. No reliable

technician will hesitate to do this. Moreover, he will search beyond the immediate pains of trouble and, if necessary, recommend replacement of other parts which show signs of deterioration.

MODERNIZING OLD RADIOS

He may also suggest ways to modernize your radio, such as by adding a record player, by installing a noise-reducing antenna, or by some other means.

Throughout his business, he follows the same principles which guide any good professional man. He knows you will judge him, not by "quacks" which exist in his, as well as in other professions, but solely by his ability for reliable, economical service in making your radio perform better and last longer.

CHOOSING A RADIO SERVICEMAN

Like any other good business man, the reliable radio technician is best known by his reputation, by his skill, by his associations, by his equipment, by the manufacturers he represents, and by his standing in the community.

Although Radio itself may be a newcomer to you, these common sense business principles are not. Judge by them, and you will have no difficulty choosing the right man—whether he be the dealer from whom your radio was purchased, a well-established independent serviceman, a department store, or any other concern offering modern radio service facilities.

RCA MANUFACTURING COMPANY, INC., CAMDEN, N. J.
A Service of the Radio Corporation of America



RADIO TUBES • TEST EQUIPMENT

Fig. 4. Sherman, Clay & Company, San Francisco music and radio shop blossomed forth with the advertisement shown to the right shortly after the Reader's Digest article was published. The ad took about two-thirds of a page and appeared in several of the local newspapers.

WHEN READER'S Digest published their radio repair man article we felt that, while in general it would affect the service industry adversely, individual service shops could act to make the article go to work for them. It seems that we were not alone in this belief. Several receiver manufacturers, as well as service shops throughout the country, are using the public interest which the article aroused to their own or to industry benefit.

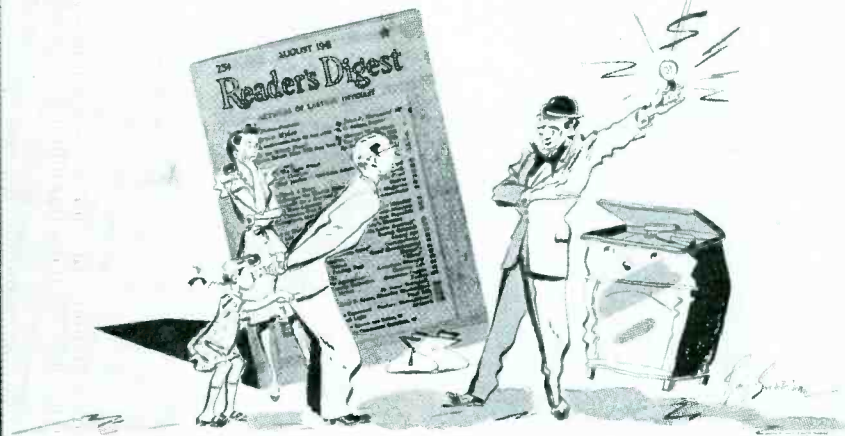
In a recent Radio Manufacturer's Service (RMS) mailing, Philco offered members a handsome sign (See Fig. 1) designed to assure the public that the shop displaying it charges reasonable prices. To bolster this contention prices for the most common repairs are listed. A bold line at the bottom lists minimum charges.

Fig. 2 shows the first of a series of full-page advertisements, placed by RCA, which began in the October 11 issue of Collier's Weekly. The initial ad pictures a typical man and wife looking, somewhat mystified, into the back of a console receiver while a Service Man points out a defective tube. Behind is the service bench with modern signal tracing equipment, meters and other service equipment. The text points out that in these days radio becomes ever more important as a means of emergency communication and for keeping in touch with fast moving world events. The desirability of keeping old sets operating efficiently is emphasized, in view of the present limitations on the production of new receivers caused by shortages of essential materials. The ad continues by pointing out that many sets which seem to operate well would be more satisfactory if "tuned up" at a cost of \$1.50 or \$2. The text also points out that old radios may be modernized by adding a record player, by installing a noise-reducing antenna, or by other means.

A. B. Swantz Radio Service, of Madison, Wis., capitalizes on the survey through the ad shown in Fig. 3. He calls local attention to his continued service in behalf of the public.

Sherman Clay & Company, California radio and music dealers with branches throughout the West, ran the huge ad shown in Feb. 4 in a number of local newspapers. They tell a rather complete story of the history behind their radio service department.

"The Radio Repair Man Will Gyp You If You Don't Watch Out"



Mr. Riis . . . You said a mouthful . . . But you Don't Know The Story of Sherman, Clay

We refer to your fine article on radio service, pages 6 to 10, August issue of the Reader's Digest . . . in which you expose unscrupulous tactics imposed on a trusting public by 304 radio repair and service shops investigated under your supervision.

We hope that everyone who owns a radio or radio-phonograph reads this article, because you've

said exactly the things about service that need to be said. Firms like Sherman, Clay can't say these things because it isn't good taste . . . nor is it good business . . . to say anything unpleasant (however true) about the other fellow.

So, thank you Mr. Riis, for telling this unsavory side of the service picture!

And now for the story you don't know . . .

THE STORY OF SHERMAN, CLAY'S SERVICE DEPARTMENTS



We use radio's newest scientific invention, the oscillograph, to find out just what's wrong with your radio or radio-phonograph.



You do not pay a penny more than the standard accepted rate for the specialized service of Sherman, Clay craftsmen.

We've been in the music business since 1870. It's highly specialized and people expect us to know all about everything that pertains to a musical instrument from rare old violins to Steinway pianos . . . and for the past 20 years, radios and radio-phonographs.

Our repair shops, all the way through, are manned by experienced technicians and repair men. They are answerable to a manager chosen by us for his expert knowledge, fairness and sense of responsibility to our customers and to our house.

Our repair men are on a salary. They are paid according to union scale. THEIR INCOME IS NOT BASED ON THE AMOUNT OF SERVICE OR PARTS THEY SELL TO CUSTOMERS. Paid by Sherman, Clay our repair men are responsible to Sherman, Clay for their conduct and work.

Whenever possible we repair instruments right in the home. When not possible, the set (with the customer's consent) is taken to our shops. It is our policy to inform the customer of the charges IN ADVANCE, when these charges exceed a certain modest sum. If requested, we gladly furnish estimates on all work, however small.

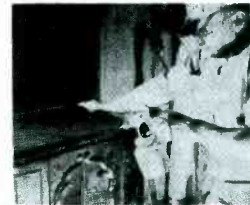
It is our policy to return old radio tubes to the customer. Also, if requested, worn-out parts are returned.

An itemized statement of parts replaced and work hours put into the job is furnished with every instrument we repair. It is delivered with the radio, or mailed to the customer within 24 hours.

All repair work is fully guaranteed . . . 90 days on service, 90 days on parts.



Sherman, Clay's service men are used to working on the world's finest radios. They are true technicians in the fine art of radio repair.



Whether it needs new tubes or complete overhauling, you get lasting dependability in our specialized repair work.

Sherman Clay

MAIL THIS COUPON FOR FREE, ILLUSTRATED SERVICE FOLDER

A *Canada Camera* Enter Through Sherman, Clay's Service Departments. No obligation. You'll find it interesting and informative.

SHERMAN, CLAY & CO. (Service Department)
 1741 BAY STREET, SAN FRANCISCO, CALIF.
 Gentlemen: Without obligation, please send me your illustrated folder on Radio, and other Service Departments.

Name _____
 Address _____ City _____

Another New Display to Add to Our Big List of Sales Helps



MARK UP ONE for the Sylvania Advertising Department. When Rosemary La Planche was named Miss California, she was picked for our big Football window display. Months afterward, on September 7, she was named Miss America. So the Sylvania Radio Serviceman's window display this Fall is a portrait of Miss America.

Other Sales Helps by the dozen are yours **FREE** or at a modest cost. Get full information and samples of what you may want by writing Hygrade Sylvania Corp., Dept. S10, Emporium, Pa. Write today before you forget.

Sylvania Helps You Sell — See Below

- | | |
|---|--|
| 1. Miss America Football Window Display | 15. Service hints booklets |
| 2. Counter displays | 16. Technical manual |
| 3. Electric Clock signs | 17. Tube base charts |
| 4. Electric Window signs | 18. Price cards |
| 5. Outdoor metal signs | 19. Sylvania News Sheets |
| 6. Window cards | 20. Characteristics Sheets |
| 7. Personalized postal cards | 21. Interchangeable tube charts |
| 8. Imprinted match books | 22. Tube complement books |
| 9. Imprinted tube stickers | 23. Floor model cabinet |
| 10. Business cards | 24. Large and small service carrying kits |
| 11. Doorknob hangers | 25. Customer card index files |
| 12. Newspaper mats | 26. Service Garments |
| 13. Store stationery | 27. 3-in-1 business forms |
| 14. Billheads | 28. Job record cards (with customer receipt) |

SYLVANIA

SET-TESTED RADIO TUBES
EMPORIUM, PENNA.

Also makers of Hygrade Lamp Bulbs,
Hygrade Fluorescent Lamps, and
Miralume Fluorescent Light Fixtures

VOLUME EXPANDERS

(Continued from page 13)

level of the signal fed to the output tube of the amplifier.

Emerson Symphonizer

A somewhat similar system of volume expansion was employed in several of Emerson's 1938 phonograph combinations. A circuit of the system, called the "Symphonizer," is shown in Fig. 7. The particular parts values and arrangement is for the Models X146, X178, X183, AB178, AB182, and AB183.

Referring to Fig. 7, the grid of the 6C5 first-audio tube is fed from the volume control (R13) through the 0.01-mfd coupling condenser C32. After amplification in this tube, the signal is developed across the 75,000-ohm (R21) and 15,000-ohm (R18) resistors in the plate circuit.

With the Symphonizer switch in the off or No. 1 position (See Fig. 8) the signal passes from the junction of these two resistors (R19 and R21) through the 0.02-mfd coupling condenser (C39) to the grid of the 6C5 second audio stage.

With the Symphonizer switch in the on or No. 2 position (See Fig. 7) a portion of the signal is fed to the 6C5 used as a diode through a 0.1-mfd coupling condenser (C36) and takes effect on the 6C5 Symphonizer tube, which is fed through the 3-meg filter resistor (R24) from the 1-meg diode-load resistor (R23). The effect is such that the plate resistance of the Symphonizer tube increases when the audio signal increases.

Since the Symphonizer switch is in the No. 2 position, the 0.02-mfd second-audio coupling condenser (C39) has been connected to the 75,000-ohm resistor (R21) together with the 200,000-ohm Symphonizer tube plate load resistor (R20).

The 2-meg resistor (R22), the 0.01-mfd condenser C37, and the internal plate-to-cathode resistance of the Symphonizer tube form a voltage dividing network which permits more or less signal voltage to be fed through the coupling circuit between the first and second audio stages. Since the internal resistance of the 6C5 Symphonizer tube varies with the bias applied, which in turn varies with the signal strength, the desired volume expansion effect on strong signals and contraction on weak signals is thus obtained. The 0.01-mfd condenser (C37) in the divider network, however, has a tendency to prevent the suppression of bass tones on weak signals.

Bass Compensation

In so far as the human ear is con-

cerned, weak lower frequencies fall below audibility while higher frequencies of the same intensity can be heard without difficulty (See Fig. 9). Thus, for example, it will be seen that a sound pressure of 0.1 dyne is needed to make 64 cycles audible, while at 3,000 cycles 0.0005 dyne is sufficient.

For this reason the volume expanders discussed employ filters or other methods to alter the response. In general the alteration is such that at maximum output volume the overall response is flat, but at lower levels the bass frequencies are progressively enhanced.

Bibliography

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"New Volume-Expansion Circuit," SERVICE, March 1936, page 102.

"Complete Volume Expansion," by C. M. Sinnett, SERVICE, November 1936, page 572.

"Functional Diagram of Componder Unit," SERVICE, December 1937, page 763.

"Automatic Volume Expansion," by Robert G. Herzog, MASTER SERVICING, January 1938, page 9.

"Amplifier Expansion Circuits," by Aaron Nadell, COMMUNICATIONS, February 1938, page 11.



Old Man Centralab
reminds you to always "specify
Centralab" when ordering parts.



**FIXED
RESISTORS**



**CERAMIC
CAPACITORS**



**VOLUME
CONTROLS**



**WAVE CHANGE
SWITCHES**



**TOGGLE
SWITCHES**

Centralab

DIVISION OF GLOBE UNION INC.
MILWAUKEE, WIS.

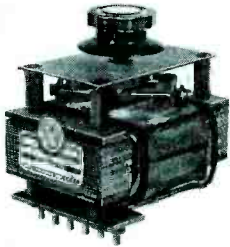
New Products...

SYNCHRO POWER SUPPLY

The Electric Products Laboratories, 549 W. Randolph St., Chicago, announce their Model 2500 Synchro power supply. The unit is a vibrator type power supply which furnishes 6-volts and 300-volts at 100 ma d-c from a 6-volt d-c source. Radio audio filter system is included, as are input and output battery cables, plug, fuse and clips.

CENTER-TAPPED VARITRAN

A Varitran variable voltage transformer (not an autotransformer) is available from United Transformer Corp., 150 Varick St., New York City. The new unit provides an isolated secondary with two con-



tacts that move in opposite directions from the secondary center tap. In this manner variable full-wave rectified d-c can be obtained with the use of a single Varitran instead of a Varitran-stepdown transformer combination. Standard units provide output voltage of 0 to 130 for a 115-volt a-c input.

TEST LIGHT

A new neon test light named "Ideal Test-Glo" for testing radio and electrical circuits, etc., has been placed on the market by the Ideal Commutator Dresser Co., 4025 Park Ave., Sycamore, Ill. Enclosed in a



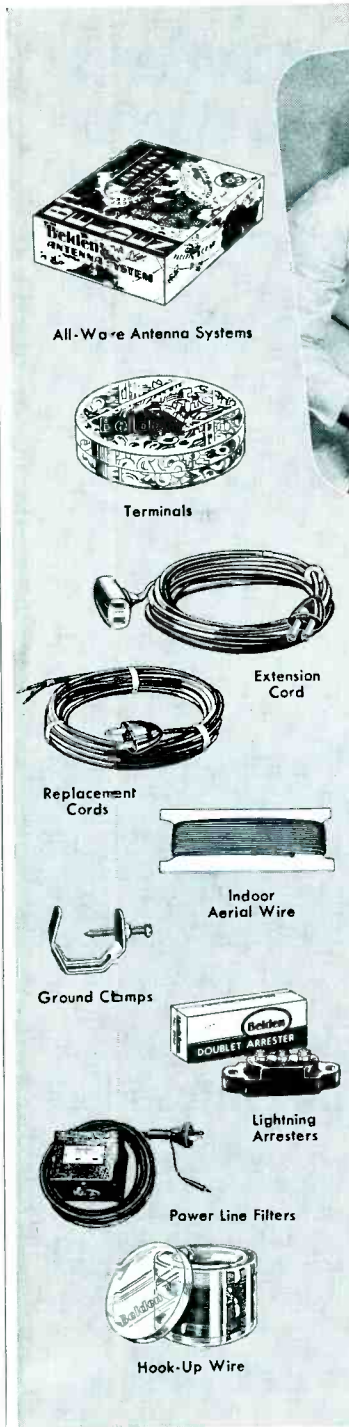
transparent, plastic housing it is protected against high voltages by a special resistor. Rated capacity is 80 to 550 volts A.C. or D.C. Overall length, 8". Test leads are 4½" long and insulated for safety.

MULTICOUPLER ANTENNA SYSTEM

The inclusion of F-M reception along with the already well-known features of all-wave reception and minimized noise, marks the latest development in the multi-coupler antenna system for apartment



houses and other multi-radio buildings, according to Any, Aceves & King, Inc., 11 West 42nd St., New York City, its patentees and licensors. The new type system usually employs for its aerial a doublet of two wires, one 45 feet long and the other



Things to Take Along to Make a Good Connection

Good radio service usually requires more than tube replacement, which any clerk might handle. As a professional serviceman—you can easily find the other troubles that interfere with good reception. A new antenna, a power line filter, hook-up wire, or one of the many other radio wire accessories may restore that "brand new" set condition. Take them along—give satisfaction to your customer—get the real profits your knowledge of this business deserves.

You'll find these fast selling items and many more in the Belden radio wiring line. Make a good connection—buy Belden from your jobber.

Belden Manufacturing Company
4615 W. Van Buren St., Chicago, Ill.

Belden Wire

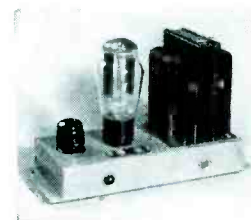
FOR GOOD CONNECTIONS

15, supported by neat angle-iron masts mounted on coping or superstructure. Lightning arrester and antenna transformer mount on mast, coping or wall, close to the aerial, so that no superfluous strain is placed on the wires. Where space is limited, vertical rod aeriels are used.

SPEAKER FIELD SUPPLY

Thordarson laboratories now have designed a speaker field supply for electrodynamic speakers. The flexibility of this field supply makes it adaptable to practically any loudspeaker that is equipped with a 2500-ohm field. The switching mechanism permits operation of two 2500-ohm fields requiring approximately 14 watts field excitation; four 2500-ohm fields requiring approximately 8 watts field power; or, eight 2500-ohm fields requiring about 4 watts field power. Operates on 110-120

volts 50-60 cycle current, and measures approximately 9" long by 5" wide by 7" high. Information on the Thordarson speaker field supply and the entire Thordarson



line of amplifiers is contained in Catalog No. 600-F available free from your distributor or direct from the factory. Thordarson Electric Mfg. Company, 500 West Huron Street, Chicago.



Above: N-Series Microphone, \$17.50



Right: N-Series Microphone with On-Off switch, \$20.00

NEW N-SERIES MICROPHONES FOR MODERN P. A. SYSTEMS

An exceptionally smooth frequency response along with other improved characteristics make these Astatic Crystal Microphones especially desirable for public address use. Swivel joint, tilting head for adjustment to directional or non-directional positions. Concentric cable connector provides for quick interchange of cables. Available in Wide Range Model N-30, and Voice Range Model N-80. List price, each \$17.50.

See your Astatic Radio Parts Jobber or write for catalog

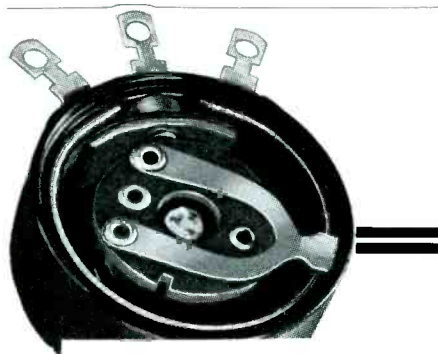
ASTATIC

THE ASTATIC CORPORATION

YOUNGSTOWN, OHIO

Licensed Under Brush Development Co. Patents

In Canada: Canadian Astatic Ltd. Toronto, Ontario



WIRE-WOUND CONTROLS

★ Here's what you see when you look inside a Clarostat wire-wound control: Precision winding on bakelite strip; perfected sliding contact of special alloy; exclusive winding lubricant for smooth rotation. ★ Linear controls are rated at 3 watts; tapered, 1.5 and 2 watts. 1 to 100,000 ohms. Ad-a-Switch feature. ★ Clarostat Wire-Wound controls are in constant use on equipment designed and built for use in many electronic devices NEEDED FOR NATIONAL DEFENSE. ★ Order from your local Clarostat jobber. Ask for latest catalog—or write us direct.

CLAROSTAT MFG. CO., Inc.
285-7 N. 6th Street, Brooklyn, N. Y.



Don't FALL for this one!

Numerous complaints have recently reached us that subscription salesmen, who have no connection with SERVICE MAGAZINE, are offering subscriptions to SERVICE and then delivering another radio publication.

Beware of this subterfuge!

WHEN YOU CHANGE YOUR ADDRESS

Be sure to notify the Subscription Department of SERVICE at 19 E. Forty-seventh St., New York City, giving the old as well as the new address and do this at least four weeks in advance. The Post Office Department does not forward magazines unless you pay additional postage, and we cannot duplicate copies mailed to the old address. We ask your cooperation.

"We Quote"

"The Service Man is the final and vital link in radio parts distribution. Parts manufacturers realize this more than ever today and are putting forth strenuous efforts to find ways and means to get materials so that parts distributors will continue to obtain essential stocks.

"The competent sound specialist has found increased opportunity for sales of industrial sound equipment in defense engaged plants. There sound equipment plays an important part in improving employees morale, increasing efficiency and stepping up production. Good preference ratings are generally available to assist in obtaining early deliveries. Go after this profitable business—and at the same time, you will make an important contribution to the National Defense program."

Thomas A. White, Vice President,
JENSEN RADIO MANUFACTURING CO.

"National Defense and the tremendous increase in employment throughout the country has now given the Service Man the opportunity to ignore the evils of the past in his profession, and place service on a more profitable and higher plane, comparable to other highly technical experts.

"The government's consideration in granting the highest priority civilian rating for the manufacture of parts and tubes for the repair of over fifty-five million sets now in operation, along with the reduction in the manufacture of new sets, will keep all live, responsible Service Men extremely busy for the next few years. The responsible men in radio servicing who have thorough knowledge of their business, with efficient up-to-date equipment and adequate stock of nationally known quality parts and tubes, are sure of big rewards in increased operations and income.

"The loss of a great many part-time and young Service Men who have been absorbed in defense projects and the draft, places the burden on those who make a full-time job of service work to handle this tremendous task of keeping present sets in operation. This not only applies to entertainment, but to keep open the most effective way for the government to keep the public informed on vital issues, necessary for their welfare and protection."

Edgar S. Riedel,
General Sales Manager,
RAYTHEON PRODUCTION CORPORATION.

Catalogs, Bulletins, etc. . .

Copies of the catalogs and bulletins discussed below may be obtained directly from the respective manufacturers mentioned. Write for them today!

• • • • Catalog No. 37 has been issued by the American Microphone Co., Ltd., 1915 S. Western Ave., Los Angeles, Cal. The catalog illustrates and gives the characteristics of the latest American microphones.

• • • • The annual edition of National Union's "Radio Foto Log," a listener's publication edited by Samuel Kaufman has been issued by the National Union Radio Corp., 57 State St., Newark, N. J. The 28-page magazine contains a station log for broadcast and short-wave listening as well as television reception. Features and photographs cover many phases of radio programs. The publication is intended for distribution to the public by Service Men throughout the country.

• • • • A 16-page catalog illustrating and describing Precision test instruments for the Service Man is available from Precision Apparatus Co., 647 Kent Ave., Brooklyn, N.Y.

• • • • Transformer replacements for over 4,000 receiver models are listed in Thordarson's new 32-page edition of their Replacement Encyclopedia (No. 352F). Electrical and physical characteristics of the replacement power, audio and output transformer or filter choke are included with the listings. Thordarson Electric Manufacturing Co., 500 W. Huron St., Chicago.

Displays . . .

• • • • A floor display stand, designed to sell Burgess flashlights and batteries is available from the Burgess Battery Co., Freeport, Ill. The display is included free with the purchase of an assortment of flashlight cases.

Personnel . . .

• • • • In order to familiarize themselves with expanded Clarostat Production facilities Clarostat representatives Jim Youngblood of Marion, Ind., and Frank Murphy of Chicago, spent a week recently in the Brooklyn plant and home office.

• • • • Maurice S. Despres, president of Dale Radio Co., Inc., of New York City, was appointed chief of the radio and battery division of the durable goods unit of the Office of Price Administration under Leon Henderson. He has taken a leave of absence from his business interests.

• • • • With the acquiescence of the Philco Corp., William H. Grimditch has accepted an appointment to the executive staff of the Hazeltine Service Corp. as vice president. The appointment is the outcome of suggestions and requests for expansion, acceleration and improved coordination between research and production in the communication fields important to national de-

SERVICING by SIGNAL SUBSTITUTION

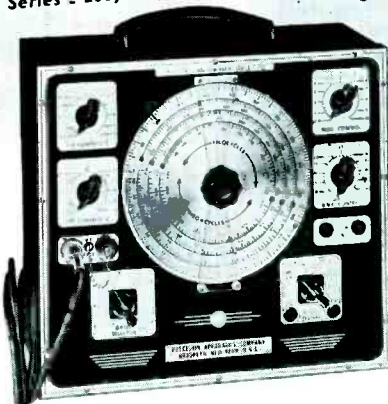
As Simple As **AA** **BB** **CC**

After service engineers acclaim this simplified method of dynamic receiver analysis . . .

Because "S-S-S" requires NOTHING COMPLEX TO LEARN . . . IS UNIVERSAL . . . NON-OBSOLESCE . . .

Cost is low, Performance high . . . "S-S-S" employs ONLY BASIC TEST EQUIPMENT . . . NO EXTRAS . . .

Every necessary facility for modern servicing (AM & FM) can be provided by a proper selection of ONLY 2 BASIC TEST INSTRUMENTS. Signal Generator (such as PRECISION Series E-200) . . . Tube Tester and the multi-range meter (such as PRECISION Series 920).



E-200 SIGNAL GENERATOR

Featuring a Simplified Method of Dynamic Receiver Analysis "Servicing by Signal Substitution"

Not only an efficient laboratory Signal Generator, but ALSO specifically designed for complete, systematic dynamic signal analysis of every receiver stage from loud speaker to antenna post, regardless of age, make, type. "Servicing by Signal Substitution" provides a new high in simple, rapid localization and determination of receiver troubles with a minimum and economical selection of Basic test equipment.

Series E-200, illustrated above. . \$39.95

Now in its THIRD printing, and FREE to all purchasers of Series E-200, an illustrated text book describing this amazingly simplified speed approach to receiver adjustment problems, "Servicing by Signal Substitution." Also available at your local distributor or direct from factory at only 35c.

See the more than 40 Precision 1942 models at your local distributor. Or write for new catalog.



ELECTRONOMETER Series 920

Dynamic Mutual Conductance Type Tube, Battery and Set Tester

An indispensable, single compact instrument for both field and service laboratory ★ 33 AC-DC set testing functions to 3000 Volts, 10 Megohms and 12 Amperes ★ Provides the individual functions of tube tester, battery tester and multi-range meter ★ Permits simplified, rapid check of tubes, voltage, current, resistance, etc., in troublesome stages, quickly localized through "Servicing by Signal Substitutions."

Series 920P, illustrated above. . \$59.95

PRECISION TEST EQUIPMENT

Standard of Accuracy SEE THEM AT YOUR JOBBER

PRECISION APPARATUS COMPANY • 647 KENT AVENUE • BROOKLYN, N. Y.
Export Division: 458 Broadway, New York City, U.S.A. Cable Address: Morhanex

fense. Mr. Grimditch will also continue his activities as an officer and director of the Philco Corp.

• • • • Paul S. Ellison has been appointed director of advertising and sales promotion for the Hygrade Sylvania Corp., manufacturers of radio tubes and fluorescent and incandescent lamps. Mr. Ellison joined the Hygrade Sylvania Corp. in January 1932. He entered the radio industry in January 1926 as advertising manager for Brunswick-Balke-Collender.

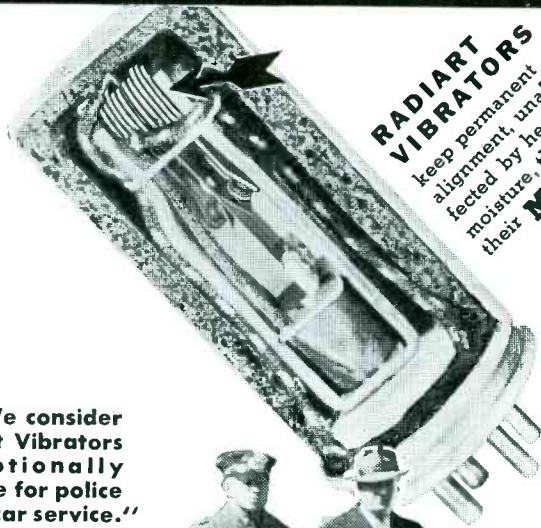
• • • • W. A. Coogan, Foreign Sales Manager, Hygrade Sylvania Corp., has been reappointed chairman of the RMA export committee for the coming year. Four important meetings are held during the year, two in New York and two in Chicago, for dis-

cussion and cooperative action on radio export problems arising out of the fast changing economic structures of foreign countries, involving foreign exchange, quotas, priorities, licenses, etc.

• • • • L. M. Bornstein, 333 Manufacturers' Exchange Bldg., Kansas City, Mo., has been named sales representative for the Turner Co., Cedar Rapids, Iowa. Mr. Bornstein will cover Iowa, Nebraska, Eastern Kansas, Mo., and Southern Illinois.

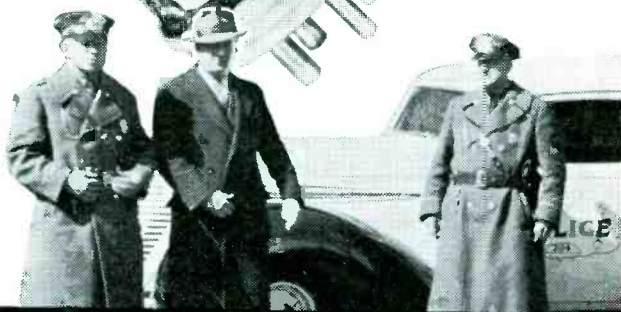
• • • • Alan Ramsay has been appointed factory coordinator on defense orders for the Universal Microphone Co., Inglewood, Cal. The position is a newly created one within the Universal Microphone Co., and should not be confused with similar government posts.

RADIART VIBRATORS "come through" in the toughest test of VIBRATOR DEPENDABILITY



RADIART VIBRATORS keep permanent alignment unaffected by heat or moisture, thanks to their **MICA and STEEL STACK**

"We consider Radiart Vibrators exceptionally suitable for police squad car service." Supt. GINTHER, WPDS, St. Paul Police Radio, which has records of Radiart Vibrators in operation after 3000 hours.



THE RADIART CORP., CLEVELAND



10 heat treatments
PROTECT
TRIPLET PRECISION

The need for controlled processes and uniform quality in parts has been answered by Triplet in setting up manufacturing facilities that make the company practically self-sustaining in the fabrication of instrument and tester components. Shown here is a view of one section of the automatic screw machine department in the modern Triplet plant where essential parts—some as minute as the smallest used in watches—are turned out 24 hours a day. More and more, Triplet has turned to wholly automatic fabrication of materials to speed up production and to eliminate any possibility of human error. To assure parts best suited for Triplet needs, company engineers have pioneered in the design and manufacture of countless fabricated materials including switches, bar knobs, resistors, jacks, special adapters, etc.—a complete service intended to give each user the fullest measure of satisfaction.

THE TRIPLET ELECTRICAL INSTRUMENT CO.
Bluffton, Ohio

Sound News...

Atlas Sound Corp., 1449 Thirty-ninth St., Brooklyn, N. Y., have announced a speaker power volume control for use across the voice coil of the speaker to provide gradual control of volume. The unit consists of a special tapered wire wound potentiometer and a fixed wire wound resistor for power absorption at minimum



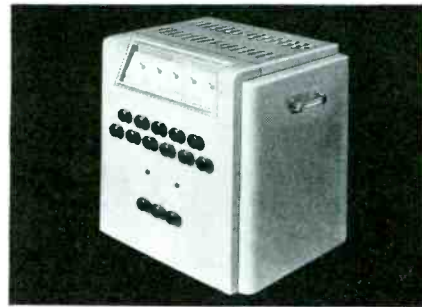
volume settings. The unit is rated at 10-watts, and is called Model RC1. Overall diameter 3 in.

BANTAM P-A SYSTEM

Allied Radio Corp., 833 W. Jackson Blvd., Chicago, introduces a 20-watt Bantam sound system in a 24 by 11 by 10 3/4 inch case. The overall weight of the system is 40 lbs. Field excitation is provided for two speakers and 4 and 8-ohm output taps are available. Three individually controlled input channels are also provided.

TWIN-POWERED AMPLIFIER

The Model 700 Bell Sound amplifier is powered by two 50-watt units, each capable of operating the system alone when desired. Their combined output provides 100-watts of audio power. Each amplifier unit has provision for one or two speakers with



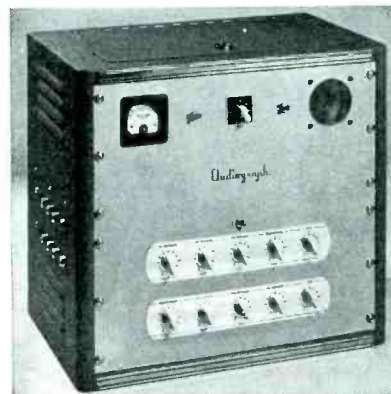
a multitapped output transformer for matching. Five input positions are available with separate volume controls. Separate master gain controls are also provided for each amplifier channel. A special switch permits the B power of one channel to be used with the other when the system is operated from one unit. Bell Sound Systems, Inc., Columbus, Ohio.

PLAYBACK NEEDLE

A duraluminum shaft sapphire playback needle, curved to meet the record straight on, without drag, is being offered by Duotone, Inc., 799 Broadway, New York City. The sapphire used is small and not easily broken, and the effect is to reduce the surface noise, it is said.

DUPLEX AMPLIFIER SYSTEMS

John Meck Industries, 1313 W. Randolph St., Chicago, offer two new models:



the B70D and the B140D. Both of these are duplex (two-channel) units. The former provides 70 watts output from two 35-watt channels and the latter provides 140 watts from two 70-watt channels. Each model is mounted in a 17 1/2-inch high cabinet with built-in monitor speaker. Channels may be used separately or combined. Eight separately controlled input positions are available. A master gain control permits overall control of volume.

GLASS-BASE DISC CARTONS

Audio Devices, Inc., 1600 Broadway, New York City, announce a new shipping carton for from one to three recorded glass-base instantaneous discs. Each carton consists of a double corrugated container and a sufficient supply of shredded lint-proof wax paper. They are available in 12- and 16-in sizes and are designed for reshipment of recordings.

NAVY TRAINS RADIO MEN

THOUSANDS of young men between the ages of 17 and 28 are becoming trained radio operators at Uncle Sam's expense, through enlistment in the Naval Reserve. Not only are they obtaining training which will likely prove valuable on return to civilian life, but in the meantime they are helping the Navy to meet its urgent need for radio personnel.

With the concentrated training program developed by the Navy, a man, even with-



One of a number of receiving positions at the U. S. Naval Reserve Training School, Noroton Heights, Conn. Each position is equipped with its own Hallicrafters Sky- rider communications receiver.

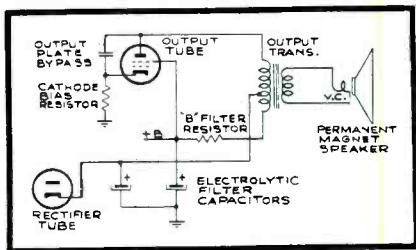
out previous radio experience, becomes a qualified operator ready for active service at ship or shore stations after only sixteen weeks of training. He is then capable of copying code directly on a typewriter at a rate of 25 words per minute, has developed general familiarity with navy transmitters and receivers, has acquired knowledge of the fundamentals of visual and underwater signalling, and has been trained in basic naval subjects and routine.

Every effort is made to keep this training as practical as possible. This is carried even to the extent of providing at the schools groups of complete receiving positions similar to those encountered in active service. These afford practical experience in tuning regular naval communications channels and copying actual naval dispatches from the air.

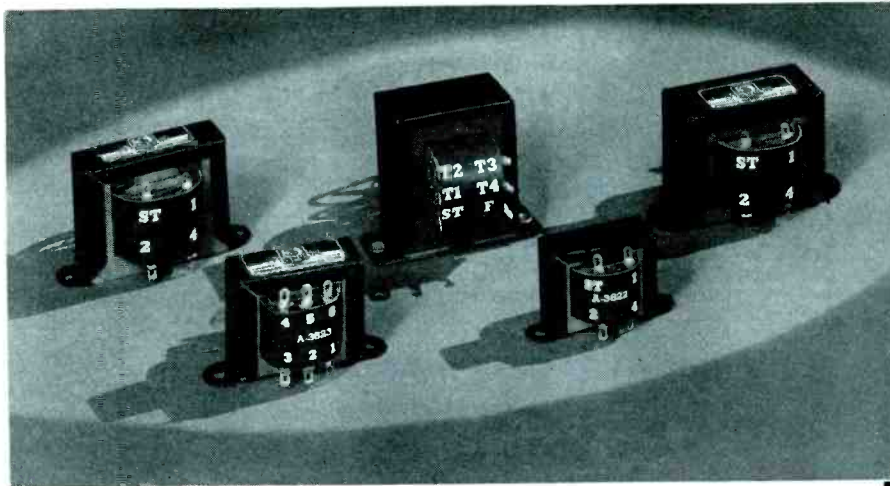
The U. S. Naval Reserve Training School at Noroton Heights, Conn., alone trains 500 operators every four months and others distributed throughout the country are training thousands each year. These are men selected on the basis of aptitude or previous radio experience from among those enrolled at naval training stations.

HUM BUCKING

IN RCA a-c, d-c receivers that use a p-m (permanent-magnet) speaker effective hum bucking is obtained through the use of an output transformer with tapped



primary. The tap is established at a point where the "ampere turns" of ripple in the direction of the output plate balances the



EXCLUSIVE FEATURES!

- ★ Many types and sizes to choose from.
- ★ Easy to install.
- ★ Comprehensive hook-up chart furnished with each unit.
- ★ Excellent overall frequency response.
- ★ Well engineered—carefully made.
- ★ Vacuum-impregnated the STANCOR way.

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STANCOR output transformers enjoy an enviable reputation for their adaptability, ease of replacement, and excellent overall frequency response. Servicemen everywhere demand them.

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Because of their versatility a supply should always be on hand. Order your favorite types today. Your jobber has them in stock.



FREE!

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TROPIC IMPREGNATED!!

ALL Stancor replacement transformers are tropic impregnated and at NO EXTRA COST!

Stancor . . . Used by Most Servicemen Most!



"ampere turns" of ripple in the direction of the screen and other plate circuits.

High residual hum (at zero volume setting) may be due to incorrect balance, and can usually be remedied by one of the following steps:

- (a) Output tube with off-standard characteristics.
- (b) Filter capacitor too low capacity, or too high internal resistance.
- (c) B filter resistor not correct value. Measure resistance and change if necessary.
- (d) Cathode bias resistor of output tube with incorrect value.
- (e) If hum persists change the output-tube-plate by-pass to the rectifier cathode instead of to the output-tube cathode.
- (f) If none of preceding steps reduces the hum to a satisfactory level, replace the output transformer.

Expansion . . .

• • • • The Amplifier Co. of America, 17 W. 20th St., New York, has recently increased its factory space to take care of increased requirements for ACA products in industry and in National Defense.

• • • don't miss
the feature article by
ALFRED A. GHIRARDI
in November SERVICE

**Because these Linear Standard Speakers
are made of the Finest Materials
. . . Precision = Fidelity . . .**

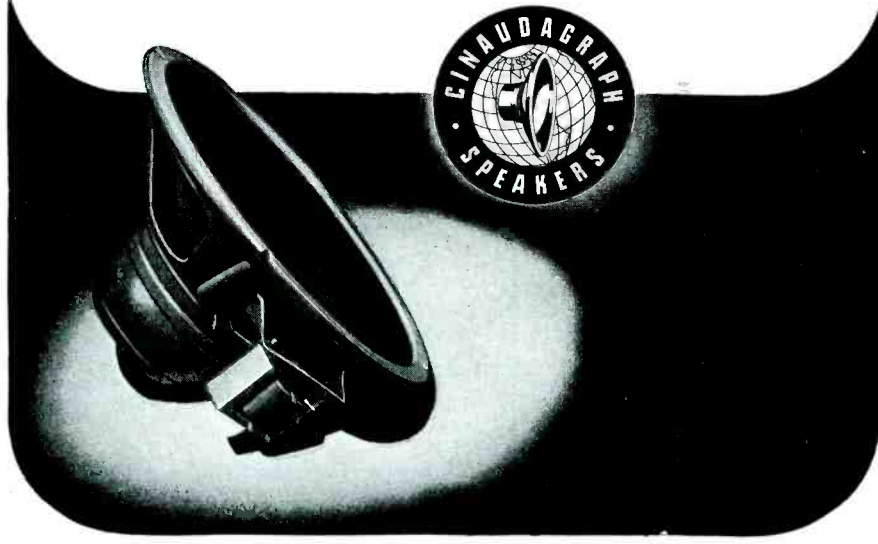
As definite as a Mathematical Formula is the fact that Fine Material plus Precision Workmanship, properly applied, invariably equals FIDELITY. . . . The Linear Standard presents the Ultimate in that type of reproduction.

Small wonder that CINAUDAGRAPH SPEAKERS are being chosen by the discriminating buyer—are finding their way into more and more installations!

Write now for full description in the Fall Catalog, just out, listing this, and all other models.

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**SUPREME 549
ELECTRONIC
VOLT-OHMMETER**

THE SUPREME Model 549 electronic volt-ohmmeter will take care of all multimeter requirements since it has standard provisions for a-c and output volts, direct current

measurements, etc., in addition to the electronic circuit for d-c voltage and resistance measurements.

D-c voltages from 0.1 to 6,000 are covered by six overlapping ranges of

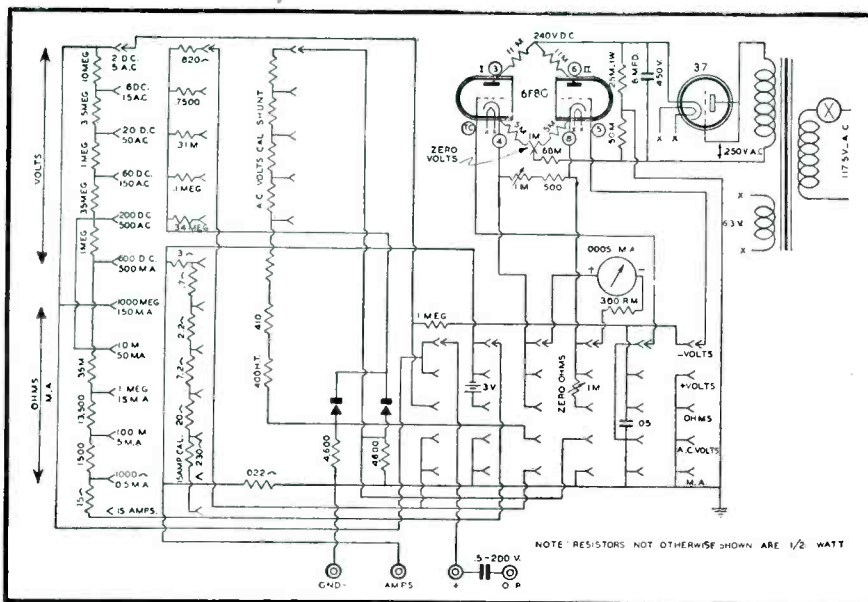
The Supreme 549 electronic volt-ohmmeter provides all the normal multimeter functions together with the electronic voltmeter and ohmmeter circuits.

0 to 2, 6, 20, 60, 200, 600 volts. These ranges may be extended to 6,000 volts through the use of a special probe. The impedance of all ranges up to and including the 600-volt range is 15,000,000 ohms. The input impedance of the 6,000-volt range is 150,000,000 ohms. The probe supplied for measuring d-c volts is designed so that the voltage developed across an oscillator grid leak can be measured without materially affecting the oscillator. Plate, screen, bias, avc and afc voltages can also be measured without upsetting the operation of the receiver. Voltages of either negative or positive polarity with respect to chassis or ground may be measured by setting the circuit selector switch to "plus" or "minus" volts as the case may be. The low range of 2-volts, full scale, provides a sensitive meter required for determining small control voltages.

Resistance measurements from 0.5 ohm to 1,000 megohms are covered by 5 overlapping ranges of 0 to 1,000 and 100,000, 1 meg, 10 meg, and 1,000 meg. An electronic circuit is incorporated in the ohmmeter which allows the 1,000 megohm range to be reached with a three-volt self-contained battery. After once adjusting the ohmmeter at zero and full scale positions there are no further adjustments to be made between ranges. The low ohmmeter range has a center scale reading of 15 ohms. Since the meter is of an electronic type, it is fully protected and accidental application of voltage to the ohmmeter terminal will not injure the instrument.

A-c voltage from 0.1 to 500 volts is covered by 5 ranges of 0 to 5, 15, 50, 150 and 500 volts in a copper oxide circuit. Output measurements from 0.1 to 500 volts a-c is also provided by five ranges similar to the a-c voltage ranges.

Current from 10 microamperes to 15 amperes, d-c, is covered by 7 ranges of 0 to 500 microamperes; 0 to 5, 15, 50, 150 and 500 ma and 0 to 15 amperes.



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for this one!**

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Resident courses.

Midland Radio & Television Schools, Inc.
Power & Light Building
Kansas City, Mo.
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National Schools
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Combination resident and correspondence.

New York Technical Institute
108 Fifth Avenue
New York City
Resident courses.

Nilson Radio School
51 East 42nd Street
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of resistances from .1 ohm to 10 megohms, also the range of currents, wattages and voltages commonly used in radio and commercial work. A setting of the slide also tells you the stock number of the resistor or rheostat you may need. Size of Calculator only 4 1/8" x 9".

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YOUR EQUIPMENT

(Continued from page 16)

be sure that I need every bit of it. I certainly would not have purchased it, if I didn't need it. I wouldn't have been able to buy it if it didn't pay its own way in time and effort saved. Because of this saving of time and effort I can do more work easier and quicker and charge much less for each job than I could if I didn't have all these special instruments."

"You can easily say that you must have all that equipment, just as I can say that I don't think so. . . . There is no way for me to be sure."

"Your radio receiver is a delicate and complex ma-



The public certainly should have more confidence in the shop pictured above than in the one shown to the right.

chine that operates with an accuracy nowhere approachable in any other man made device. You'll admit that the original design of such an intricate machine required a great deal of planning and skill. I'm sure that you would not need much convincing to believe that here, at least, a good many different types of instruments are required to make certain that the finished product will operate properly under every possible condition met in the listener's home."

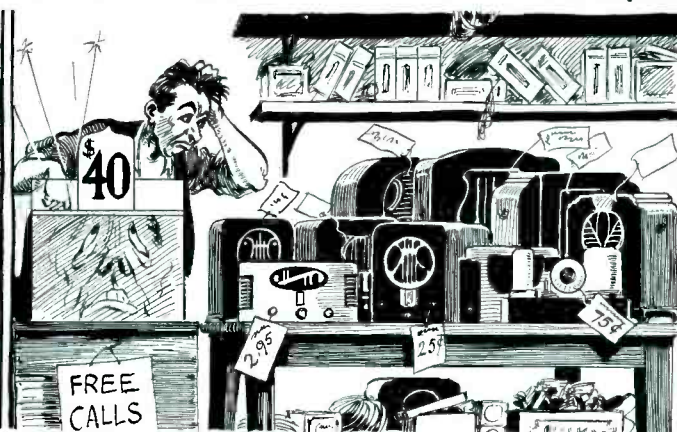
"Well . . . er, I suppose you're right."

"You probably would believe, also, that in manufacturing the receiver on the production line dozens of different types of test instruments are required to select and check the various components that make up the completed set. For adjusting the many intricate circuits, so that each station will tune in at its appointed place on the dial, even more test equipment is essential. A visit to any of the radio factories will prove that fact. *Would anyone dare say that all the equipment used by the receiver manufacturers is mere window dressing?*

Prices of radio receivers are so low that there is no relation between the cost and the complexity of design, or the quality of appearance and performance, or the year 'round service which the radio sets render. Can anyone say that the manufacturers purchase this equipment to increase their costs?"

"Maybe it's necessary to have a lot of meters and things to adjust the sets in the factory, but once they are adjusted why should Service Men fool with them?"

"I was coming to that. Let us say, for the sake of argument, that these circuits keep their adjustment throughout their normal life. How we can expect this to be the case, we'll pass over for the moment. Suppose you bring your set in for repairs and it requires



the replacement of a part in one of the many intricate circuits. We replace that part with a duplicate from our stock. Certainly that circuit, at least, must be readjusted, just as it had to be when the receiver was first built. But, even before we replaced the part, we must check every other part in your set: first to determine which one was defective and also to make sure that all the others have not been affected by the age and condition of the receiver. We need just as much equipment and more than the manufacturer uses to enable us to accomplish this with a minimum of time and effort."

"Do you really check all the parts in a radio set even if you don't suspect that they are defective?"

"Yes, we do so without exception. It doesn't take a great deal of time because we have the proper facilities. That's why we can do a better job than our competitors who haven't the instruments. We make sure that we have completely repaired your receiver before we return it to you. We can therefore give you a guarantee that really means something."

"You have convinced me enough to have me trust you with my radio set. Could you have one of your men pick it up soon?"

KEN-RAD

You can depend upon profits and satisfied customers when you handle and recommend Ken-Rad Radio Tubes. Hundreds of users write us in this vein: "We are receiving programs we never dreamed of getting before. Foreign countries come in like local stations."

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SUPREME INSTRUMENTS CORP. GREENWOOD, MISSISSIPPI

FENCE CONTROLLERS

(Continued from page 15)

guards must be taken in the installation and operation of these units. In addition to proper fusing, lightning arrestors, etc., the fence should be provided with suitable signs indicating the fact that it is charged with electricity.

Local and state regulations should be investigated and carefully followed before installation is actually made. Several communities have statutes forbidding the use of such controllers.

Underwriters' Recommendations

Taking into consideration all the data presented and discussed and bearing in mind the device and subject to which an attempt has been made to adapt these data, the Underwriters' Laboratories recommend the following as constituting safe electrical operating characteristics of electric fence controllers:

(1) *Voltage*: That where the current output is limited by inherent impedance of the device, the open-circuit voltage need not be limited.

(2) *Frequency*: That regardless of the frequency employed, the output current shall not exceed the values indicated in 3 (a) and 3 (b) below.

(3) *Current*:

(a) *Alternating-Current Type Controllers*—That for intermittent type controllers the output current shall be interrupted in such a manner as not to exceed the current-time relationship expressed in Graph No. 4, Fig. 6.

(b) *Battery-Operated Type Controllers*—That for intermittent type controllers the output current shall be interrupted in such a manner as not to exceed the current-time relationship of 4.0 milliamperes-seconds for "on" periods between 0.10 and 0.20 seconds. The output of controllers having "on" periods less than 0.10 seconds, shall not exceed that permitted by Graph No. 4 (Fig. 6) for the time involved.

(c) *Peaks*—That the time associated with peak currents as high as 300 milliamperes should not exceed 0.0003 seconds.

(4) *"Off Period"*:

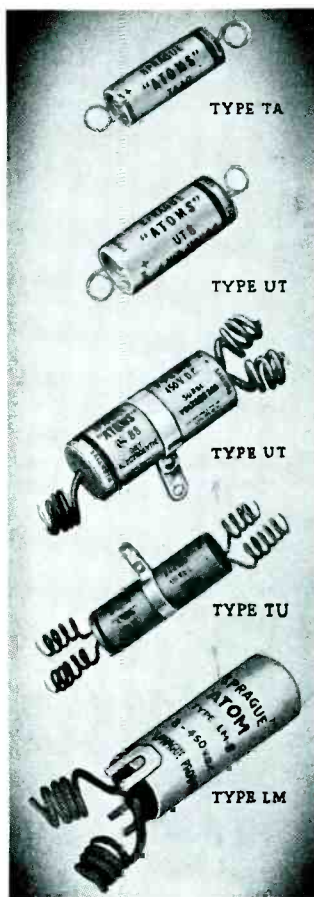
(a) *Alternating-Current Type Controllers*—That the "off" period between successive shock impulses shall not be less than 0.90 seconds.

(b) *Battery-Operated Type Controllers*—That the "off" period between successive shock impulses shall not be less than 0.75 seconds.

Bibliography

1. "Electric Shock as it Pertains to the Electric Fence," by H. B. Whitaker, Bulletin No. 14, Underwriters' Laboratories, Inc.

2. "Service Guide," 6th edition, Standard Transformer Corp., pps. 44 and 45.



5 SPRAGUE ATOM TYPES

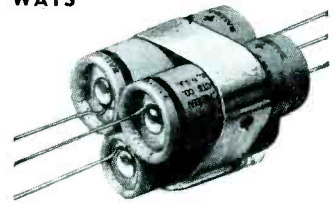
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Make up hard-to-get replacements by strapping individual Atoms together with ST Mounting Straps—supplied free! You'll find the combined Atoms actually smaller, often cheaper, and fully as reliable. You save time—money—space.



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North Adams, Mass.

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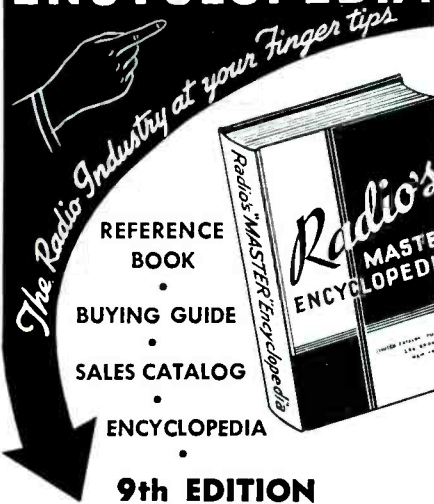
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WATCH

... for these full-page advertisements in Collier's. This one appeared October 11. A second will appear in the November 15 issue and there will be still another one in December. Display them in your windows and store. Cash in on this opportunity!



WHAT YOU SHOULD KNOW ABOUT RADIO SERVICE
During the National Emergency

In this National Emergency, our radios become increasingly important to us all. They keep us in touch with our Government's Defense Program and other events of the utmost significance. They stand as safeguards to national unity and as aids to national defense. Thus, the desirability of keeping old radios operating efficiently becomes evident—and especially so in view of present limitations on the production of new receivers, caused by shortages of certain essential materials.

Actually, the average radio receiver requires little attention. What it does require, however, should not be neglected.

WHEN DOES A RADIO NEED SERVICE?

It is seldom wise to wait for service until a radio stops operating entirely. As a rule, any receiver that has been in use for 18 months or more will benefit from a routine service check-up at a probable cost of not more than \$1.50 or \$2, depending on local rates. Most old receivers could be greatly improved, simply by the replacement of worn tubes. In other cases, the realignment of tuned circuits, the replacement of worn volume controls or other parts may make an amazing difference.

HAVE YOU A "RADIO EAR"?

Deterioration in essential radio parts may result in noise, distortion, tuning difficulties, weak volume, poor tone and other annoying factors. Often, this

occurs so gradually you are not fully aware of it. Your ear comes to accept inferior reception as good reception, or you take poor operation for granted. With occasional attention from a competent technician, however, your radio should continue to perform satisfactorily for many years.

WHAT OF SERVICE CHARGES?

The reliable technician—and you'll have no trouble locating such a man—is equipped for fast, economical service on any radio. He will charge on the basis of time required, plus standard prices for any tubes or parts used. For minor jobs, he will probably charge his advertised minimum service fee. This is sound business practice—for your protection as well as for his.

It is also sound practice for the service shop to have modern test instruments. RCA service equipment, for instance, permits testing along the lines followed in the RCA Laboratories, and in RCA radio manufacturing. Such equipment is conducive to better, faster and hence more economical work.

It is sound practice for a radio serviceman to explain just what is required to repair your radio. No reliable

technician will hesitate to do this. Moreover, he will search beyond the immediate point of trouble and, if necessary, recommend replacement of other parts which show signs of deterioration.

MODERNIZING OLD RADIOS

He may also suggest ways to modernize your radio, such as by adding a record player, by installing a noise-reducing antenna, or by some other means. Throughout his business, he follows the same principles which guide any good professional man. He knows you will judge him, not by "quacks" which exist in his, as well as in other professions, but solely by his ability for reliable, economical service in making your radio perform better and last longer.

CHOOSING A RADIO SERVICEMAN

Like any other good business man, the reliable radio technician is best known by his reputation, by his skill, by his associations, by his equipment, by the manufacturers he represents, and by his standing in the community.

Although Radio itself may be a mystery to you, these common-sense business principles are not. Judge by them, and you will have no difficulty choosing the right man—whether he be the dealer from whom your radio was purchased, a well-established independent serviceman, a department store, or any other concern offering modern radio service facilities.

RCA MANUFACTURING COMPANY, INC., CAMDEN, N. J.
A Service of the Radio Corporation of America



RADIO TUBES • TEST EQUIPMENT

RCA GOES TO BAT

FOR THE RADIO SERVICEMAN

Over three million buyers of Collier's Magazine will see the above advertisement. Millions of other readers will also see it. Reprints supplied for use by dealers and servicemen will reach countless more. Similar RCA advertisements devoted to radio servicing appearing later this Fall will carry on the good work.

These advertisements are published because RCA believes in the serviceman. We believe in his ability to do a competent, workmanlike job. We also believe that, in

view of the national emergency with its curtailment of new radio production, his job of keeping old receivers working at top efficiency looms more important than ever before. Consequently, we regard it as both a duty and a privilege to bring these facts to public attention. A fairer appreciation by radio owners of the competent, honest job the modern serviceman is equipped to do should be a mighty good thing all around.



Where else can you obtain this support?

Tubes and Test Equipment

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In Canada: RCA Victor Company Limited, Montreal

