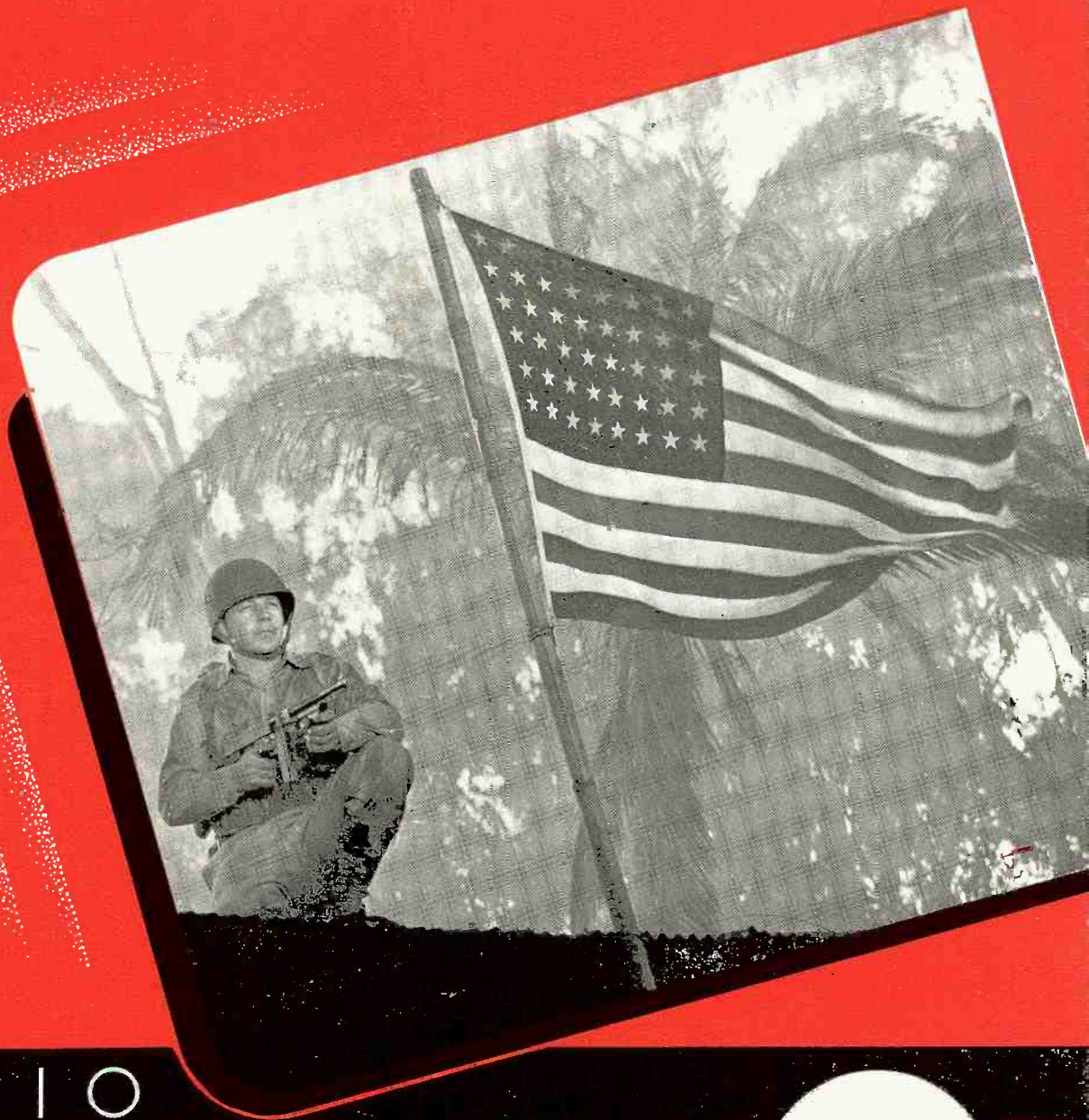


# SERVICE

A MONTHLY DIGEST OF RADIO AND ALLIED MAINTENANCE



★ RADIO

★ TELEVISION

★ ELECTRONICS

JULY  
1943



# You are going to be a bigger man

Keep this fact clearly in mind: *electronics* is the growing art of harnessing electron tubes—in many cases, familiar types of radio tubes—to new applications; and it means everything to your future.

Big as the radio and communications industry has been, it is only *one phase* of electronics. Hitherto your opportunities have been practically limited to that one phase—transmission of sound. At the start of the war, television—transmission of sight—was just opening up.

When the war is over, television will arrive—but *it won't be alone*. RCA electron tubes will be put to work on thousands of *new jobs*—new electronic devices.

As a Tube and Equipment Distributor and Serviceman *YOU* will service these devices—sell replacement tubes they will require.

*YOU* will draw income from this vastly widened field. You will be a *bigger man*—expanding, reaching out, grasping opportunity. RCA Engineers and RCA Tube and Equipment Distributors and Servicemen, working together, can help enormously to make electronics the biggest industry, and the greatest public service, this country has ever known!



## RCA ELECTRON TUBES

RCA Victor Division • Radio Corporation of America • Camden, N. J.



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**WARTIME**  
**AID!**



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Remember the "Here's How" contest, recently sponsored by IRC in leading Service Papers throughout America? . . . Hundreds of Service Men sent in their suggestions on how to replace volume controls and get radio sets working satisfactorily when the controls which normally would be used were not available.

The contest judges had a tough job picking the winners and the runners-up. Piles of letters had to be read—diagrams checked. But now it's all in shape and we've put the *ten top ideas* in a booklet to help everyone in the industry faced with a volume control problem. As an added feature we've included the latest data on ½, 1 and 2-Watt Resistors (both Metallized and Wire-Wound), together with substitution information on 10-Watt Wire-Wound Resistors, now so difficult to obtain.

*These booklets are so timely and so useful to Service Men that we don't think our supply will last very long. May we suggest that you write today for your copy? No charge, of course.*



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# EDITORIAL

**A**N exchange of correspondence between Honorable James F. Byrnes, director, Office War Mobilization, and Neville Miller, president of NAB, has resulted in a concrete promise by Ray C. Ellis, director, Radio and Radar Division, WPB, that sufficient tubes will be available for civilian use in the third quarter.

The letter to director Byrnes from Neville Miller said in part . . . "Lack of radio tubes for home sets has created an alarming problem. It has already seriously endangered the delivery of vital war messages from various government agencies and departments into the homes of citizens.

"It is our belief that the continued operation of mass communication throughout this nation is of the utmost importance and depends upon the immediate implementation of a balanced program which recognizes the needs of both the military and the civilian economy.

"National minimum requirements call for between two-million and three-million tubes per month. This is based on the maintenance of one set per radio home and excludes from consideration all automobile and portable receivers.

"Practically all dealer and jobber civilian tube stocks are exhausted. Only a limited quantity of tubes have reached civilians during the past eighteen months.

"The recently issued Order L-265 may control distribution. However, no directive is in effect to insure production of tubes in the quantity and of the type required to satisfy now critical needs. A program exists in WPB which should solve the tube problem if put into operation immediately."

The industry is indeed grateful to Mr. Miller for this pointed request which appears to have resulted in action!

**W**E are indebted to the War Department, Headquarters, Services of Supply, Office of the Chief Signal Officer, for our front cover illustration this month. The photograph is from a scene in the U. S. Army Film "Attack Signal."

# SERVICE

A Monthly Digest of Radio and Allied Maintenance

Reg. U. S. Patent Office

Vol. 12. No. 7

July, 1943

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Published monthly by Bryan Davis Publishing Co., Inc.  
19 East 47th Street, New York, 17, N. Y. Telephone PLaza 3-0483



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**F. Walen, Secretary**

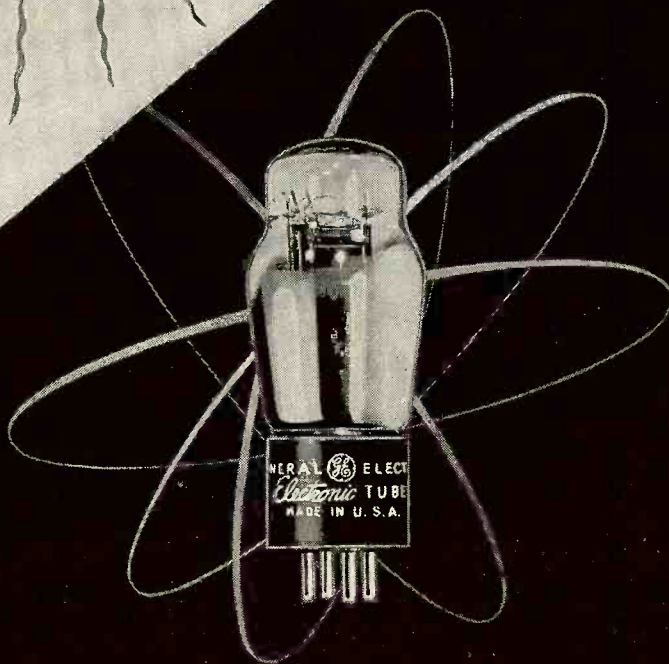
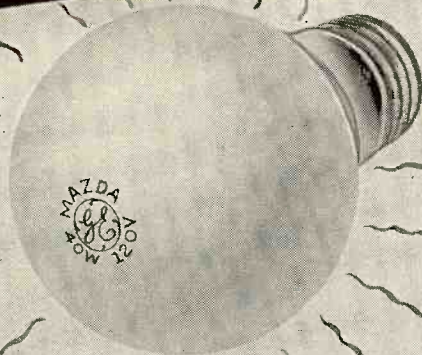


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Entered as second-class matter June 14, 1932, at the Post Office at New York, N. Y., under the Act of March 3, 1879. Subscription price: \$2.00 per year in the United States of America and Canada; 25 cents per copy. \$3.00 per year in foreign countries; 35 cents per copy.

# What have G-E Mazda Lamps and G-E Electronic Tubes in common?



**T**HE General Electric Mazda Lamp and the General Electric Electronic Tube have a lot more in common than meets the eye!

But radio service men and service dealers should recognize the important similarities. Both lamp and tube bear the same G-E symbol that the public has long shown its respect for by buying countless millions of electric lamp bulbs for its homes, stores, farms, factories.

Both are durable. Both are efficient. Both bring a fair profit to the retailer. Both are as American as Chevrolets,

Plymouths, Fords. Both give much more service than their cash value indicates.

The history and development of both are closely tied in with General Electric's history and development. Both are being widely and currently advertised to consumers through the nation's most effective advertising media.

As a result, the G-E Electronic Tube is earning the same complete consumer confidence now given to the famous G-E Mazda Lamp.

There is already an increased demand for G-E Electronic Tubes. And when

peace is restored, General Electric Electronic Tubes will be in greater public demand for replacements than they ever were before. Insistent General Electric advertising and promotion are carefully planned to make them your fastest moving radio tubes. *Electronics Department, General Electric, Schenectady, New York.*

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Tune in "THE WORLD TODAY" and hear the news direct from the men who see it happen, every evening except Sunday at 6:45 E.W.T. over CBS. . . . On Sunday listen to "The Hour of Charm" at 10 P. M. E.W.T. over NBC.

## GENERAL ELECTRIC

LEADER IN RADIO, TELEVISION, AND ELECTRONIC RESEARCH

176-B4

# THE EXECUTIVE WHO STOPS TO THINK . . .



*Knows that "10% for War Bonds isn't enough these days"*

Workers' Living Costs going up . . . and Income and Victory Tax now deducted at source for thousands of workers . . .

Check! You're perfectly right . . . but all these burdens are more than balanced by *much higher FAMILY INCOMES for most of your workers!*

Millions of new workers have entered the picture. Millions of women who never worked before. Millions of others who never began to earn what they are getting today!

A 10% Pay-Roll Allotment for War Bonds from the wages of the family bread-winner is one thing—a *10% Pay-Roll Allotment from each of several workers in the same family is quite another matter!* Why, in many such cases, it could well be jacked up to 30%—50% or even more of the family's *new money!*

That's why the Treasury Department now urges you to revise your War Bond *thinking*—and your War Bond *selling*—on the basis of *family incomes*. The current

War Bond campaign is built around the family unit—and labor-management sales programs should be revised accordingly.

For details get in touch with your local War Savings Staff which will supply you with all necessary material for the proper presentation of the new plan.

Last year's bonds got us started—*this year's bonds are to win!* So let's all raise our sights, and get going. If we all pull together, we'll put it over with a bang!

This space is a contribution to  
America's all-out war effort by

S E R V I C E



you've done your bit  
... now do your best!



## AN ANALYSIS OF LOW POWER PHONO AND A-F AMPLIFIERS

By **ALFRED A. GHIRARDI**

Advisory Editor

**P**ORTABLE a-c phonographs have become exceedingly popular during the past ten years.

A number of developments have contributed to the economy and performance of modern record players, particularly the high state of development of crystal pickups, high gain audio power tubes and efficient forms of dynamic speakers. Audio equalizers, voltage doublers and high level needles have increased output power or given better quality. The single tube (and rectifier) amplifier phonographs have had a considerable degree of success, you may be sure there will be plenty available after the war. Either the 35L6 or 50L6 series of beam power tubes are usually employed because of their high transconductance. But, while the gain is admirable, it is not always adequate for maximum power output from all types of records. Hence, plenty of attention must be given to gain in these amplifiers.

But, in so simple an amplifier, not much originality is possible. The selection of a high level pickup giving a peak voltage of 2 to 15 is the most important requirement. A p-m speaker with a large magnet is desirable because of its sensitivity. Where an electrodynamic speaker is used, plenty of ampere turns should be used in the field. This precludes the use of the series field because of the low current drain and low plate voltages in these units. A shunt-fed field would seem more desirable.

### Voltage Doublers

The voltage doubler rectifier comes to the rescue in providing some extra plate voltage, and economically, too. Fig. 1 illustrates a circuit in which the power supply uses a voltage doubler circuit and a 1,060-ohm series-fed speaker field. Doublers are most suitable where the loads are light, so the small player is a better application than

the midget radio set. The extra voltage permits a surprisingly high output. . . . 2.25 watts undistorted and 4.5 watts maximum. A similar doubler power supply is used in the Automatic Radio model 265, shown in Fig. 4.

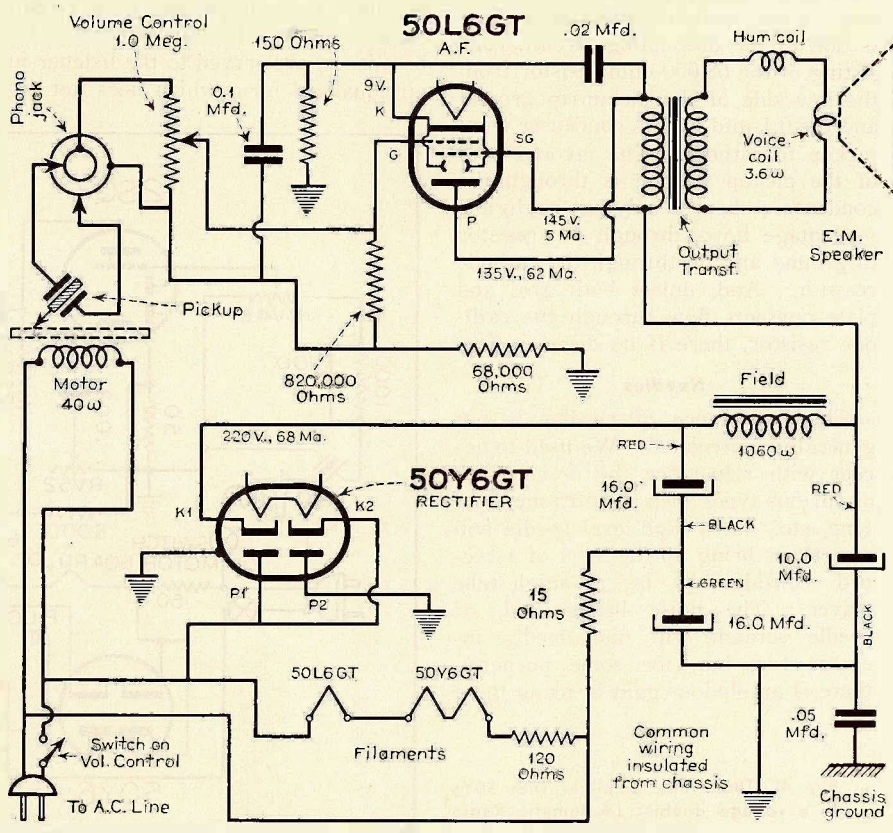
Where a voltage doubler is not used, the first filter condenser is an important item, as this condenser controls to a considerable degree the voltage output under normal load conditions. But, where large condensers are used, the surge current through the rectifier may be excessive. Thus surge limit-

ing resistors will usually be found in the rectifier circuit. We note this in Figs. 1, 2 and 4. In Fig. 1, a 15-ohm resistor is used; 50 ohms in Fig. 2 and 50 ohms in Fig. 4. Where a power transformer is used, sufficient reactance is present to limit the surge current. Thus the surge resistor is not required.

### Degeneration

In single tube amplifiers it is important to discourage degeneration. About the only place this can occur is

Fig. 1. A two-tube phono unit with a single audio stage that affords a maximum of 4½ watts.



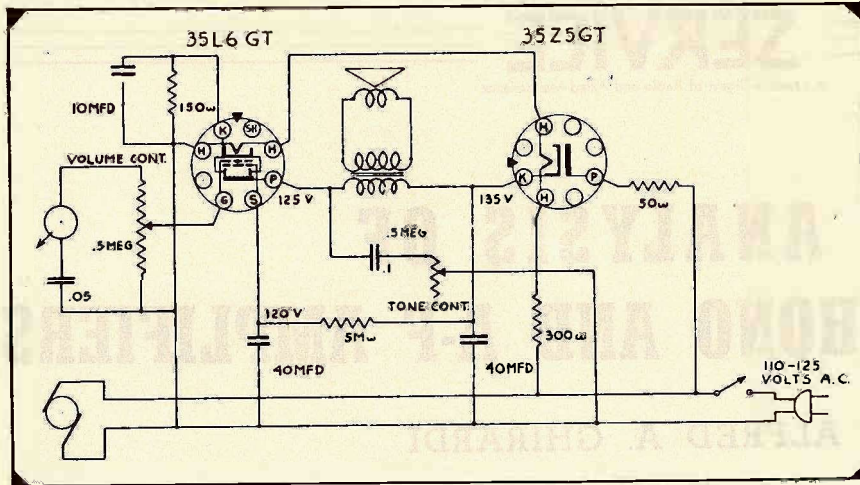


Fig. 2. A simple one-stage amplifier using variable tone control (Silver-tone 5818).

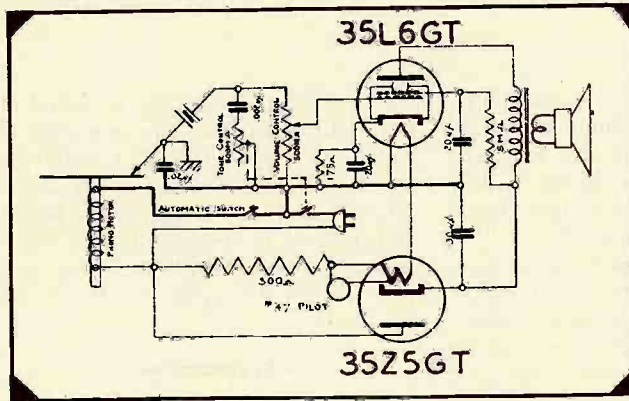


Fig. 3. One-stage amplifier with a tone control across the crystal cartridge (Silver-tone 5828). Since the crystal pickup has the equivalent capacity of a condenser of from .001 to .002 mfd, shunting it with a resistance as shown affords effective tone control.

in the cathode-bias circuit. Therefore, this bias resistor is usually shunted with a large electrolytic. But this is not the only means of preventing degeneration. In Fig. 1 there is no cathode resistor bypass condenser, yet there is very little degeneration. This is due to the decoupling circuit, consisting of the 68,000-ohm resistor from the low side of the pickup to ground and the 0.1-mfd bypass condenser from pickup to cathode. The favored path of the pickup voltage is through the condenser; hence only a negligible percentage flows through the resistor to ground and up through the cathode resistor. And, unless both grid and plate currents flow through the cathode resistor, there is no degeneration.

#### Needles

The importance of needles is not generally appreciated. We used to accept with reluctance the descriptions of various types such as soft tone, loud tone, etc., but a high-level needle will sometimes bring up the level of a record considerably in a single-tube player. The noise background, or needle scratch will undoubtedly increase too, but, for some purposes, there is an obvious gain in using these

needles. In two-stage amplifiers the gain in a loud needle is not required.

#### Tone Control

Tone control, audio spectrum control, or whatever else it may be called, is much more important in a record player than in a radio receiver. Radio broadcasts are served to the listener in an equalized form which does not or-

dinarily require modification. The ear of a highly experienced control operator sees to that. But, in record it's much different. There is considerable difference in the standards used by different recording companies. This requires frequent setting of the tone control for a given type of response. In addition, as records become worn, the noise background increases. This requires the cutting of highs in proportion to age. The loss of highs subtracts from the quality but the reduction in noise makes the net result more pleasing.

#### Two-and Three-Tube Phono Models

Figs. 1, 2 and 3 show different versions of 2-tube phono models. Figs. 4 to 8 present various 3-tube players. The addition of an amplifier stage permits the use of a low level, higher quality pickup and also permits the use of degeneration for equalizing.

In Fig. 4 incidentally, neither cathode bias resistor is bypassed, introducing degeneration into each stage.

#### Equalizing Circuits

The application of equalizing circuits to crystal pickups is widespread. Yet, there is an enormous amount of variation in the circuits and constants that are employed. Fig. 1 shows an 820,000 ohm resistor shunting the grid circuit. Fig. 3 shows a .002-mfd condenser in series with a 1/2-megohm tone control resistor across the crystal. Fig. 4 shows a series equalizer consisting of a .0001-mfd condenser in

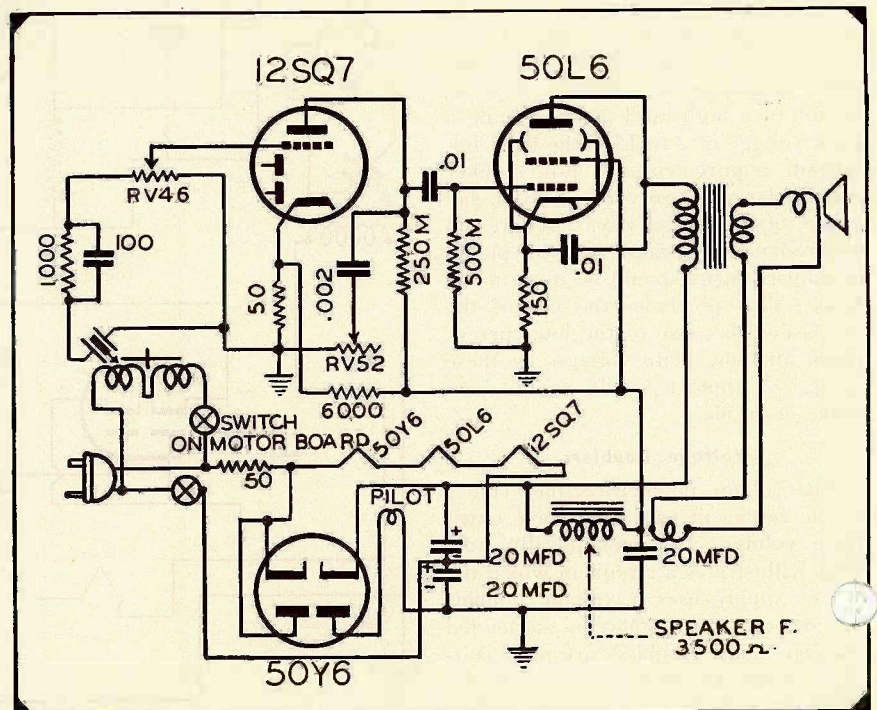


Fig. 4. Three-tube amplifier with 50Y6 as a voltage doubler (Automatic Radio 265 A.C.)



shunt with 1-megohm. Fig. 5 shows a resistance equal to the volume control in series. While this is more of an attenuator than an equalizer, there is a definite loss of highs caused by the filter consisting of the series resistor and tube input capacity.

### Crystal Pickups

In order to understand these equalizers we must know the electrical behavior of a crystal pickup. Electrically the crystal is the equivalent of a condenser having a capacity of .001 to .002 mfd. Calculating the capacitive reactance of a .0015-mfd condenser, we find that at 100 cycles, the reactance is a little over 1 megohm; at 1,000 cycles it is a bit over 0.1 megohm; at 10,000 cycles it is only 10,000 ohms, etc. From this we see that the lower the frequency, the higher the impedance. Then, in order to cut lows, we shunt the pickup with a resistor which has a low enough value to cause appreciable loading at low frequencies but which will not load the pickup at high frequencies. That is why 0.8 megohm is used in the unit shown in Fig. 1. Since the crystal acts like a condenser, it may be shunted directly with a condenser to reduce the output voltage. This explains why we can get away with a 10- or 20-foot shielded cable from pickup to amplifier without an obvious loss in highs (in a high impedance circuit). Where a long cable is used, it is a mistake to have a volume control in the player. The unused part of the volume control (when set below maximum position) in combination with the cable capacity acts like a low pass filter, killing the highs.

### Automatic Changers

In Fig. 6, we have a 3-tube player with an automatic changer. Changers are bound to become more popular and

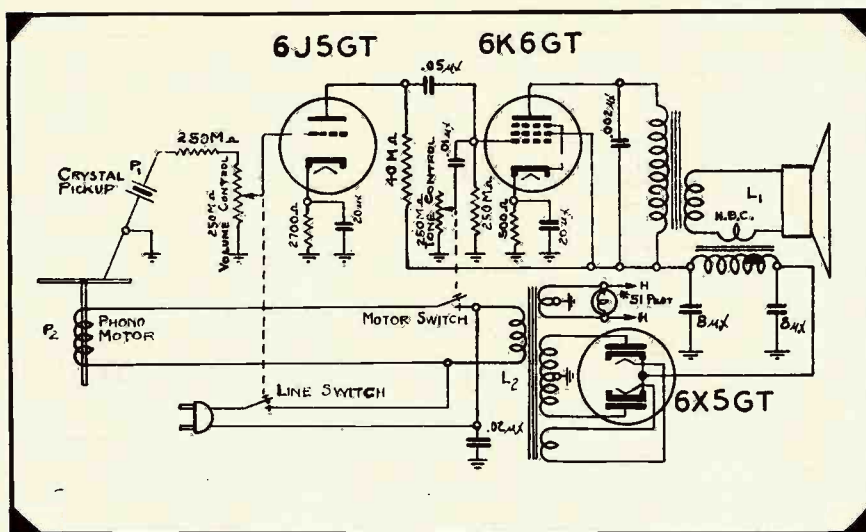


Fig. 5. Three-tube a-c amplifier delivering 4 watts of audio (Silvertone 5829).

more reliable when new models are introduced after the war.

Fig. 7 shows a model that utilizes a bias cell as insurance against degeneration. No speaker is shown in this unit, as it is designed for an external speaker.

Fig. 8 is an all-purpose amplifier designed for use with a low-level, high-impedance microphone (such as a crystal), as well as a phono pickup. The gain is 110 and 70 db, respectively, which is plenty for most purposes. A 2-section filter is used; the first section making use of the speaker field as a choke, the second section using a 0.1-megohm resistor and an 8-mfd condenser. We note that both sections of the 6SC7 dual triode are used as a 2-stage amplifier with a single volume control. The control is grounded in the center, cutting out one channel or the other, depending upon the position of the arm. The two inputs cannot be used simultaneously.

Crystal pickups, while giving quality reproduction at a low cost, can cause a number of troubles. They must not

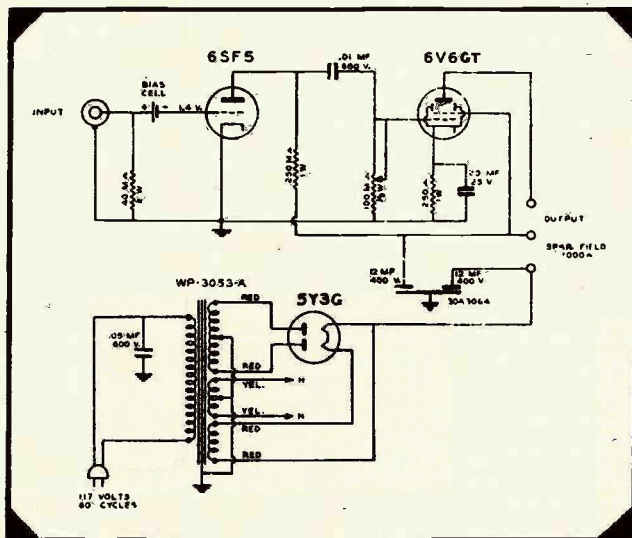
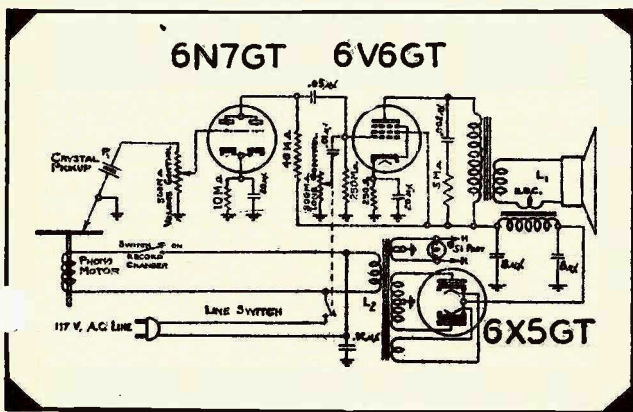
be subjected to temperature above 120° F, for they will be permanently damaged. This may happen by exposing the crystal to direct rays of sunshine, having the player too close to a radiator or designing a player badly when the pickup is above the amplifier.

### Rumbles

Rumbles or growls are sometimes caused by pickups. A simple cure is the application of several thin rubber bands around the pickup head which has a dampening effect to mechanical vibration, but does not interfere with reproduction. Mounting the pickup base on a soft rubber cushion or other resilient mounting will often clean up a rumble. In severe cases of rumble, the surest cure is to attenuate the bass frequencies. With a crystal pickup this is accomplished with a shunt resistor, using the highest value which will eliminate the rumble.

Another kind of rumble is caused by

Figs. 6 (below) and 7 (right). In Fig. 6, we have an electric phono using a 6N7 as an input driver (Silvertone 5833). Fig. 7 shows a three-tube guitar amplifier with provisions for remote speaker (Silvertone 2327).



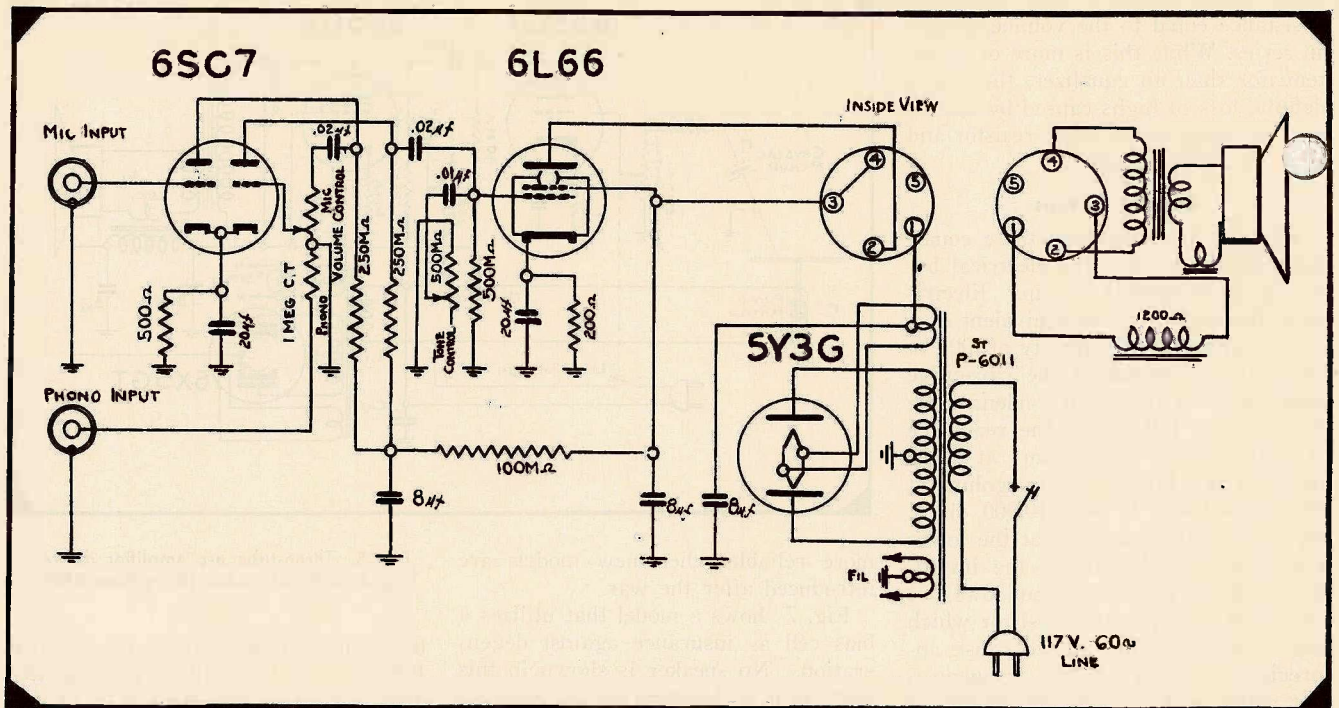


Fig. 8. Seven-watt 2-stage amplifier with dual input circuits (Silvertone 12874).

mechanical coupling between the motor-turntable and the pickup, or between the motor and first amplifier stage, similar to microphonics. This is often due to the hardening of shock absorbing mountings with age, causing mechanical feedback. The cure is obvious—new mountings. Where a high gain amplifier is used, we must be careful to choose for the first stage a tube that is not microphonic.

Some 2-tube phonograph units use a single beam-power tube in an amplifier. One such model (Fig. 1) has an undistorted power output of 2.25 watts and a maximum output of 4.5 watts for jitterbugs (who are unconscious of quality). The high level crystal pickup has sufficient output voltage to drive a 50L6GT to full power output with standard commercial records. Some difficulty might be experienced in playing home recordings which are usually of somewhat lower level than commercial pressings.

In the amplifier input circuit in one model instead of the a-f cathode being bypassed in the usual manner with a large electrolytic, as is being done more and more lately, or left completely unbypassed to provide degenerative feedback, an R/C decoupling system is used. The low side of the 1-meg volume control is run to cathode through a 0.1-mfd condenser and to ground through 68,000 ohms. The cathode resistor of 150 ohms does not require bypassing to prevent degeneration because most of the input voltage is routed through a 0.1-mfd condenser direct to the cathode—thus it does not get to the ground and cannot get through the cathode bias resistor.

There will be a slight output audio voltage drop in this resistor, however, but this is negligible when compared to the tube plate resistance drop.

#### Tone Compensation for Pickup Circuits

Because of the widely varying frequency characteristics of various types of audio amplifiers with which crystal pickups may be used, it may be desirable in some cases to make refinements in the pickup circuit to compensate for the characteristics of the amplifier. In Fig. 9 appears examples of compensation adjustments.

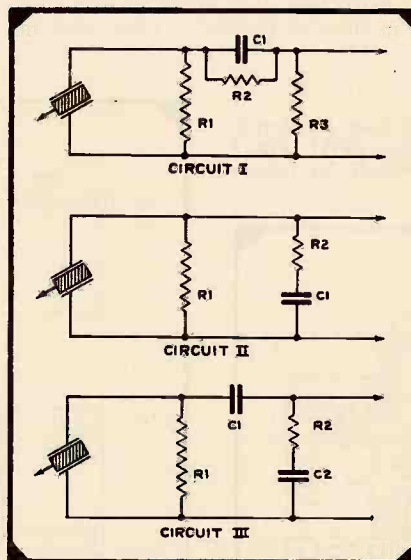


Fig. 9. Adjusting resistance and capacitance in pickup circuits to secure best tonal range.

*Circuit 1:* Increasing R1 increases low-frequency response. Increasing C1 increases high-frequency response. Increasing value of R3 with respect to total value of R2 plus R3 increases the output.

*Circuit 2:* Increasing R1 increases low-frequency response. Increasing R2 increases high-frequency response. Decreasing C1 increases output.

*Circuit 3:* Increasing R1 increases low frequency response. Increasing R2 increases high frequency response. Increasing value of C1 with respect to total value of C1 plus C2 increases the output.

#### Replacement of Sapphire

The sapphire is an important element in phono units. It is delicate and must be handled with extreme care. In some models such as the G. E. the sapphire is cemented in the pickup with a rubber cement (such as Goodrich Plasticon). To remove the sapphire it must be grasped firmly with a pair of tweezers. Then it should be turned a bit to loosen the cement and then pulled out. Much easier handling of the sapphire will result if the tweezers are first notched with a file. Naphtha may be used as a thinner should difficulty with the cement be experienced.

Before inserting the new sapphire should be dipped in the rubber cement, previously thinned with naphtha. After insertion, clean the point with naphtha.

# AN UNIQUE ALIGNING AID FOR LOOP RECEIVERS

By JOHN T. WILLARD

WHEN noise is present it is difficult to align receivers, particularly those using loops, with any kind of output meter, be it a scope, vacuum tube voltmeter or low or high impedance a-c meter, because the noise is indicated along with the signal. Under such conditions it is appropriate to take advantage of the avc voltage as a measure of receiver sensitivity. This article describes a

sensitivity and, therefore, is a check on the condition of the tubes as well. The volume control setting is not critical and, once the signal has been tuned in, aligning may be done without any audio signal. No shielded booths are required to calibrate loop receivers when using this aligning method.

### Requirements For Perfect Tuning

To do a perfect tuning job with an output meter, the signal-to-noise ratio must be favorable and the avc must be put out of action. A method sug-

gested by many manufacturers calls for the use of a small dry battery, usually 3 volts, to provide a fixed and constant bias for the avc bus which is unaffected by the signal. Sometimes, in noise-free locations, it is possible to use a weak signal which would not generate sufficient detector voltage to start avc action. The battery need not then be used. It depends upon the individual case. With these points in mind, the advantages of the tuning indicator device for use under all conditions should be obvious.

### Filtering Not Important

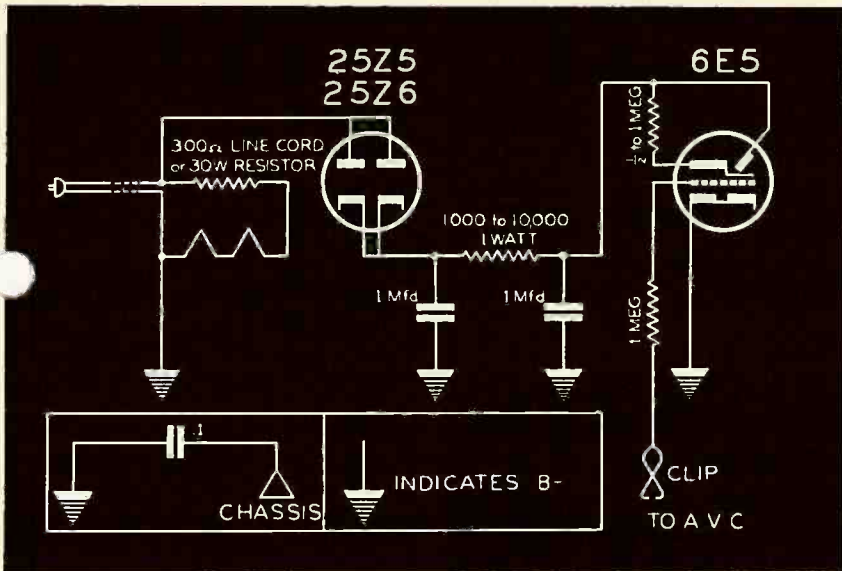
In either the a-c/d-c or a-c unit, filtering of the rectifier is not very important as the current drain is very small and a fairly large percentage of ripple may be present on the plate or target of the 6E5 without affecting operation. For this reason,  $C_1$  and  $C_2$  may be as small as 1 mfd and the resistor value is not critical.

### Resistor As Protective Device

The resistor in series with the grid of the 6E5 acts as a protective device. Its value is not critical. If necessary, in order to simplify this unit, especially the a-c type, the Service Man may connect the 6E5 socket direct to the power supply of receiver being tested and make similar adjustments as stated.

Fig. 2, (below). A tuning device for a-c receivers.

Fig. 1. Tuning device for a-c/d-c receivers. If the eye closes, line connection should be reversed.

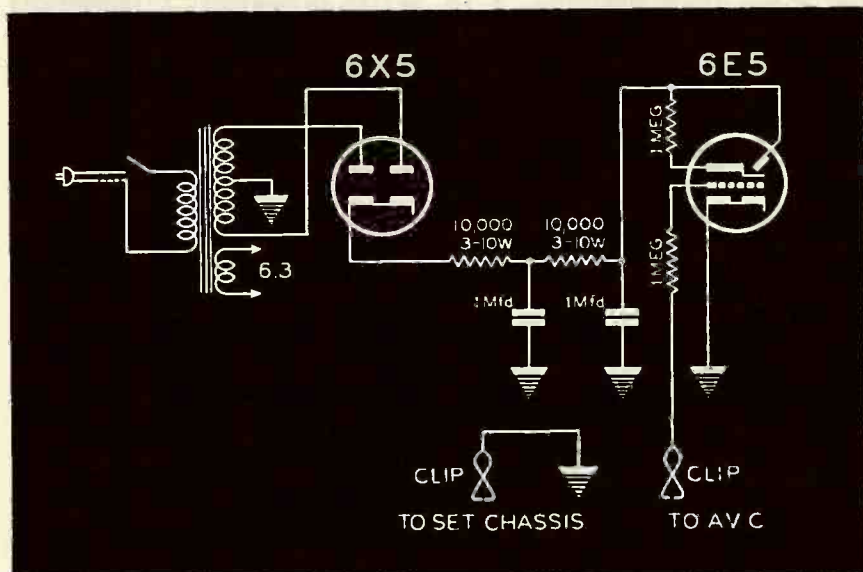


novel method of peaking loop receivers of the superhet type. The system works well for aligning push button sets, too.

### Simple Device

The device, itself, is simply a tuning indicator which clips on to the avc bus, a 6E5 eye being used for resonance indication. In a-c/d-c sets it is only necessary to clip the grid lead of the tuning eye on the avc bus as the ground return is made via the line. If the eye closes completely, the line connection taps then have to be reversed. In Fig. 1 appears the circuit for the a-c/d-c set. Fig. 2 shows another circuit for a-c applica-

tions. A ground clip is needed in the a-c system. The indicator checks the avc action of the receiver which involves



# AN U-H-F CONVERTER

## That Extends Test Instrument Frequency Range

By WILLIAM CARROLL

THE increased use of short-waves and ultra short-waves has prompted the need for test units covering these ranges. One of the most effective ways of obtaining such coverage is through the use of a converter. This procedure adopted by RCA for their 164 u-h-f unit extends the range of the RCA Rider Chanalyst to 80 mc. The entire range of 1.6 to 80 mc (187 — 3.75 meters) is covered in four bands in superheterodyne fashion with an output i-f of 1,500 kc,  $\pm 20$  kc. A 6AC7-1852 serves as a r-f amplifier, 6SA7 as converter and a 6SJ7 as oscillator with a 6X5G rectifier and R/C B supply filter. The Chanalyst alone covers a range of 100-1,700 kc as a t-r-f receiver and all applications within this range are possible over the extended range with the converter.

### No Coverage of R-F Section

The r-f section of u-h-f receivers above 80 mc cannot be covered by the converter but, since little or no gain is

possible in a standard type of r-f amplifier at these frequencies, this is not a serious shortcoming. All the gain and selectivity in these sets will be in the i-f amplifier which the converter will cover. The u-h-f oscillator may be checked by measuring the rectified grid voltage developed across the grid leak by the electronic voltmeter in the Chanalyst. The antenna coil and its associated tuning means can be checked pretty well by visual inspection plus the services of an ohmmeter.

Input and output jacks are provided for quick connection. A special u-h-f probe is furnished. This has a capacity of .5 mmfd as compared to 1.5 mmfd for the regular r-f, i-f probe furnished with the Chanalyst. The lower capacity is important for minimizing disturbance to u-h-f tuned circuits where the regular probe would cause excessive detuning. It is also a boon to careful work at broadcast frequencies where the detuning is entirely negligible. The shielding of the special probe extends all the way to the tip, preventing stray signal pickup. This shield-

ing is obtained at the expense of a 400:1 attenuation as compared to 100:1 for the regular probe; hence there is a 75% decrease in sensitivity. This is not serious when used with the converter because the converter has a considerable gain of its own. However, where the increased detuning capacity is not important, the regular probe may be inserted in the input jack for a fourfold increase in gain. An example of such an application is in picking up weak harmonics of a signal generator or crystal calibrator. The a-f probe of the Chanalyst has much less attenuation than the r-f shielded probes. Thus it should be used to receive outside signals as a short-wave receiver with a short antenna connected to the probe tip.

### Minimizing Detuning Effects

To minimize detuning effects, the following precautions should be observed:

(1)—Use the low frequency end of the receiver range to minimize detuning by the probe tip.

(2)—Keep probe and probe cable in the clear and away from hot leads and u-h-f coils.

(3)—When using the probe as a pickup device to check the frequency of an u-h-f oscillator, simply place the probe in a strong field; do not make contact to a circuit element.

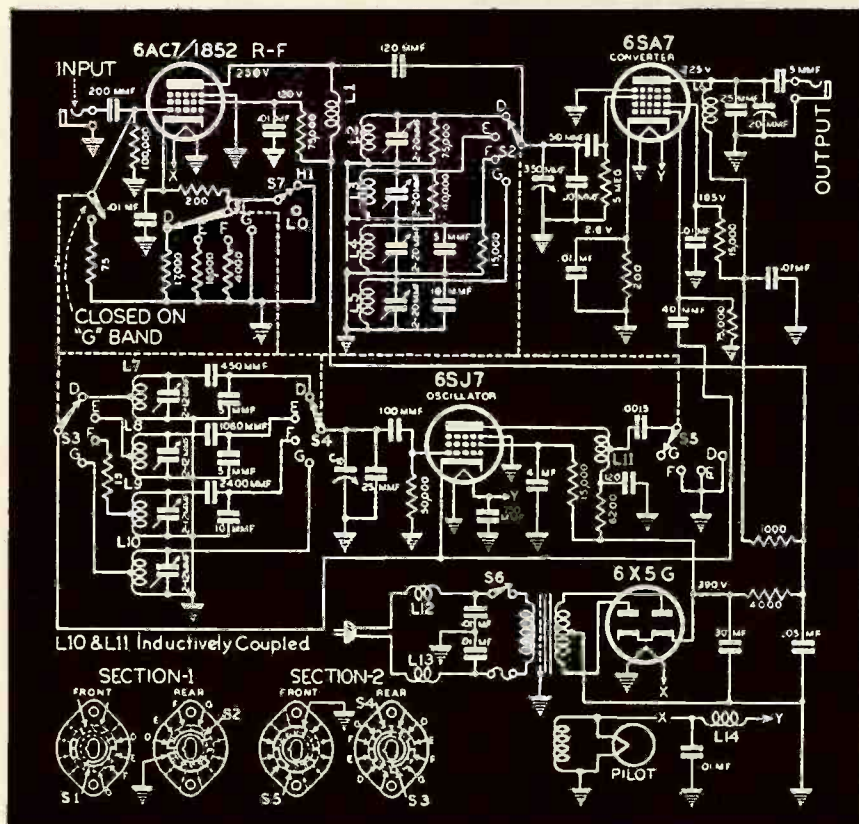
(4)—In signal tracing, check from the plate of one tube to the plate of the next, instead of from grid to plate of the same tube.

### Circuit Analysis

The input resistance of the converter proper is 0.1 megohm for all bands except G band (the highest frequency) where the resistance is 75 ohms, which is the proper matching load for the probe cable. Following through the r-f amplifier, we find a plate choke and 120-mmfd condenser coupling to the tuned input of the converter tube. The converter output coupling is similar but uses only a 5 mmfd condenser. A 20-mmfd variable condenser is used to tune the out frequency from 1,480 to 1,520 kc to select an interference-free i-f channel. The Chanalyst is tuned to this fre-

(Continued on page 23)

Fig. 1. The U-H-F Converter.



# The SPRAGUE TRADING POST

EXCHANGE — BUY — SELL

**FOR SALE OR SWAP**—New 35-watt amplifier; tubes, used, one 6X5, two 6N7, two 6L6, one 5Z3; two Jensen 12" P.M. speakers in wall baffles; cable and dust cover, for crystal mike and phonograph pick-up, for 110 V.A.C.—Price \$85. Want late model signal generator and electronic multimeter. Leroy Dye, 368 Grove Ave., Galion, Ohio.

**WILL BUY FOR CASH**—Superior signal generator #1230, multi-meter #1250, dynamometer of channel-analyzer and a good communication receiver, or what have you in testing equipment? Maurice Dubreuil, Lavaltrie, Que., Canada.

**WANTED**—Thordarson condenser tester; must be in fine shape. James Gardiner, 3725 So. 53rd Ave., Cicero, Ill.

**WILL BUY OR SWAP**—Want Rider's manuals, vols. 5 to 13. Have Readrite tube tester, model #430, in A-1 shape, price \$10. Bert Price, Lewis, Ind.

**URGENTLY NEEDED**—Hickok or Precision late model tube tester, also voltohmmeter or combination—RCA Voltohm, Simpson model 260 voltohmmeter, Hickok model 202 electronic voltohmmeter—or what have you? Also need signal generator. Melton R. Parle, 72 West End Ave., Brooklyn, N. Y.

**FOR SALE**—Complete shop equipment—1 1940 Superior 9" scale exrayometer; 1 1940 Superior signal generator model 11230; 1 1940 Superior tube tester model 1180; parts, tubes, cabinets, speakers, etc. Must all in one unit. Write for list. W. L. Reno, Route 4, Mayfield, Kentucky.

**BADLY NEEDED**—The following tubes—4-50L6, 2-35Z5, 2-12SA7. Spot cash for these. J. W. Miller's Radio Service, 128 York St., Lexington, Zone #16, Kentucky.

**BATTERY CHARGER FOR SALE**—Adams-Barre battery charger for 6 amp. bulb; will handle 1 to 4—6 volt batteries; for 110-volt—60 cycle A.C.; without bulb. Price \$5. Also have 30 tubes. Will send list. Want Superior signal generator. E. C. Entler, Bonaparte, Iowa.

**WANTED**—Tubes, transformer, meters, batteries (dry), condensers (variable, paper, also wet and dry electrolytics), used radio books in good condition, and anything you have to sell in the radio line. Samuel H. Porter, 606 N. Lincoln, Bay City, Mich.

**OSCILLOSCOPE TO TRADE**—Will trade National 1" oscilloscope model CRM, in perfect condition, for small pocket multimeter such as Supreme model 542 or equivalent. Emil's Radio & Sound Service, 128 18th St., Union City, N. J.

**WANTED**—Good O-1 foundation meter with O-1, O-5 and O-25 marked on D.C. scale (similar to Beede #541). Will pay your price. C. M. Allman, 922-23rd St., Newport News, Va.

**INSTRUMENTS WANTED FOR CASH**—Jackson Model 640, Triplett 1232-A, Weston 776, Precision E-200, Radio City 702 or 703 or any good make oscillator urgently needed; tube tester Supreme 589, Triplett 1213 or 1612, Jackson 634, Radio City 309 (P or C) or 310 (P or C) or any other good make tester also needed; also latest edition of Sprayberry's Master Servicing Course. All must be in perfect condition. Gentil G. Da Rosa, Lincoln Highway, Box 114, Plainfield, Ill.

**WANTED**—An "outside-in" recorder lead screw, RCA type, MI-4821, for RCA recording attachment MI-4815-4820. Radio Station WMRN, N. Main St., Marion, Ohio.

**URGENTLY NEEDED**—Motor—generator (separate units) or rotary converter; input 110 V. AC—output 32V. DC. 75/100/125 watts; must be in working order. Joe's Radio Service, Berrysburg, Penna.

**MARINE CORPS OUTFIT NEEDS**—Good used communications receiver similar to an SX28 or SX32, for use in recreation hut. Government check for immediate action. A. E. Kirkland, Marine Gunner, USMC, Corps Signal Battalion, 1st M.A.C., c/o Fleet Post Office, San Francisco, Calif.

**FOR SALE**—Rider's Manuals, vols. 1 to 7—\$40. Pernal's Radio Service, 1311-10th Avenue, Beaver Falls, Pa.

**WANTED**—Radio tubes types 84, 75, 15, 45, 41, and 31. Will pay 30c apiece. M. O. Smith, Box 263, Pagosa Springs, Colo.

**WANTED**—Pocket size volt-ohm M.A. meter or Triplett model 321 0-1 M.A. meter. All letters answered. Wendell Derry, 16 Park St., Hyde Park, Mass.

**WANTED**—Volt-ohmmeter, signal generator, V.T. voltmeter and Rider chanalyt or oscilloscope; any make or model—reasonable. Send list of what you have, and price. Ray L. Brown, 159 1/2 Second Avenue, South Charleston, W. Va.

**TUBES FOR SALE**—Types 6X5, 5Y3, 6A8, 6L6, 6F7, 6U7, 6F6, 6K6, 6Q7, 6V6, 12SA7, 12J5GT, 12SK7, 32L7, 25N6, 25L6, 30, 56, 58 (total quantity is 25 tubes—priced 25% under list). Also, for sale, Hammarlund variable condensers types MDC, SM-100, and MC-20-S; Thordarson Transf.; one audio coupler \$1.00; one microphone coupler \$1.00; bound vol. Zenith service manual 1928 to 1938—75c. N. J. Cooper, 4617 No. Damen Avenue, Chicago, Ill.

**WANTED AT ONCE**—A good communication receiver, a Halli-craft S-20R, S-29, Skybuddy or Echophone EC-1. Must be in excellent condition. Give full details and price. Pfc. G. F. Preston, H & S Co. Inf. Bn. TC, U.S.M.C., Camp Elliott, Calif.

**URGENTLY WANTED**—A Weston model 698 selective set servicer; also a signal generator with a frequency range to 25 MC. Blaney's Radio Shop, 202 Troy St., Canton, Pa.

**FOR SALE**—2" oscillograph, in perfect shape. The Radio Man, 1724 Central Ave., Middletown, Ohio.

**FOR SALE**—RCA type TMV-122B cathode-ray oscilloscope, 3" screen, A-1 condition. Best cash offer takes it. George Dohm, W3G22, 438 West King St., York, Pa.

**WANTED**—Test sets, all kinds; radio tubes; also 16 M.M. sound projector. Send list and prices to Robleski Electric, Hastings, Mich.

**WILL TRADE**—Want pistols, rifles, ammunition, all types; have photographic equipment and radio tubes. Carl Morris, Instructor, U. S. Army Sig. Corps., Johnson Radio School, Lexington, Ky.

**FOR SALE OR TRADE**—Hickok traceometer, model 155; would take good volt-ohm-milliammeter of reliable make in on trade. Seifert Motor & Impl. Co., Utica, Minnesota.

**FOR SALE**—Complete eight-unit, 6-station, 56-tube Carrier call inter-building communicator; private communication between any two stations without interstation wiring. Write for details. Cash preferred or 5" Dumont scope. Oscar W. Tyree, 2101 Fifteenth St., Troy, N. Y.

**WANTED**—Ohm-volt-milliammeter; preferably with AC and DC scales, with or without analyzer provisions. T. M. Duffield Co., 1617 So. 17th St., Lincoln, Nebr.

**FOR QUICK SALE**—Korelle reflex series 1, 2.9 Schneider, carrying case, Dallmeyer 6" telephoto, lens shade; all guaranteed perfect; going foreign service; close out for \$150. Carl Morris, P.O. Box 1094, Lexington, Ky.

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# SER-CUITS!

By HENRY HOWARD

TO provide suitable control of antenna inputs, many circuit innovations have been developed, such as shown in Fig. 1. In this a-c/d-c 3-band receiver, Knight D-109, four condensers are involved in the antenna circuit. There is a .01-mfd condenser in series with the antenna; a .05-mfd bypass condenser in the ground lead, a .002-mfd coupling condenser for all bands and a .005-mfd loop coupling condenser from the low side of the loop to chassis. The untuned first detector has an i-f wave-trap with the avc connection to the junction of the coil and condenser. The coupling to the first detector is a combination of several types, fixed tuned, but somewhat peaked. The 6SA7GT converter uses a 150-ohm cathode bias resistor to supplement the avc bias, while the i-f stage uses only 35 ohms. The latter resistor is not bypassed, allowing some degeneration. Bandspread on the short-wave bands is obtained by inserting series condensers in the tuned circuits of both the r-f stage and oscillator (note the 150 and 500-mmfd condensers). The intermediate band also uses a 250-ohm resistor in the oscillator trimmer cir-

cuit, while the short-wave band uses 5,000 ohms in shunt with the tuned coil.

### Knight D-127, 149, 189, 190

In Fig. 2, we have a Knight D-127, 149, 189 and 190 push-pull a-c set, with a similar antenna circuit except for the antenna and ground series condensers, which are not required in an a-c set. The antenna choke, neglecting its distributed capacity, favors the high frequencies. The actual behavior may be more complicated due to resonance. Under certain conditions when an aerial picks up a static charge of insufficient voltage to jump a lightning arrester, annoying crackling may be heard. Any conductive circuit to ground, resistor or choke, prevents the building up of such a charge.

In this receiver we note that the r-f and i-f stages have additional cathode bias, whereas the converter does not have this bias. Bandspread is obtained with a tapped coil instead of series condensers and 250-ohm resis-

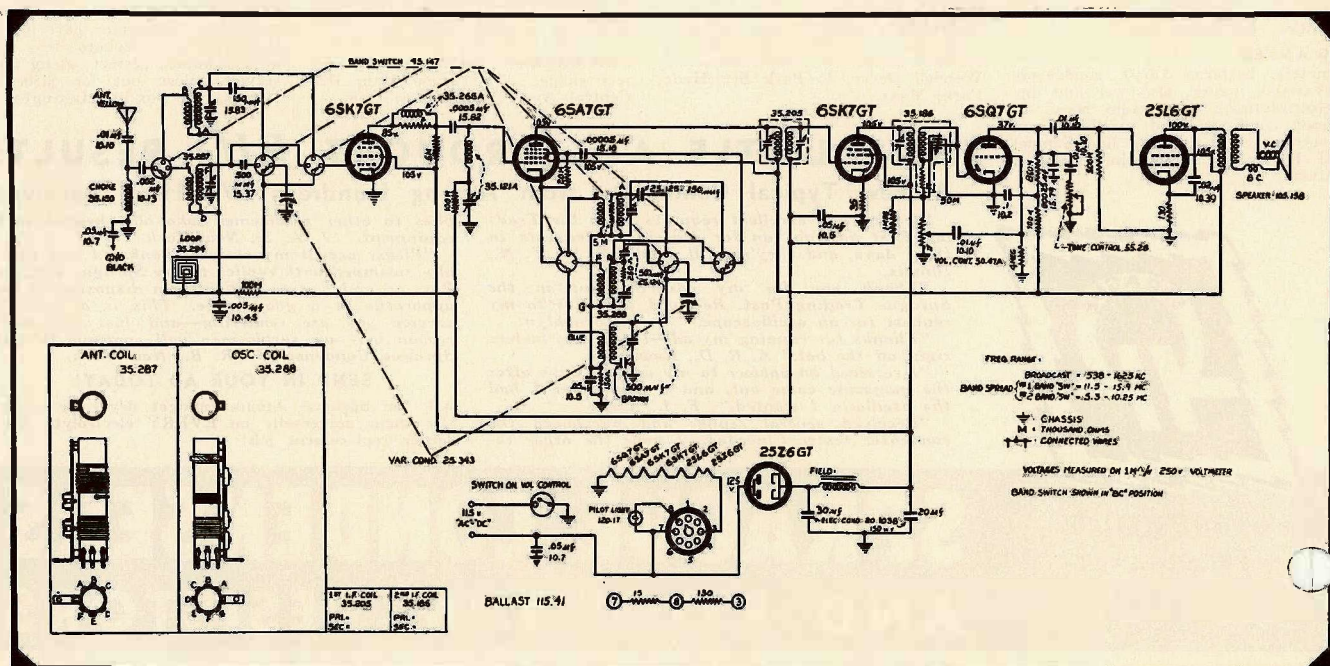
tors are used in the short-wave trimmer circuits.

### Detrola 386, 3861

A high impedance capacity coupled antenna is used in Detrola's models 386 and 3861, shown in Fig. 3. A 2-mmfd condenser connects the aerial to grid unassisted. The avc bus in this receiver is biased by the contact potential of the second detector diode and also by the oscillator grid through a 15-megohm resistor.

In using condensers we must remember that the reactance of a 1-mfd condenser at 60 cycles is roughly 2600 ohms. This 1-mfd unit at 60 cycles will have the same reactance as 10 mfd at 6 cycles, or 0.1 mfd at 600 cycles, or .01 at 6 kc, etc., or 2600 ohms. Keeping the capacity constant and varying the frequency, the 1 mfd will offer an impedance of 260 ohms at 600 cycles, 26 ohms at 6 kc, 2.6 ohms at 60 kc, 0.26 ohms at 600 kc, etc. Generally speaking, 1 mfd is a large value for radio circuits. Its use is confined principally to audio and hum filtering. So, it may be reasonable to memorize a second capacity-reactance value in the

Fig. 1. Knight D-109 with versatile antenna control system.



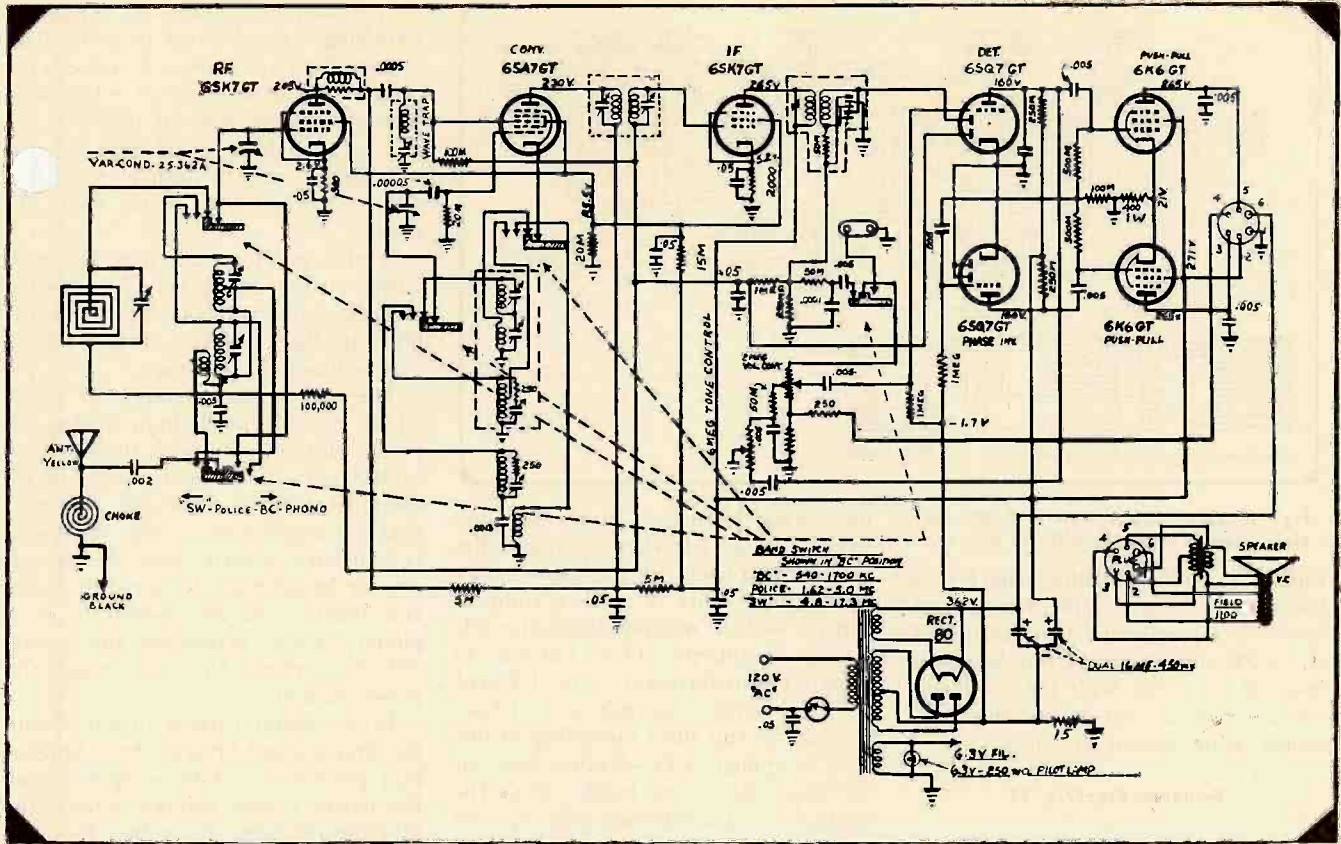


Fig. 2. Knight D-127, 149, 189 and 190 with antenna choke that favors high frequencies.

r-f range. How about .001 at 1000 kc, which is the middle of the broadcast band, and which has a reactance of approximately 160 ohms?

A .0001-mfd condenser will equal 1600 ohms at 1 mc and 160 ohms at 10 mc. At 50 mc, the reactance will be 160 divided by 5, or 32 ohms. The method of diverting the current is to simply provide a favorable impedance ratio, making the circuit impedance as low as possible for the desired path and as high as possible for the unwanted circuit. When a condenser is used to stop a direct current or low

frequency a-c while passing a higher frequency a-c without much attenuation, it is usually called a stopping or blocking condenser; it looks the same as and actually is, a bypass condenser.

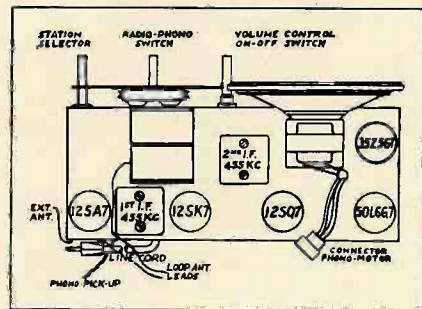
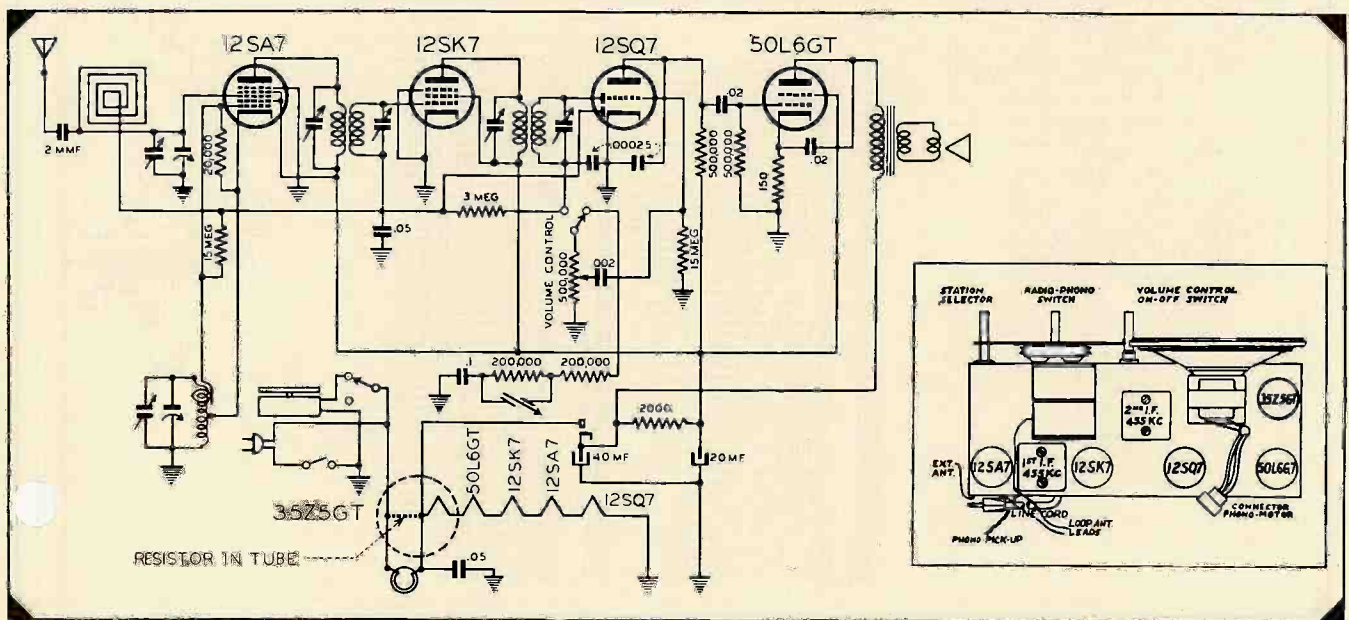
Capacitive reactance, identified mathematically by  $X_C$  and having the ohm as the unit of expression, is de-

Fig. 3. Detrola 386, 386I that features a high impedance capacity coupled antenna.

pendent on the value of capacitance and the frequency. And as we can see from the earlier data, the higher the frequency, the smaller the capacitive reactance. We must remember, too, that the effect of capacitance on the phase relation of voltage and current is opposite to that of inductance.

#### Zenith 6B14

Fig. 4 shows Zenith's 6B14 chassis with 3-gang tuning for two bands. The r-f stage is completely eliminated on short-wave. On bc, the detector grid is tapped down on the r-f trans-



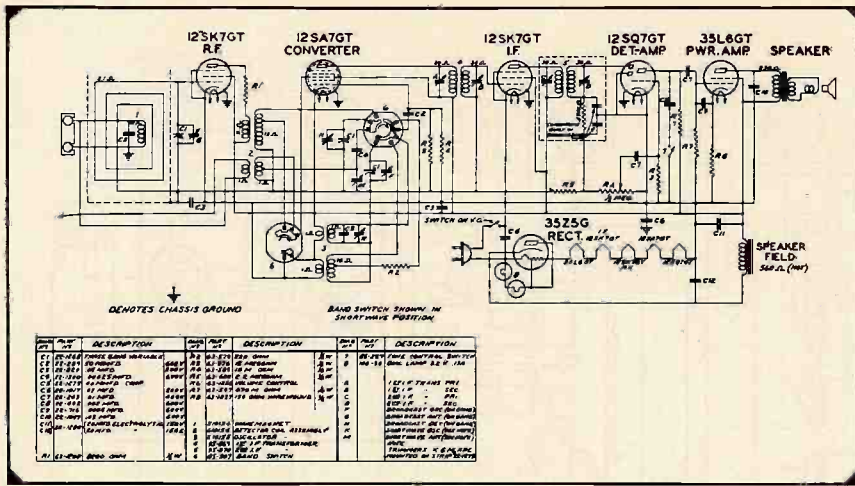


Fig. 4. Zenith 6B14 with a 8,200-ohm plate resistor in series with r-f primary.

former to reduce loading, sharpening the tuning. On *sw*, the tuning condenser is tapped down for bandspread. An 8,200-ohm plate resistor has been inserted in series with the r-f transformer primary for more linear response with varying frequency.

#### General Electric 35

The General Electric 35, Fig. 5, using 9 tubes and a tuning eye, and covering 3 bands, has many novel and

interesting features. In the antenna circuit, is an i-f wave trap and the various components of the band-change switch, *S*<sub>1</sub>. This is quite a comprehensive switch, accomplishing the following operations: (1)—Antenna to three r-f transformers; (2)—R-f grid to transformer secondaries; (3)—Grounding and short circuiting of unused windings; (4)—Reduce bias on r-f stage on two *sw* bands; (5)—Interstage r-f transformer primary and secondary, similar to antenna circuit, and (6)—Oscillator coil switching similar to above.

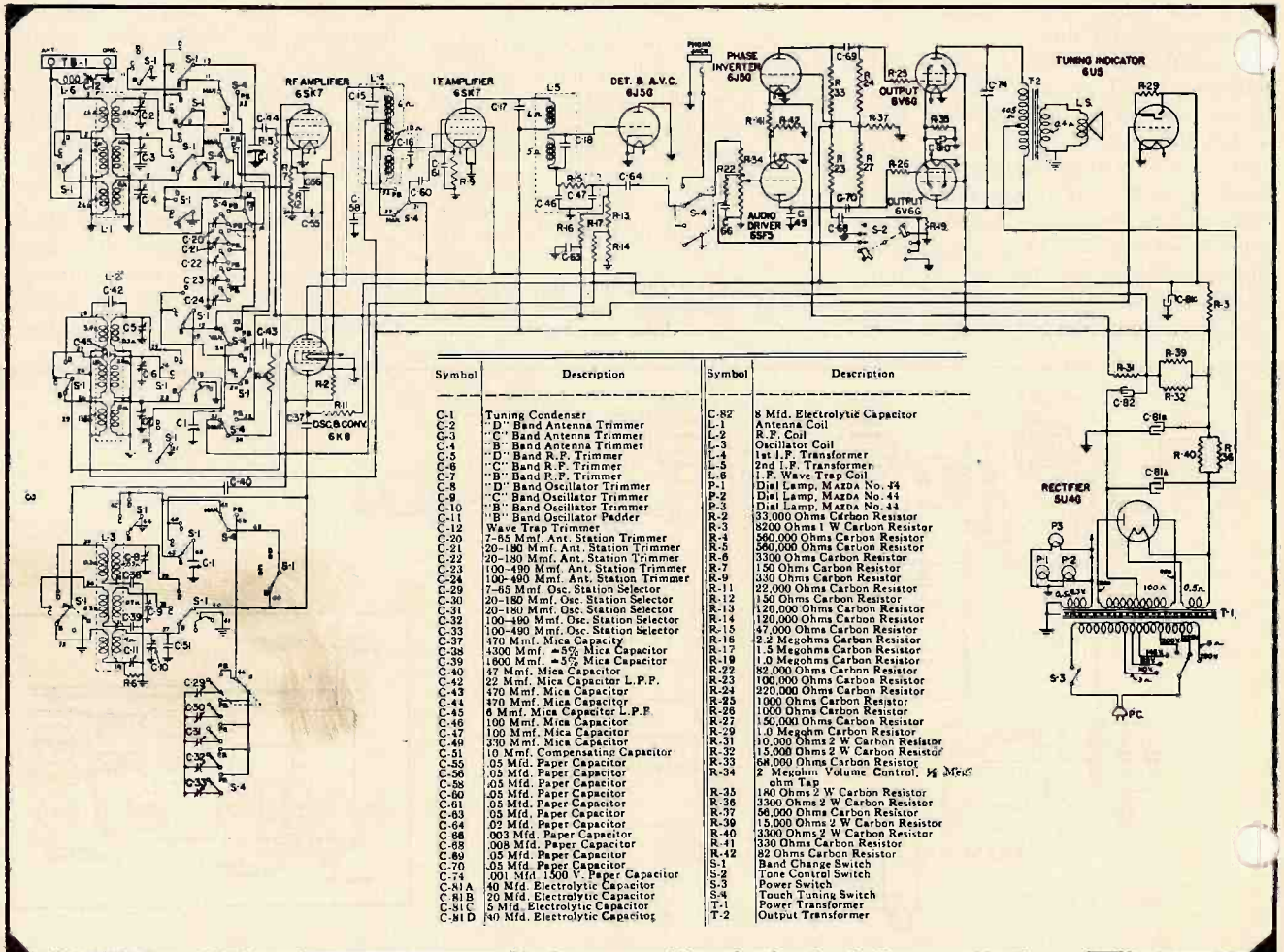
*S*<sub>4</sub> is another complicated switch for switching from *Manual* to *Push Button*, or *Touch Tuning*. It provides a change over of antenna circuit to push buttons; change over of detector circuit to push buttons; change over of oscillator circuit to push buttons, and changes the avc bias on the 6K8 converter.

It also provides full bias for push button and reduced bias for manual tuning. Full avc bias is always applied to the r-f stage while reduced bias is given the i-f stage.

The switch also changes i-f bandwidth to wide band, high fidelity on push button, sharper tuning and higher gain on manual. This is accomplished in the three-coil, iron core first i-f transformer. The third coil is connected in series with the secondary for broadening the response. The last function of the switch is as a phono switch, grounding the second detector output and connecting the phono pickup.

In the audio portion of the circuit the first a-f and inverter have unusual bias provisions. Bias is derived from the power supply voltage divider, the inverter receiving more bias than the

Fig. 5. General Electric 35 with an i-f wave trap in the antenna.





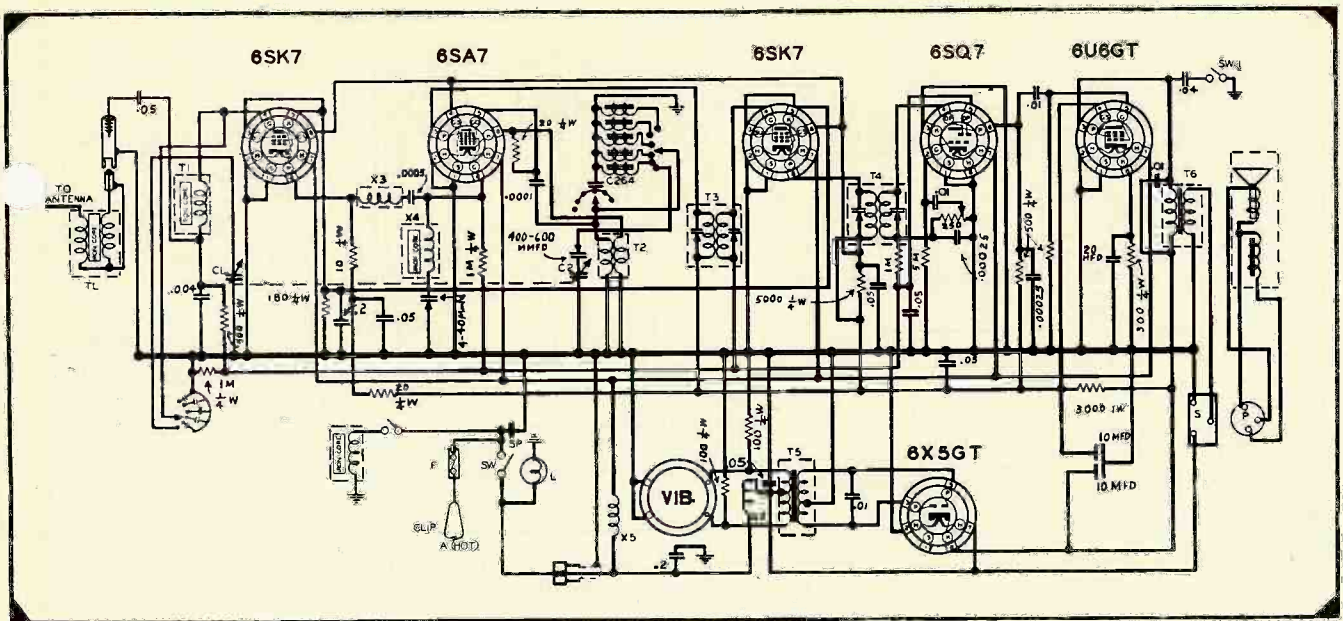


Fig. 6. Arvin RE-90 car receiver with series-tuned circuits for equalization and trapping.

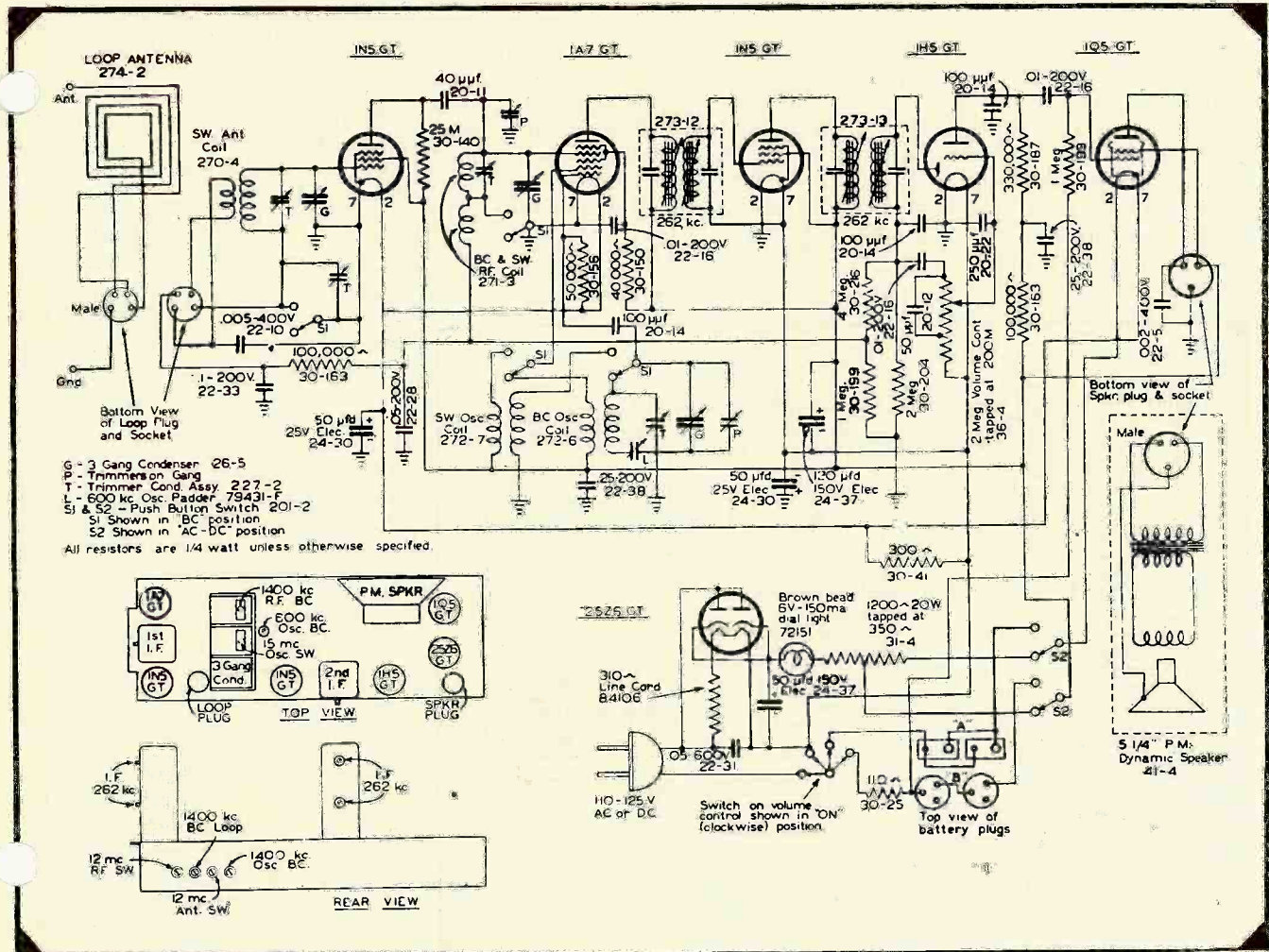
6SF5 audio. The tone control (see  $S_2$ ) operates to modify the bass compensation circuit as well as shunting a .008-mfd condenser across the first audio output.

A 1,000-ohm resistor is inserted in each output tube grid to suppress oscillation, or reduce regeneration. The 180-ohm bias resistor is bypassed with

a 40-mfd condenser. The bypassing of a push-pull cathode resistor is not usually required but it helps to reduce harmonic distortion.

The power supply is quite unusual too. The power transformer is tapped for voltages from 110 to 250 but, in this model which uses a 115-volt phono motor, only the 110 or 125-volt taps may be used. Note the resistance filter. Since a pm speaker is used, there is no field to supply. For the first section two 3,300-ohm, 2-watt

Fig. 7. Pilot T-186, a-c/d-c portable.



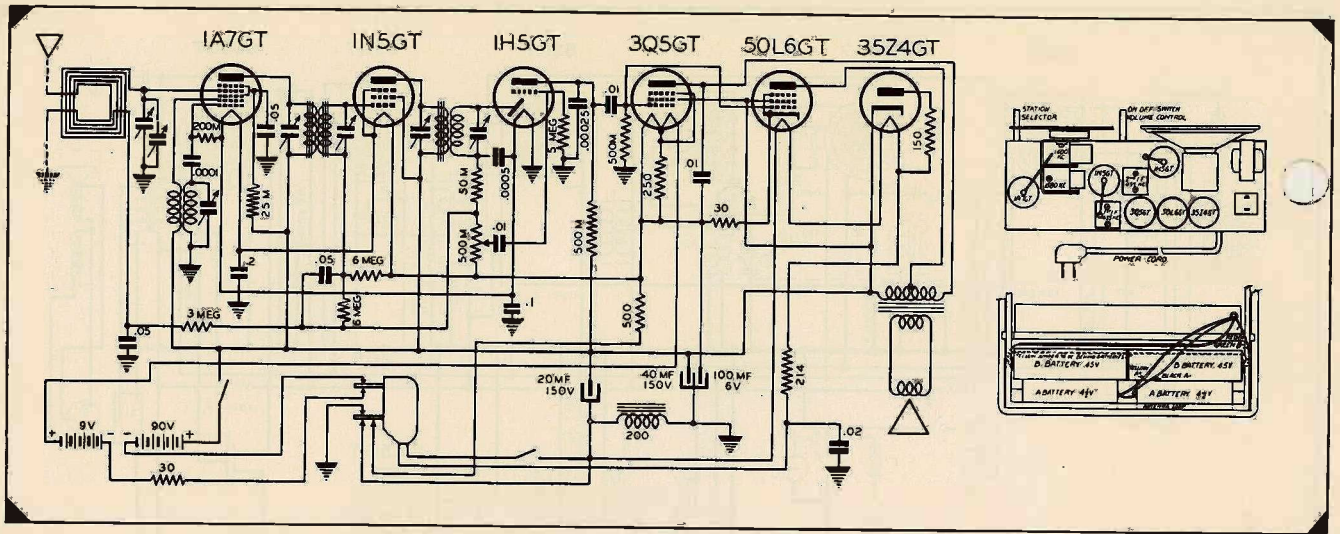


Fig. 8. Detrola 360, using a separate power tube for line operation.

resistors are paralleled. Thus, if one opens up, the other will carry on for a while. In the next section, two 15,000-ohm, 2-watt resistors are used.

Stage gains, measured on a sensitive vacuum tube voltmeter, are as follows:

Antenna to r-f amplifier grid . . . 5.0 at 1,000 kc decreasing to 2.6 at 18 mc.

R-f amplifier grid to converter grid, 14 at 1,000 kc, 10 at 4 mc, 10 at 18 mc.

R-f on converter grid to i-f on first i-f grid . . . 16 at 1,000 kc, 30 at 4 mc, 34 at 18 mc.

I-f on converter grid to i-f on first i-f grid . . . 24 at 455 kc and manual tuning.

I-f amplifier grid to detector grid . . . 112 at 455 kc.

The d-c voltage developed across oscillator grid resistor ( $R_2$ ) with gang closed . . . *B* band is 6.2 volts, *C* band is 7.8 volts, and *D* band is 4.8 volts. A voltage of .05 across the volume

able trimmers for antenna tuning and permeability tuned coils for the oscillator.

#### Pilot T-186

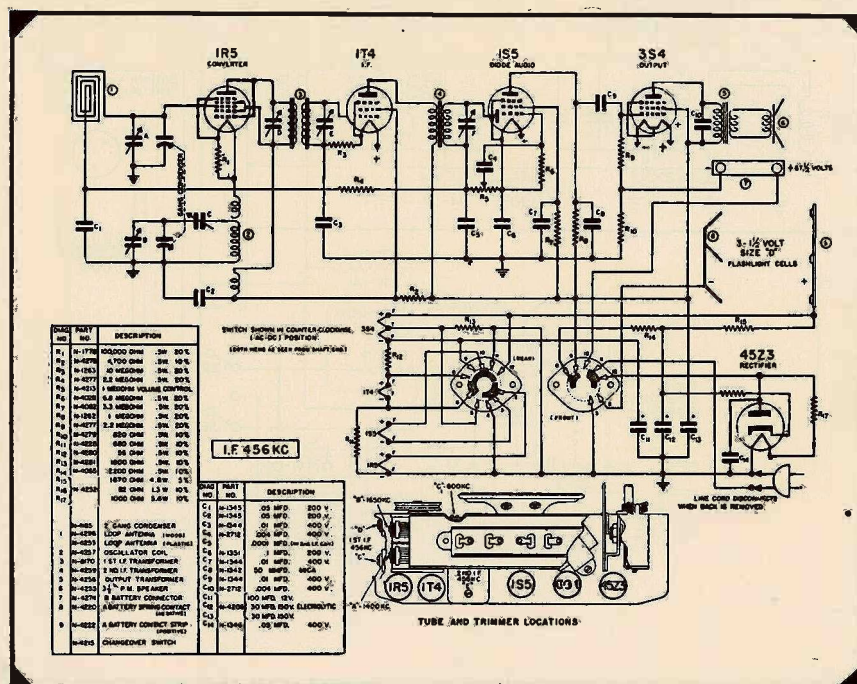
An ac/dc battery portable, Pilot T-186, with a *sw* r-f transformer secondary acting as a *bc* loading coil, is shown in Fig. 7. This set has two bands, a tuned r-f stage with 3-gang tuning and a dial lamp which serves as a fuse on line power operation. The r-f interstage coupling system uses a 25,000-ohm plate load resistor, a 40-mfd coupling condenser and *sw* and *bc* coils in series. Short-wave tuning is obtained by shorting out the *bc* coil. The speaker moving coil is grounded. Note the novel *on-off* combination switch which is attached to the volume control.

#### Detrola 360

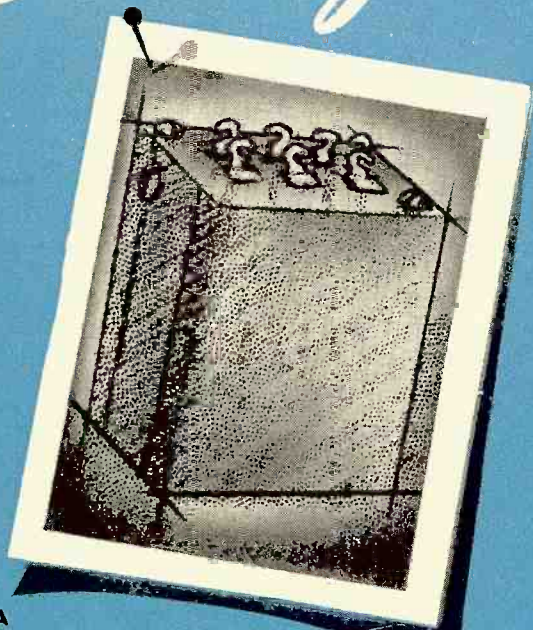
A combination receiver using a separate power tube on line operation, is shown in Fig. 8. It is the Detrola 360. A unique switching method for battery-line operation is used. The line plug makes five connections when plugged into its receptacle. The *A* is grounded through a 30-ohm filament limiting resistor. The *B* is grounded through a 500-ohm bias resistor. With the arrangement shown, a simple *sps*t switch serves as both a line and battery *on-off* switch. On line operation, the tube filaments act as a bias resistor for the 50L6GT power tube.

#### Knight D-155, 156, 157

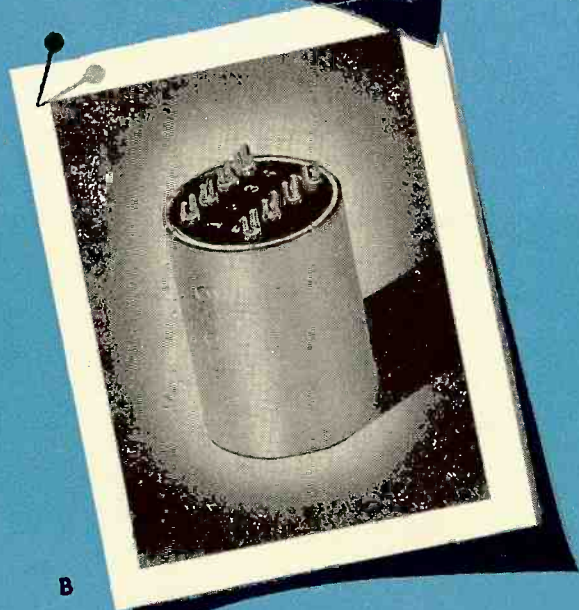
Fig. 9 shows a three-way receiver, the Knight D-155, 156, 157. The oscillator plate feedback coil is connected directly to the screen grid, using both screen and plate for feedback. The i-f stage is biased by a 10-megohm grid leak and does not receive any bias. A series parallel switching system is used to permit running the filaments in parallel for portable service.



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B... UTC final design, illustrating design savings.

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# THE REPAIR OF AUTO RADIO CONTROL CABLES

By **BURTON V. SELLE**

Burt's Factory Radio Service Supply Company

**T**HE auto radio cable is an important link in auto control. While under ordinary conditions repair of the cable usually meant a simple replacement, today that is impossible. Flexible cable is very difficult to obtain. Thus the Service Man is finding that it is necessary to repair these cables, rather than just replace them. This is not a complicated process as many may believe. No special equipment is actually needed. A good hot soldering iron and a good pair of tin snips or side cutters are all that are basically required, in addition to, of course, the method used to repair the cable.

We have used the methods illustrated here for many years with great success.

## Acid Core Solder Recommended

For work of this kind, acid core solder works the best. However, it is imperative that all remains of the acid solder should be removed when the work has been completed. Incidentally, do not use acid core solder on

any work where the current is on. The electricity will prompt corrosion due to the acid.

## How to Cut Cable Housing

At *A* in the illustration is indicated the first step in repairing and making up of an auto radio control cable. When cutting the cable housing, the inner cable should always be removed when possible. Incidentally the right and wrong ways of cutting the cable housing are also indicated in the illustration. At *B*, we see the soldering iron which should be of at least 200 watt capacity.

## Preventing Unraveling

At *C* is indicated a very important step. A layer of solder should be applied before cutting the cable. This prevents unraveling. When inserting the cable in the tip (*D*) the iron should be held on the side of the tip until the solder boils. Then the cable should be inserted and held there until

the solder hardens. Of course it is always best to fill the inside of the tip with solder before inserting the cable end.

## Alternate Repair Methods

If new material is not available, there are many tricks that can be used to provide suitable results. For instance, if the tip does not have a suitable hole, a punch hole should be made first and then the hole enlarged by a drill. In this step it is necessary to use a drill that is slightly smaller than the cable. About  $\frac{3}{8}$ " or  $\frac{1}{2}$ " space should be allowed between the cable washer and the tip to prevent the cable from binding when bent.

In the event that a set screw holds the housing to the case, a layer of solder should be applied on the housing to prevent the set screw from damaging the cable housing. This layer of solder can extend over a  $\frac{1}{2}$ " area.

The methods described are very simple but nevertheless will provide effective results.

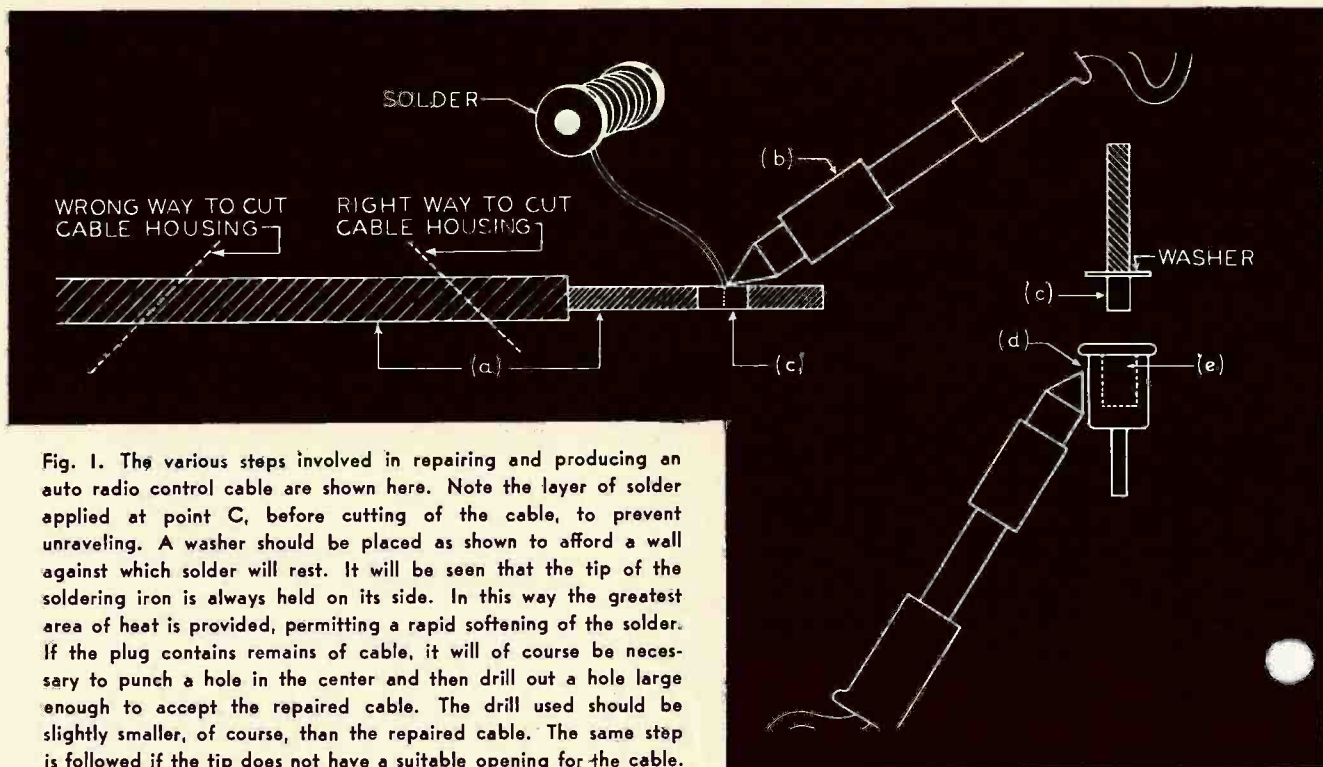


Fig. 1. The various steps involved in repairing and producing an auto radio control cable are shown here. Note the layer of solder applied at point C, before cutting of the cable, to prevent unraveling. A washer should be placed as shown to afford a wall against which solder will rest. It will be seen that the tip of the soldering iron is always held on its side. In this way the greatest area of heat is provided, permitting a rapid softening of the solder. If the plug contains remains of cable, it will of course be necessary to punch a hole in the center and then drill out a hole large enough to accept the repaired cable. The drill used should be slightly smaller, of course, than the repaired cable. The same step is followed if the tip does not have a suitable opening for the cable.



## In ten more minutes what will you be doing?

**I**N TEN MORE MINUTES they'll be in action—American fighters risking life and limb to conquer one more bridgehead on the road to freedom.

And in ten more minutes—what will *you* be doing to help win this war?

Because it's up to you as much as it's up to them. Unless you—and all the rest of us at home—are devoting every spare minute of our time to fighting this war as civilians, *their* chances of victory are slim.

Next time you read of an American raid on enemy positions—with its tragic footnote of lost planes and ships and men—ask yourself:

"What *more* can I do today for freedom?"

What *more* can I do tomorrow that will save the lives of men like this and help them win the war?"

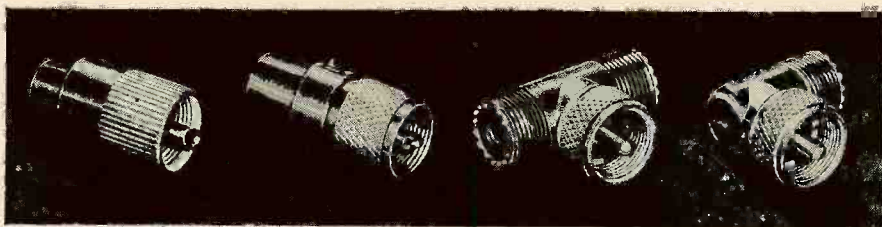
\* \* \*

To help you find *your* place in America's War for Freedom, the Government has organized the Citizens Service Corps as part of local Defense Councils. Probably there is one of these Corps operating now in your community. Give it your full co-operation. If none exists, help organize one.

Write to this magazine for a free booklet, "You and the War," telling you what to do and how to do it. This is *your* war. Help win it. Choose what you will do now!

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equipment. While Astatic production facilities are devoted in large part to the manufacturing of these important products, a limited number of Microphones and Phonograph Pickups, for which Astatic is so widely known, are still being made for government use and industries with high priority ratings.



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## HIGHLIGHTS OF G.E. 90 TELEVISION RECEIVER

**I**N this interesting combination television and radio receiver, the antenna and converter unit includes all of the circuits between the antenna posts and the output side of a 6AC7 converter tube. Starting at the antenna terminals is a balanced input wave trap consisting of two stages of high pass filter. The radio antenna input is tapped off at the center of the first wave trap coil. The r-f is coupled from the wave trap to a 6AC7 amplifier through double-tuned circuits (one for each band). A 6AC7 converter tube is coupled to a 6AC7 r-f amplifier through individual band-pass filters. Oscillator signals are injected into the converter tube at the same point as the r-f signal is injected.

### Audio Channel

The audio channel is an f-m 8.25 mc i-f superheterodyne receiver with noise limiter and balanced discriminator. The first stage of the audio i-f is included with the video i-f amplifier which follows the converter tube. Degeneration of the audio amplifier is incorporated. The output circuits are switched over for use with the radio receiver by means of a push button on the television control panel. Audio i-f signals are diverted into the audio i-f channel from the suppressor of a 6AB7 first video and audio i-f tube.

### Video Section

Four stages of video i-f amplification follow the converter tube, the first stage being common to the audio i-f also. Wave traps are provided in interstage transformers for attenuating 14.25 mc, 8.25 mc and 13.5 mc respectively. The 13.5 mc trap is used to get a sharp linear slope on the high side of the band and to attenuate 12.75 mc to 50% of the pass band. The video is detected in a 6H6 detector and is amplified and finally applied to the picture tube control grid. Contrast is controlled by cathode degeneration in the first video amplifier tube.

### Video AVC

The video i-f gain is controlled by amplified and delayed avc. The video i-f is amplified in another stage after the video signal has been taken off and is passed to a 6H6 avc and separator tube. The right section of this tube is the avc detector which works in conjunction with the left section of a 6H6 delay and clipper tube to give delayed avc.

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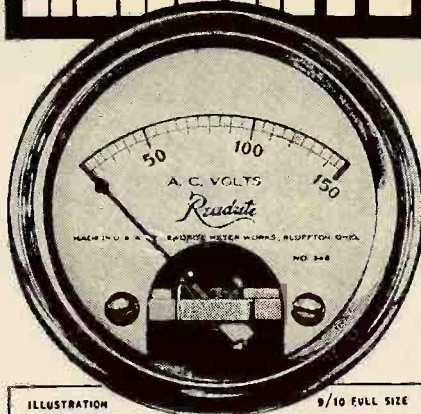


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### SYNC Pulse Clipper

The left section of the 6H6 AVC and separator tube detects the video i-f signal and injects it into the 6AC7 clipper which separates the video signals by tube cut-off.

### Horizontal Oscillator—Output

The negative sync pulses are coupled to the horizontal multivibrator through a very small capacitor which blocks the vertical sync pulses and leaves only horizontal sync pulses. The horizontal pulses are passed through proper wave shaping and amplifier circuits to the horizontal deflection coils of the picture tube.

### Vertical Oscillator—Output

The sync pulses from the 6AC7 clipper are coupled into the left section of a 6F8G vertical sync amplifier tube. The tube acts as a low frequency amplifier thus presenting much more gain to vertical than to horizontal pulses. The resultant signal is fed into the right section of the 6H6 delay and clipper tube and the vertical pulses are separated from the horizontal. The vertical pulses are then amplified and injected into the vertical oscillator circuit. The vertical oscillator is of the blocking type, transformer-coupled. The generated sawtooth waves are amplified and transformer coupled to the vertical deflection coils of the picture tube.

### Low-Voltage Rectifier

Two 5U4G rectifiers are necessary to supply plate current for the low voltage supply which includes the radio receiver. A combination of choke and resistance filters is used so that the audio and oscillator plate supplies will be free from video and sweep signals.

### High-Voltage Rectifier

The high voltage rectifier uses a resistance filter. The bleeder is connected across the filter input to reduce ripple.

### Alignment Procedure for Television Channel

The problem of aligning the several circuits in a television receiver is much more involved and requires more specialized equipment than the alignment of conventional radio receivers. Fortunately, the use of stable components in carefully engineered circuits of wide-band characteristics reduces to a minimum the necessity for alignment under normal operating conditions.

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# REPAIRING SPEAKERS TODAY

By **BARRY KASSIN**

Assistant Editor

THE difficulty in obtaining parts need not cause the abandonment of a contemplated change or improvement. Replacement or interchange can, in many instances, solve the problem.

The unavailability of dynamic speakers, for instance, may be overcome by replacing the original speaker with a magnetic type unit. In effecting this replacement, it is advisable to eliminate the d-c component from the coil. This is beneficial because the armature of a magnetic speaker becomes energized by the d-c current and this usually causes rattling. This is especially true when a high current tube similar to a 35L6 or 50L6 type is used to supply the speaker.

Fig. 1 shows a conventional electrodynamic circuit using a field coil as combination field and choke.

Fig. 2 shows a p-m dynamic with a resistance type filter and a p-m speaker. It is important that the screens be returned to the d-c side of the filter. If not, a loud hum will be heard in the speaker.

Fig. 3 is a suggested magnetic speaker type connection with isolation or blocking condenser  $C_1$  which permits the audio frequencies to bypass to the speaker. This condenser blocks the d-c which the power tube draws under normal operation.

The choke in the plate circuit could be either an old output transformer primary with the secondary leads left open or an iron core choke with a resistance of about 150 to 500 ohms.

An old type magnetic unit will han-

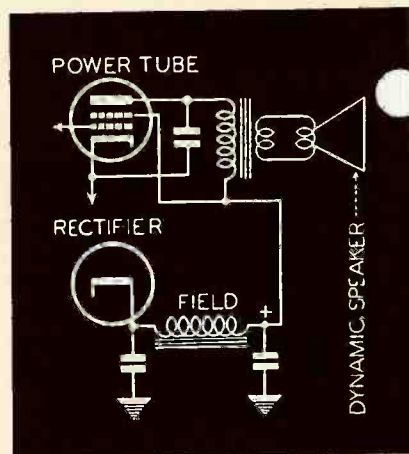
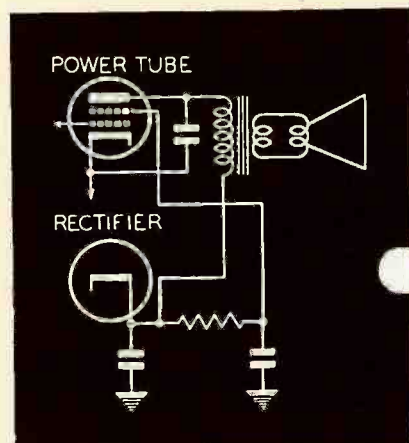
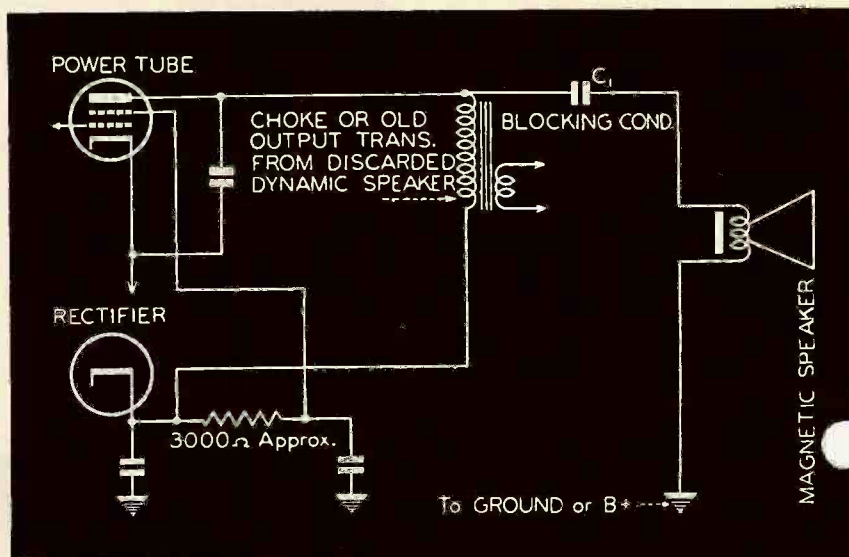


Fig. 1. A conventional electrodynamic circuit using a field coil as combination field and choke.



Figs. 2 (above) and 3 (below). Resistance type filter is shown in Fig. 2. Note isolation blocking condenser in Fig. 3.





dle a surprising amount of audio output, if the d-c component is omitted. In an actual demonstration, an old 5" electrodynamic unit was replaced with a 5" magnetic speaker. The latter yielded up to two full watts with surprisingly fine quality and results. Originally the speaker was connected so that the d-c ran through the winding. The speaker rattled at less than one watt.

## U-H-F CONVERTER

(Continued from page 10)

quency, serving as an i-f amplifier and detector. Or the converter output may be fed to any broadcast receiver for u-h-f reception, best results being obtained with a high gain, quiet receiver.

It should be noted that the only tuned u-h-f circuit, except the oscillator, is placed in the first detector input. In order to keep an approximately uniform gain on all bands, several ingenious circuit improvements are employed. We find, for instance, that the cathode bias of the r-f stage is decreased as the frequency is increased (see  $S_1$  which cuts in various extra bias resistors from 4,000 ohms to 17,000 ohms). We note too that a  $H_1$  switch short circuits  $S_2$  to provide additional gain on the three low-frequency bands. Another improvisation is found in the tuned circuits which are shunted with graduated resistors. Further inspection reveals that the oscillator plate is ungrounded on  $G$  band for additional pickup. The oscillator coupling is from the hot cathode of the 6SJ7 to grid 1 of the converter through a small (40 mmfd) coupling condenser which favors high frequencies.

Several filters are included for the prevention of stray coupling and to keep the oscillator from radiating into the power line. A pair of chokes and condensers are in the power transformer primary and .01-mmfd and 750-mmfd condensers and choke  $L_{11}$  is in the oscillator tube heater circuit.

### Using the Converter

After connecting the converter to the Chanalyst and lining up the latter for maximum gain the converter is ready for use. Its operation may easily be checked by using it as an u-h-f receiver, as previously suggested. For signal tracing, the u-h-f probe should be used for minimum circuit disturbance. Either a signal generator or a steady *a-m* station may be tuned in on the receiver under observation; the

(Continued on page 25)



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"Handie talkies"—miniature transmitter-receivers, each not much larger than a carton of cigarettes—are in constant use by our fighting men over-seas.

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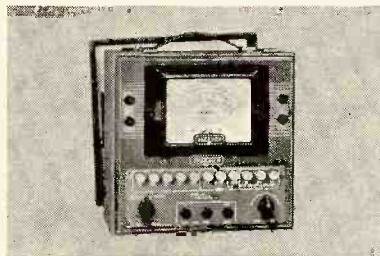
But occasionally, of course, severe usage may put these little "talkies"

out of order . . . and then the Signal Corps experts—quite possibly aided by Jackson testing equipment—will soon have the "talkie" back in operation.

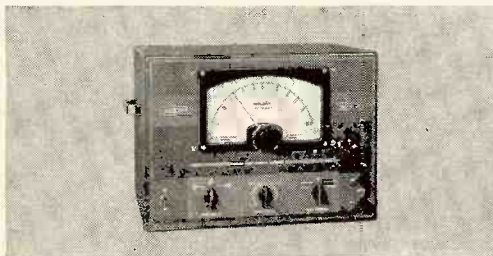
Jackson production is now entirely war work. We are happy in doing our best toward helping to keep vital war communication lines open.

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Model 642 Multimeter



Model 652 Audio Oscillator

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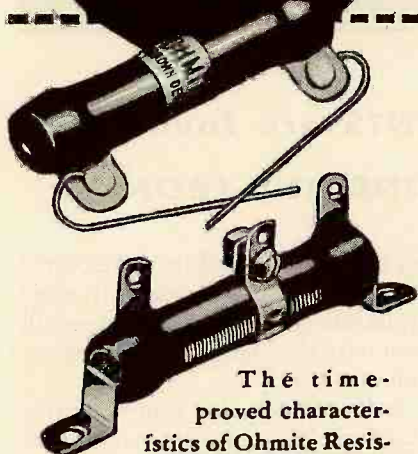
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# BOOK REVIEWS . . .

*RADIO TROUBLESHOOTER'S HANDBOOK*, by Alfred A. Ghirardi, Author of the *Radio Physics Course*, *Modern Radio Servicing and Radio Field Service Data* . . . 744 pp. . . . New York: Radio & Technical Publishing Co. . . . \$5.00.

This, the third edition, is replete with an unusual variety of servicing data. Mr. Ghirardi presents, for instance, case histories of common trouble symptoms and remedies for over 4,300 models of over 200 makes of home and auto-radio receivers and record changers. These data are presented in step-by-step fashion.

The alignment of I-F peaks of over 20,000 superheterodyne receivers is featured in another section of the book. A rapid trouble-shooting chart for common troubles in home receivers and auto radio models also appears.

To facilitate installation of auto-radios, ignition data for all of the American passenger cars since 1933 are presented. Gear ratios and dial directions of auto-radios are also shown in chart form. A discussion of auto-radio ignition interference in all types of cars appears, too. In addition, there are wiring diagrams of 88 recent models of American cars.

Presented in chart form, too, are vibrator buffer-condenser replacement data, recommended replacement and electrically comparable batteries for 1,250 models of portable radios, physical dimensions and electrical specifications of 12 different makes of A, B and A-B dry batteries and packs for portable and farm radio, grid bias resistor resistance values and wattage ratings for all self-biased tubes, receiving tube classification and operating characteristics and basing data, tube types for substitutions, etc. Base pin and socket connection diagrams for standard tube RMA bases are also presented.

There are also chapters on . . . spe-

cial-purpose tubes, transmitting tubes, cathode ray tubes, U. S. Navy standard tube types and their nearest commercial (RMA) equivalents, U. S. Army standard tube types and their nearest commercial (RMA) equivalents, U. S. Army-Navy preferred list of tube types to be used in new equipment, modernizing old receivers by substituting newer types of tubes, tube testers, interpretation of RMA receiving tube ratings, and pilot and dial lamps.

RMA standards also appear in the following charts . . . molded resistors, flexible resistors and resistor-cords; preferred values of molded resistors; molded mica condensers; power, I-F, interstage audio and output audio transformer leads, and proposed symbols for radio schematic diagrams.

Included, too, are a variety of calculation charts covering Ohm's Law, reactance, resistance, power transformer design, etc.

This volume is indeed a handy book for student and Service Man to have around.

*BASIC ELECTRICITY FOR COMMUNICATIONS*, by William H. Timbie, Professor of Electrical Engineering and Industrial Practice, Massachusetts Institute of Technology. 603 pp. . . . New York: John Wiley & Sons, Inc. . . . \$3.50.

A book of fundamentals written for workers in communications and industrial electronics. Professor Timbie presents the basic electrical principles that every worker must be familiar with to solve a variety of problems arising in practice. He discusses such fundamentals as molecules, atoms and electrons and protons, as well as vacuum tubes and gaseous conduction. However, both subjects are explained with extreme clarity so that their usefulness is fully appreciated and understood.

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Classroom technique of questions and answers are employed at the conclusion of each subject. In addition typical practical examples are provided within the discussions.

An interesting assortment of explanatory photographs and schematic diagrams appear throughout the book.

**WHAT YOU SHOULD KNOW ABOUT THE SIGNAL CORPS**, by Harry M. Davis, Office of the Chief Signal Officer, War Department, and F. G. Fassett, Jr., Editor of the "Technology Review," Massachusetts Institute of Technology. . . . 214 pp. . . . New York: W. W. Norton & Co., Inc. . . . \$2.50.

The Signal Corps, one of the most interesting branches of the Service, receives an effective analysis in this presentation.

Although the details presented are of a non-technical nature, Service Men nevertheless will find the data interesting, revealing as it does the fascinating story of the Signal Corps from its inception to present day operation.

The book shows just how a Signal Corps man is trained and his function in the Service. Since Army Photography is also a branch of the Signal Corps, a chapter is devoted to this phase, too.

## U-H-F CONVERTER

(Continued from page 23)

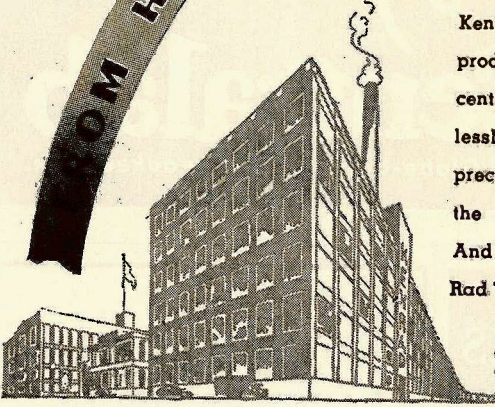
generator is, of course, preferable.

The standard signal tracing procedure is then followed. This is similar to that of the Chanalyst starting with the probe tip on the antenna terminal, then grid, plate, etc., always setting the Chanalyst multiplier and level controls so that the eye indicator is just closed when everything is in tune.

Two very important departures from the general procedure are strongly recommended when checking gain in u-h-f receivers:

(1)—Remove the oscillator tube or otherwise stop the oscillator to greatly reduce the possibilities of beats, images and birdies which are caused by the signal generator, receiver oscillator and converter oscillator being closely coupled.

(2)—Check the gain of i-f tubes and transformers with an i-f signal fed to the first detector grid instead of using an u-h-f signal at the antenna terminal of the receiver. Stability and accuracy of measurement are thereby greatly increased.



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### FOIL ANTENNA USES

In many console receivers of the older type there are no loops installed and the use of the external antenna is necessary. It is a simple operation for the Service Man to replace the outside antenna by running a foil around the inside of the console. The foil may be either cemented or stapled on and then connected to the antenna post of the receiver. Surprisingly good pick-up can be obtained from this foil. The foil may be obtained from discarded paper or electrolytic condensers.

\* \* \*

### HUM CURES

Many receivers develop loud hums which are due to the actual mechani-

cal vibration created by the power transformer laminations to the chassis. The chassis in turn uses the cabinet as a sound board. The hum is usually caused by reason of the fastening of the power transformer to the chassis. And the chassis in turn acts as a large lamination because of the extremely close magnetic field from the transformer lamination to the chassis. This effect may be eliminated by placing a small washer or spacer between the transformer and the chassis before mounting the transformer.

It has also been found that induced hum from the chassis to the second detector coil may be eliminated by this procedure.



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# NEWS

## REPS ADD NEW MEMBERS

Two local chapters of the Representatives of Radio Parts Manufacturers report the recent acquisition of two members each. The Mid-Lantic chapter has added I. R. Blair, Box 212, North Wales, Pa. and C. H. Fryberg, 402 Cherry Street, Philadelphia, Pa. to its roster.

The Missouri Valley Chapter's new members are H. C. Rees, of 2017 Grand Avenue, Kansas City, Mo. and F. C. Somers, Jr., 614 City Bank Bldg., Kansas City, Mo.

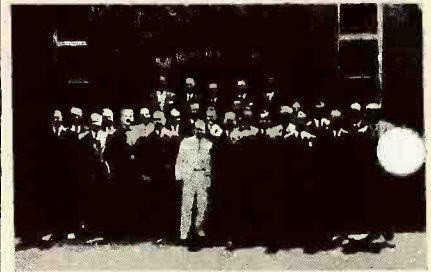
N. W. Kathrinus of the Missouri Valley chapter has moved to 45 Country-side Lane, Kirkwood, Mo.

\* \* \*

## AEROVOX REPS VISIT PLANT

Field representatives of the Aerovox Corporation from widely scattered points throughout the United States and Canada, recently held a three-day conference and plant inspection at the company's headquarters in New Bedford, Mass., following their attendance at the annual RMA Convention in Chicago.

On the way east from Chicago the group of some 30 representatives, plus



company men and officials headed by S. I. Cole, Aerovox president, stopped off at Hamilton, Ontario, to inspect the new and greatly expanded Aerovox plant.

\* \* \*

## RTA PUBLICIZING WARTIME SERVICE PROBLEMS ON COAST

Approximately 85,000 handbills calling attention to *What You Should Know About Radio Service During the National Emergency*, have been distributed to radio stores by the Radio Technicians' Association, Long Beach, California.

According to Harry E. Ward, Jr., of RTA, the purpose of these circulars is to remind consumers that we are at war and parts are not available as readily as heretofore. Mr. Ward has found that the circulars have been very effective in disseminating this information. The circulars are being distributed to all RTA member stores. Those who are not members of the association are also being given a small quantity for distribution.

*Our country is at war. On the home-front, it is your obligation, small enough sure, to keep your industry functioning smoothly "for the duration".*

**PIONEER GEN-E-MOTOR WORKERS IN ABSENTEEISM CAMPAIGN**

In a recent rally employees at the Chicago plant of Pioneer Gen-E-Motor pledged their allegiance to a *Stay In The Safety Zone* campaign to stop absenteeism and also reduce accidents.

The *Safety Zone* campaign was presented by David Bright, president of



Pioneer Gen-E-Motor. Invited guests included Governor Dwight H. Green of Illinois; Colonel Paul G. Armstrong, Illinois Selective Service Director; Major General Henry S. Aurand, Commanding Officer of the 6th Service Command; Admiral John Downes, Commandant of the 9th Naval District; Wilfred Hansford Gallienne, British Consul in Chicago, and many high ranking Army and Navy officials.

\* \* \*

**TECHNICAL MANUAL DEPARTMENT AT SUPREME**

A new department, providing the preparation of Technical Instruction Manuals for manufacturers who have government contracts, has been established at Supreme Publications, 328 South Jefferson Street, Chicago, Illinois.

The new division will be under the supervision of M. N. Beitman.

\* \* \*

**HENRY TAYLOR ON AIR FOR FADA**

Henry J. Taylor, war correspondent is now broadcasting daily for Fada Radio and Electric Company, Inc., Long Island City, New York. He is on the air over WJZ, from 11:05 to 11:15 P. M., Monday through Friday.

\* \* \*

**HEROES TALK TO JENSEN EMPLOYEES**

Two heroes, who have been decorated with the Order of the Purple Heart, Fireman 1st Class A. W. Ambler of the U. S. Navy and Sergeant J. E. Barry of the U. S. Marines, spoke recently to employees of Jensen Radio Manufacturing Company, Chicago, Illinois.



*Immediate Delivery*  
**"Plastic" I.F. Transformers!**



**Meissner "Plastic" I.F. Transformers are ideal for replacements . . . especially where space is limited, yet superior performance is required . . . only 1 1/4 inches square and 2 1/2 inches high.**

**SUPERIOR CONSTRUCTION . . . one-piece molded plastic coil form and trimmer base eliminates separate parts . . . unit has greater stability . . . fully protected against the effects of humidity and temperature changes.**

**No. 16-6649 . . . 175 kc. . . No. 16-6652 . . . 262 kc. . .**

**No. 16-6658 . . . 456 kc. . . Can be used in either input or output positions. . . List price \$1.10 each.**

**For better performance replace with Meissner "Plastic" I.F. Transformers. . . See your Meissner distributor.**

*Meissner*

MT. CARMEL, ILLINOIS

**"PRECISION-BUILT ELECTRONIC PRODUCTS"**



**RESISTANCE AND TRANSFORMER COUPLED DRIVE DATA FOR 28D7**

An engineering news letter covering several methods of driving 28D7 tubes has been released by Sylvania Electric Products, Inc., Emporium, Pennsylvania.

The news letter provides distortion and power output data as well as circuit diagrams showing uses of the tubes in various applications.

\* \* \*

**METAL AND RUBBER SCRAP ARE STILL URGENTLY NEEDED. BE CERTAIN TO SAVE AND CONTRIBUTE YOURS.**

**S. I. COLE ON RMA EXECUTIVE COMMITTEE**

S. I. Cole, president of Aerovox Corporation, was recently elected a member of the Executive Committee of the Radio Manufacturer's Association at its annual convention held in Chicago.

\* \* \*

**RADIO DATA HANDBOOK**

A 48-page Radio Data Handbook, edited by Lieut. Nelson M. Cooke, United States Navy, U. S. Naval Research Laboratory, Washington, D. C. has been published by Allied Radio Corporation, 833 West Jackson Boulevard, Chicago, Illinois.

The book is divided into four parts: mathematical data, radio and electronic (Continued on page 28)

# TRIPLETT *Combat Line* TESTERS



## TRIPPLETT MODEL 625 T PORTABLE TESTER

A long scale 4.58 highly sensitive, compact, easily portable Tester.

12 A.C.-D.C. Voltage Ranges to 5,000 Volts,

Six Direct Current Ranges including microamperes, milliamperes and amperes,

3 Resistance Ranges to 4 megohms.

Bakelite Case 6" x 5 1/2" x 2 1/2".



Although some older designs are no longer obtainable several alternate models are available to you under Government requirements.

TRIPPLETT ELECTRICAL INSTRUMENT CO. • BLUFFTON, OHIO

## IF YOU CANNOT REPLACE RADIO PARTS REPAIR THEM WITH *Walsco* PRODUCTS



### WALTER L. SCHOTT CO.

Manufacturers of  
**WALSCO PRODUCTS**  
For Communication Equipment Manufacturers,  
Laboratories, Schools and Radio Repair Men  
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Dept. S

#### Walsco RADIO CHEMICALS

- Speaker Cements
- Cements For Plastics
- Special Adhesives
- Contact Cleaning Fluids
- Noise Eliminating Compounds
- Radio Lubricants



#### Walsco RADIO HARDWARE

- Dial and Knob Springs
- Trimounts, Set Screws

#### Walsco CABLES, BELTS

Of course—we are concentrating our efforts on war production—but not for a second are we neglecting the RADIO SERVICEMEN who require so many WALSCO RADIO PRODUCTS to keep the radios of their customers in perfect working order. Write today for WALSCO Catalogue No. 112, giving complete information about WALSCO PRODUCTS.

## NEWS

(Continued from page 27)

formulas, engineering and servicing information, and a complete set of four-place log and trig tables.

Formulas are given for decibels, reactance, capacitance, inductance, resonance, frequency, Q factor, impedance, conductance, susceptance, admittance, transients, peak average and RMS voltage and current values, meter shunts and multipliers, vacuum-tube constants, etc.

Data section contains such subjects as radio color codes, interchangeable tubes, pilot lamps, plug-in ballast resistors, coil winding.

Copies are available from the publisher at 25c per copy.

\*\*\*

### FORMER RADIO SERVICE MAN WINS WAR PRODUCTION AWARD

Lawrence Handler, former Service Man and "ham," recently received a substantial suggestion award from the Westinghouse Lamp Division, Bloomfield, N. J., where he is a maintenance foreman for an idea



that has boosted production of radio tubes needed for war communication equipment.

His idea to change the design of a machine tool fixture has resulted in an average daily saving of nine production hours and critical materials by preventing tube breakage, engineers reported.

The fixture is essentially a collar-like device which fits over the end of the tube mechanism to hold it in place while the glass bulb is sealed around it. In order to release this collar after each sealing operation, it formerly was necessary to hammer it back to its original position, thus sometimes damaging the fixture and cracking the tube glass.

In searching for some way to avoid this damage, Handler hit upon the idea of installing three metal "jaws" on the fixture which would pull the collar to its original position and eliminate the need of hammering.

Mr. Handler also concluded that if ball bearings were installed on the fixture, it would eliminate the motion caused by friction when the collar was released. This motion had been another frequent cause of injury to the radio tubes.

\*\*\*

BUY UNITED STATES  
WAR SAVINGS BONDS AND STAMPS  
EVERY PAY DAY

**NEW RMA RESISTOR-CONDENSER  
COLOR CODE WALL CHART**

A new color-code wall chart, with complete RMA resistor and condenser color codes and also color code marking arrangements used by all resistor and molded mica condenser manufacturers has just been issued by the Radio & Technical Publishing Company, 45 Astor Place, New York City, in conjunction with the release of the new 3rd edition *Radio Troubleshooter's Handbook* by Alfred A. Ghirardi.

The chart may be obtained by writing to Radio & Technical Publishing Company, enclosing a 3c stamp to cover postage.

**NEW HIT RECORDS**

A new album of Hit records has been released by the Classic Record Corporation, 2 West 46th Street, New York City. The recordings are by the Korn Kobblers and are entitled *Down on the Farm*.

**RMA OFFICERS ELECTED**

At the recent RMA meeting in Chicago, Paul V. Galvin was reelected president. Reelected as vice-presidents were Ray E. Sparrow and M. F. Balcom. Mr. Balcom heads the tube division and Mr. Sparrow the parts division. R. C. Cosgrove was elected vice-president and chairman of the set division. Thomas A. White, newly elected vice-president, was also elected chairman of the amplifier and sound equipment division. W. P. Hilliard was also elected a vice-president. Leslie F. Muter was reelected treasurer and Bond Geddes was also reelected to his posts.

**AEROVOX WORKERS HEAR SERGEANT  
BARNEY ROSS**

Sergeant Barney Ross of the Marines visited with several thousand workers at the Aerovox Corporation plant in New Bedford, Mass., recently.

Ross, who visited the Aerovox plant through arrangements made by the War Department and by S. I. Cole, president of Aerovox, told of the trials and tribulations experienced by his buddies during eight months' stay in the Solomons. He made it plain that our civilian privations and inconveniences are trivial compared with what our fighting men are doing.

**UNIVERSAL INSPECTOR WINS BOND  
FOR AIR APPEARANCE**

Mrs. Florence Hillstead, inspector at the Inglewood, California plant of the Universal Microphone Company, was recently selected as a typical war worker and chosen to appear on a CBS broadcast featuring Billie Burke. For her efforts on the program, she was awarded a \$25.00 war bond.



Some Things are REALLY Scarce Right Now



THERE are no substitutes for some things that are scarce today. There are no "ersatz" servicemen to take the places of those called to the colors.

But, there are just as many, and more, sets needing repair. And you, brother 3A or 4F, have to see that they're repaired.

Today it's your patriotic duty to ration your time; use it so you get the utmost production out of each unit of labor.

Use your testing instruments—employ the latest servicing techniques—and reach for one of your thirteen RIDER MANUALS before you begin each job. These volumes lead you quickly to the cause of failure; provide the facts that speed repairs.

It isn't practical or patriotic to waste time playing around, guessing-out defects. Today you must work with system and certainty. RIDER MANUALS provide you with both.

**RIDER MANUALS**

- Volumes XIII to VII.....\$11.00 each
- Volumes VI to III..... 8.25 each
- Volumes I to V, Abridged.....\$12.50
- Automatic Record Changers and Recorders..... 6.00

**OTHER RIDER BOOKS YOU NEED**

- The Cathode Ray Tube at Work  
Accepted authority on subject.....\$3.00
- Frequency Modulation  
Gives principles of FM radio..... 1.50
- Servicing by Signal Tracing  
Basic method of radio servicing..... 3.00
- The Meter at Work  
An elementary text on meters..... 1.50
- The Oscillator at Work  
How to use, test and repair..... 2.00
- Vacuum Tube Voltmeters  
Both theory and practice..... 2.00
- Automatic Frequency Control Systems  
—also automatic tuning systems..... 1.25
- A-C Calculation Charts  
Two to five times as fast as slide rule.  
More fool-proof. 160 pp. 2 colors..... 7.50
- Hour-A-Day-with-Rider Series—  
On "Alternating Currents in Radio Receivers"—  
On "Resonance & Alignment"—On "Automatic Volume Control"—On "D-C Voltage Distribution"  
..... 90c each

**JOHN F. RIDER PUBLISHER, INC.**

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Export Division: Rocke-International Electric Corp.  
100 Varick Street New York City. Cable: ARLAB

**RIDER MANUALS  
SPEED REPAIRS — AND VICTORY**

**LAMINATED PLASTICS DISCUSSED AT  
INSTITUTE MEETING**

A new era of peacetime consumer applications of laminated plastics appears to be on the horizon, according to Formica engineers and chemists who appeared at the recent annual meeting of the Ohio Mechanics Institute, Cincinnati, Ohio.

The program arranged by D. J. O'Connor, Formica president and board member of OMI, revealed that laminated plastics will be utilized in a variety of postwar applications with many new innovations. The two limitations, namely color and heat resistance, have been overcome to a great extent, thus eliminating a laminated plastic production problem.

**NEW HEADSET FOR SIGNAL CORPS**

In view of the peculiar construction of new helmets worn by American soldiers, Signal corps engineers in association with engineers of private industry have developed a compact flat-type headset, which fits under the helmet. An interesting feature of the new headset is a soft plug which fits into the orifice of the outer car, thus eliminating outside noises. These inserts afford increased sanitation too, for each user receives a new insert with the headset issued to him.

The headset is said to have a very flat frequency response and can be used very effectively for both telephone and radio work.



**CLAROSTAT**

ROLLING ON TO  
**Victory**

★ Clarostat continues to be engaged 100% in the most important job of all—winning the war—on land, sea and in the air. But after victory has been won, Clarostat promises the trade—servicemen, jobbers and others—that Clarostat products for initial and replacement uses alike, will once more be generally available for peacetime pursuits. Meanwhile, let's keep 'em rolling!



**CLAROSTAT Controls and Resistors**  
CLAROSTAT MFG CO., Inc. 285 7 N. 6th St. Brooklyn, N. Y.

# NEW PRODUCTS

## G. E. ADDS SELENIUM STACKS TO RECTIFIER LINE

Selenium rectifier stacks have been added to the G. E. tungar and copper oxide rectifier line.

As is the case with other types of metallic rectifiers, the Selenium stacks can be arranged to obtain higher current output by connecting the stacks in parallel. Higher voltage ratings can be obtained by connecting the stacks in series.

An important advantage of the Selenium stacks is their light weight and small size. They are both lighter in weight and smaller in overall size than any other type of metallic rectifier.

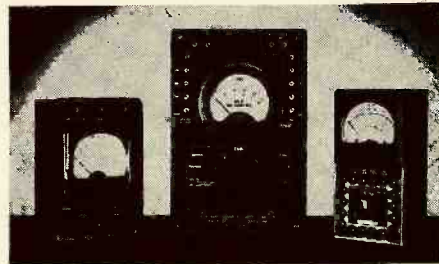
## NEW TALK-A-PHONE

A new master station and sub-station unit, LP-77, is now available from Talk-A-Phone Manufacturing Company, 1219 Van Buren Street, Chicago, Illinois. It utilizes in any combination up to ten, both master stations and a new *selector type* sub-station. Master stations may carry on a completely private conversation between each other without interruption or eaves-dropping by the remote stations, and, in addition, may communicate with the different sub-stations at will. Any master station may also have a private sub-station with which no other master can communicate or listen in on.

Operation on the system is 110 volts, a-c/d-c. These systems are available in 10, 20, 30, 40, 50 etc., stations.

with a 200-microampere movement and a sensitivity of 5,000 ohms per volt. It has four d-c milliammeter ranges: 0-0.3/6/30/150 (with a first scale division of 5 microamperes); four d-c voltmeter ranges: 0-6/150/300/1,500 (with a first scale division of 0.1 volt); four a-c voltmeter ranges: 0-6/30/150/600 (with a first scale division of 0.1 volt); four output voltmeter ranges: 0-6/30/60/150/400 and four decibel ranges from -6 to +6.

The output meter, model 471 (rectifier type a-c voltmeter) has a constant impedance of 4,000 ohms. All resistors are precision wire wound, and, said to be accurate within 1%.



Five voltage ranges are available by turning a selector switch: 0-1.5/6/15/60/150. A self-contained condenser for blocking any d-c components is connected to separate terminals.

The test meter, model 481, has a meter sensitivity of 50 microamperes. Its d-c voltmeter readings are from 0.1 to 1,000 volts; d-c milliammeter readings from 0 to 100 milliamperes; resistance measurements from 0.1 ohms to 10 megohms. Energy for resistance measurements is supplied from self-contained batteries.

## AMPERITE THERMOSTATIC DELAY RELAY

Delays from 1 to 100 seconds are made possible with a new thermostatic delay relay, developed by the Amperite Company, 561 Broadway, New York City. The relay is compensated for ambient changes of -40° to +100° F. It can be furnished in single pole, either normally open or normally closed. Contacts are capable of handling up to 12 amperes, 115 volts a-c or d-c.

The unit is hermetically sealed in an inert gas to assure clean contacts at all times. Replacements can be made easily. Fits standard octal radio base.

**BONDS — BONDS — BONDS**  
**KEEP BUYING 'EM — AS MANY AS YOU CAN. THERE'S NO BETTER WAY TO HASTEN ULTIMATE VICTORY**

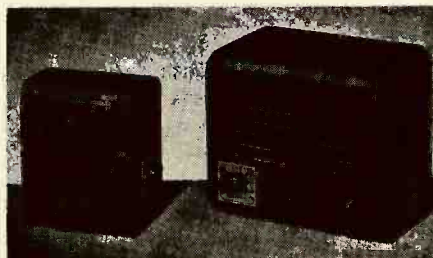
# FADA

## FACTORY SERVICE DEPT.

has a large stock of Record Changer Parts. Also replacement parts for all FADA MODELS, as well as a completely equipped SERVICE DEPARTMENT.

## FADA OF NEW YORK

928 Broadway, New York, N. Y.  
Tel.: GRAMERCY 7-0951-2



## NEW RCP TEST INSTRUMENTS

Three new test instruments, a pocket-size multimeter, output meter and voltohmmeter have been introduced by Radio City Products, Inc., 127 West 26th Street, New York City.

Model 442 is a compact multimeter

**GUARDING COMMUNICATIONS WHERE THE GOING IS TOUGH!**

# SUPREME

## TESTING INSTRUMENTS

The famous 504-A and other SUPREME Testing Instruments are on active duty in all parts of the world. Now more ruggedly built, more accurate and dependable than ever, SUPREME Instruments will be your logical choice when victory is won.

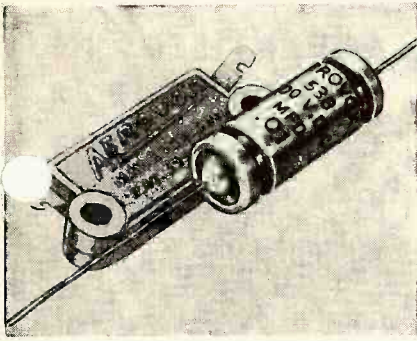


**SUPREME INSTRUMENTS CORP. GREENWOOD, MISSISSIPPI**

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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.





**ULTRA-SMALL OIL-FILLED CAPACITORS**

A series of ultra small oil-impregnated, oil-filled capacitors for use in assemblies where both space and weight are at absolute minimum, have been announced by Aerovox Corporation, New Bedford, Mass. Originally designed as metal-cased alternates for mica capacitors, these oil tubulars, known as type 38, are now being used for newly-designed equipment.

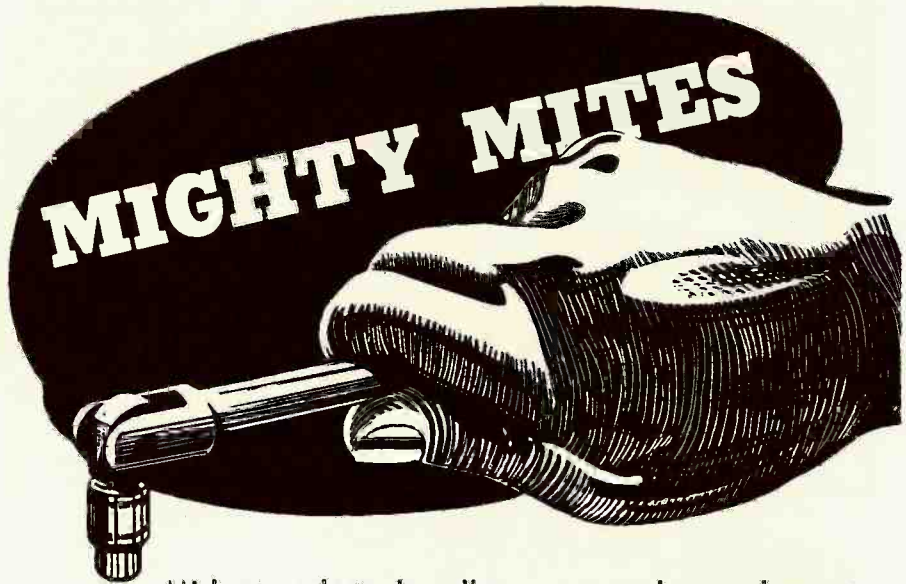
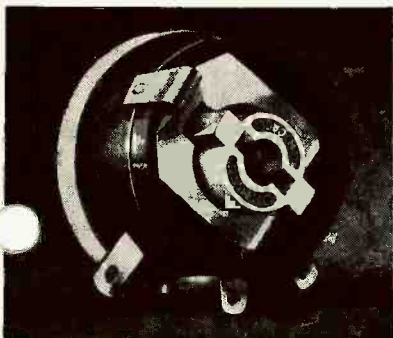
The metal case on the capacitor is capped by an Aerovox double-rubber-bakelite terminal insulator assembly. Units are available with both terminals insulated or with one terminal grounded to the case, and pigtail terminals. They are normally supplied without outer sleeve, but can be had with insulating jacket adding 1/16" to diameter and length (1 and 3/16" long, 5/16" and 7/16" diameters). Castor (Hyvol) or mineral oil impregnant and fill, is used. The d-c working voltage is 300 to 800. Capacitances are from .001 to .01 mfd.

**\* \* \***  
**OHMITE CIRCULAR SLIDE-WIRE RHEOSTAT**

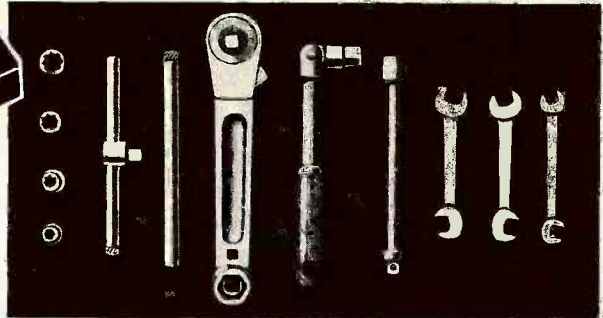
neostat-potentiometer, designed especially for low resistance, low wattage applications, has been developed by Ohmite Manufacturing Company, 4835 Flournoy Street, Chicago, 44, Illinois.

In the unit a length of resistance wire is stretched tightly around the outside of a cylindrical core which is bonded to a ceramic base. The wire is firmly anchored to two terminals. Contact to the wire is made by a phosphor-bronze spring arm which is connected to a third terminal. The provision of three terminals allows the unit to be used as a potentiometer or voltage divider.

The maximum resistance which can be supplied on this unit is approximately 1 ohm, while the minimum total resistance can be made approximately 0.1 ohm. Since the contact arm travels along the wire from end to end, the resistance variation is stepless. Shafts for knob control or for screw driver control can be supplied. These units are made to order to suit the particular application and inquiries on this basis are welcomed.



Midget sockets, handles, open end wrenches, etc., specially designed for hard-to-get-at radio, carburetor and ignition work . . . made under Walden Worcester's rigid standard . . . extremely strong and rugged. You can depend on Walden Worcester tools . . . backed by a plant with over 36 years experience in "knowing how" to build the best. Send for complete catalog.



**STEVENS WALDEN, INC.**  
**467 SHREWSBURY STREET**

**WORCESTER, MASSACHUSETTS, U. S. A.**

**PLANT-BROADCASTING UNIT**

A standardized and packaged unit for voice-paging and music broadcasting has been announced by the Operadio Manufacturing Company, St. Charles, Illinois.

The unit operates 20 to 40 loud speakers and covers an area of up to 100,000 square feet.

The control cabinet can be located near the telephone switchboard, or placed in any convenient location with connection to the microphone and key cabinet at the switchboard. Paging calls may be sent over the system while music is being played by means of an automatic control which decreases the music volume.

In the unit is an 8" p-m monitor speaker, automatic phonograph for 10" and 12" records, voltage amplifier and power amplifier. A dynamic microphone is also supplied.

**THERMOSTATIC-CONTROLLED WAVEMETER**

E. O. Thompson of the Philco Engineering Department and David Sunstein of the Philco Factory Organization have been officially cited by the WPB for their development of a thermostatic control to be used in a wavemeter. The device is self-compensating, permitting complete control of the control coil regardless of temperature variation. Thus frequency stability, is said to be maintained at all times.

\* \* \*

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**WAR SAVINGS BONDS AND STAMPS**

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**SYLVANIA**  
ELECTRIC PRODUCTS INC.  
RADIO DIVISION

## JOTS & FLASHES

**S**TILL more space required by National Union. . . . 33,000 additional square feet leased for offices and laboratories for research engineering department . . . glad to have Utah advertising back again starting in this issue . . . E. L. Feininger heads new General Electric division handling resin and insulation materials . . . we liked Hallicrafters card congratulating the U. S. Army Signal Corps on their 83rd Birthday . . . a grand gesture . . . Allen B DuMont Laboratories, Inc., has just filed with the FCC a request for the reinstatement of a commercial television station application for Washington, D. C. . . . Universal Microphone Co. appoints Richard Hume department supervisor and stores manager . . . Federal Manufacturing & Engineering Corp., Brooklyn, N. Y., awarded white star for their Army-Navy "E" pennant . . . Sylvania Electric Products, Inc., has purchased manufacturing facilities, including plant and machinery, formerly operated by Electro Metals, Inc., of Cleveland . . . congratulations for winning Army-Navy "E" production award to Cannon Electrical Development Co., Los Angeles; Heintz & Kaufman, Ltd., South San Francisco; General Instrument Corp., Elizabeth, N. J.; General Electric Co., plastics department, Pittsfield, Mass.; Radio Speakers, Inc., Chicago . . . Lafayette Radio Corp. of Chicago appoints Joe Marcey city sales manager . . . new Sylvania offices and warehouse opened at 685 Whitehall St., S.W., Atlanta, Ga. . . large new addition being added to The Engineering Co. plant in Newark, N. J. . . . production facilities to be increased by 50% . . . how about you Service Men sending in some good servicing hints for publication in SERVICE . . . they might be of assistance to men in other parts of the country . . . we'll pay you for such material as is published . . . we can also use good photos of your work bench and shop interiors . . . keep buying War Bonds . . . that's the best way to get hostilities over with quickly . . . then you can once again get back to normal merchandising . . . might be a practical idea to start thinking about the lines of sets, tubes and components you'll stock and sell after the war . . . play ball with those manufacturers and distributors who have been and are still cooperating with you under war time stress, despite their inability to supply all your merchandise requirements . . . and remember to

**BUY WAR BONDS**

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## TESTED ON AN ATOLL

ON a tiny strip of coral . . . an observation post pierces the dawn with cryptic messages that may spell the difference between victory and defeat. Duty on this speck on your map calls for iron men and dependable equipment.

Under the toughest of conditions . . . under the roughest of handling . . . far from sources of replacement . . . parts must work—for men's lives hang in the balance. Utah Parts are passing this final test on tiny atolls, in steaming jungles, on burning sands in all parts of the world—from pole to pole.

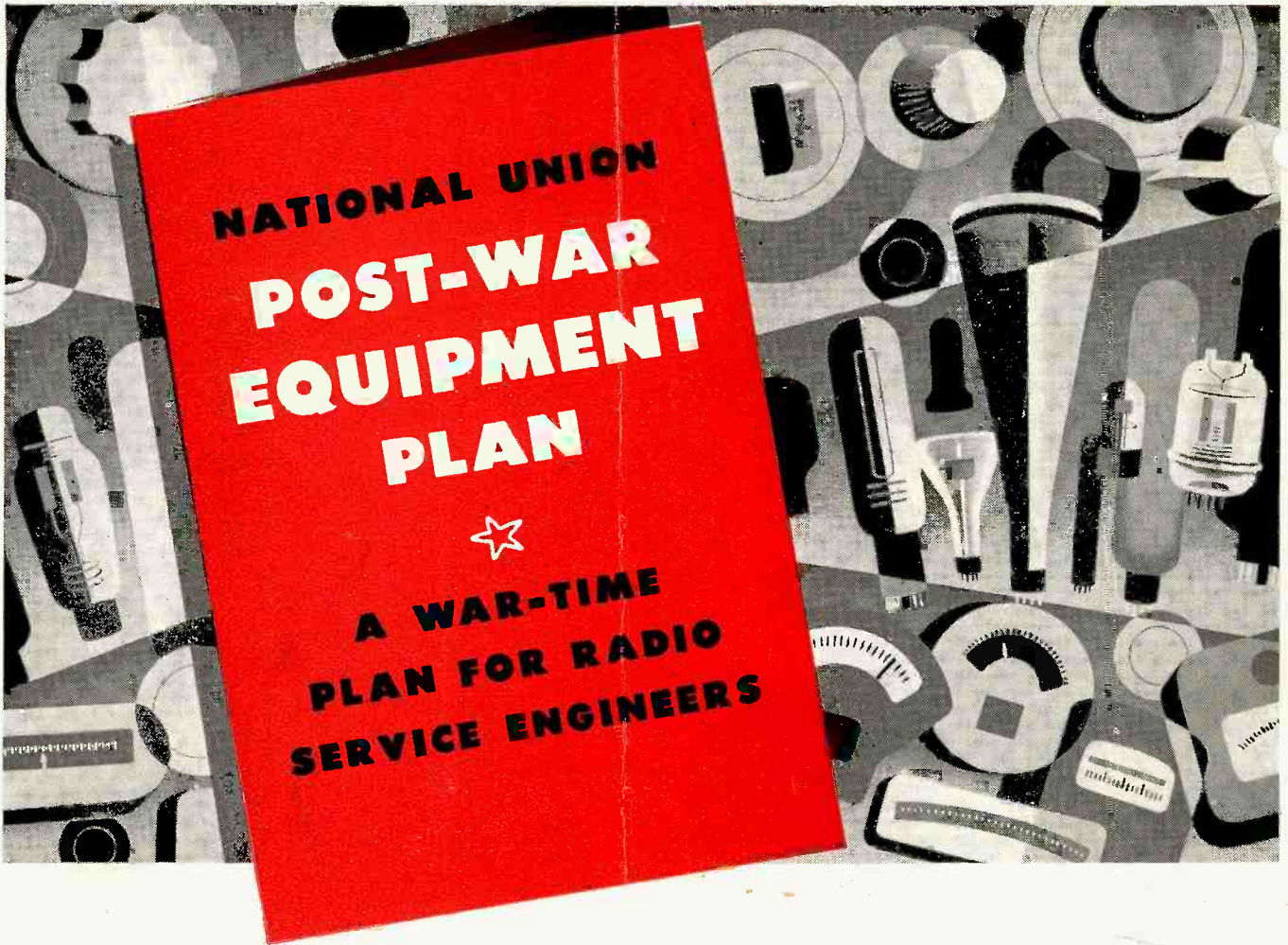
A shooting war is also a talking war. The weapons of communications must have the same dependability and non-failing action as weapons of destruction. These qualities are built into Utah Parts at the factory where

soldiers of production are working 100% for Victory. In Utah laboratories, engineers and technicians are working far into the night developing new answers to communication problems—making improvements on devices now in action.

But "tomorrow" all this activity, all this research, all this experience learned in the hard school of war, will be devoted to the pursuits of peace. Thanks to the things now going on at Utah—there will be greater convenience and enjoyment in American homes . . . greater efficiency in the nation's factories. UTAH RADIO PRODUCTS COMPANY, 816 Orleans Street, Chicago, Ill. Canadian Office: 560 King Street West, Toronto. In Argentine: UCOA Radio Products Co., SRL, Buenos Aires. Cable Address: UTARADIO, Chicago.

**PARTS FOR RADIO, ELECTRICAL AND ELECTRONIC DEVICES, INCLUDING  
SPEAKERS, TRANSFORMERS, VIBRATORS, VITREOUS ENAMELED RESISTORS,  
WIREWOUND CONTROLS, PLUGS, JACKS, SWITCHES, ELECTRIC MOTORS**





**NOW READY—Send for Your Copy Today!**

IN presenting Radio's first post-war plan for servicemen, National Union has set the whole industry a "buzzing".

Yet to servicemen the real beauty of this National Union plan is that it is *ready now—to be put to work now*. You use it *during the war* to prepare for the bigger peace-time business that lies ahead.

It is no secret that one of Radio's most spectacular war-time expansions has taken place right here at National Union. Our all-out war production has added greatly to our manufacturing facili-

ties, our trained manpower, our engineering knowledge and skill. With these we will be able to serve you better than ever after the war.

But why wait till the war ends? How about some help for servicemen in meeting their *present* problem? With this plan National Union answers that need too—demonstrating that it pays to do business with National Union in war as well as in peace.

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