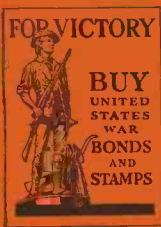
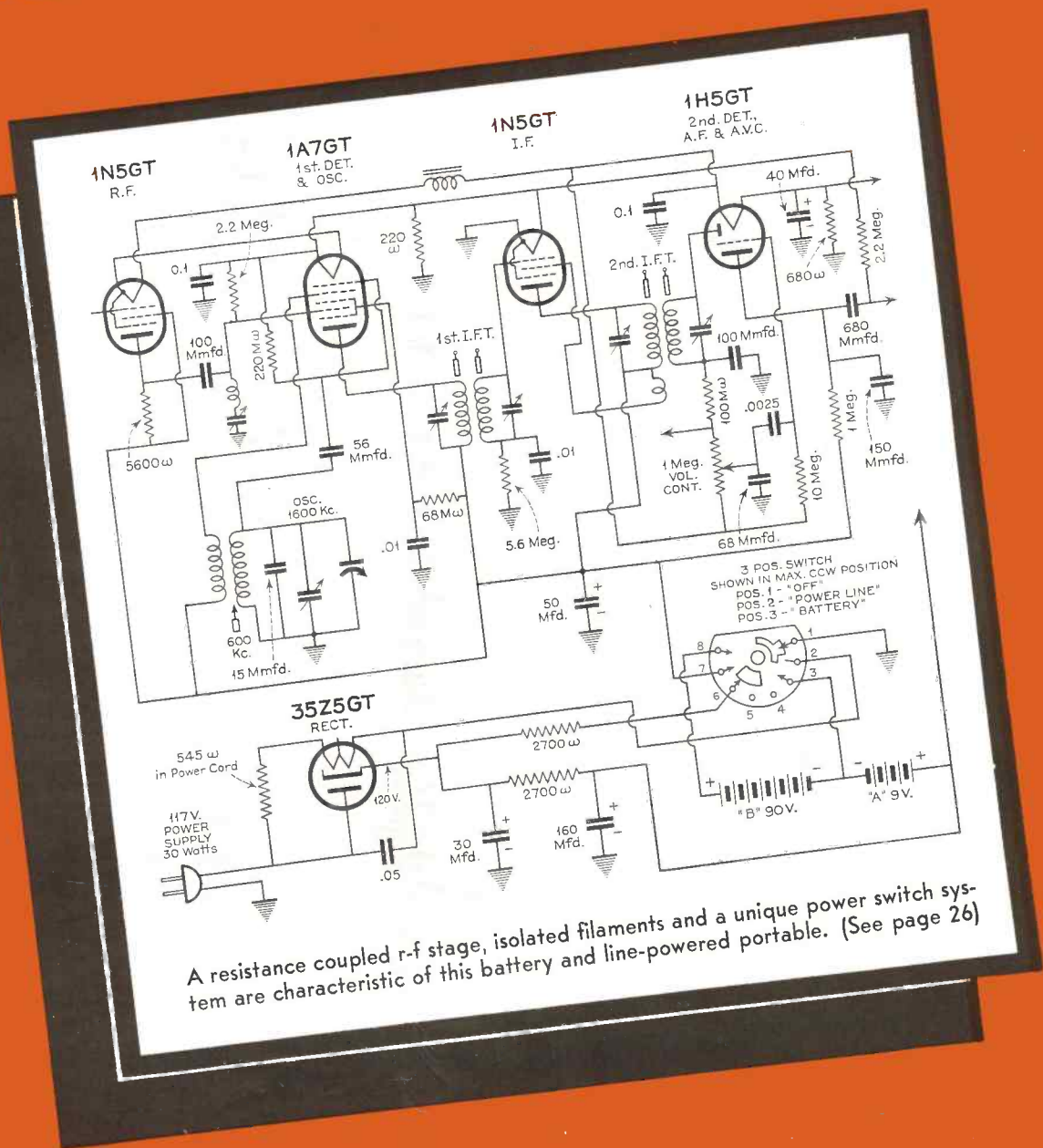
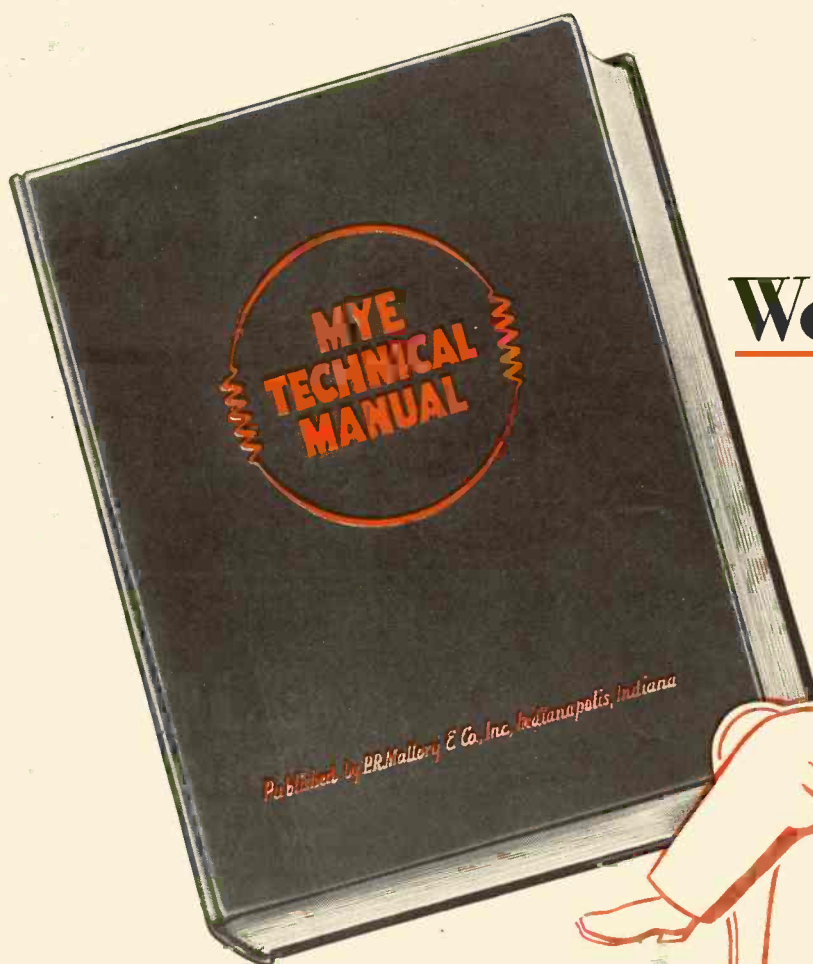


# SERVICE



November  
1942



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# EDITORIAL

**T**HE most dynamic program ever instituted, to assist the Service Man on the home front, has been arranged by the NAB and the RMA. The plan calls for a barrage of national broadcasts that will tell listeners to help increase production of individual Service Men by saving their time. This can be done, the broadcasts will say, by having sets brought in. And although this may sound like a drastic request to make, it is necessary today. In addition, broadcast stations will further cooperate locally, so that every Service Man achieves full benefit from these broadcasts.

So that Service Men will be able to have the necessary parts to service these sets, WPB is arranging for a suitable flow of parts and materials for repair and maintenance. This information is supplied on the authority of Frank McIntosh, Chief, Civilian Radio Section, Radio and Radar Branch, WPB.

It appears as if the Service Man will be able to smile again!

**O**N page 8 of this issue appears a discussion of another program of tremendous importance to the Service Man. Presented by Jerome J. Kahn, well known president of Stancor, it reveals vital problems of the day and how they can be solved. By all means read this dynamic analysis.

**“Y**OU'RE way ahead of the action in the U. S. Army Signal Corps,” says the U. S. Army advertisement appearing on page 9. If you're physically fit and between 18 and 44 . . . want to see action and do a job . . . here's your opportunity to do it!

**W**ASHINGTON will soon issue a wire program that will sift various types of wire, their sources and usefulness in military and civilian application. As a result of this program, thousands of pounds of wire now frozen and undeniably suitable for such purposes as repair and maintenance only, will be released. What a relief that will be to Service Men and the suppliers!

# SERVICE

A Monthly Digest of Radio and Allied Maintenance

Reg. U.S. Patent Office

Vol. II, No. 11

November, 1942

**ROBERT G. HERZOG,**

Editor (On Leave)

**ALFRED A. GHIRARDI,**

Advisory Editor

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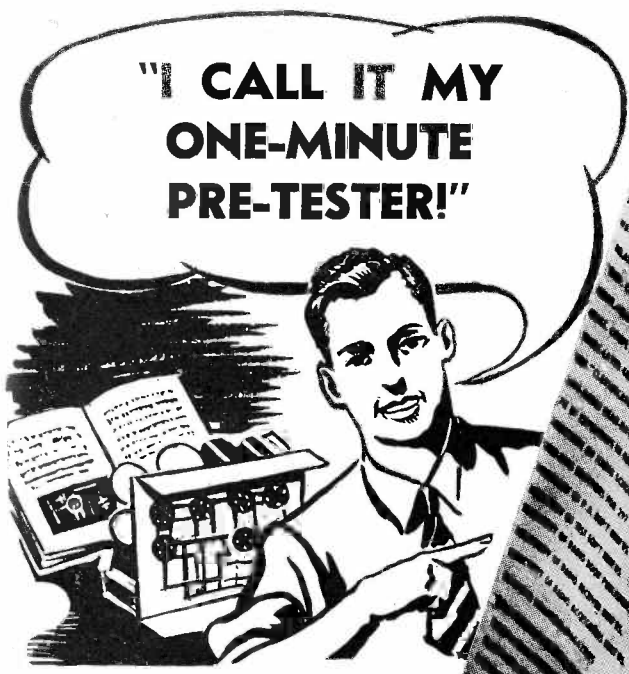
**BECAUSE** . . . IRC offers "best product" and "most complete line."



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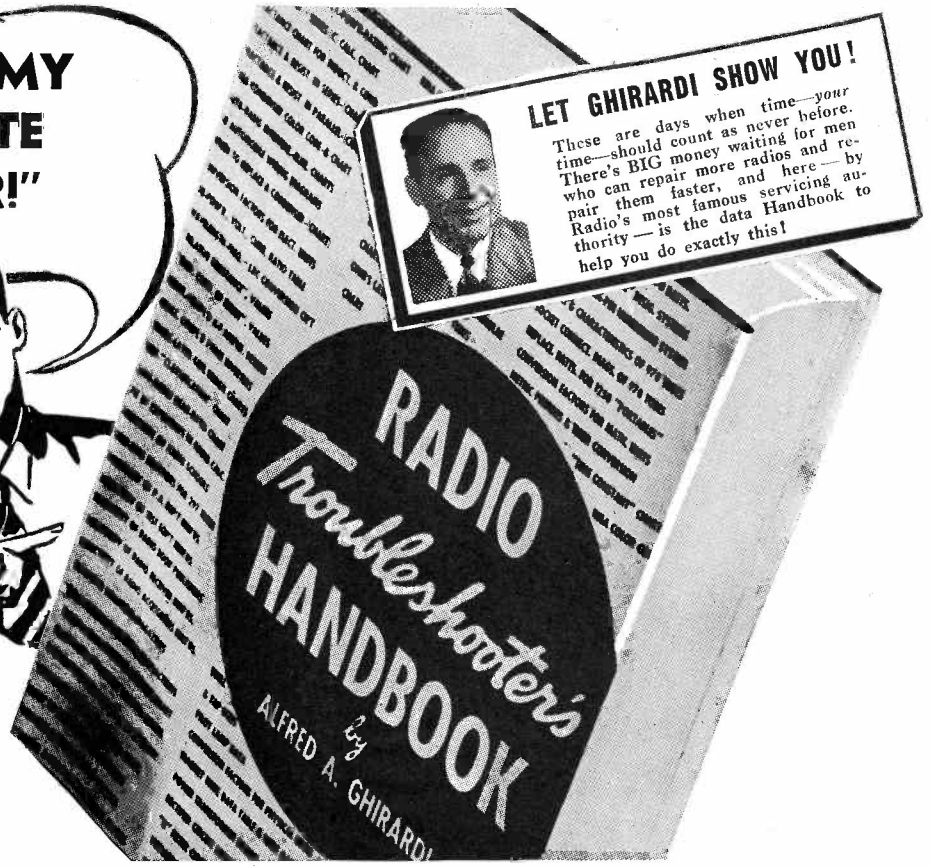
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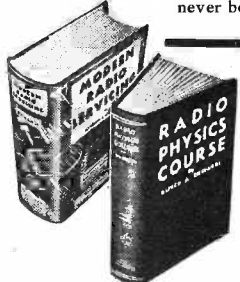
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## BYPASS CONDENSER SUBSTITUTION

By M. E. HELLER

A BYPASS condenser is used to provide an easy (low impedance) path for an alternating current around some circuit or circuit element. Or, if you prefer, it may be used to divert an alternating current from an undesired path to a desired one. 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 but it looks the same as and actually is, a bypass condenser.

In order to use these condensers intelligently, we must be able to calculate the impedance of a condenser. For approximate calculation, we may neglect its resistance and consider its impedance as pure reactance. With few exceptions, the results will be of ample accuracy for all problems met by the Service Man. The reactance,  $X_c$ , of a condenser is, of course,

$$X_c = \frac{1}{2\pi fC}$$

where  $C$  is in farads and  $f$  in cycles.

This formula indicates that the reactance will be lowered as the frequency or the capacity is increased, which is obvious enough. Although the mathematics involved should be simple for any radio bug, some fellows prefer to memorize the reactance values for one or two cases and calculate all problems from these. In many cases

this merely involves juggling a decimal point. Let's take a few examples.

We believe the most useful value to remember is the reactance of a 1 mfd. condenser at 60 cycles which is roughly 2600 ohms. For practice, suppose you check this by the formula. Or you may have one or more of those very useful reactance charts which appear in the appendix section of many books on radio or electronics and even in some catalogs. But if you depend entirely on the chart, you will be lost without it. To get back to the case, 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 mfd. 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 ohm at 600 kc, etc. You see how useful this single value can be. But, 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 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?

Using this new relation, calculate the reactance of a .0001 mfd. condenser. First, the .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. Now that this subject is understood, we will consider the various factors that we should keep in mind when replacing a condenser of unknown characteristics or when evaluating condensers in a new circuit.

The first step includes the determination of the maximum peak voltage likely to be present. At least 10 per cent extra should be allowed as a safety factor; more than this if the condenser is of doubtful heritage. The second step covers the determination of the frequency range to be bypassed, and the third step covers the determination of the impedance of alternate undesirable paths which the current in question might follow. We may then guess intelligently the correct capacity range to be used. An experienced Service Man should know these values at a glance.

In the fourth step we must determine the type of condenser to use . . . air, mica, paper, electrolytic, etc., as well as the shape, type of leads, housing. These factors will be determined largely by experience but the engineer carefully considers the reactance (inductive) of the leads, maximum possible ambient temperature as well as the temperature of every circuit element in the vicinity, and the possibilities of picking up excessive humidity. In the fifth step which is very closely tied in with the fourth, the amount of losses (or the

Fig. 1. Series condenser used mostly in a-c/d-c receivers.

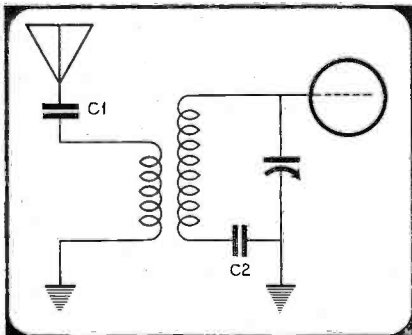


Fig. 3. At A, cathode and avc bypass condensers. At B, critical condenser for bypass and coupling.

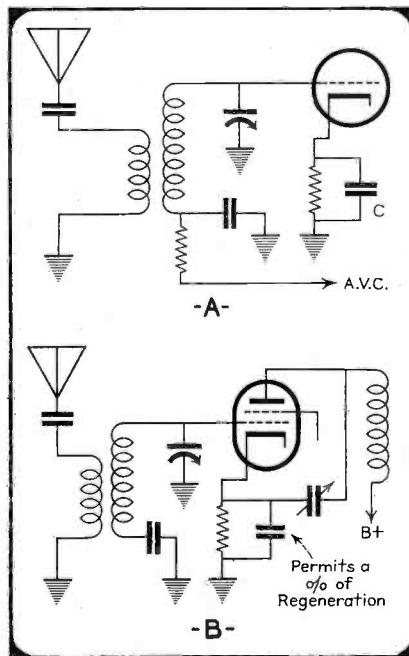


Fig. 2. External method for loop coupling.

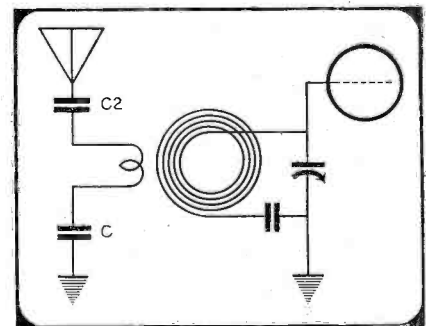


FIG.	ITEM	USE	TO BYPASS	USUAL SIZE	TOLERANCE	VOLTAGE	TYPE	INDUCTIVE OR NONIND.	REMARKS
1	C <sub>1</sub>	ANT.	R-F	.0001-.02 MFD	NOT CRITICAL	400	PAPER OR MICA	EITHER	THE LARGER THE ANTENNA, THE SMALLER SHOULD BE THE CONDENSER.
1	C <sub>2</sub>	AVC	R-F	.02 - .05 MFD	NOT CRITICAL	200	PAPER	EITHER	THE LARGER THE AVC RESISTOR, THE SMALLER SHOULD BE THE CONDENSER.
2	C AND C <sub>2</sub>	ANT.	R-F	.01 - .05 MFD	NOT CRITICAL	400	PAPER	EITHER	HUM MODULATION WITH EXTERNAL ANTENNA IF C IS TOO SMALL.
3	C	CATHODE	R-F	.01 - .25 MFD	NOT CRITICAL	200	PAPER	EITHER	
3A	C	CATHODE	RF AND IF	.006 - .02 MFD	COMMERCIAL	200	PAPER	EITHER	SIZE CRITICAL FOR OPTIMUM VALUE OF REGENERATION.
4	C	CATHODE	IF	.01 - .25 MFD	NOT CRITICAL	200	PAPER	EITHER	
4	C <sub>1</sub>	AVC	IF AND AF	.02 - .05 MFD	NOT CRITICAL	200	PAPER	EITHER	THE LARGER THE AVC RESISTOR, THE SMALLER SHOULD BE THE CONDENSER.
4	C <sub>2</sub>	SCREEN	IF	.05 - .25 MFD	NOT CRITICAL	200 AND 400	PAPER	EITHER	USE 200 VOLT CONDENSER ON CATHODE TYPE RECTIFIER; 400 VOLT ON FILAMENT TYPE.
4A	C	CATHODE	IF OR IF AND RF	.1 - .5 MFD	COMMERCIAL	200	PAPER	NON-IND.	KEEP TO MANUFACTURER'S SPECIFICATION WHEN POSSIBLE.
5	C <sub>1</sub>	2ND DET.	IF	150 - 500 MMFD	NOT CRITICAL	STANDARD	MICA	—	CERAMIC TYPES ALSO USED.
5	C <sub>2</sub>	COUPLING	AF	.001 - .01 MFD	NOT CRITICAL	200	PAPER	EITHER	
5	C <sub>3</sub>	CATHODE	AF	5 - 25 MFD	NOT CRITICAL	25	ELECTROLYTIC	—	HIGH CAPACITY HERE ELIMINATES HEATER-TO-CATHODE HUM - REPLACE LOW CAPACITY PAPER.
5	C <sub>4</sub>	PLATE	AF AND IF	50 - 500 MMFD	NOT CRITICAL	STANDARD	MICA	—	
6	C <sub>1</sub>	COUPLING	AF	.002 - .02 MFD	NOT CRITICAL	400	PAPER	EITHER	USE NOTHING BUT BEST GRADE CONDENSER IN THIS APPLICATION.
6	C <sub>2</sub>	CATHODE	AF	5 - 25 MFD	NOT CRITICAL	25	ELECTROLYTIC	—	
6	C <sub>3</sub>	PLATE	AF AND PARASITICS	.002 - .04 MFD	SEE NOTE	400	PAPER	EITHER	FOLLOW MANUFACTURER'S SPECIFICATION OR A CHANGE IN TONE MAY RESULT.
7	C <sub>1</sub>	GRID	RF	50 - 250 MMFD	NOT CRITICAL	STANDARD	MICA	—	MAY BE CRITICAL ON SHORT WAVE - DEPENDS UPON FEEDBACK VALUE.
7	C <sub>2</sub>	PADDER	TANK	700 - 1500 MMFD	DEPENDS ON IF	—	MICA OR CERAMIC	—	FOLLOW MANUFACTURER'S SPECIFICATION.
7A	C <sub>4</sub>	PADDER	TANK	700 - 1500 MMFD	DEPENDS ON IF	—	MICA OR CERAMIC	—	FOLLOW MANUFACTURER'S SPECIFICATION.
7B	C <sub>4</sub>	BLOCKING	R-F	.001 - .01 MFD	NOT CRITICAL	400	PAPER	NON-IND.	DEPENDS SOMEWHAT ON FEEDBACK COUPLING.

power factor) which can be tolerated must be determined. This is of particular importance in short wave work where, for instance, a tubular paper condenser may not properly be used to replace a mica condenser because of the losses involved. In a resonant circuit, the loss in a paper condenser may cause a great decrease in gain and selectivity. In some "beautifully" designed receivers, the space allotted to some bypass condensers is so little that the Service Man couldn't use a better grade replacement if he wanted to. Here, safety factor must be sacrificed because of space. A little horse sense should take care of most replacement problems.

There is one factor of the moment, however, where physics or engineering is not involved and this is urgent. Mica condensers are becoming very scarce because of war requirements. Some of the best mica comes from India and Madagascar. Hence, it is up to the Service Man to show his patriotism and use as few mica condensers as possible.

In dealing with r-f circuits, there are still other factors that are met. For one thing, the length and cross-section of the leads are important. The higher the frequency, the higher the voltage drop in a given length of lead. At ultra-high frequencies, the common type of condenser is rendered useless because of the reactance of the leads.

The method of wiring is also very important. Suppose, for instance, we have two bypass condensers and there is a single wire which connects one to the other and then runs to ground. This ground lead is common to both circuits and, when current flows in either one, there will be a voltage drop across this wire. This causes an inductive coupling between the circuits, permitting feedback, perhaps oscillation, to occur. The ounce of prevention, of course, is to run separate ground leads from each bypass condenser.

In choosing a paper condenser for bypassing, the method of winding the foil should be known. Condensers of

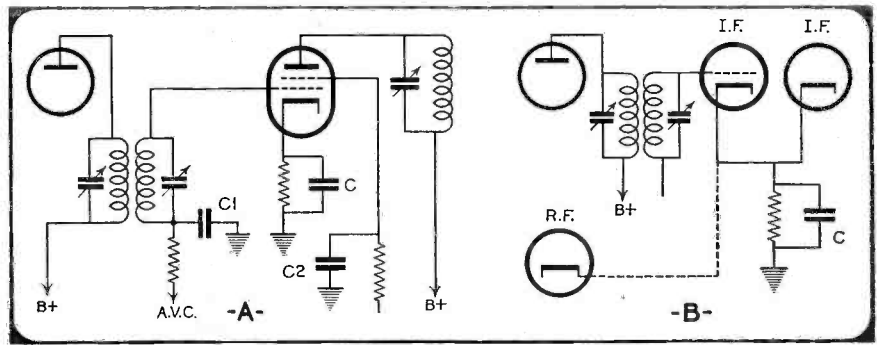


Fig. 4. At A, i-f stage with bypass condenser. At B, common cathode bypass condenser.

this type dielectric are wound in two ways, inductive or non-inductive. Generally speaking, the inductive-wound condensers should be used only for low frequency purposes while the non-inductive type may be used for all purposes where a paper condenser is permissible. However, due to the pinch of the times, inductive wound paper condensers may usually be used where non-inductive ones cannot be had. Sometimes, particularly at short waves, this substitution will cause trouble. Probably the best philosophy today is . . . "if it works and if it will stand up, it's OK."

We have prepared a table of 20 typical uses of bypass and blocking condensers which will cover almost all replacement problems. The data given refers to average usage; an occasional exception may be found. The inductive . . . non-inductive column is optimistic! As mentioned before, inductive wind-

ings for r-f uses are acceptable only when non-inductive units are not obtainable and, even then, only when the circuit performs properly.

All the losses in a condenser may be grouped together and represented by a hypothetical series or shunt resistor for calculating purposes. The value of this imaginary resistor changes with frequency according to the following formulae:

$$\text{Series Resistance} = \frac{\text{power factor}}{\text{power factor} \times \bar{X}_c} = \frac{2\pi f C}{1}$$

$$\text{Shunt Resistance} = \frac{1}{2\pi f C \text{ power factor} \bar{X}_c} = \frac{1}{\text{power factor}}$$

where  $\bar{X}_c$  is the reactance of the condenser.

It is interesting that practically all electrical losses are due to a molecular friction in the dielectric which is analogous to magnetic hysteresis in an iron core. Losses are usually given in terms of power factor. The following table gives the most common types of dielectrics:

Dielectric	Power Factor
Air	0
Mica	below .001
Paper	.01-.04
Dry Electrolytic	.05-.2

Fig. 6. Conventional output circuit. C2 in many receivers is omitted to produce a % of regeneration.

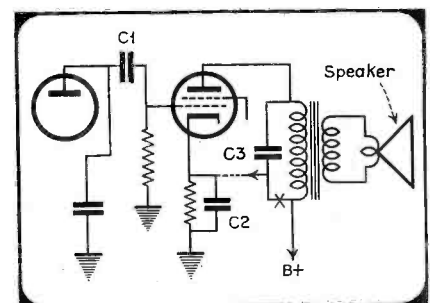


Fig. 5. Bypassing at the 2d detector and 1st a-f.

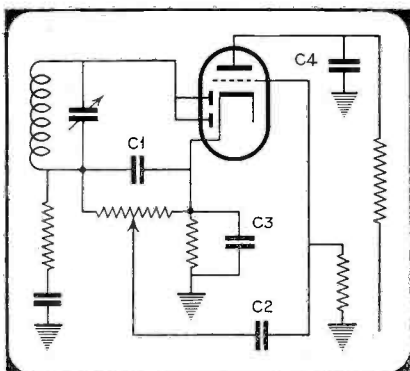
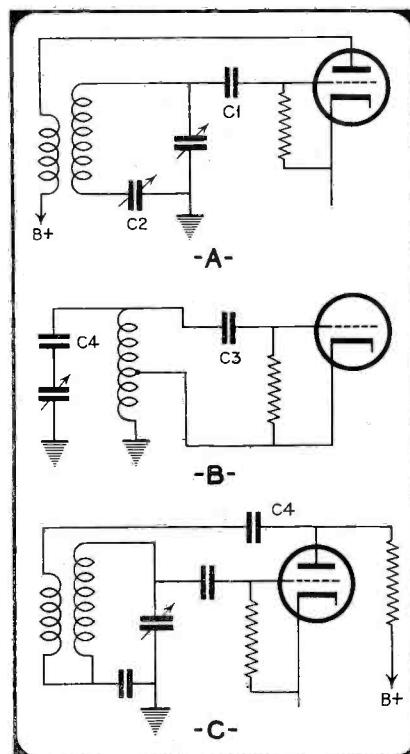


Fig. 7. Various types of coupling with associated bypass circuits.





# THE FUTURE OF SERVICING

**O**BVIOUSLY, our Administration and the various divisions of the Government consider home radio receiving sets an essential part of our war program. Efforts have been constantly made to clarify the problems relative to the procurement of materials for the further maintenance of those radio sets.

The present program of filling in the PDIX form on the part of the jobber will serve to acquaint the War Production Board with the exact status of the inventories of replacement parts, and will provide the vehicle upon which the radio section of the War Production Board may present to the various material sections any requests for allocations of materials to produce the much talked about "Victory Lines" of replacement parts or components.

Suppose that, as of today or tomorrow, this allocation program was approved by the various departments within WPB. What next? When I ask what next, I am pondering over the problem of man power to properly utilize these replacement parts and get them into the inoperative home receiving sets to provide the proper types of reception the Administration is anxious to see the radio industry provide "John Q Public" from broadcasting station down to Service Man.

Very bluntly, the continued requests of the Army Air Force for radio men, the Signal Corps campaigns to enlist radio Service Men, the Navy's enlistments of qualified radio men, as well as the draft, have fallen short of their quotas and as well have left our radio Service Man's market pretty well depleted of qualified men, competently equipped to properly service a receiver in the home of Mr. Public user. If these parts were available, where would the Service Man come from that could properly use them? This presents the problem of correlating all the facts, material, and man power into one unified program so that the proper servicing may be accomplished. There are several ways in which this could be done. One would be to have the public service or utility companies handle the servicing of home receivers. My thought, however, is that for the duration of the war a mobilization of Service Men, dealers, and radio parts jobbers, might answer our problem and keep the servicing of radio receiving sets in the field where it belongs.

**By JEROME J. KAHN**

President, Standard Transformer Corporation



The writer is of the opinion that time saving primarily is the essence of defeating this difficulty we are now facing in the servicing problem. Experience teaches that the average radio set can be actually repaired in a matter of a few moments. If this be the accepted fact, the greater portion of time against which charges are made is the time spent in analyzing the trouble and energy spent in making the call, and, if necessary, the toting back and forth of that particular receiver to the Service Man's shop to permit the efficient installation of whatever part or parts may be required.

Our first problem, then, is to save that time devoted in making the service calls, picking up and delivering the defective units. My plan would call for the set user to bring his radio set into the dealer's or Service Man's place of business and, after it has been repaired, to pick it up. This might even mean that "Mr. John Q Public" might have to take his chassis out of a console cabinet, unless it were in large combination installations, but, during war times, I don't think that they could object to this.

Today, if a person wants a receiver to play he must be made to realize that some discomfort and some effort and energy must be experienced on his part to provide sufficient time saving on the part of the Service Man to permit him to devote his valuable time to the technical aspects of servicing the receiver itself and not merely to that of being a delivery boy.


The second problem would be the

establishing of these collection agencies wherein the public might bring their receiving sets for service. We know the average Service Man who has a shop is so busy these days that it may take some time to get around to actually perform some operations on the receiver. These Service Men or individual shops should effect a mobilization and concentration of the remaining technical skill into an organization such as the local parts jobber wherein all service work could be done by these consolidated Service Men. The service dealer's store would then act as the media through which the receiver is delivered by the public and then turned over in quantities to this master servicing organization operating over the local parts jobber's guidance. By having the actual servicing done within the parts jobber's establishment, it would salvage the time generally required by the average Service Man to run down and pick up one specific type of tube or one or two other miscellaneous parts that would go into the service work for that particular day. Bear in mind that, in order to expedite man power, time is the one element that can be saved.

When these sets are delivered to the master service organization or the parts jobber as we have established him, it would then be turned over to a master diagnostician who by experience could in most instances tell within a few minutes just what is the difficulty, and in many instances could repair it in making the diagnosis. If difficulty in diagnosis is met, the set could then be turned over to one man that would be termed in the vernacular as a "piddler"; the kind of an individual who has enough patience and knowledge to sit down and trace out the circuit and find out just what is wrong. Thus, service work would be expedited to a large degree. Upon completion of the job, the radio service dealer would then pick up the sets to be taken back to his store or the user could pick them up at the master servicing establishment. Thus, much time would be saved and it may tend to keep radio service available to the public.

The above suggested plan would facilitate the reclamation or salvaging of used and defective parts. The Radio Section of WPB has asked that some plan be presented to effect the most general salvaging of such defective units, and it would appear most logical

*(Continued on page 29)*



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SERVICE, NOVEMBER, 1942 • 9

# SER-CUITS:

By HENRY HOWARD

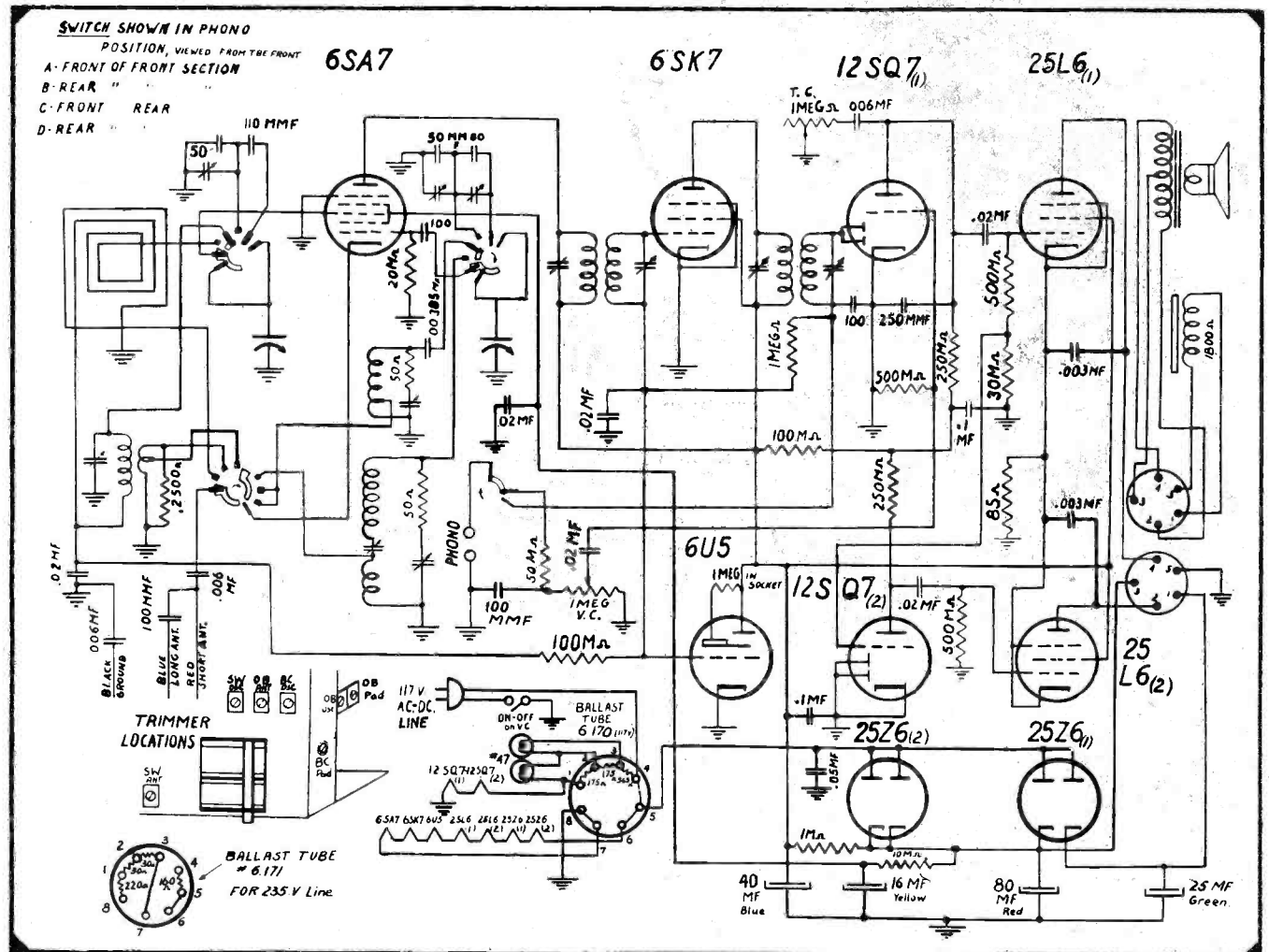
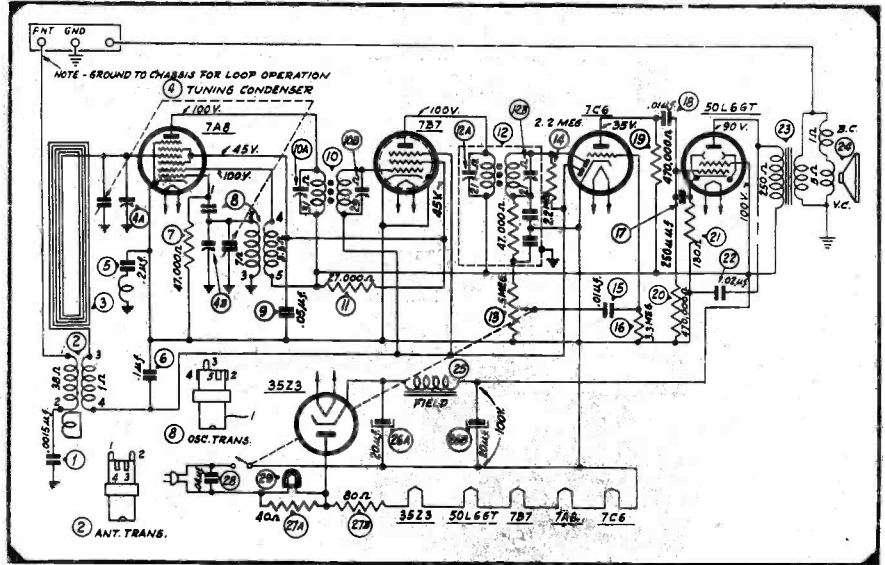
band, close to the i-f. We usually find a shunt resistor across the primary doing this job and, also, very often, some serious resistance. These 5 tube a-c/d-c receivers, as well as most other Philcos, have the high side of the output transformer secondary brought out to the antenna terminal strip for the conveni-

**A**NTENNA circuits, rotatable loops and their allied coupling systems serve as the bases of receiver analysis this month.

In the Philco PT-91 to 95 (Fig. 1), appears an interesting antenna coupling transformer system. The primary is connected to the external aerial and chassis while the secondary feeds the input grid via the loop antenna, also acting as loop loading inductance. You will note the short-circuited tertiary winding which acts as a spoiler, preventing peaking of the antenna circuit when an external aerial is used. It also reduces the possibility of i-f regeneration when the peaking would normally occur at the low frequency end of the

Fig. 3. Parallel capacity loading condensers feature this Garod receiver. (Series 100)

Fig. 1. Philco's PT-91 to 95 series with short-circuited tertiary winding.



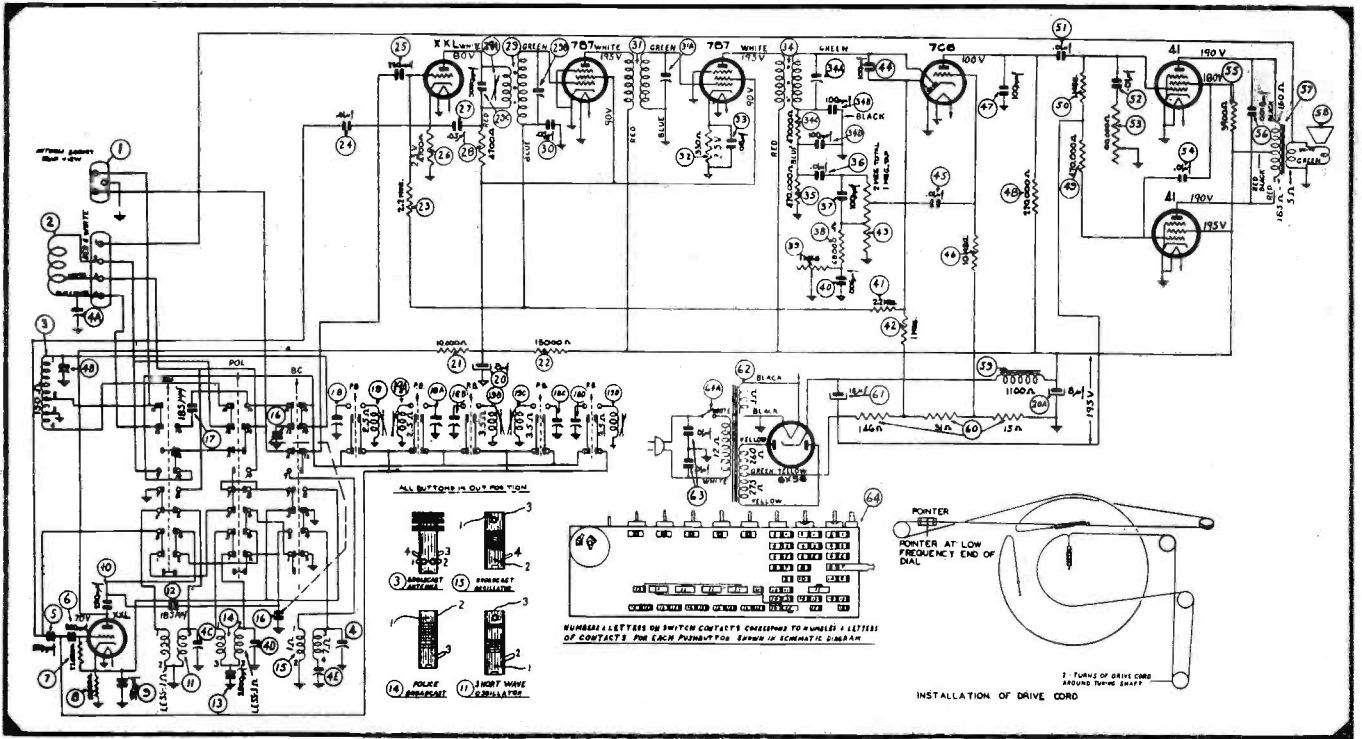


Fig. 2. Philco's 42-380 with the low-impedance rotatable loop.

ence of Service Men. The low side of the winding is connected to chassis.

**Philco 42-380, Code 121**

In the Philco 42-380, code 121, 8-tube, 3-band a-c set (Fig. 2), we find a low impedance rotatable loop, 9 push-buttons for tuning and switching and screen grid inversion with a pair of 41's. Oscillator voltage is fed from the grid of the XXL triode oscillator to the cathode of the XXL converter. The 4700-ohm cathode resistor is, therefore, unbypassed to ground. The output i-f circuit is bypassed direct to cathode by a .05 mfd. condenser. The first i-f transformer has an iron core primary compensator while the other two trans-

formers have no primary tuning at all. The avc bus feeds the converter and first i-f stage.

Note the negative "B" voltage divider providing three different bias voltages, for the power stage, avc sys-

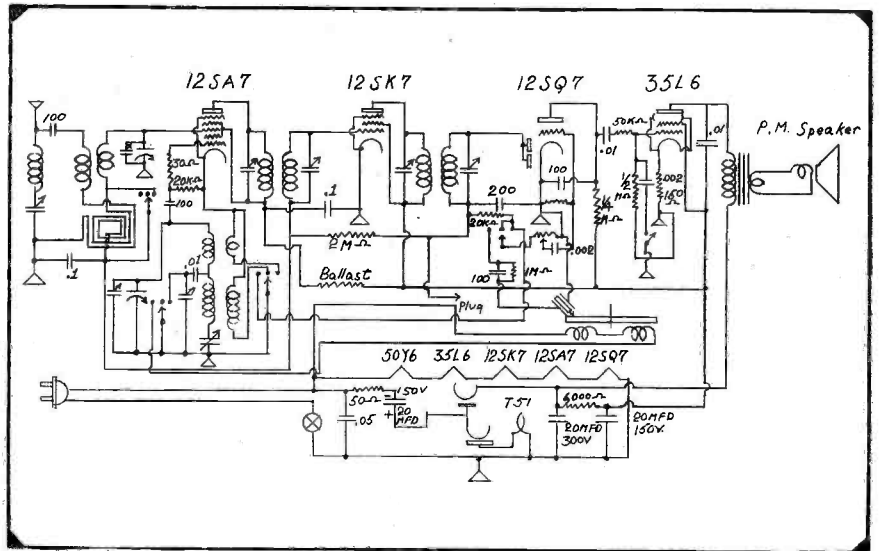
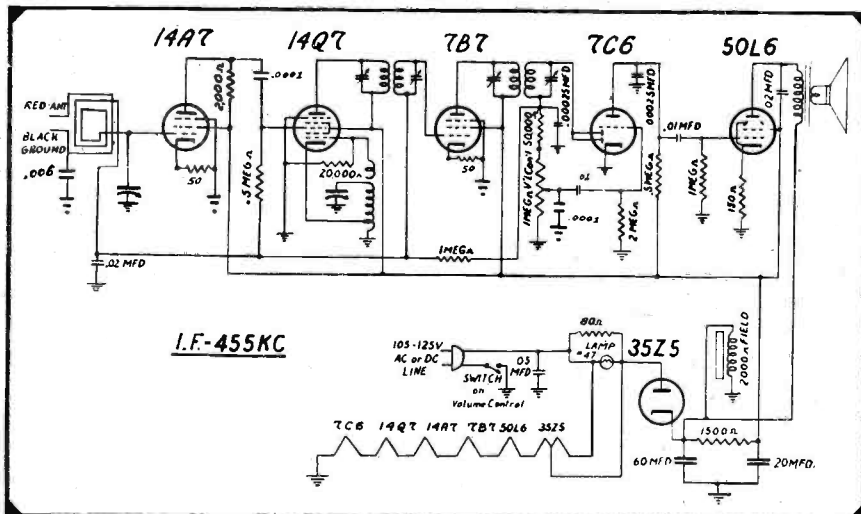


Fig. 6. Garod's series 60 unit with pure resistance r-f stage.

Fig. 4. Two band a-c Automatic Radio model 148 with an i-f wave trap.



tem and first audio stage. Note also the bass compensation and bass tone control built around the 2-megohm volume control with a center tap. The screen grid inverter requires a drop resistor (3900 ohms) in series with one screen and a coupling capacitor from the screen to the opposite control grid. The screen resistor causes a slight amount of unbalance between the two push-pull tubes which is usually unnoticeable.

**Garod Series 100 Chassis**

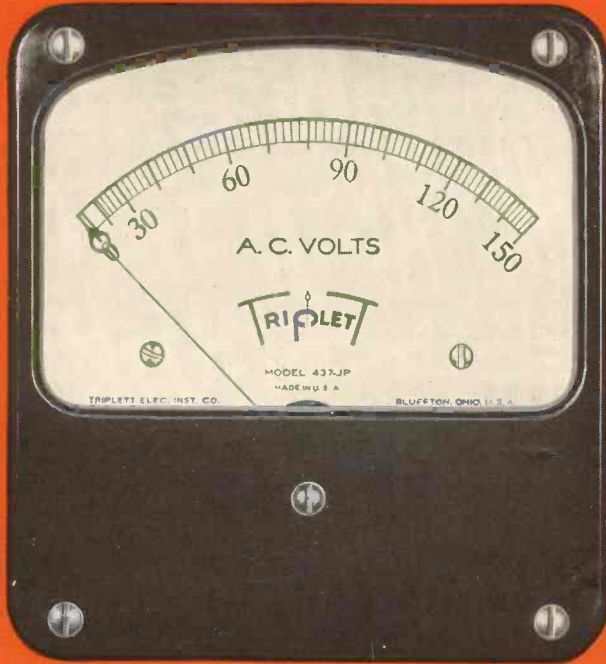
Fig. 3 shows the combination phono and bandswitch and associated circuits of Garod's series 100 chassis. This is a 3-band, 9-tube a-c/d-c receiver covering



# TRIPLETT

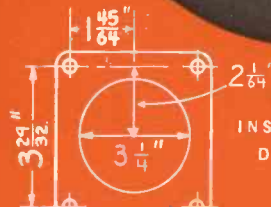
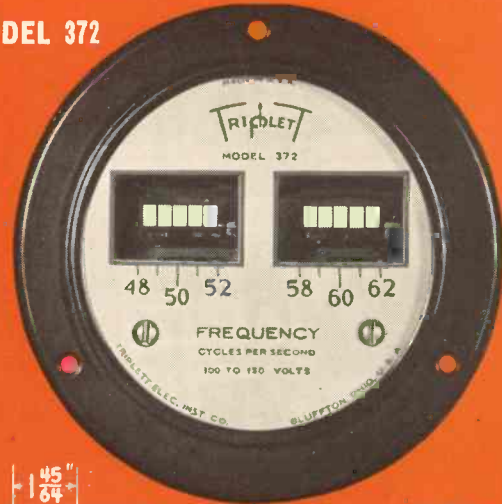
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MODEL 372



Model 437 - J P

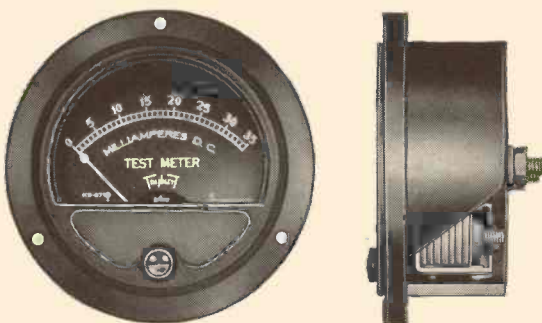


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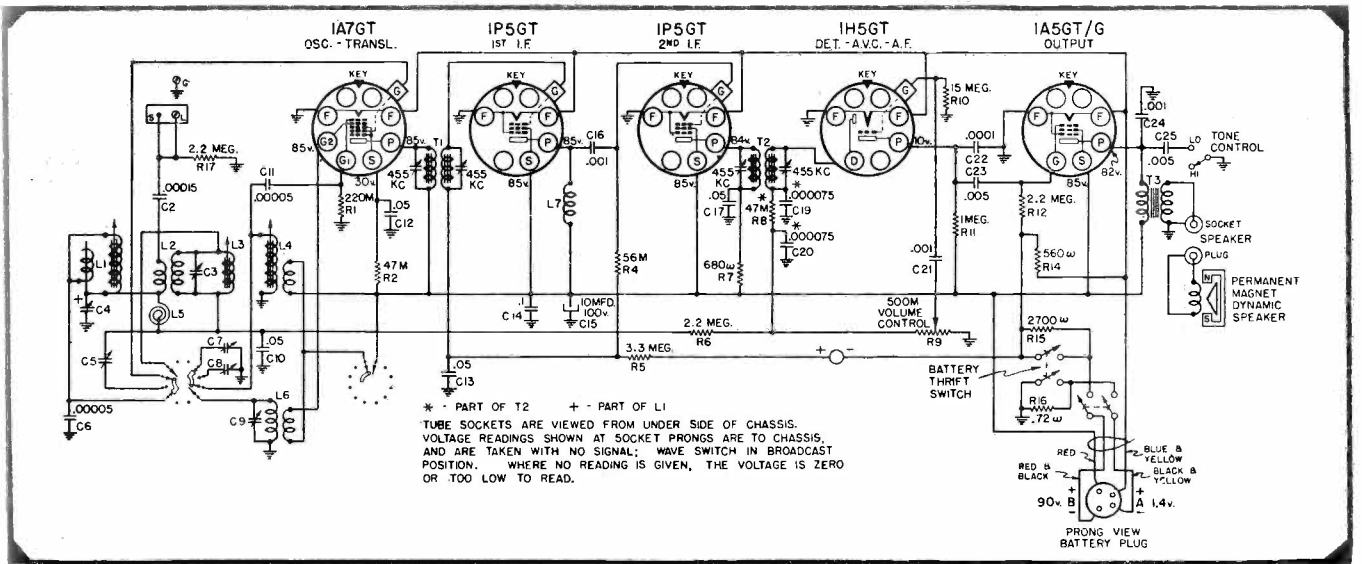


Fig. 8. Dual voltage dropping resistors highlight this Silvertone 7108-7158 receiver.

described. In the shortwave position, the loop is simply shorted.

Now, note the voltage doubler power supply. This doubler system differs from the one usually shown in textbooks and previously shown in this column where two large condensers are connected in series, with the power line going to the junction. Here, one condenser is placed between the power line and the junction of the two series connected rectifiers while the other condenser is directly across the doubler output. In addition, this receiver uses a resistance filter and PM speaker, whereas we have always noted a choke or speaker field used as

a choke for the filter in voltage doubler circuits. For phono operation, the cathode of the 12SA7 converter is opened and the detector output grounded.

The second Automatic receiver 175 (Fig. 5), has a similar voltage doubler, but here the speaker field is used as a choke. The oscillator circuit is unusual, in that it has a split-coil arrangement

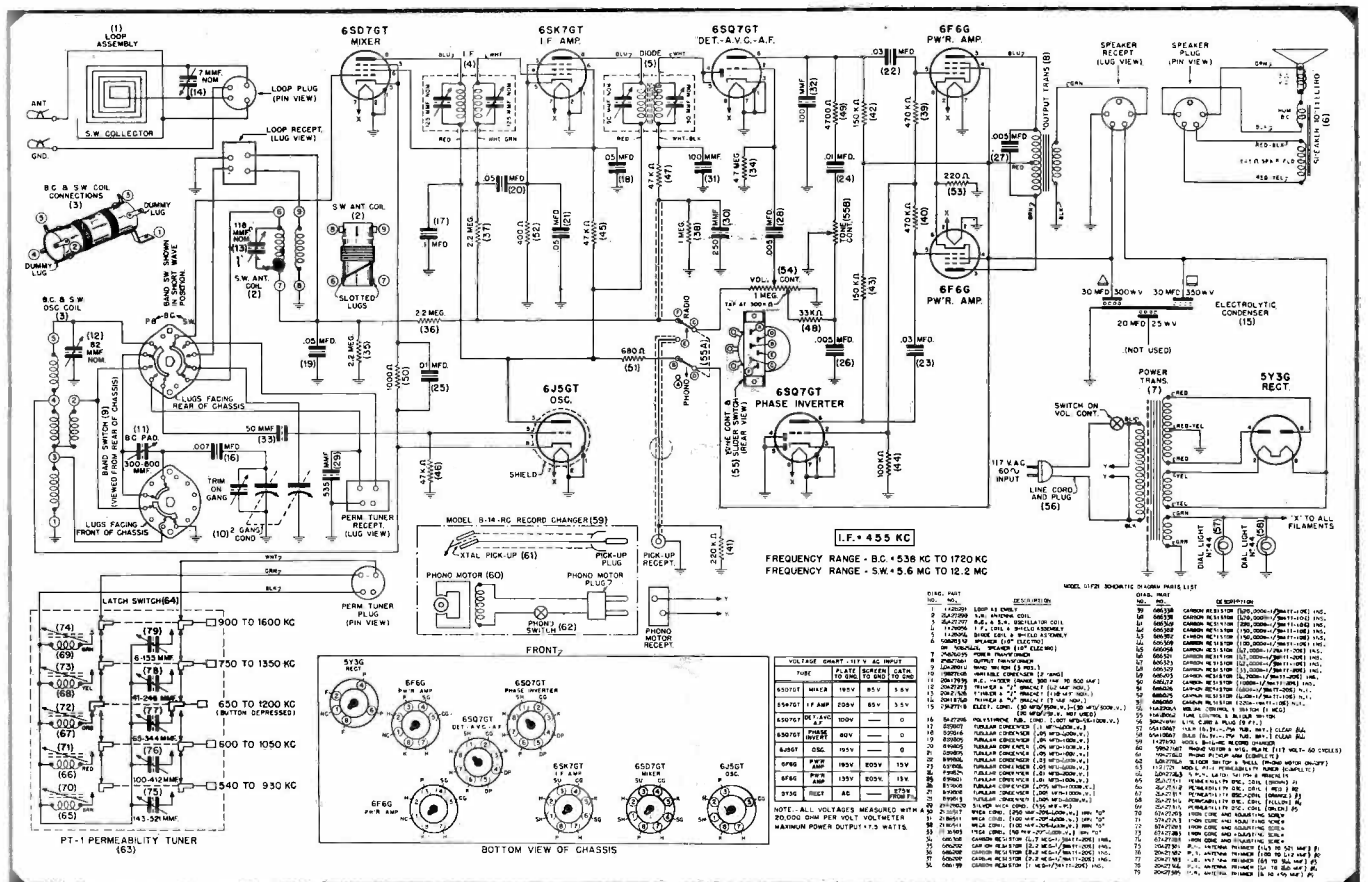
with the padder in the middle. The cathode tickler inductance extends from ground to the cathode tap while the grid inductance is split, part being in the tapped coil from the tap to the padder and the remainder in the top coil. Note that the 20,000-ohm grid leak runs to cathode instead of ground.

### Garod Series 60 Receivers

The Garod series 60 receivers (Fig. 6) employ a pure resistance coupled r-f stage without reactance of any kind. Although avc bias is fed to the r-f, converter and i-f stages, additional 50-ohm

(Continued on page 24)

Fig. 11. Motorola 81 F 21 with plug-in permeability tuner.



# INSTANTANEOUS SOUND-RECORDER

## WARTIME SERVICE

By **ALFRED A. GHIRARDI**

Advisory Editor

### PART 2

**W**HEN it is realized that the process of cutting the continuous spiral groove in a record blank is comparable in precision requirements to the watchmaker's task of cutting screw threads as fine as 100 to the inch on a precision machine lathe, one cannot help but realize how important it is that the cutting stylus be of the proper material, shape, and sharpness, and free from nicks and imperfections. On a 10-inch disc recorded at the usual pitch of 96 grooves per inch a continuous spiral groove having approximately 336 concentric turns is cut into the recorded portion of the disc. This means that the recording stylus actually cuts out a groove about 528 feet long, the length of two full city blocks, from the material of each 10-inch disc it records!

The shape of the cutting edge should be such that it will produce a groove of the standard dimensions shown at (a) of Fig. 1 (page 17), for it is upon these dimensions that all record playing needle design is based. In cutting the groove at the usual pitch of 96 grooves per inch, this leaves a "land" space of about 0.004" between adjacent grooves. Consequently the proportion of "land" to groove area will be in the ratio of about 40:60 as illustrated at (b). The depth of the groove may be checked visually by observing the relative area of "land" and groove under a magnifying glass. If the cut is too shallow, poor tracking will result, the pickup tending to slide across the record. If the cut is too deep there is danger of overcutting and breaking through the walls of an adjacent groove on the loud passages, pushing the thin walls of the groove so as to alter the shape of the adjacent groove so that "double talk" or "ghosting" results when the record is played back.

The recording stylus may be made of one of several materials. Hardened carbon steel ground to a V shape makes the least expensive cutter, but the useful life of the cutting edge is only 30

to 60 minutes of cutting. Stellite (a cobalt-chromium alloy used in machine tool manufacture) is widely used for recording styli. A stellite cutting needle can be used from 2 to 10 hours. "Permo Metal" tipped styli (containing the rare metals ruthenium, osmium, iridium and rhodium) will give from 3 to 5 hours of service. A stylus of this type is illustrated in magnified form at (c) of Fig. 1. Note the flattened shank which assures proper insertion of the stylus in the recording head chuck so the cutting face is always turned in the right direction. The better recording heads are equipped with styli containing a polished sapphire or diamond insert to do the cutting. The cutting life of a sapphire styli varies from about 15 to 25 hours. Factory resharpening service is offered for most alloy sapphire and diamond type styli.

#### Turntable and Motor

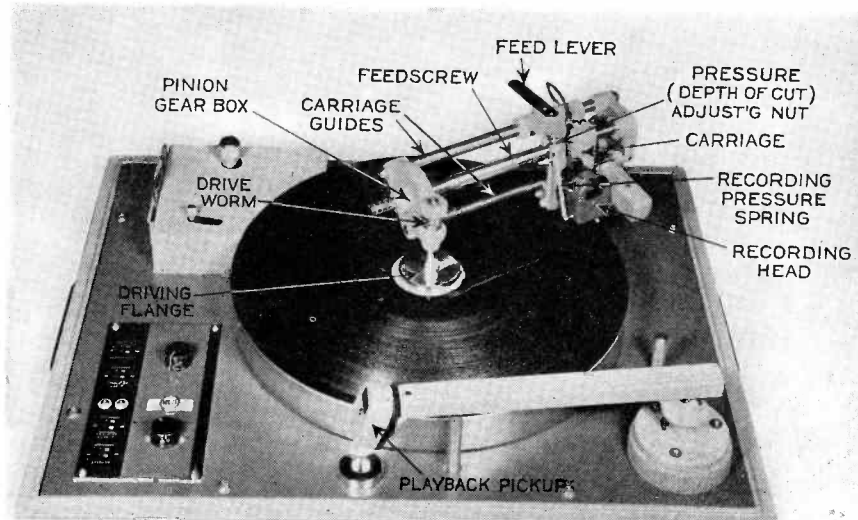
The turntable and motor employed in a recorder must possess some important characteristics that are not necessary in ordinary phono motors. The recorder motor must develop sufficient power to maintain a constant turntable

speed under the widely different loads imposed during the "plowing" of the recording stylus though the record coating, during the cutting of the record and the comparatively frictionless riding of the playback needle in the record groove during playback of the record later. If the motor slows down when the recording stylus bites into the blank, it will speed up under the lighter drag of the playback pickup, and all the reproduced frequencies will be higher than those of the original. The turntable should also be free from slight variations in speed during recording due to variations in stylus loading caused by the moment-to-moment variations in the frequency and amplitude of the sound being recorded. Such speed variations will cause frequency distortion. This accounts for the larger motors used in recorders. So-called "constant speed" induction type motors are usually used, but synchronous motors are also employed in some recorders.

The shaft speed of an average motor suitable for recording purposes is many times that of the turntable (e.g., the motor speed may be 1,800 rpm and the required turntable speed may be 78 or 33 1/3 rpm). This makes direct motor drive impossible, and necessitates the use of some kind of speed reducing arrangement between the motor shaft and

Fig. 3. A semi-professional recorder which employs the straight-across type of cutting feed.

(Courtesy RCA Mfg. Co., Inc.)





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the turntable. Worm gear and pinion drives between the motor shaft and turntable, or a friction drive to the inside or outside rim of the turntable by means of rubber-rimmed drive and idler wheels (see Fig. 2), are commonly employed in commercial machines. In many recorders, dual turntable speed (i.e., 78 rpm or  $33\frac{1}{3}$  rpm) is obtained by either manually exchanging rubber-rimmed driving or idler wheels of different sizes, or by means of a simple shifting lever which puts a smaller or a larger wheel into engagement.

The turntable itself should be carefully cut to run true and level, should be dynamically balanced and have a sufficiently high moment of inertia to eliminate irregularities ("flutter") in the rotating speed under all recording and playback conditions.

#### The Cutter Feed Mechanism

In order that the recording head may cut a continuous *spiral* groove in the record it must be slowly fed radially across the record at the proper uniform speed while the record is being cut so that the groove will be cut at a gradually *diminishing* or gradually *increasing* radius (depending upon whether the record is being cut from the outside toward the center, "outside-in," or from the center toward the outside, "inside-out"). This is the function of the cutter feed mechanism. The feed must move the recording head in the exact proper ratio to the speed at which the turntable is revolving. For example, to cut 96 grooves per inch at a disc speed of 78 rpm the head must be fed radially  $78 \div 96 = 0.812$  inches per minute. This will produce a groove pitch of  $1 \div 96 = 0.0104$  inches (for each revolution of the disc).

In most home recorders the cutter feed mechanism is located out of sight under the motorboard. In most semi-professional recorders the mechanism is more precise, sturdy (and expensive) and is usually located above the turntable.

Three different types of mechanism arrangements are in use. The arrangements widely used in home recorders appear in Fig. 2 (page 18). At (a) rotation of the motor shaft wheel (B) drives the turntable rim through the rubber rimmed idler wheel A. The rotating turntable spindle in turn is step-down geared to the feed drive shaft and rotates it slowly. The feed drive shaft is provided with a fine threaded portion at its outer end. This is called the "worm" or "feed screw." The "knife" edge of the guide arm fits into a single groove of the worm, and this worm feeds the knife and its supporting arm inward toward the center of the record. Since the guide arm is rigidly fastened



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to the recording arm and head by a vertical shaft, it feeds the recording head and stylus slowly toward the center of the disc during the cutting of the groove.

In the arrangement shown at illustration (b) parts A, B and C are similar to those in illustration (a) but the feed drive shaft drives the recording arm and head directly by means of the worm and pinion gear arrangement shown.

In both of the foregoing arrangements, raising the recording arm above a 45 degree angle lifts the drive mechanism sufficiently to clear the grooves of the feed worm for return of the head arm to its rest position, or to stop the lateral feed movement for an interrupted recording. In some models a lever or other device must be operated in order to accomplish this disengagement of the feed.

The other important cutting feed arrangement is the straight-across carriage type of feed in which the recording head is attached to a carriage which is driven radially across the recording disc in a straight line by means of a rotating feed screw which engages a half-round threaded nut on the carriage when the carriage is lowered on to it for the recording position. This arrangement is illustrated in the recorder

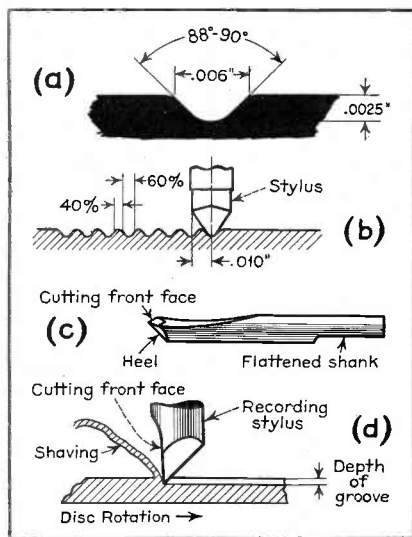


Fig. 1. Characteristic grooves and styli. At (a) a groove of standard dimensions is shown, while at (b) the proportion of "land" to groove area is shown.

shown in Fig. 3 (page 15), and the parts are labelled for identification.

The machined threads of the feed screw are accurately spaced so as to provide accurate, even radial feeding of the cutter head. The cutting pitch (number of grooves per inch) is determined by the number of threads per inch on the feed screw and by the speed at which it revolves. The manufacturer supplies feed screws containing different required numbers of threads per inch for recording at various pitches. Such precision feed screw arrangements are quite expensive, and the cost of recorders employing them is much higher than that of the "home" type of recorders which employ the more simple less precise arrangements of Fig. 2.

#### Feed Screw Operation

The feed screw is driven either through a spindle and driving flange (which is lowered directly on the turntable after the disc is in place) driving a worm and pinion gear arrangement (the arrangement used in Fig. 3), or through an external gear-train or belt-and-pulley drive direct from the motor or turntable spindle. The feed screw and drive may be mounted either above or below the turntable, depending on the drive arrangement employed.

The straight-across type of cutter feed has the important advantage of maintaining the same correct cutting angle of the stylus face as it progresses across the disc. In the cutter feed that results from the pivoted swinging recording arm arrangements of Fig. 2, the cutting stylus travels in an arc across the disc as illustrated at Fig. 2 (c), instead of in a straight line. Con-

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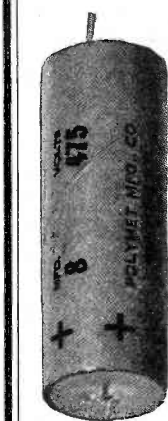
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sequently there is a change in cutting angle of the stylus face as it progresses across the disc, so that only at one point does it cut a theoretically perfect groove. At all other points the tangential error results in unsymmetrical groove shape.

### The Playback

All commercial instantaneous recording machines are provided with playback facilities comprising a phonograph pickup and its playback needle. Both the crystal and the magnetic types of pickups with which all Service Men are familiar are widely employed in this work, but the crystal type is most popular in home recorders because it is simpler and cheaper to manufacture. Philco employs the photo-electric type of pickup.

The same types of steel, alloy, sapphire and diamond point playing needles that are used in ordinary phonograph reproduction are also used for playing instantaneous recordings.

### Importance of Monitoring Input Level

To insure satisfactory recordings it is essential that some visual means be provided for measuring and indicating the volume level fed to the cutter and being placed on the record during the entire recording period, so that the volume level may be kept within the desirable upper and lower limits at all times.

If the recording is done at too low a volume level, the natural surface noises of the record will be comparable in strength with the loudness of the re-

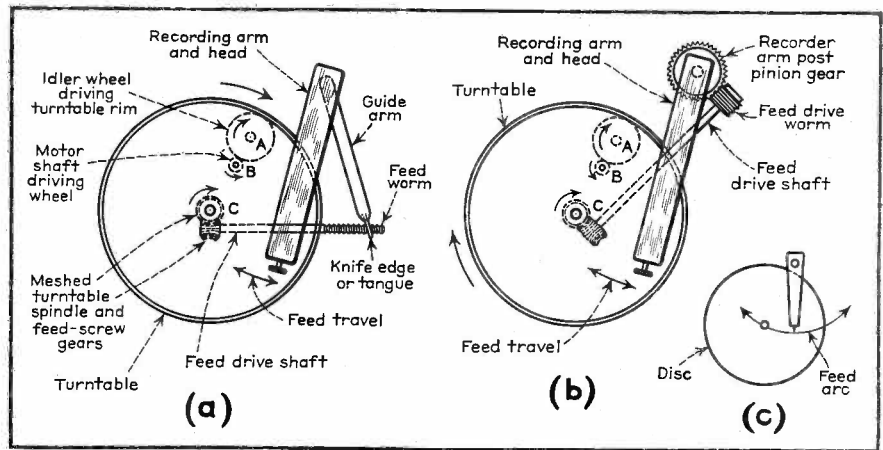


Fig. 3. Three different types of cutter feed mechanism arrangements widely employed in home recorders. They are located under the motorboard, while in most semi-professional recorders, the mechanism which is more precise is located above the board.

corded program and they will not be "covered up" during playback of the record. A "noisy" record results. In addition it may not be possible to raise the volume sufficiently on playback to give adequately loud response. On the other hand, the maximum amount of volume level (modulation) that can be applied to a record is very definitely limited to a point where the edges of the undulations in one groove almost meet the

Fig. 4. (A) Magnified view of several unmodulated grooves cut to proper depth. (B) Proper modulation level to prevent "echo" or "overcutting." (C) Results of recording at too high a level. (D) Broken wall results of exceedingly high level recording.

edges of those in an adjacent groove, as illustrated at (c) of Fig. 4. As this level is closely approached, the modulations of one groove effect those in the adjacent groove through bending or "flowing" of the extremely thin body of recording material between them (as shown), producing a double-talk effect called "groove echo" or "ghosting." If this level is exceeded, "over-cutting" or "break-through" from one groove into the next may result as illustrated at (d). When this occurs, distortion results, and after a few playings the playback needle will jump completely through the groove wall at the break-through point, and into the next groove. It is essential to keep the cutting "level" well below this point to avoid these dangers during un-anticipated bursts of high volume. In some recording equipment amplifier overloading at the high volume levels is another factor that must be guarded against.

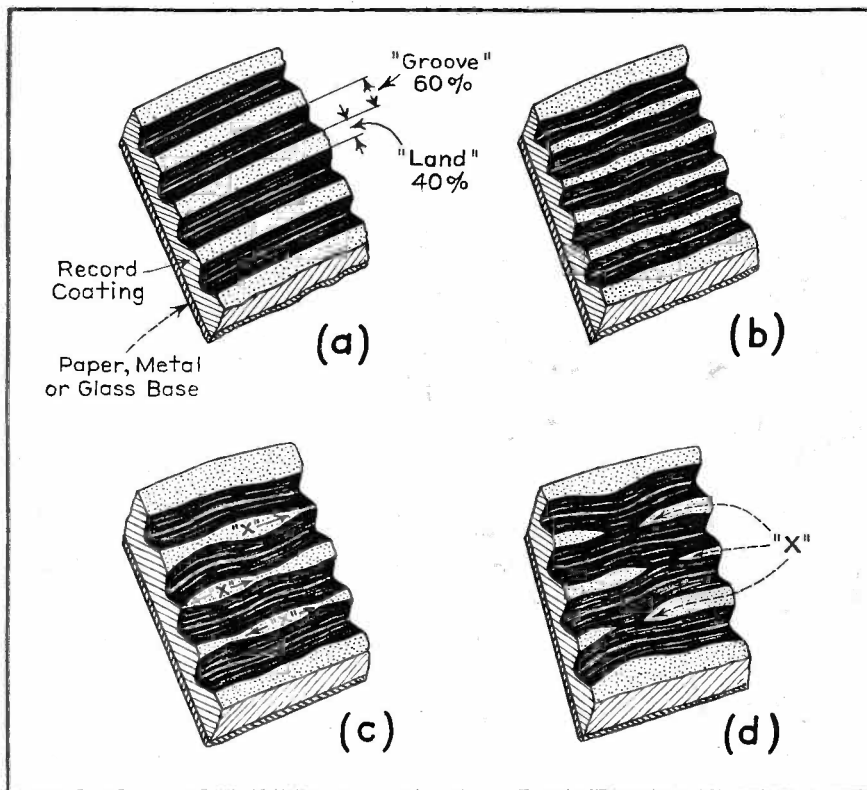
No one definite value of the maximum allowable level can be recommended, since it depends upon so many variable factors, such as the type and make of recording disc used, the depth of cut and groove-pitch being used (these determine the amount of "land" left between adjacent grooves), condition of the cutting stylus, etc. Cutting and playing back a few test grooves before making an actual recording is one simple way of determining the maximum and minimum allowable volume levels for any particular recording setup.

Properly monitoring the input to the cutting head does not mean that an absolutely even "level" is to be maintained throughout the recording. That would produce very unpleasing, "flat" reproduction. The volume level should be continuously controlled so that the modulations recorded will be *above* surface noise level on "low" passages and *below* the distortion or destructive over-cutting level on "loud" passages.

### Recording "Level" Indicators

The recording equipment is usually provided with a visual means of indicat-

(Continued on page 21)





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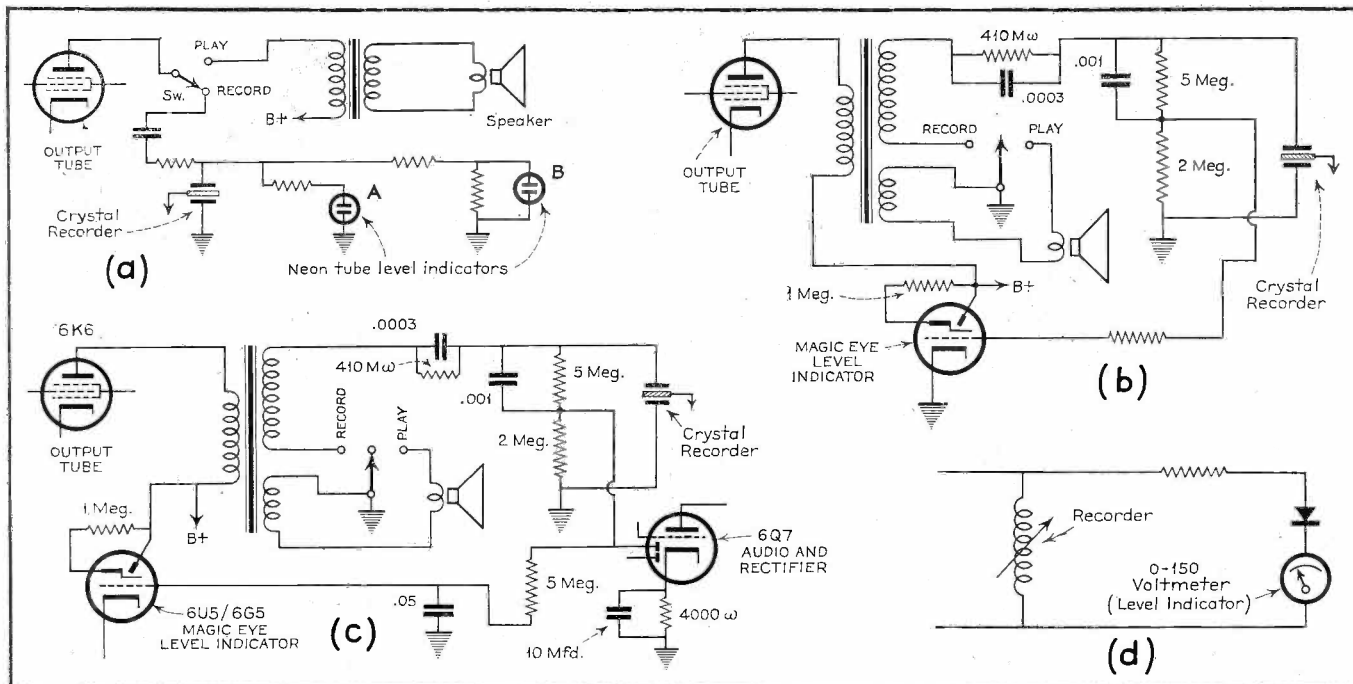


Fig. 5. Typical recording level indicator circuits. At (a) flashing neons A and B serve as level indicators. At (b) a magic eye operating as an a-c voltage indicator is used. At (c), Wilcox-Gay A72 recorder circuit with magic eye which indicates a-c voltage values. At (d), a-c copper oxide rectifier type a-c voltmeter for level indication.

ing the volume level being recorded, as it is impossible to properly control the volume level by "ear." The "level" indicator used should be able to move very rapidly since it should accurately indicate the "peak" level being placed on the record at any instant. Most indicators also have a clearly defined overload point marked on them.

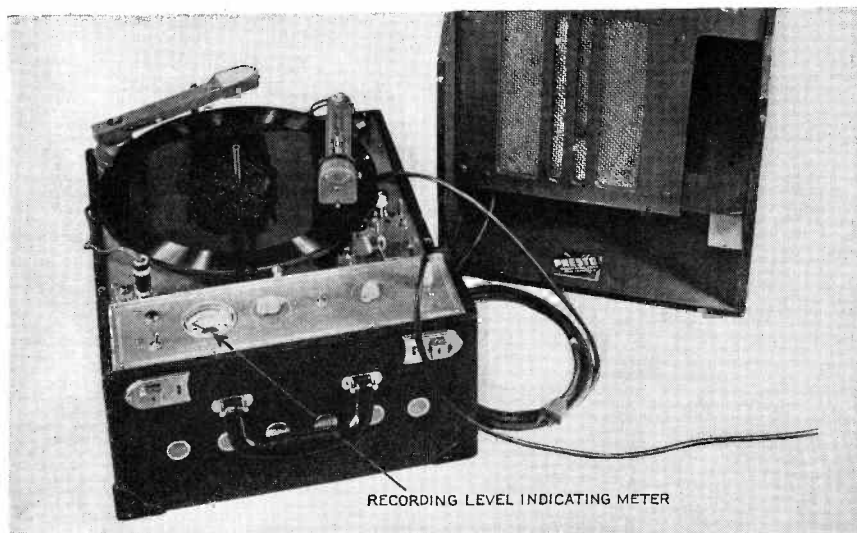
Since the recording level indicator is simply a means of indicating visually the instantaneous voltages fed to the cutting head (the output voltage of the amplifier), ordinary voltage-indicating devices connected in the output circuit are used for the purpose. The three common types used most are: the neon flashing tube, the ordinary electron tuning eye tube, or a copper-oxide type a-c voltmeter.

A typical double flasher neon tube type of recording level indicator arrangement is illustrated at (a) of Fig. 5. A pair of neon tubes are employed

The resistance in series with neon tube A is of such value that this tube strikes when the a-f voltage applied to the cutter is about 5 volts below the normal operating cutter voltage range. Therefore, it will continue to flash as long as the recording is being done above the "minimum" advisable level. As a result of the voltage-divider circuit, neon tube B always has sufficiently less voltage applied to it so it does not flash until

Fig. 6. A semi-professional recording showing the meter employed to indicate the recording level.

Courtesy Presto Recording Corp.



the a-f voltage applied to the cutter has exceeded the safe value and the danger of over-cutting is present.

A somewhat similar system employs only a single neon tube with the circuit constants properly adjusted so proper operation between the advisable lower and upper recording level limits is indicated when the tube flashes on and off intermittently at a fairly rapid rate.

Those recorders that employ a "magic-eye" type of recording "level" indicator, use it in one of two ways: either as an indicator of the straight peak audio frequency a-c voltage being fed to the recording head as shown at (b) of Fig. 5, or as an indicator of the rectified component of this same voltage, as illustrated in the circuit at (c). When used as an a-c voltage indicator the "magic eye" indicates the instantaneous peak voltage fed to the recording head at each instant, and its rapid fluctuations are tiring to the eyes of the operator. When used as a d-c voltage indicator, only the "average" values of the voltage are indicated. This allows enough delay to facilitate following the program being recorded without having too slow a response to catch excessive overloading peaks.

In the typical output circuits shown at (b) and at (c) the output transformer of the power stage contains a separate high-impedance secondary winding to supply the a-f signal voltage to the recording head. The resistance-capacity filter employed in this circuit serves to match the impedances of the winding and the recording head. A portion of the recorder head a-c voltage is fed back directly to the indicator tube in the arrangement of (b). In the circuit shown at (c) this voltage is recti-

# SYLVANIA SERVICEMAN SERVICE

by  
**FRANK FAX**



**I**T'S no cinch for servicemen to keep the nation's radios in trim these days—with limited materials.

For our part, we're glad to do anything we can to make your task easier. As a matter of fact, many of you have been nice enough to say that you've found our Tube Simplification Chart and our Base Chart the best things of their kind.

So our engineers got busy and now they've turned out another item for you—the Color Code Resistor Card.

This is in a convenient pocket size and shows clearly the A, B, C and D color denotations of a resistor. We think it'll fill a definite need on circuit revision jobs.

On the reverse side of the card is Ohm's Law, explained in a way you'll find mighty helpful.

Why not get one of these Color Code Resistor Cards now from your Sylvania jobber? They're free, as are many of the other technical and sales helps listed below. If your jobber is short on any of them, write to Frank Fax, Dept. S-11, Sylvania Electric Products Inc., Emporium, Pa.

#### WARTIME PROMOTION ITEMS

- |  |  |
|--|--|
| 1. Blackout button                         | 5. Air raid precautions folder and window poster |
| 2. First aid index                         | 6. Direct mail letter                            |
| 3. War bond poster                         |  |
| 4. Radio caretaking hints to the housewife |  |

#### REGULAR ITEMS

- |  |  |
|--|--|
| 1. Window displays, dummy tube cartons, timely window streamers, etc. (From your Sylvania jobber only) | 13. Service hints booklets                   |
| 2. Electric clock signs  | 14. Technical manual (35c)                   |
| 3. Electric window signs   | 15. Tube base charts                         |
| 4. Outdoor metal signs   | 16. Price cards                              |
| 5. Window cards  | 17. Sylvania News                            |
| 6. Imprinted match books   | 18. Characteristics sheets                   |
| 7. Imprinted tube stickers   | 19. Interchangeable tube charts              |
| 8. Business cards  | 20. Tube complement books (35c)              |
| 9. Doorknob hangers  | 21. Large and small service carrying kits    |
| 10. Newspaper mats   | 22. Service garments                         |
| 11. Store stationery   | 23. 3-in-1 business forms                    |
| 12. Billheads  | 24. Job record cards (with customer receipt) |

**SYLVANIA**  
ELECTRIC PRODUCTS INC.  
RADIO TUBE DIVISION  
Formerly Hygrade Sylvania Corporation

fied by one diode portion of the 6Q7 tube and is then fed to the indicator tube through a highly damped circuit consisting of the 5-megohm resistor and the 0.05 mfd. condenser. This allows enough "delay" to facilitate following the program, and yet is not too slow to catch excessive overloading peaks. The visual indicator eye circuit is always designed to *close* just below the recording level where there is danger of overcutting the groove. Excessive audio peaks cause it to overlap.

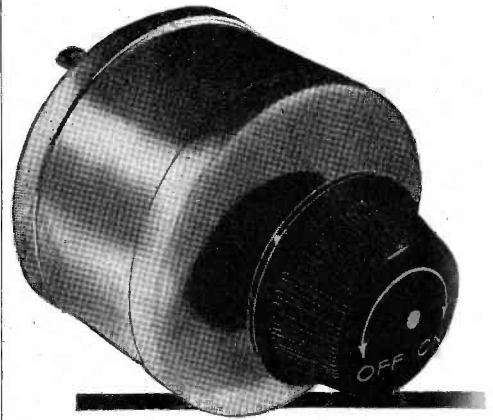
When a-c voltmeters are used as the level indicators they are usually of the rectifier type and connected across the recording head as shown at (d). A 0-150 volt a-c instrument is usually used. For normal recording, the "peaks" will usually be about 100 volts. This type of indicator is probably the easiest and most accurate to follow if it is designed properly. Also it gives a clear warning for both the *minimum* and the *maximum* advisable recording levels. That is why it is used in most recorders of the professional type (see Fig. 6). Since the meter must accurately indicate the peak levels of the recorder-actuating signal, its movement should be very rapid so it can indicate a peak quickly. Highly damped meters are not satisfactory for this work. However, a meter having a very fast undamped movement is also unsatisfactory for it is annoying to work with. The pointer will shoot up and down so rapidly that it often is impossible for the eye to follow it. Special meters, designed with little damping on the "up" movements so they instantly indicate the peak values, but with greater damping on the "down" movements are often employed to overcome this difficulty. They rise instantly to register the peak values of the signal, but return to the average-level position more slowly. Most fast moving meters (those having but little damping) can be given this characteristic by incorporating a suitable resistance and condenser network with the rectifier circuit. On professional recorders the meter is often calibrated to indicate the actual output in decibels.

(To be continued)

**Buy United States War  
Savings Stamps and  
Bonds for Victory**

## JOTS & FLASHES

Congratulations to Fred Ellinger just rounding out 10 full years selling Aero-vox condensers out of Chicago. . . ditto to J. H. Robinson (Robby) succeeding Henry Hutchins (now Lieut.-Commander U. S. Navy) as Sales Manager of National Union. . . good to see Ed DeNike located back in headquarters



## Tough . . .

★ This is the Clarostat 50-watt power rheostat in uniform—just as it appears in many military planes these days as standard equipment. For the duration, many Clarostat wire-wound controls and power resistors are being drafted exclusively for fighting service. These veterans of extra-severe usage will be that much tougher in the peacetime applications to come. ★ Meanwhile, your Clarostat jobber has essential replacement types for your servicing. Consult him.



once again. . . Army-Navy "E" Production Awards to Weston Electrical Instrument Co. of Newark, N. J., and also Sylvania's Emporium plants. . . same award also to the Chicago Division of Philco and Clarostat. . . Insuline Corp. of America just acquired a new modern factory building in Long Island City, N. Y., to be called The Insuline Building. . . regret to report death of J. Douglas Fortune, Industrial Sales Engineer for Thordarson, fatally injured while piloting a plane near Chicago on October 17th. . . Walter L. Schott Co., Beverly Hills, Calif., awarded "Bulls Eye" Flag by Treasury Dept. for 100% employee participation in Payroll Allotment Plan. . . a big pat on the back for employees of Jefferson-Travis and Union Aircraft, New York concerns, for presenting American Red Cross with a fully equipped station-wagon ambulance. . . Radio Division of Sylvania Electric Product, Inc., received annual citation as one of the leading direct mail users of the country by the Direct Mail Advertising Association. . . congratulations, Henry. . . John G. Porter now in charge of all sales promotion activities of the Transmitter and Electronic Tube Division of General Electric, Schenectady.—P. S. W.

# Farrell Says:

By C. H. FARRELL

## Nation of Boosters

Some years ago, an organization of Service Men paid me the compliment of appointing me an unpaid publicity man to promote "Radio Service Week." Of course, geography had something to do with my appointment—my native habitat being New York City, which is, as all know, the fountain-head of Eastern radio sales promotion. I was urged to get as much free advertising time from the radio broadcasters as was humanly possible; to wangle free space from radio trade magazines; to seduce radio editors of newspapers and "plant" news releases which were no more and no less than free advertisements. All of this whoop-de-doo and ballyhoo was intended to arouse the supine public from its tinned lethargy and send them helter-skelter to the nearest phone to call a Service Man for the purpose of having their radio receivers checked and repaired.

I guess that, as far as the broadcasters were concerned, I put on some pretty high-pressure sales talks. I purported to prove to them that radio advertisers were not getting the full measure of listening audience to which they were entitled because, at any given moment, a good 30% of all of the radios in the country were not working.

Credit the broadcasters with an important assist in making the campaign somewhat successful, for such men as Phillips Carlin of NBC and Major Bowes gave "Radio Service Week" a beautiful network play and even prepared their own commercial scripts, thus relieving me of the task of pounding out 40,000 words or so. Good guys like Nick Kenny of the New York Mirror and Ulmer Turner of the Chicago American and scores of other leading radio columnists devoted many a stick of type to the good cause, and if my memory serves, the Radio Corporation of America went to great expense to prepare big banners and window displays which were given to dealers and servicemen gratis. For a fortnight, then, the Service Men of the nation had a nation of boosters. But it only lasted two weeks and no "follow through" ever took place, although "Radio Service

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For many years Meissner Coils have been the accepted standard by engineers who insist upon high quality performance . . . Meissner precision coil construction never varies . . . they are the best that engineering research and modern production methods can make.

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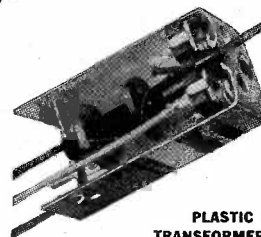
Coils illustrated and described represent only a few of the complete Meissner Coil line.

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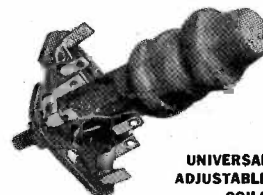
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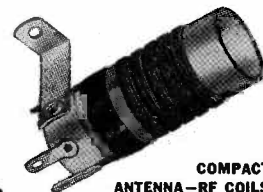
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The most popular replacement types. Compact in size, 1 1/4" square, 2 1/4" high. Available in all frequencies from 175 kc. to 456 kc. List price \$1.10 each.



UNIVERSAL ADJUSTABLE COILS

Adjustable—Inductance Ferrocart (Iron Core) coils will replace the broadcast band coils in practically any receiver. 3 types available, Antenna, RF, Oscillator. List price \$1.38



COMPACT ANTENNA—RF COILS

Ideal units for replacement in compact midget or auto Radio sets. Coils wound on form 3/4" in diameter, 1 1/4" long. List price, either type, Antenna or RF, 50c each.

Week" should have been, everyone admits, an annual "natural."

14,000  
Die  
Daily

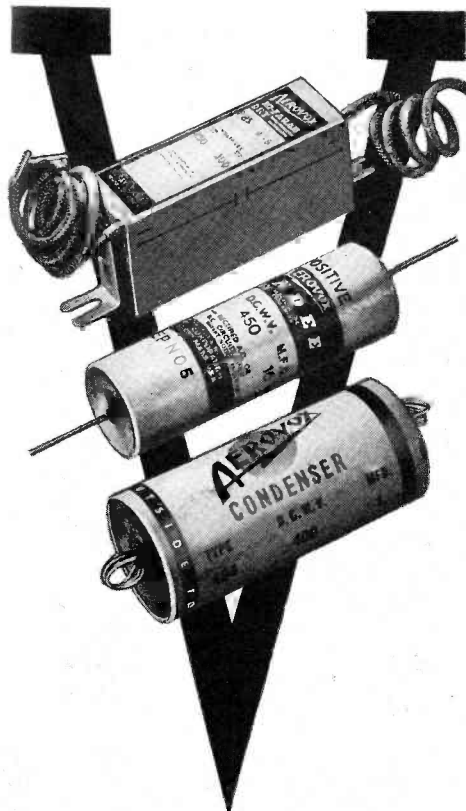
What with the shortage of radio technicians and the threatened shortage of replacement parts and tubes caused by the insatiable maw of Mars, those of the service fraternity who are still wielding the soldering iron are sitting pretty, in so far as getting the jobs is concerned. There is a great opportunity to build up their future on a rather solid foundation of good will and public confidence. And I wonder how many of them are astute enough to sense that NOW is the time for all good

Service Men to come to the aid of the 1944 bankroll!

Here are some figures which the National Broadcasting Company sent out the other week. According to the results of a recent survey made by them, an average of 14,000 radio receivers will go dead each 24 hours in the United States unless parts and Service Men are available to keep them in good working condition. This, according to NBC, would result in about a tenth of the nation's receivers giving up the ghost within the next nine months. If, for any reason whatsoever, 25% of

(Continued on page 26)





# VICTORY CONDENSERS

- There's still a correct Aerovox condenser to service most radio sets—regardless of growing shortages, curtailment of critical materials, banning of previous types.

Here, for instance, are three "Victory" types or satisfactory substitutes for types no longer available to you. They are (a) Type PBS cardboard case dry electrolytics, single, dual and triple section, 25 to 600 v. D.C.W., with handy adjustable mounting metal flanges. (b) Type PRS-V "Dandees" or tubular dry electrolytics, single and dual section, 25 to 450 v. (c) Ever popular Type 84 paper tubulars, 400 to 1600 v., extra-sealed for long service. These three "Victory" types can handle 90% of your usual service needs.

## • Ask Our Jobber . . . .

Ask him for your copy of the new "Victory" catalog which will help you in the present wartime situation. Or write us direct.



## SER-CUITS

(Continued from page 14)

resistors are used in the 14A7 r-f stage and 7B7 i-f stage. The resistors are unbypassed, allowing a small amount of degeneration. Note also the 50,000-ohm resistor in series with the volume control which limits loading of the detector. It will also be noticed that the .0001-mfd. r-f bypass condenser is at the

Wells Gardner series 7 D11, 7-tube a-c/d-c sets. Note the use of a 12SJ7 as a first detector and 6L5G as an oscillator. The oscillator circuit utilizes two tickler coils, one in the plate circuit and one in the cathode. Cathode to cathode oscillator coupling is employed via a 5000 ohm resistor in parallel with a

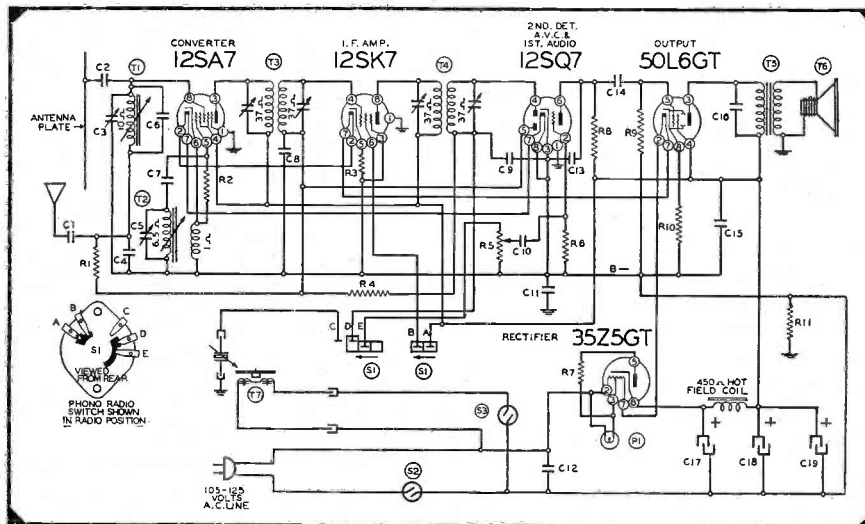
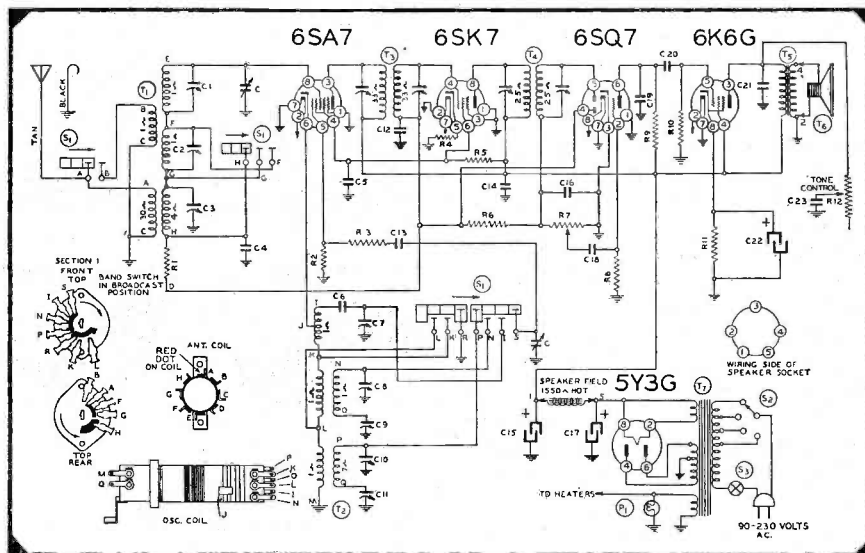


Fig. 9 (above). A 5 tuber with permeability tuner.

Fig. 10 (below). Airline's 14 BR-440A with unique band switching system.



arm of the volume control instead of the usual position at the high side of the control. This provides additional filtering whenever the control is set at any position below maximum. Note also the 80-ohm shunt across the No. 47 pilot lamp which guarantees a much longer life in return for less brilliance.

.02 mfd. condenser. The set also has a resistance coupled i-f stage, a 500,000-ohm tapped volume control and a second section resistance filter for supplying the first a-f and the entire r-f section except the second i-f. The avc supplies the converter and both i-f stages.

### Silvertone 7108 and 7158

Wells Gardner 7 D11  
Fig. 7 shows the oscillator circuit of

In the Silvertone 7108 and 7158 5-tube battery receivers (Fig. 8) we

have such features as dual voltage dropping resistors in a battery thrift switch, permeability tuning and iron core i-f's with impedance coupling between the two i-f stages. The second i-f transformer contains a low-pass filter to pass a-f and avc voltage. In this set, avc controls only the converter. Note the 0.72 ohm "A" circuit resistor which would drop the "A" voltage, .18 volt, assuming 50 mils per tube at the new value. In practice, the current would be a bit less. The "B" circuit resistor of 2700 ohms would drop the "B" voltage about 22.5 volts, assuming a drain of 8 mils at the lowered voltage. The "B" economizer resistor is common, but we seldom see also the filament resistor. Note the "B" decoupling filter in the second i-f plate consisting of 680 ohms and a .05 mfd. condenser. In the permeability tuning system, on shortwave, the tuning elements are shunted by small coils.

Fig. 9 shows the antenna input circuit an interesting five-tube a-c phono-job. This utilizes a permeability tuner and antenna plate. The external aerial is connected through the usual .0001 to the low side of the antenna inductor, the input voltage being coupled in across a .0008 mfd. condenser—a true capacity coupled aerial. The .0001 mfd. condenser prevents excessive detuning from a long antenna. On phono operation the i-f screen is opened to kill the signal.

#### Airline 14 BR-440A

The Airline 14 BR-440A 5-tube, 3-band universal a-c voltage receiver (Fig. 10), has a neat band-switching system. The external antenna is permanently connected to the broadcast transformer primary. On both the medium and short wave bands, a primary common to these bands is shunted across the broadcast primary. The three antenna transformer secondaries are connected in series and are shorted out in order. For broadcast, all three are in: For medium, the broadcast coil is shorted and for shortwave both broadcast and medium are shorted. Similarly, in the oscillator circuit, the tickler coils are all in series and are shorted out as required. The oscillator grid coils are switched in the conventional manner. A 10-ohm resistor is placed in series with the grid condenser. Note the treble tone control in the 6K6G output.

#### Motorola 81 F 21

Motorola phono-model 81 F 21 features a plug-in permeability tuner shown in Fig. 11. A 6SD7GT is used as a mixer with a separate oscillator. A separate "B" supply filter is used for the r-f portion of the receiver and this entire portion is cut off for phono operation.



## ★ "Sure, I'd Rather Have Roast Beef" ★

... but if it's a question of who it goes to—me or a boy at the front—

★ Brother, I'll eat fish and like it."

People are accepting with ever-increasing good-grace each day's new war-born inconvenience—WHEN they know the reason for it.

★ If you explain to your customers how war needs are taking all new radio parts—how you have licked a tough situation to get their sets into operation without those parts—they'll be satisfied with performance that's a "little less than perfect."

★ Improvising repairs, however, may require your eliminating certain stages, substituting for specific resistors, condensers, sockets, etc. It may require that you transfer certain materials from one part of a set to another. But one thing it is always certain to require is a knowledge of exactly what is inside the set.

★ That's where Rider Manuals help you out—quickly. They save you hours otherwise wasted "guessing out" defects and experimenting with "possible" methods of improvising repairs. They lead you right to the cause of the trouble and furnish the facts that enable you to turn out a big volume of work in spite of material and labor shortages.

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A-C CALCULATION CHARTS—Two to five times as fast as a slide rule—and more fool-proof. All direct reading—operative over a frequency range of from 10 cycles to 1000 megacycles. 160 Pages—2 colors—9½x12 inches—\$7.50.

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#### EMERSON 109

*Tunable hum caused by open condenser from rectifier plates to chassis: New .1 mfd. .05 mfd. unit clears the trouble. Should be at least 400 volt condensers.*

Willard Moody.

#### FADA 360

*Weak reception: Look for the bent or broken connection on the primary of the transformer coupling antenna to the 6A7 grid circuit.*

Willard Moody.

BUY UNITED STATES  
WAR SAVINGS BONDS AND STAMPS  
EVERY PAY DAY

#### FAIRBANKS 56

*Distortion at high volume: There is a leak in grid condenser between the 75 plate and 42 grid.*

Willard Moody.

#### LAFAYETTE C-29

*High positive voltage in the avc: This is due to one of so-called insulated resistors touching one of the plate prongs. The silver band on these resistors is conductive and if placed together they will leak through. This can happen in many receivers, on some of the resistors.*

Robert Dixon.



## Talk with Your RADIO PARTS JOBBER

● An over-the-counter conversation with your Radio Parts Jobber will supply answers to most of the questions you may have concerning the availability of Astatic parts for replacement or repair of existing radio, public address or phonograph equipment. Many Astatic products you may desire are still available in jobber stocks. In any case your Radio Parts Jobber is the man who knows. He will serve you to the best of his ability.

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## First Choice of Servicemen!



## STANDARD TRANSFORMER

• CORPORATION •

1500 NORTH HALSTED STREET . . . CHICAGO

### FARRELL SAYS

(Continued from page 23)

the nation's receivers should go dead, this fact alone would be a major victory for the Axis forces, for then planted rumors could be communicated by word of mouth; the propaganda grapevine of our enemies could flourish without the pitiless spotlight of TRUTH to interfere with its growth.

It is heartening, therefore, to note that the *National Association of Broadcasters* and the *Radio Manufacturer's Association* are getting together to take what steps they can to encourage the American set owner to "keep 'em playing." Here is a short item from the New

Keeping the nation's radio sets in repair is gradually becoming a more pressing problem, due as much to the lack of repair men as any shortage of parts. The National Association of Broadcasters and the Radio Manufacturers Association now have taken official cognizance of the situation and pretty soon one should be hearing announcements over local stations recommending that listeners keep their receivers continually in repair and not ignore any symptoms of unsatisfactory reception.

York Times, which is somewhat indicative of the campaign which has already started and which will burgeon into a major publicity campaign, with every station in the country giving plenty of radio time to remind listeners that sets must be kept in repair.

### Building Good Will

Yea, verily, a slew of business is going to drop into the laps of those Service Men who are still functioning as independent business men. It would be well for their future prospects if they were to remind themselves daily that the business which they get will be practically a present. For forces are at work and will be at work to send this business to them. These forces have, perhaps, a selfish interest, in that the very lifeblood of broadcasters is the size of a radio audience which they can deliver to a radio advertiser. Advertising rates are based on potential listening audiences and it is obvious that a drop of 10% in circulation would have to be met by a corresponding drop in time charges. Thus, it is apparent that the broadcasters have a definite pecuniary interest in the campaign to "keep 'em playing," although this pecuniary interest is, I am certain, secondary. It has been my observation that the broadcasting stations have gone "all out" in backing up the nation's war effort and their contributions have added up to a major "assist" in winning the war.

It is axiomatic that when a business improves, the operator of that business usually falls into the error of patting himself on the back and telling himself that he is a pretty hep hombre. Service Men, being human, are also prone to this habit of self-laudation, and it is an error I would warn against. For one of the concomitants of smugness is a certain "*I'm-busy-today-got-all-the-work-I-can-handle-and-I-don't-care-if-you-go-somewhere-else-with-your-business*" attitude. Such an attitude on the part of any business man does not—at least in my opinion—build that glowing feeling of good will on the part of the customer.

### BATTERY PORTABLE FEATURES RESISTANCE COUPLED R-F

(See Front Cover)

**M**ANY unusual features, including a resistance coupled r-f stage, isolated filaments and a unique power switch are in the Westinghouse models WR-62K1 and WR-62K2, battery and line-powered portables.

In the r-f resistance stage, coupled to the first detector, a wave trap has been placed in the signal grid of the converter. Note that the 1N5GT r-f am-

plier has its screen at the full "B" voltage while the plate potential is lowered by the 5600 ohm plate coupling resistor. The biasing of the 1N5GT i-f stage consists of a 5.6 megohm grid leak by-passed by a .01 mfd condenser. The first detector has a 2.2 megohm leak. Neither stage makes use of avc voltage, this being limited to the r-f stage only. A regenerative coupling coil is used in the i-f screen.

The detector and audio end are conventional, but the second condenser of the r-f filter from the detector is placed in the volume control arm instead of at the high side. This allows additional attenuation of r-f whenever the pot is at other than the maximum position.

In many portables, adequate filtering is not always provided. In this receiver, notice how the filaments are isolated to prevent undesirable coupling. Starting with the "A plus" terminal, current flows through the output tube filament to the 1H5 detector. Note the 40 mfd. filter and a-f bypass. This condenser, in conjunction with the 60 ohm 3Q5 filament, acts as an additional filter section for 60 cycle ripple. The low side of the detector filament is bypassed by a .1 mfd. condenser. Continuing, we now come to a 1 ohm r-f choke for decoupling the r-f filament, through the converter to another .1 mfd. condenser bypass to the i-f filament and to ground. There is no need to call attention to the shunt resistors for equalizing filament voltages at this late date.

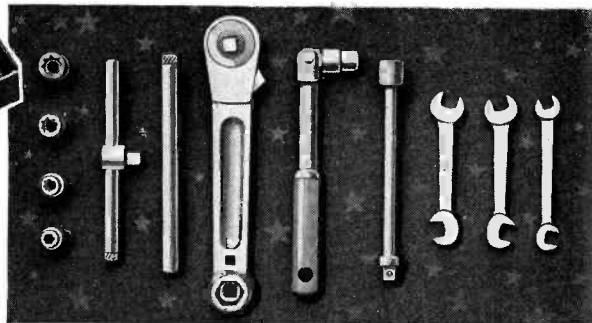
We now come to a unique feature of the models . . . the power switch. Shown in the "Off" position, the "A—" and "B—" common connection is open; also, the "B+". Turning the switch one point clockwise turns on the set with line power. "Ground" is connected to the 35Z5 heater, completing the heater circuit through the 545 ohm power cord resistor. Connecting the "ground" also completes the 50 mil filament circuit from the rectifier. The switch also connects the rectifier "B plus" to the positive bus, completing the "B" circuit.

In position 3, "ground" is connected to the common battery terminal, completing the "A" circuit. Also, the "B plus" battery terminal is connected to the positive bus, displacing the rectifier. The 50 mfd. filter remains on the bus at all times, but is disconnected from the "B" battery in the "Off" position. A neat window is provided in the dial, giving a visual indication of the switch position.

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



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.**

**PHILCO 38-4**

*Set plays clearly with one of the 6F6 tubes removed: Short circuit or leak in .01 mfd. condenser between screen of one 6F6 and control grid of the other 6F6 (phase inversion circuit). Insert a new condenser.*

*Willard Moody.*

**PHILCO 38-7**

*Set distorts with antenna connected but alright on weak stations without antenna: The avc circuit is not working in this instance. Badly soldered connection or broken lead to the 110 mmfd. condenser between grid and plate of*

*6J5 detector will be found to have caused the trouble.*

*Willard Moody.*

**ZENITH 6S 152**

*Found set dead in cabinet, played satisfactorily on bench; distorted chassis caused intermittent; blocked chassis in distorted condition: Check showed a 6 ohm r-f grid to the ground. The r-f shield can was found touching the r-f trimmer plate. The installation of a wedge between the condenser gang and the r-f shield can and cementing the can in place, within an hour, cured the trouble.*

*R. G. Crouch.*

## JENSEN NEEDLE DISPLAY

Jensen Industries, Inc., 737 North Michigan Avenue, Chicago, have produced a new counter merchandising dealer display  $4\frac{1}{2}$ " x  $11\frac{1}{2}$ ". This merchandiser contains a



"baker's dozen" of Jensen phonograph needles, each needle being attached to a two color round package which is inserted in individual compartments.

## CLAROSTAT RECEIVES "E"

The Army-Navy "E" excellence in production was awarded Clarostat Mfg. Co., Inc., of 285-7 N. 6th St., Brooklyn, N. Y., with impressive ceremonies held in the Grand Ballroom of the St. George Hotel.

## AEROVOX MICA STOCK RECOVERY PLAN

The Aerovox Corporation of New Bedford, Mass., has sent out an urgent appeal to jobbers asking them to make existing mica capacitor stock available to Uncle Sam. Special inventory forms have been provided so that jobbers can simply, quickly and explicitly tabulate their available stock and send the information to the Army-Navy Communications Production Expediting Agency, Pentagon Building, Arlington, Va.

## FIRST AID INDEX

A first aid index in handy pocket size form is being issued by Sylvania for Service Men to use with local war emergency volunteer groups. It measures  $6\frac{1}{2}$  x 3 inches folded, and fits into pocket, purse or auto compartment. They are available at 5c each; minimum quantity for imprinting by Sylvania is one hundred.

The Sylvania first aid index is said to be authoritative, bearing the approval of the Commander-in-Chief of the U. S. Volunteer Life Saving Corps. It is printed in patriotic red, white and blue, and contains data helpful to everyone.

## CLAROSTAT EARNS "A"

The inspection routine or quality control practiced in the Clarostat plant has won an

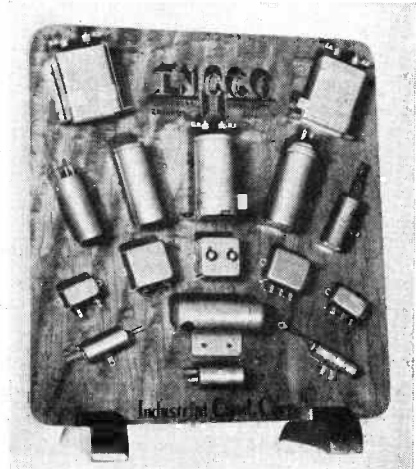
"A" classification recognition granted by the Eastern Procurement District, Army Air Force.

## RAYTHEON SALES OFFICE MOVES

The Raytheon replacement sales department has been transferred from the New York office to the factory at 55 Chapel Street, Newton, Massachusetts. A. E. Akeroyd is manager of this division.

## INDUSTRIAL CONDENSER DISPLAY

Industrial Condenser Corp., Chicago, has issued a new counter display to their



distributors, featuring sixteen representative types of condensers.

## PROTECTING THE VOICE AND EARS OF OUR FIGHTING FORCES

Lives—Victories—depend on the proper performance of the radio equipment which is the voice and ears of our fighting forces. Army and Navy technicians depend on the same accuracy, dependability and ease of operation which have made the name Supreme famous for over 14 years.

Supreme Radio Testing Instruments keep communications open.



**SUPREME** GREENWOOD, MISSISSIPPI U. S. A.  
TESTING INSTRUMENTS

## WHEN YOU CHANGE YOUR ADDRESS

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

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

Of SERVICE—A Monthly Digest of Radio and Allied Maintenance published monthly at New York, N. Y., for October 1, 1942.  
County of New York, }  
State of New York, } ss.:

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

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

2. That the owners are: Bryan Davis Publishing Co., Inc., 19 E. 47th St., New York, N. Y.; B. S. Davis, Ghent, N. Y.; J. C. Munn, Union City, Pa.; A. B. Goodenough, Port Chester, N. Y.; P. S. Weil, Great Neck, L. I., N. Y.

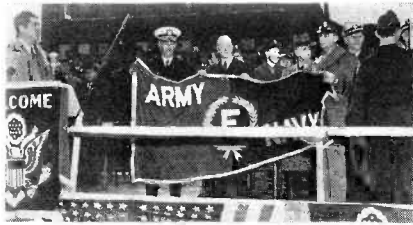
3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities, are: None.

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

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

Sworn to and subscribed before me, this 30th day of September, 1942.  
(Seal) FRANKLIN B. GOULD, Notary Public.

Commission expires March, 1944.



### SYLVANIA WINS "E"

Rear Admiral Charles W. Fisher, Director of Shore Establishments, United States Navy, presented the Army-Navy "E" pennant to Sylvania Electric Products, Inc., in Emporium, at the recent ceremonies.

\* \* \*

### FUTURE OF SERVICING

(Continued from page 8)

that were a procedure of this type accepted as a standard interim practice for the duration; by having the units serviced by the jobbers or master servicing organization set-up under the jobber's surveillance, the salvaging of materials would be thus effected in the most important link in the chain of returning those strategic materials to the melting pot. The question of salvaging is to develop directly in proportion to the proximity of our receiving material allocations and must, therefore, be considered as one of the salient elements of the above plan.

Many jobbers throughout the country have already been affected by the shortages reviewed in this article. Many jobbers have already converted to a plan coinciding in principle with the above-mentioned outline in cities such as Pittsburgh, Pa.; Moline, Ill.; Denver, Col.; Oakland, Calif.; and Long Beach, Calif. In the middle West, two other distributors have written their Service Men accounts obtaining their reactions to a plan very similar in nature and outlining to them the necessity of action being taken promptly. It would be well, therefore, that the parts distributing groups consider this phase as an industry problem to perpetuate their own organizations.

As time goes on our service problem is going to become increasingly acute and if we expect materials to be freed by the cooperation of WPB, we must also find some way of "unfreezing" the man power so that these materials may be used advantageously.

Let us try to think ahead of the man power problem in radio service and have our own program well established so that when we receive the materials we expect we will have a place to use them!

**Help beat the Axis by buying United States War Bonds and Stamps every pay day.**



## THE CONDENSERS YOU NEED

*When You Need Them*

You can handle 90% of all dry electrolytic condenser replacements with Sprague ATOM Midget Drys and Sprague El Prong-Base Drys. They fit anywhere. They're more dependable than the big condensers they replace. Equally important, your Sprague jobber has them in stock in a full line of voltages and capacities, as well as in dual and triple combinations.

Speed up your work—insure greater customer satisfaction by using Sprague ATOMS on every job!

SPRAGUE PRODUCTS CO., North Adams, Mass.

# SPRAGUE

## ATOMS

*"Mightiest Midgets of All"*

## NEW PRODUCTS

### SYLVANIA SERVICE KITS

A gray tweed-mixture aeroplane cloth—washable and smooth-finished now covers the Sylvania service kit. This new model is known as the 1A, and features sturdy construction, removable tool tray, metal lock and fittings, leather corners and handle, and plenty of room for tubes, parts and small tools. Inside dimensions are 17 x 10 x 7 inches.

Black leatherette covered Sylvania Kits in two sizes are still available. Kit No. 1 is identical with 1A, except for the covering. Kit No. 2 has almost twice the carrying

capacity. Inside dimensions are 14 x 22 x 8 inches. Deep cover has a leather flap to hold contents in place.

\* \* \*

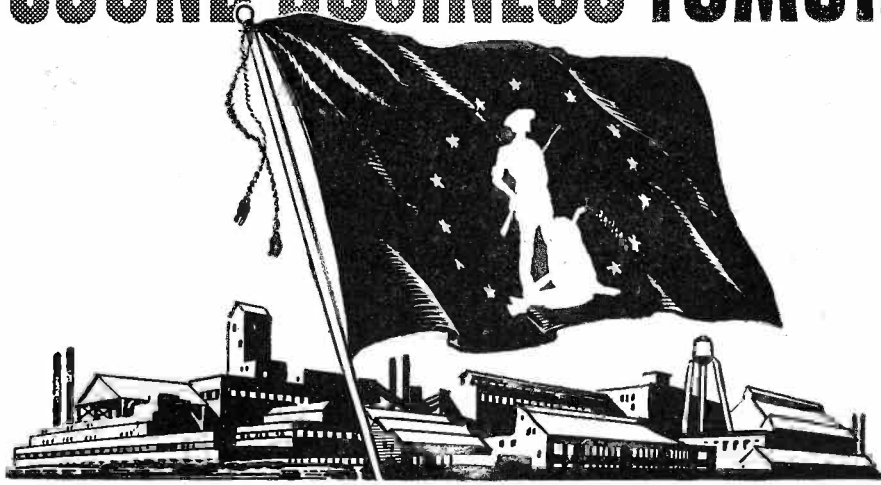
### GLASS-INSULATED FLEXIBLE HEATING ELEMENT

A low-power flexible heating element, the glasohm, made by Clarostat Mfg. Co., Inc., 285-7 N. 6th St., Brooklyn, N. Y., is now being used in a variety of applications.

In the glasohm construction the resistance wire is wound on a fibre-glass core and is protected by a fibre-glass braided covering. The fibre-glass while providing the desirable properties of unbreakable and virtually indestructible glass, is almost as flexible as silk, so that the unit can be readily bent and compacted to fit snugly

(Continued on page 31)

# FOR VICTORY TODAY AND SOUND BUSINESS TOMORROW



## Get This Flag Flying Now!

This War Savings Flag which flies today over companies, large and small, all across the land means *business*. It means, first, that 10% of the company's gross pay roll is being invested in War Bonds by the workers voluntarily.

It also means that the employees of all these companies are doing their part for Victory . . . by helping to buy the guns, tanks, and planes that America and her allies *must* have to win.

It means that billions of dollars are being diverted from "bidding" for the constantly shrinking stock of goods available, thus putting a brake on inflation. And it means that billions of dollars will be held in readiness for post-war readjustment.

Think what 10% of the national income, saved in War Bonds now, month after month, can buy when the war ends!

For Victory today . . . and prosperity *tomorrow*, keep the War Bond Pay-roll Savings Plan rolling in *your* firm. Get that flag flying now! Your State War Savings Staff Administrator will gladly explain how you may do so.

If your firm has not already installed the Pay-roll Savings Plan, *now is the time to do so*. For full details, plus samples of result-getting literature and promotional helps, write or wire: War Savings Staff, Section F, Treasury Department, 709 Twelfth Street NW., Washington, D. C.



Save With

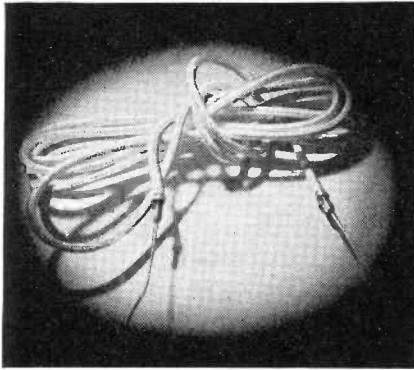
## War Savings Bonds

This Space Is a Contribution to America's All-Out War Program by

### SERVICE

(Continued from page 29)

about parts to be heated, or again jammed into very tight spots, in either case providing an efficient heating means. Typical glasohm heating elements range from a few inches to several feet in length. Watt-



age ratings are from 1 to 4 watts per body inch depending on the application.

Glasohm heating elements are now found in electric soldering irons, electric pencils, curling irons, water immersion heaters, and other low-power appliances. Also in temperature-controlled ovens for oscillating radio crystals, the heating of aviation and marine instruments, etc.

\* \* \*

#### NEW RCA TUBES

New tube types for use in connection with WPB rated orders, have been released by RCA.

They are the 1C21 gas-triode, 2A1 high-vacuum cathode-ray tube, 5R4-GY full-wave high-vacuum rectifier, 6AG5 r-f amplifier pentode (miniature type), 6J6 twin triode (miniature type), 934 vacuum phototube (2 15/32" long x 23/32" in diameter), 935 vacuum phototube (Ultra-violet-Sensitive Type).

The 1C21 is for use primarily as a relay tube. The 2A1 is similar to type 902 except that it has separate leads to all deflecting electrodes and the cathode, employs a magnal 11-pin base, and can be operated with higher anode voltages. The 6AG5 has a sharp cut-off characteristic and a high value of transconductance. Having miniature construction, the 6AG5 is useful in compact, light-weight equipment as an r-f amplifier up to about 400 megacycles, and as a high-frequency intermediate amplifier. It has low input and low output capacitance.

The 6J6 is a miniature twin triode having two grids and two plates with a common cathode indirectly heated. The twin units may be operated in parallel or in push-pull. With push-pull arrangement of the grids, and with the plates in parallel, the 6J6 is particularly useful as a mixer at frequencies as high as 600 megacycles. It is also useful as an oscillator.

The 934 is a small high-vacuum phototube intended primarily for use in sound and facsimile equipment but it is also suitable for light-operated relays and light-measuring equipment. Its S4 photosurface has exceptionally high response to blue and blue-green radiation and negligible response to radiation.

\* \* \*

#### OSCILLOGRAPH WITH EXPANDED FREQUENCY RANGE

An oscillograph with a wide frequency range, type 224, is now offered as a standard instrument by Allen B. Du Mont Laboratories, Inc., Passaic, N. J. One of



Coming through . . .

Clear . . . intelligible . . . in the heat and noise of battle . . . orders are coming through

## Electro-Voice MICROPHONES

While we cannot discuss the actual developments embodied in many of our new models, we can say that they have been designed specifically to limit background noises and to allow speech to come through the bedlam of battle.

**ELECTRO-VOICE MFG. CO., Inc.**

1239 SOUTH BEND AVENUE

SOUTH BEND, INDIANA

Export Office: 100 VARICK STREET, NEW YORK, N. Y.

## Vibrator powered PACKS

are finding increasingly wider acceptance in U. S. Signal Corps and other applications of United Nations armed forces.

If you have such an application, covered by adequate priority, your inquiry is invited by our Engineering Department.

The **RADIART Corp.**

West 62nd Street & Barberton Ave.  
CLEVELAND, OHIO

**RADIART VIPOWER**

Quality above all..

**SOLAR**

**CAPACITORS**

DRY ELECTROLYTICS

WET ELECTROLYTICS

PAPER CAPACITORS

MICA CAPACITORS

"ELIM-O-STAT" SUPPRESSORS

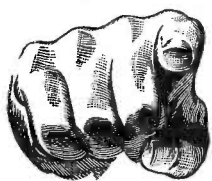
CAPACITOR ANALYZERS

**SOLAR MFG. CORP.**

Bayonne, New Jersey



# Are You Making Good in Your New Radio Job?



## New Jobs Create New Opportunities

There's no "ceiling" to the better jobs available today. CREI home study courses can give you the practical technical training you need to "make good" now — and to enjoy security in the years to come!

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- If you are a practical radioman who realizes that fortunate circumstances have placed you in a job requiring technical ability . . .
- If you are smart enough to know that you will "get by" only so long as a fully qualified man is unavailable . . .
- If you have the ambition to make good in your new job and to rise to even a still better job . . .

then a CREI home study course in Practical Radio Engineering will help you to acquire the necessary technical knowledge and ability which is demanded by the better-paying positions in technical radio. More than that, CREI training will enable you to HOLD that job after you get it and advance to an even better position.

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The CREI Placement Bureau is flooded with requests for CREI trained radiomen. Employers in all branches of radio want trained men. Your government wants every man to perform his job, or be placed in a job, that will allow him to work at maximum productivity. If you are or will be in need of re-employment write your CREI Placement Bureau at once.

## CAPITOL RADIO ENGINEERING INSTITUTE

E. H. RIETZKE, President

Home Study Courses in Practical Radio Engineering for Professional Self-Improvement

Dept. S-11, 3224 — 16th Street, N. W. WASHINGTON, D. C.

Contractors to U. S. Signal Corps and U. S. Coast Guard Providers of Well-Trained Technical Radiomen to Industry

its features is the Y-axis or vertical deflection response which is uniform from 20 cps to 2 million cycles, with a comparably faithful square and sinusoidal wave response. The X-axis or horizontal deflection amplifier has a uniform characteristic from 10 cps to 100 kilocycles. Both amplifiers are said to have distortionless input attenuators and gain controls.

In addition to the conventional amplifier connections, signals can be applied directly to the deflection plates of the 3-inch cathode-ray tube, when it is desirable, by means of terminals at the front panel of the unit. The Y-amplifier has an input connection for the shielded-cable test probe type 242A, supplied with the instrument. This reduces input capacitance and eliminates stray pickup. All high-voltage electrotype condensers are eliminated from circuit.

Type 224 oscillograph weighs 49 lbs. and measures 14 $\frac{1}{4}$ " high, 8 $\frac{3}{8}$ " wide, 15 $\frac{1}{8}$ " deep. It operates on 115 volts, 60 cycles a-c.

\* \* \*

### TORQUE MEASURING WRENCHES

The P. A. Sturtevant Co., of Addison, Illinois, has developed a complete line of torque measuring wrenches comprising 8 models. These wrenches are being used for gauging or measuring torsional force or for measuring the frictional drag in motors or mechanisms.

\* \* \*

### HIT RECORD RELEASES

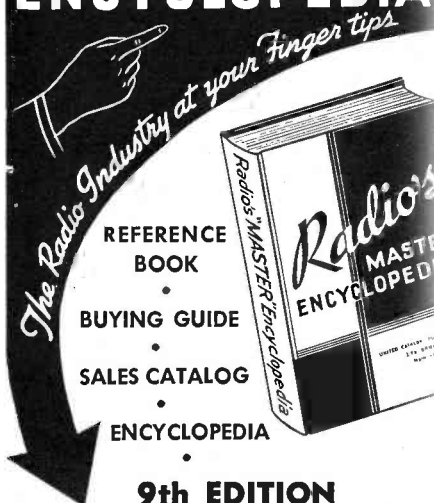
Four new record releases have been released by the Hit Record Co., 300 Brook Street, Scranton, Penn.

They are "He's My Guy," "Amen," "I Met Her on Monday," and "Daybreak." They are all foxtrots, recorded by the Marshalls and their orchestra.

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## Radio's MASTER ENCYCLOPEDIA



REFERENCE BOOK

BUYING GUIDE

SALES CATALOG

ENCYCLOPEDIA

9th EDITION  
OVER 800 PAGES

### THE ONLY OFFICIAL RADIO PARTS AND EQUIPMENT MANUAL

It took six years and thousands of dollars to develop this "MASTER CATALOG" of the radio industry to its present size—yet it costs you only \$3.50.

Compiled in co-operation with and approved by the Radio Manufacturers Group as the industry's official source book.

### GIVES THIS IMPORTANT DATA

Contained within the hard covers of this 800 page MASTER BOOK are the listings of the products of 90% of all Radio Parts and Equipment Manufacturers in the industry. In it you will find many thousands of items, such as electronic devices, transmitting and receiving sets, tubes, antennas, transformers, condensers, replacement parts, meters, laboratory test equipment, relays, plugs, coils, wire, and numerous other radio components. Thousands of clear illustrations with descriptions and specifications. —Yes, this is your "MUST HAVE BOOK".

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As the official source book of the radio industry it is constantly used by many American and Foreign governmental agencies, also industrial organizations, engineers, purchasing agents, laboratories, radio amateurs and service men, radio distributors, broadcast stations, schools, colleges, libraries, and by many others interested in Radio and allied fields.

### SAVES TIME—SAVES MONEY

WHERE, WHAT AND HOW MUCH: Such information is instantly at your fingertips. This Valuable RADIO MASTER eliminates the maintenance of bulky files. It is completely indexed for speedy reference.

If you buy, sell or specify you will find the RADIO MASTER an indispensable and handy book to have around at all times.

### MONEY BACK GUARANTEE!

Order your copy today—look it over. You will find it to be an excellent investment; if not, return it to us in five days for full refund.

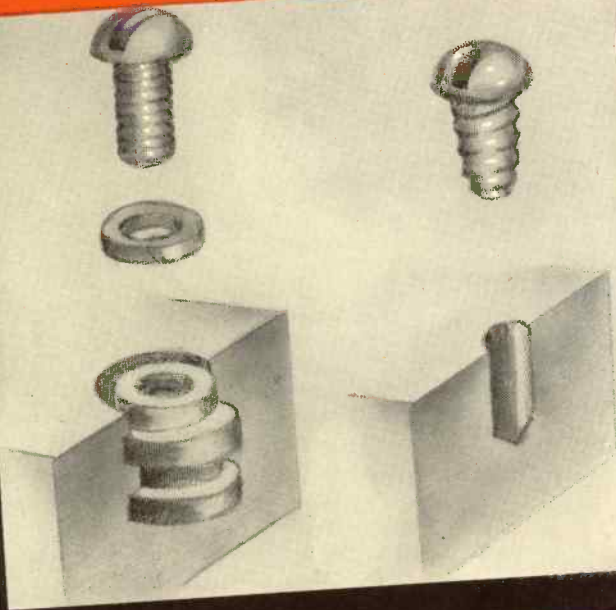
The price is only \$3.50 shipped anywhere in U.S.A.—\$4.00 elsewhere. We prepay transportation charges if remittance accompanies order.

UNITED CATALOG PUBLISHERS, Inc.  
106A Lafayette St. New York, N. Y.

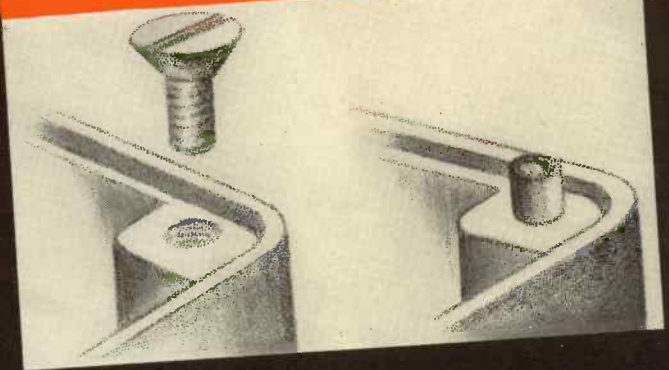
# In the Battle of Design

A waste of material or machine time in engineering design today is as damnable as sabotage. The battle of design will be won by refinements in existing components as well as by new inventions. Savings in small things add up . . . to big things. Here are some examples:

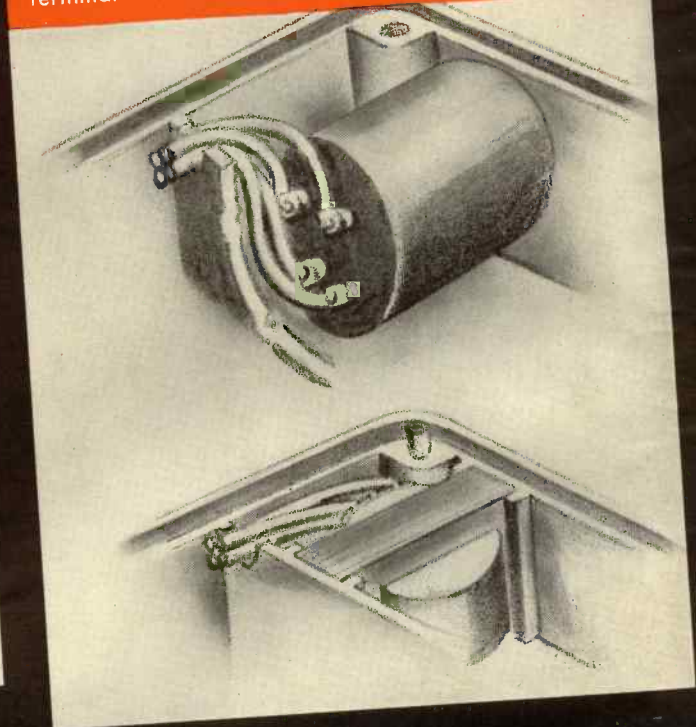
One of our engineers changed the construction of a plastic assembly from brass insert + lockwasher + brass screw to steel PK screw only. Approved by the Army, the savings represented 1,000,000 inserts and lockwashers.



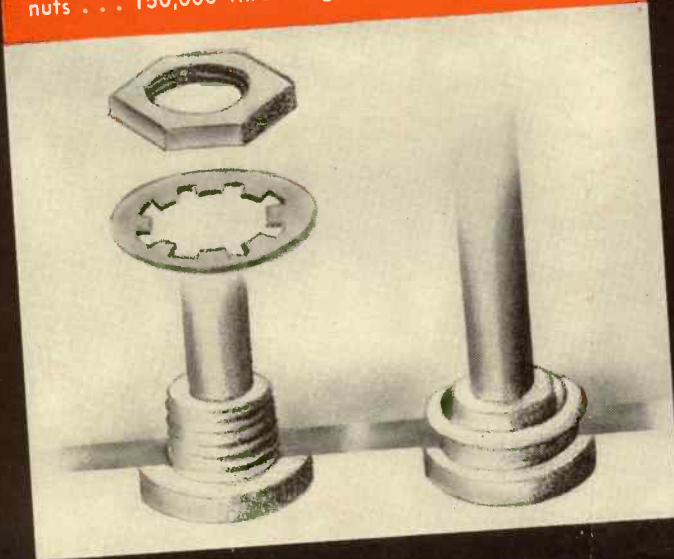
In die cast structures, covers and nameplates were held on by screws. A UTC design modification added a round projection in the casting, which is spun over to hold the plate or cover. Saving: over 2,000,000 screws and lockwashers . . . over 2,000,000 tapping operations.



This structure employed a cased transformer fastened to a compartment wall with screws. A changed design permitted potting the transformer directly in the compartment. Saving . . . 1,000,000 terminals . . . 300,000 screws . . . 400,000 aluminum cans . . . plus terminal board saving and reduction in overall size.



One UTC design eliminated a threaded shank, lockwasher and nut by changing to a spun-over shoulder on the shank. Saving . . . 150,000 lockwashers and nuts . . . 150,000 threading operations.



These savings added up. Small in themselves . . . slight for each individual unit . . . their total is impressive. Today we need all possible savings . . . even those which seem impossible at first. Review your designs for Savings for Victory.

## UNITED TRANSFORMER CO.

150 VARICK STREET



NEW YORK, N. Y.

EXPORT DIVISION: 100 VARICK STREET NEW YORK, N. Y. CABLES: "ARLAB"

# NATIONAL UNION *De Luxe* AMPLIFIER

**15 Watts Output . . . Less than 3% Distortion . . .**  
at rated output . . .

**Patented Circuit . . . Permits Extreme Compactness**

## **W15A-**

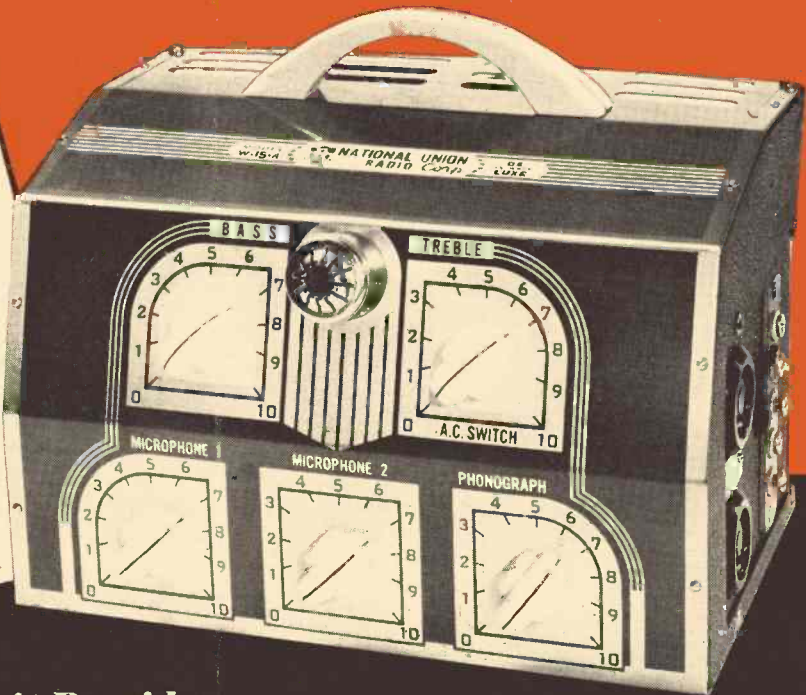
Amplifier includes set of 5 N U  
Loktal Tubes.

## **W15A-C-**

Portable Case Only — Imitation  
Leather (space for Amplifier  
W15A, Two 8" P.M. Speakers,  
Microphone and Cable).

## **W15A-CS-**

Portable Case with  
2-8" P.M. Speakers



### **The Patented Circuit Provides...**

SMOOTH AND FLEXIBLE CONTROL OF BOTH VOLUME LEVEL AND TONE GRADATIONS OVER A WIDE RANGE . . . TWO MIKE INPUTS AND ONE PHONOGRAPH INPUT MAY BE SEPARATELY CONTROLLED OR MIXED FOR SIMULTANEOUS OPERATION . . . CONTINUOUSLY VARIABLE SEPARATE BASS AND TREBLE TONE CONTROLS. . . EASILY ACCESSIBLE FUSE . . . HOUSED IN COMPACT ATTRACTIVE GREEN CRACKLE FINISHED CABINET WITH PLASTIC IVORY KNOBS AND CARRYING HANDLE.

## **SPECIFICATIONS**

**Rated Output:** 15 Watts.

**Peak Power Output:** 25 Watts.

**Distortion:** Less than 3% at Rated Output

**Tone Controls:** 1—Bass Boost Control.  
1—Treble Tone Control.

**Frequency Range:** ± 1 Db from 50 to 10,000 cycles

**Input Circuits:** Two high impedance microphones.  
One high impedance phonograph.

**Output Circuits:** Variable Impedance Output. Two  
Speaker Sockets. Each Socket  
has Combination Voice Coil and  
110 V. A.C. Terminals

**Output Impedances:** 4-8-16-500 Ohms.

**Power Considerations:** 110-117 Volts 60 Cycle  
A.C.

**Power Consumption:** 50 Watts.

**Circuit:** Special Patented Output and Bass Control  
Circuits.

**Tubes:** National Union Loktal 2-7N7—2-7C5—1-7Z4.

**Size:** Extremely Compact 8 $\frac{3}{8}$  x 5 $\frac{5}{8}$  x 5 $\frac{5}{8}$

**Weight:** 12 Pounds.

**Ask Your N.U. Distributor or Write**

**NATIONAL UNION RADIO CORP.**

**57 STATE STREET, NEWARK, NEW JERSEY**