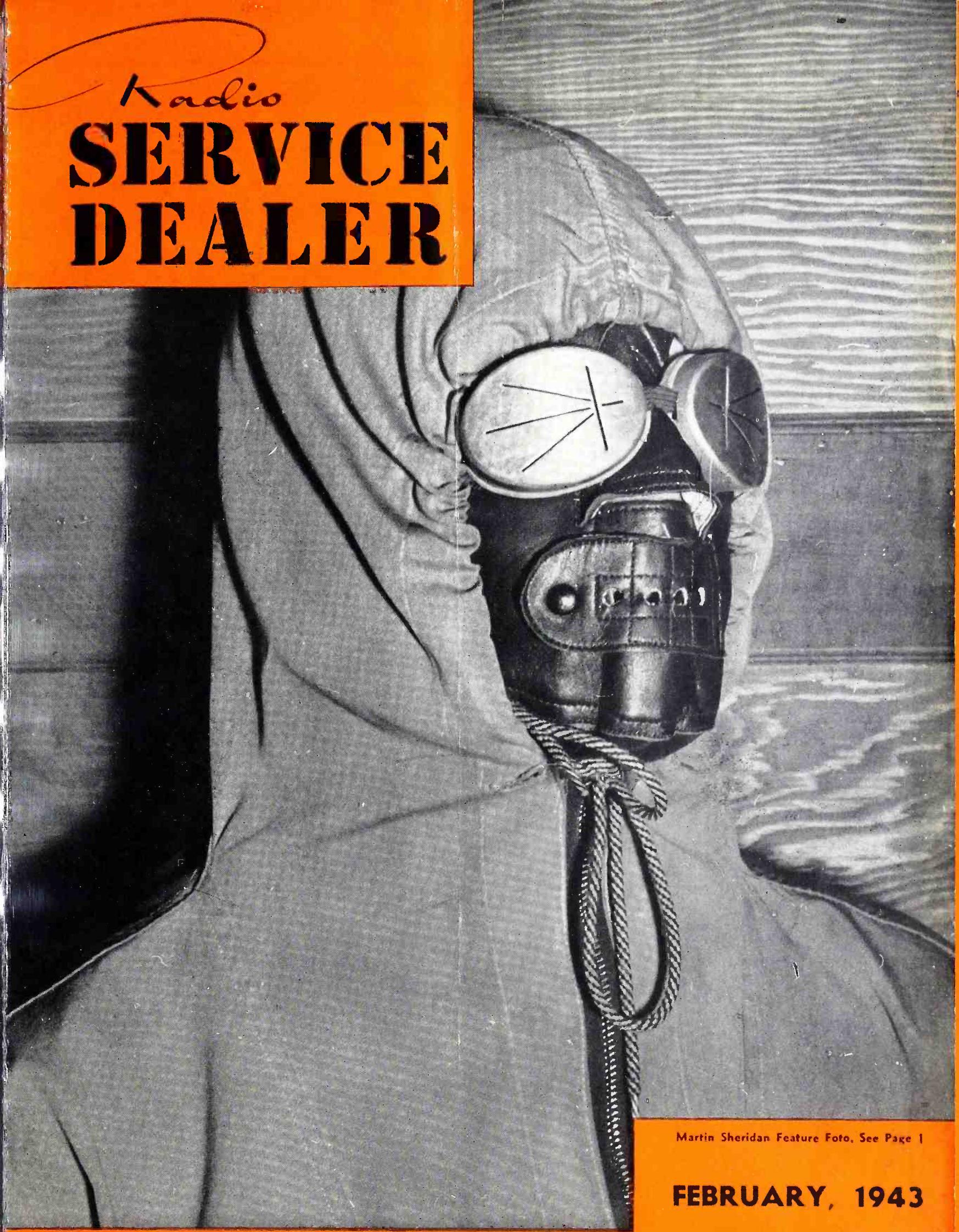


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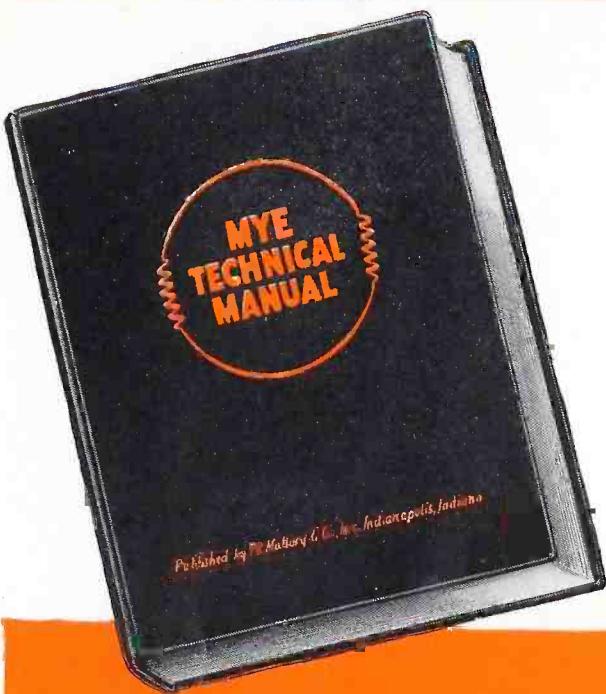


Martin Sheridan Feature Foto, See Page 1

FEBRUARY, 1943

RADIO-ELECTRONIC MAINTENANCE MEN

"Work Bench Helper" is the Name for It!



Here is the book to have at your fingertips for practical help in Wartime. The latest technical data, in simple, easily-understood text . . . invaluable aid in making the most of available parts . . . first aid for every-day receiving set problems.

408 pages, profusely illustrated, hard cloth covers. Every radio serviceman, engineer, amateur and experimenter will find this book a practical blend of theory and practice.

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Radio SERVICE-DEALER

SOUND MAN AND JOBBER

Reg. U. S. Pat. Off.

Vol. 4, No. 2 ★ February 1943



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Cover Picture

Not a Man from Mars! This is how the maintenance men of the Yankee Network F.M. Station W39B dress 80% of the time in winter because it is so cold at the transmitter station at Mt. Washington, N. Hamp.

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editorial....

Perhaps There Will Be Tubes In July

• Elsewhere in this issue is a tentative outline of the 117 tube types WPB is "considering" a production schedule of for civilian use together with a list of divers replacement parts that are under consideration by the standards committee of ASA. These tubes and parts would be called the "Victory" line, if ever produced, which only time will tell. Scan the proposals and submit your views to us, if you wish. Don't get het-up about the obvious flaws. Remember this "Victory" line is merely tentative.

The latest RMA report to its members remarks that WPB is planning to make the necessary allocation of materials and decide which tube factories will be assigned to make various types of "Victory" tubes. It even mentions the contemplated production schedule for the first quarter of 1943. It would be better if RMA had not been quite so optimistic in this regard for, as we have mentioned before, when WPB finally does decide on all the factors, make the allocations, etc., then a time lapse of no less than four months will be required before the materials can be actually assembled in the plants, and finished tubes be delivered to the jobbers. *Perhaps* there'll be tubes by July!

OPA Rules Adversely On "C" Directive

• The OPA ruled on January 26th that "household radios are entertainment devices within the meaning of Section 7706Q, Ration Order 5C, and therefore preferred mileage may not be allowed for driving done in the course of repairing such radios." We have appealed this ruling. It is entirely contrary to the original 5C promulgation and intent. Radio repairmen *must* be given more gas.

We submit that while radio is an entertainment device it is also much more important as a safety measure in time of air-raid alarm. Besides, its status as a morale factor, means of disseminating news, etc., place it in the forefront of essentials during these times of rationing of free traffic and movement.

Our appeal cites, among other things, that General Drum's regulation appertaining to dim-outs and air-raid alerts for the 17 states along the eastern seaboard specifically directs that after Blue and Red alarms have been given by signal or siren, the proper procedure is to turn on the radio because by radio the All-Clear signal will be broadcast. That fact alone should bring a favorable decision and take radio out of the pure "entertainment" class, where OPA so arbitrarily puts it. Now, if the authorities fail to issue a common-sense directive, we will have but one alternative, and that is to seek, by public petition, a reversal of the present status. More about this can be expected next month. It depends upon the OPA decision on our appeal. Are you ready to start petitioning?

Soldiers Want Radios

• Many army and navy training camps, libraries, canteens and social halls are still without radio, despite U.S.O.'s heroic efforts. Perhaps you have an old but operative receiver hanging around that you will be willing to give to the boys in service. Let us know! Small AC-DC 60 cycle models are wanted. *Don't send us* any receiver that you are willing to donate. Simply let us know what you have to offer and we will inform the proper authorities who in turn will communicate with you. We promise that every set you give will be greatly appreciated by the fighting men who will derive much pleasure from it.

A Bit Of Swapology

• Generally it is poor policy for a publisher to permit his editorial department to know what is transpiring in the advertising department as the latter might try to use detrimental influence. But when something new and creditable in the way of an advertising idea comes along we are impelled to express our views.

In this issue an old established client inaugurates a trading-post, swap or exchange idea whereby many thousand radio service-dealers may benefit. The obvious purpose is to try to help spread the few available or idle parts, tubes and instruments around and put them into immediate use where they will do the most good. Several radio manufacturers have used this idea successfully in their own house organs and in difficult times like these we are all for it.

It Is Provoking

• While shopping in various 5 and 10 cent stores the other day we found each had a plentiful supply of brass curtain rods in all sizes but nowhere could we find a single spool of solder. This is rather incongruous in view of the serious copper shortage. One cannot help but feel that WPB considers it is vitally important for housekeepers to be able to replace curtain rods, which seldom need replacing, but it is not important for anyone to be able to repair devices that might need a drop or two of solder. As usual, someone in Washington went haywire when it came time to judge real values of scarce materials; and until the men who determine allocations become competent, or the nincompoops get kicked out entirely, we'll simply have to put up with such discrimination. What provokes us is the fact that the writer, when asking for a copper allocation for aerial wire recently, was told, "Don't ask for copper for civilian radios, we need copper for bullets. That is more important, as any soldier will tell you." Well, we wonder, if soldiers were asked if they'd prefer copper wire so their folks could hear the latest war news or be warned of impending air raids—or copper so the folks could hang new curtain rods as a second choice after the bullets were made, what do you think the soldiers would choose? Or are we sarcastic?

SRC

Even in wartime

G. E. is building consumer confidence in your post-war G-E radio receiver line

In a large-scale magazine-advertising program, augmented by the G-E thrice-weekly national radio news program with Frazier Hunt, G.E. is building good will and good business for radio and appliance dealers and department and furniture stores after the war. It is building them with compelling logic.

For instance, the new G-E electron microscope, shown in the advertisement reproduced at right, magnifies tiny objects to mountain proportions. When post-war radios again come from G-E factories, the same skill and research that went into the development of the electron microscope will contribute greatly to G-E radio and television receiver quality.

Then there's the mighty stream of radio apparatus that G.E. is mass-producing for United Nations fighting men — mass-producing to Uncle Sam's toughest precision standards! *These same standards* will govern and guarantee the mass-production quality of G-E post-war radios for your showrooms.

Now glance at the advertisement at right. It is just one of many explaining to consumer-magazine readers — your future customers — how the same G-E skill that created this microscope, and that is mass-producing military radios, will build your post-war line of G-E radios.

Powerful reasons why your post-war radio customer will look for G-E electronic radios in your showrooms . . . why G-E radios will be your front-line radio leaders after the war! . . . Radio, Television, and Electronics Department, General Electric, Schenectady, N. Y.



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★ The full-page, four-color advertisement above
★ will appear in the following magazines:
★ The Saturday Evening Post . . . February 6
★ Life February 22
★ Collier's January 30
★ Look February 9
★ Fortune March
★ American Magazine April
★ National Geographic March
★ Farm Journal March
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THE G-E ELECTRON MICROSCOPE

This marvelous new G-E contribution to health and better living serves as an excellent example for telling our radio story, as in the following quotation from the accompanying advertisement:

"The same scientific skill and experience which have gone into the development of the General Electric electron microscope are represented in the General Electric radio. For the radio, too, is an electronic instrument."

GENERAL  ELECTRIC

175-82

Remember Pearl Harbor?

RACONS were there
doing their jobs well

* Sound detector apparatus at Pearl Harbor indicated the approach of unidentified planes nearly an hour before the dastardly Jap attack. And now—on all battlefronts—similar detectors aid the Allies, warning of approaching danger.

* RACON Products are, as you can see, a prime component in sound detector devices such as the one illustrated. Our military buys the finest equipment possible. No compromise is made. Quality, efficiency and dependability are basic requisites.

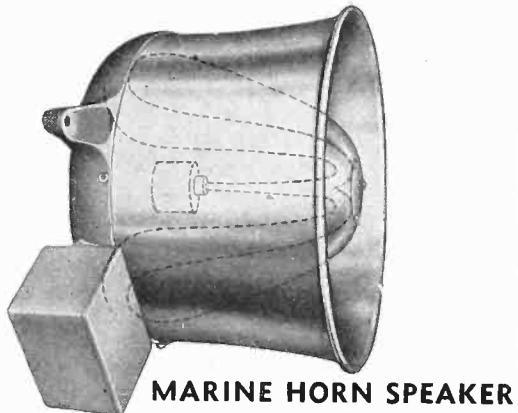
* RACON Sound Projectors, horns and speakers are made with the famous, patented RACON Weatherproof, Stormproof Acoustic Material. RACON driving units and horns deliver more energy per watt input. The RACON line is complete, there being a speaker or driving unit for every conceivable application and purpose.

* If space permitted we'd show how RACON's are used at Army and Air Force training bases—at shipyards—aboard Navy, Coast Guard, Maritime Commission and Transport ships—in factories, and in countless industrial public-address systems. RACON can help in your next installation. Inquiries are invited. Ask for our free catalog.

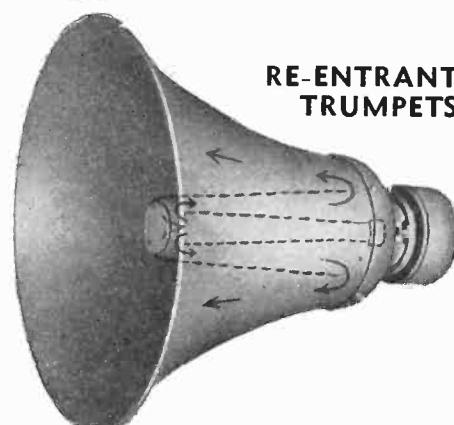
RACON ELECTRIC CO., 52 East 19th St., New York, N. Y.

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MARINE HORN SPEAKER



RE-ENTRANT
TRUMPETS

Shown here are but two of the many RACON Speakers. The Marine Horn Speaker is of the re-entrant type, for marine and general p-a applications. Available in several sizes, from 5 to 50 watts, they may be used as loudspeaker or as microphone. (Approved by the Bur. of Marine Inspection, Dep't of Commerce.) RACON Re-entrant Trumpets occupy small space but afford a long horn that carries highly concentrated sound efficiently over long distances. Made of RACON Acoustic Material that prevents resonant effects. 3', 3½', 4½' and 6' air-column sizes available.

Send for the new RACON Catalog

OSCILLATION AND ITS CAUSES

by John H. Potts

LOCATING the cause of oscillation in a radio receiver is often one of the toughest jobs we are required to tackle. While almost all other types of radio troubles result from changes in the characteristics of one or more components of the set, oscillation in some of its forms may be present when every component of the radio is in perfect operating condition. A slight rearrangement of the wiring in a critical circuit, a change in the position of a tube shield, or simply carelessness in placing the connecting wires to the speaker near high-gain amplifying circuits may be sufficient to produce oscillation.

Under ordinary circumstances troubles of this character are comparatively rare. Most experienced servicemen are sufficiently familiar with the precautions which must be observed in dressing leads away from critical circuits and in taking care not to disturb wiring in radio frequency circuits when making repairs so that such faults are seldom encountered. But as a result of war conditions a large number of experienced servicemen are now either in the armed services or in war plants. Their places have been taken by others less skilled and often so overworked that some of the ordinary precautions which every good serviceman follows almost unconsciously are ignored. This places an undue burden on the skilled, in that it is now necessary to look for troubles in places where ordinarily they would rarely be found.

There is still another reason why oscillation is bound to become a more prevalent source of trouble. Often it is necessary to substitute tubes which the receiver was not designed to use or transformers which are not exact replacements, simply because the proper ones are no longer obtain-

able. Drastic changes of this character often cause oscillation, so perhaps a few words concerning the methods of locating and correcting such troubles may be of interest.

Symptoms and Sources

Oscillation may occur either at audible or inaudible frequencies. When audible, it most frequently appears as motorboating or audio howl. The latter is quite common, of course, and most experienced servicemen know that the most probable cause is a defective electrolytic condenser in the power supply filter circuit. Another cause, not so frequently encountered, is an open grid circuit (this does not always result in motorboating). Except for this latter condition, oscillation is always

caused by common coupling between stages or by feedback, in proper phase, from the output to the input of the same stage. These causes hold both for low and high-frequency oscillations.

The manner in which common coupling develops in audio circuits is shown in *Figs. 1 and 2*. In *Fig. 1*, which shows, in simplified form, the audio and power supply sections of a typical receiver, the condenser *C* in the filter circuit normally provides a low-impedance path for the audio signal so that all other elements of the filter circuit are electrically isolated from the amplifying stages. When this condenser capacitance is normal, practically all the signal current will pass through it so there will be little which passes through the relatively high impedance filter choke. Thus there is no common coupling between stages and each stage can function independently of others.

When the capacitance of *C* decreases, due to deterioration, its reactance increases and its ability to bypass low-frequency currents drops. Eventually a condition arises where it no longer serves its bypass function and the circuit begins to resemble effectively what is shown in *Fig. 2*, in which *C* is shown in dotted lines. When this condition is reached, we see that the filter choke *L* forms a common coupling component between the two audio stages. Then any signal voltage which is present in the output circuit of the power stage will be fed back into the plate circuit of the preceding stage. Although the phase of this feedback to the preceding stage is not correct for oscillation to be caused, at least for signal voltages, the plate currents in preceding stages will fluctuate in accordance with the varia-

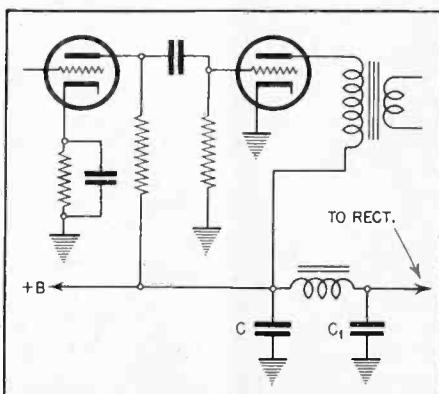


Fig. 1. The return circuit for the audio stages shown is through filter condenser *C*.

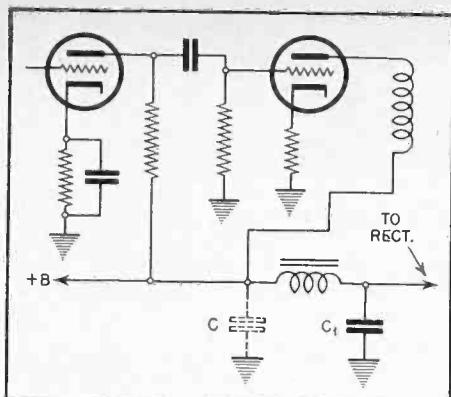


Fig. 2. This is similar to Fig. 1, except that C is shown in dotted lines. When C has decreased in capacity, the return circuit is through the choke and C₁, which have a high impedance at frequencies off resonance in the audio range. Therefore common coupling between stages occurs.

tions in the current in the power output circuit. While audio howl will not result, motorboating does occur, and at a period determined by the rate of discharge of condensers in the coupled circuits. This rate is in turn fixed by the time constant (in seconds) of the resistance and capacitance in the circuit, which is equal to the product of the resistance in megohms and the capacitance in microfarads. The time constant thus obtained represents the time required for the condensers in the circuit to lose 63% of their charge. In motorboating, the capacities are so high that the charge and discharge cycle of the condensers takes place so slowly that the cycles may be counted, and are readily identified by the familiar "put-put" sound, from which this form of oscillation derives its name.

Practically all cases of motorboating originate in the power stage. Usually the plate current in this stage is far greater than in any other; therefore variations in this current will have the greatest effect on the power supply voltages. When the output current is heaviest, the drain on the charged condensers forming a part of the filter circuits is greatest, thus the charge and discharge cycles of these condensers are most affected by variation in the output stage currents. These fluctuations are further increased when the output tube is not properly biased for Class A operation, or when some other class of amplification is employed. That is why, in Class AB or Class B audio stages, a better filter network, with low-resistance chokes and high capacity condensers is required. Since an increase in bias of a Class A stage, normally used in most broadcast re-

ceivers, causes effects similar to those of Class AB operation, it is well to check the power tube grid bias in cases of motorboating. When the plate current is low, resistance-capacity filters, as shown in Fig. 3, are effective cures for motorboating.

Open Grid Circuits

Intermittent blocking due to an open grid circuit is another frequent cause of motorboating. In some instances, the grid circuit may not be completely open; the grid resistor may have increased in resistance to such a degree that the circuit is practically open.

Parasitic oscillations, which may be of such high frequency as to be completely inaudible frequently develop in the output stages when beam power tubes, such as the 6L6, 25L6 or 6V6, are employed. This is particularly the case with the first mentioned type, and results in extremely short tube life. This type of oscillation is often of such violence as to cause the tube elements to become extremely hot. An output meter connected across the speaker voice coil will show several watts of output being delivered, though no sound is heard. This trouble may develop when an output transformer of a different type from that originally specified for the receiver is substituted, or if any of the components in the input or output of the power stage is replaced by another differing in any considerable degree from that originally used. The cure, when the proper components are no longer obtainable may be effected by placing a small resistor, say 500 to 1000 ohms, in series with and close to the control grid terminal of each power tube, as shown in Fig. 4. It is also helpful to connect a small capacitor, .002 to .006 mica, from the output plate to ground. In some cases oscillation of this character may be caused simply by carelessness in the placement of wiring. Grid and plate leads should be kept short and well separated.

In r-f and i-f stages, oscillation

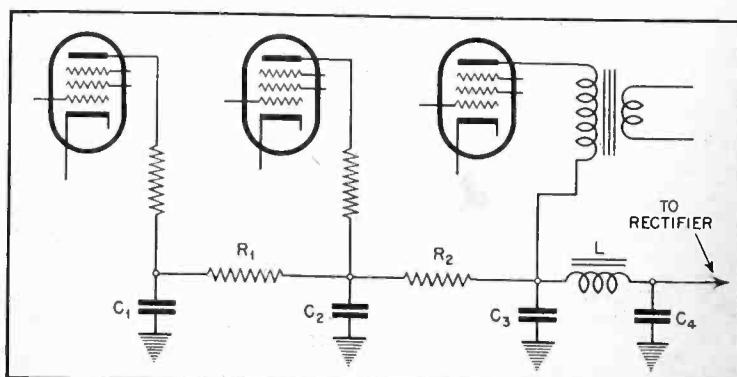
which is inaudible may be caused by dislocation of leads, particularly in stages employing the 6AC7/1852, 1232, 6AG7 and similar very high mutual conductance tubes. Particular care should be taken with band switch connections—often the slightest increase in lead length at such points causes severe oscillation, especially in frequency-modulation receivers, where the intermediate frequency is high and the tendency toward oscillation is more pronounced. In obscure cases in such receivers, it is a good idea to check the wiring of these circuits with another similar chassis which is operating properly.

Any great increase in the oscillator grid leak resistance R, in the circuit diagram shown in Fig. 5, is a likely cause of audio oscillation. This results in a blocking oscillator, which oscillates intermittently at radio frequencies. The intermittent operation gives rise to an effect similar to motorboating when the grid resistance is very high—of the order of 1 megohm or so—and to a disagreeable audio modulation when the grid resistance is somewhat lower. Normally the oscillator grid leak is seldom of a higher resistance than 50,000 ohms.

In pentagrid converter stages a peculiar type of oscillation, called flutter, is frequently encountered when tubes of the 6A7 and 6A8 type are employed. This fault is prevalent on short-wave bands and is caused in a manner somewhat similar to motorboating. When avc bias increases or decreases, as stations of different strength are tuned in, the effect of this change in control-grid bias on the pentagrid converter tube is to decrease or increase the current to the plate and anode grid. The change in current in the latter causes a slight change in oscillator frequency, so the set becomes slightly detuned and the output signal voltage at the detector-avc tube is decreased. This decreases the avc bias voltage, the oscillator anode grid current is again changed and

(Continued on page 5)

Fig. 3. Resistance-capacity filters, as formed by R₁-C₁, and R₂-C₂ serve to prevent inter-stage coupling through the power supply, when the plate current of the filtered stages is low.



The SPRAGUE TRADING POST

EXCHANGE - BUY - SELL

CHANALYST WANTED—or similar signal tracer such as Meissner or Jackson. Must be in A-1 condition. Cash. D. L. Ballengee, Chillicothe St., South Charleston, Ohio.

SIGNAL GENERATOR WANTED for cash. All-wave, A-C operated. Also 2" or 3" scope. W. A. Conklin, 70 Community Drive, Cranston, R. I.

NEEDED AT ONCE, I-T 124 Transmitting Tube, or two T-125 tubes. Will pay cash. H. D. Bennett, B & B Radio Co., 4812 Euclid Ave., Cleveland, Ohio.

TUBES WANTED at once. Types 6F6; 12A8; 12SA7; 12SK7; 12SQ7; 50L6, and others. Write giving quantity, make and price. Little's Jewelry Store, Auburn, Indiana.

TUBES NEEDED—12SA7; 12SQ7; 12A8; 6SC7; 45, and 80 tubes. Please name quantity and price. Kimmell Radio Sales, 39-43 E. Pittsburgh St., Greensburg, Pa.

TUBE TESTER FOR SALE—Hickok AC-51, just modernized last month, \$50. Would like 5" Oscilloscope. State price, number of hours tube was used. Also want Hickok Vacuum Tube Voltmeter, good slide rule, and good camera. E. M. Prentke, 1960 East 105th St., Cleveland, Ohio.

METERS FOR SALE—Have twenty O-10 mill. D'arsonval type: 2½" face, 3¼" O.D., moving coil, \$3 each. Also have 300 assorted meters iron vane type, 25c ea. or make offer. Want 16mm. projector. Jack's Radio & Music Shop, 14 Bellingham St., Chelsea, Mass.

TUBE TESTER WANTED—late model. Have fifty Mazda lamps, 300 watts, 220 v. will swap or sell for cash. Bill's Battery & Radio, 240 Blue Hill Ave., Roxbury, Mass.

MANUALS AND OHMMETER WANTED—Want Vols. 7-9-10 Rider's Manual, also ohmmeter. Name best price. Have Marlin 22 cal. rifle to swap or sell. Ristow Radio Co., 3608 Irving Pk., Chicago, Ill.

TUBES AND SIGNAL TRACER WANTED—Want 6F6M (G or GT), 35Z5GT, and 35Z3 tubes; also Philco Signal Tracer. Tubes must be factory-sealed. Duncan's Radio Service, Longhurst, N. C.

FOR SALE—Sets, chassis, and farm sets. Table models, combinations, etc. Write for details. Victory Radio & Record Shop, 1546 E. 53rd St., Chicago, Ill.

WILL BUY—Oscillator, Ohmmeter and Manuals. Give details and price. Tube Tester for sale. John Honochick, 157 First St., Oneida, Pa.

SWAP OR SELL—Will sell or trade tube checker, channel analyzer, and over 300 tubes, parts and old radios. Need a Supreme or any good make oscilloscope. Jos. M. Ortiz, 52 E. 103 St., New York, N. Y.

WILL TRADE OSCILLOSCOPE—Will swap 2" Supreme Oscilloscope Model 535 in excellent cond. for Vac. Tube Voltmeter, or new radio tubes, or will sell for \$20. Buck's Radio Service, 291 Home Avenue, Mansfield, Ohio.

FOR SALE—Jensen 12" series X speaker with 6 v. field coil; Wright-Decoster 10" speakers (two) with 6 v. coils; Triplet Model 1210 A Tube Tester in oak case; also Jannett C6 Rotary Converter, 110 v. a.c. to 110 v. d.c. All used, but in fair to good cond. Howard F. Wampole, P.O. Box 45 Gwynedd, Pa.

WATTMETER FOR SALE—Weston Model 432 in bakelite case. O-150 and O-300 watts. \$30. Radio & Electric Repair Service, 315 Beechwood Ave., Trenton, N. J.

WANTED FOR CASH—Solar, QCA, or Exam-eter; Triplet 1200 VOM, 1000 ohms per volt. Also need 12S tubes, 5Y4G, 5Y3G, 50L6GT. Will pay cash. Seymour Radio Service, 20 New St., Seymour, Conn.

50L6GT TUBES TO SWAP for a Bridge Condenser Tester. Will pay part in tubes, part cash. Leo the Radio Man, 4230 Lancaster Ave., Philadelphia, Pa.

INSTRUMENTS FOR SALE—What am I offered for this complete outfit: Meissner Analyst, Model 10-1154, cost \$80; Hickok Dynamic Tube Tester, AC51, cost \$52; Supreme Radio Analyzer, Model 339 de luxe, cost \$40; C-B A.C. Oscillator, Model OC, cost \$40; Tobe Condenser Analyzer, cost \$12. All in A-1 condition. S. Hulchanski, 119 Schroeder St., East Syracuse, N. Y.

RADIOS WANTED FOR CASH—Will buy for cash new radios and combinations. Any kind or make, small or large quantity. Acme Radio Co., 5126 Santa Monica Blvd., Los Angeles, Cal.

RECORD CHANGER WANTED—Capehart, late model preferred. Also volt-ohms-mils tester, any make but must be perfect. International Radio Stores, 232 Sherman Ave., New York, N. Y.

INSTRUMENTS WANTED—Volt-Ohmyst, Chanalyst, Volt-ohm Meters, Tube Testers and 6AC7/1852 tubes wanted. State prices, make and year of manufacture. Tubes must be in original cartons. William Platt, 710 Broadway, Schenectady, N. Y.

A WARTIME SERVICE to the RADIO PROFESSION

Is there something pertaining to Radio that you want to Buy—Sell—or Swap? If so, send us your Trading Post advertisement today. We'll schedule it for appearance here as soon as possible—at no cost to you, and providing only that your ad seems to us to fit in with the Trading Post Plan. Our aim is to cooperate with our friends throughout the trade with the object of helping keep the nation's radios working during these wartime days!

Address your ad to: Sprague Products Company, North Adams, Mass.

Your own ad run FREE!

WILL TRADE RECORDING UNITS

Two brand new units, Majestic motor, cutting head, play-back, complete. Separate amplifier makes a home recorder. Will trade for manuals, equipment, or what have you—radio or otherwise? M. J. Mensinger, c/o Radio Dept., 4551 Sheridan Rd., Chicago, Ill.

CHANALYST, VOLTOHMYST FOR SALE—Going into other business and offer following in first class cond. for best cash offer: Rider Chanalyst; Senior Rider VoltOhmyst; Philco Model 050 Tube Tester; Philco 077 Signal Generator; Rider's Manuals Vols. 1 to 12. Farmon L. Newton, 2112 Picher St., Joplin, Mo.

ANALYZERS WANTED—Need Superior Channel Analyzer, and All-Meter (Jumbo) 6" meter in good condition. Also want Jackson Condenser Analyzer or similar apparatus. Dearth Radio Service, Augusta, O.

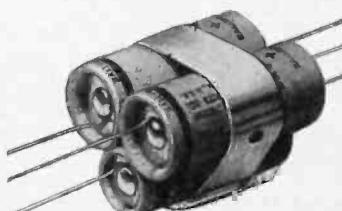
VOLTMETER FOR SALE—Weston Milli-Voltmeter, Model 45, 5" needle sweep, scale in 10's graduated 0-1000. Wood case. Make offer. Mauk's Radio Service, 717 S. Brady St., DuBois, Pa.

WANTED—What have you in the line of tubes, parts, shop equipment, and Rider's Manuals Nos. 7 to 13? Huntington Ave. Tire & Battery Service, 766 Huntington Ave., Boston, Mass.

WILL TRADE—Have plenty of used 26, 27, 24, and 01 tubes to trade for popular types—also 6 ohm rheostats for what have you? Colonial Radio Lab, 1714 Forest Ave., Dallas, Texas.

TUBES TO SWAP OR SELL—Have 40 farm style radio tubes; 19 to 34 and 1A4 to 1F7, most of them in original cartons. Would like e2zz or B & L 6x30 or 7x50 binoculars. Will pay cash difference or sell outright. Paul's Radio Service, 363 N. Canon Dr., Beverly Hills, Cal.

SPRADE—Sprague Atom Midget Dry Electrolytes are still available—and, with them, you can handle practically any condenser replacement up to their rated values. You can get Atoms in many single-section as well as multi-capacity values—and you can make up hard-to-get replacements by strapping individual Atoms together. Atoms are smaller, cheaper, and fully as reliable as the big, old-fashioned condensers they replace. Use them universally on all of your jobs!



THE CONDENSER YOU NEED . . . When You Need It!



SPRADE
PRODUCTS CO.

North Adams, Mass.

SPRADE CONDENSERS AND KOOLOHM RESISTORS

Obviously, Sprague cannot assume any responsibility, or guarantee goods, services, etc. which might be exchanged through the above advertisements.

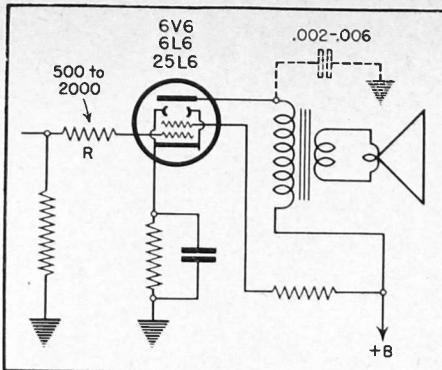


Fig. 4. The grid suppressor R and the capacity in dotted lines help to cure parasitic oscillations in power stages.

the oscillator frequency is restored to approximately its original frequency, increasing the signal strength and consequently again changing the output signal level at the detector-avc tube. Thus we see that a continuous cycle of tuning and detuning goes on through the avc network, without any attention from the operator.

These changes do not take place immediately. When the avc voltage is decreased, the condensers in the avc network hold their charge for a brief instant, usually about 1/10th to 1/20th of a second, so the effect of change is not evident until the condenser charge is reduced. Thus the time constant of the avc system really governs the speed at which these variations in avc voltage, and consequently of the oscillator frequency, take place. Since this time constant is within the audio range, this flutter becomes audible. This trouble may also occur at a rate determined by the plate supply filter circuit constants.

Eliminating "Flutter"

There are several ways by which this trouble may be corrected. The simplest is to increase the capacitance of the plate filter circuit, as

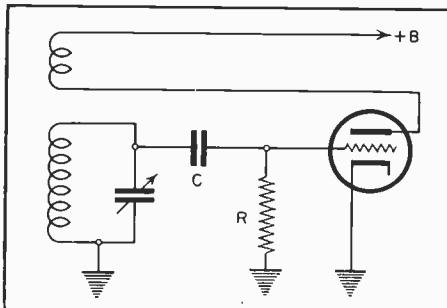


Fig. 5. In this oscillator circuit, if R is too high, audio modulation of the r-f oscillation results. A further increase in the resistance of R creates intermittent blocking or motorboating.

shown in Fig. 6. When the 15,000 ohm resistance and 8 mfd condenser are added, any flutter appearing in the oscillator plate circuit as a result of plate voltage variations is filtered out. The extra 0.1 mfd condenser shunting the 8-mfd electrolytic is to bypass radio frequencies — electrolytics are not much good as r-f bypasses.

A more sure-fire way of correcting this difficulty is to use a separate oscillator tube. When the oscillator is completely divorced from the converter, so that the latter serves merely as a mixer, best results are secured, particularly at high frequencies. Often this is impractical, however, because there is seldom room in the smaller sets for an additional tube. Then recourse may be had to one of the more modern converter tubes, such as the 7J7, 6K8, 6AS7, which are substantially free from this trouble. However, in some cases, a complete new oscillator cir-

However, in practice, it will be found pretty difficult to localize oscillation with the signal tracer in this manner. It is useful, however, to tune in the oscillation, note its frequency, and with the signal tuned in, remove and replace one tube after another until the oscillation ceases. Where the oscillation results from feedback over a large number of stages, this may be determined by starting at the antenna stage and removing and replacing each tube in turn. If removing the first tube stops oscillation, this will not prove that the first tube is oscillating, of course, but it will show that the stage in which this tube is used forms a part of the chain of stages through which the oscillation feeds. That is, some portion of this stage is picking up energy from a succeeding stage and feeding it back through the amplifying circuits.

Oscillation in an r-f or i-f stage is immediately evidenced in receivers

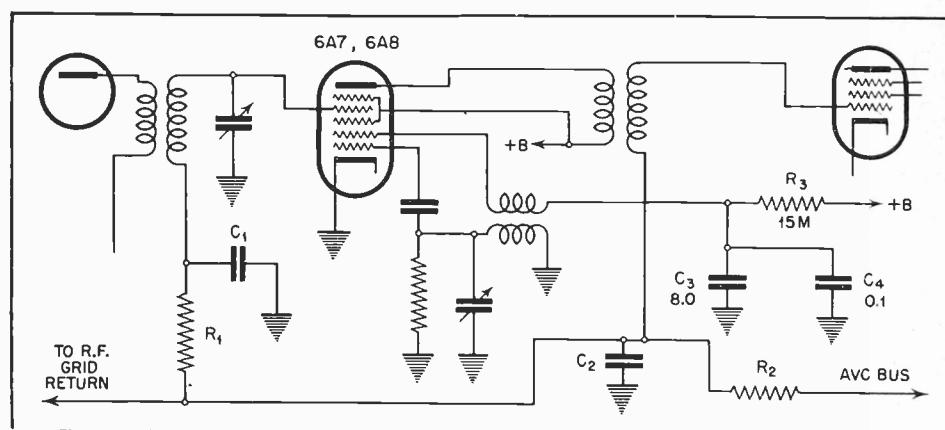


Fig. 6. A 15,000.ohm resistor, bypassed as shown and placed in series with the plate supply voltage to the oscillator section of the converter, is often effective in eliminating flutter.

cuit will be required — particularly when the 6SA7 is substituted, because this latter tube requires a Harley oscillator circuit.

In tracing oscillation by the signal-tracer method, the RF-IF channel is first tried, placing the probe near the receiver and tuning the channel over its range to locate the oscillation frequency. If not found, the oscillator channel is employed, which permits tuning up to 20 mc. Due to the lower sensitivity of the oscillator channel, the probe may have to be held rather close to the various circuits under test. Usually, however, when r-f oscillation exists, the output is sufficiently high to be detected without using the probe at all.

Theoretically, the source of the oscillation will be in that circuit in which the oscillation originates.

employing a tuning eye by complete closure and overlapping of the eye. The signal feeds through the r-f and i-f stages—or merely through the i-f stages if it originates in the latter—and actuates the avc network, just as a broadcast signal does.

In a-c/d-c receivers, where it is impractical to remove tubes to localize oscillation, an 0.1 mfd condenser may be connected, in turn, from grid to ground of each stage ahead of the detector, to render it inoperative and to localize the trouble. Once the trouble has been localized, tests and inspection of individual components in the stage or stages affected will show the cause, supplemented when necessary by a check of the wiring placement.

In audio stages, misleading results are sometimes obtained when an ef-

(Continued on page 29)



and RCA continues to lead it!

Two years is a long time in an industry as fast-moving as Electronics. Yet it has been almost that long since RCA Tube Distributors received a graphic demonstration of this field in RCA's now-famous presentation "Electronics on Parade." Long years before this, many of the Electronic developments now being heralded as "new" and "revolutionary" were a familiar story to RCA.

Remember: The *Magic Brain* of ANY Electronic equipment is an electron tube and, since the days when Radio itself was a scientific novelty, RCA has been the fountain-head of tube development. Wherever Electronics is already on the job, chances are, it has been RCA that led the way. Wherever Electronics will lead in the future, you can count on RCA to continue in the forefront of the parade!



RCA RADIO ELECTRONIC-TUBES

RCA Victor Division, **RADIO CORPORATION OF AMERICA**, Camden, N. J.

THE MULTIVIBRATOR FOR INTERMITTENTS

by H. F. Gulliver

THE Multivibrator, so well explained by Mr. John H. Potts in the November issue of RADIO SERVICE-DEALER, can be a very helpful instrument for use in locating intermittent receiver troubles. A suitable amplifier and multichannel output arrangement are all that need to be added. The average serviceman can

build the entire equipment in a few hours and may, by using the multivibrator, release his signal tracing equipment for other service work.

Fig. 1 shows the complete circuit with the compensated amplifier and five output channels added, each with level control and switch. The 6N7 tube operates as a multivibrator, and

the other two tubes are amplifiers, which have little gain at audio frequencies, but do have a gain at R.F. frequencies. Fig. 2 shows the simplicity of the panel and controls. Fig. 3 shows the voltages obtained from the multivibrator alone, and also from the output of the amplifier.

(Continued on page 12)

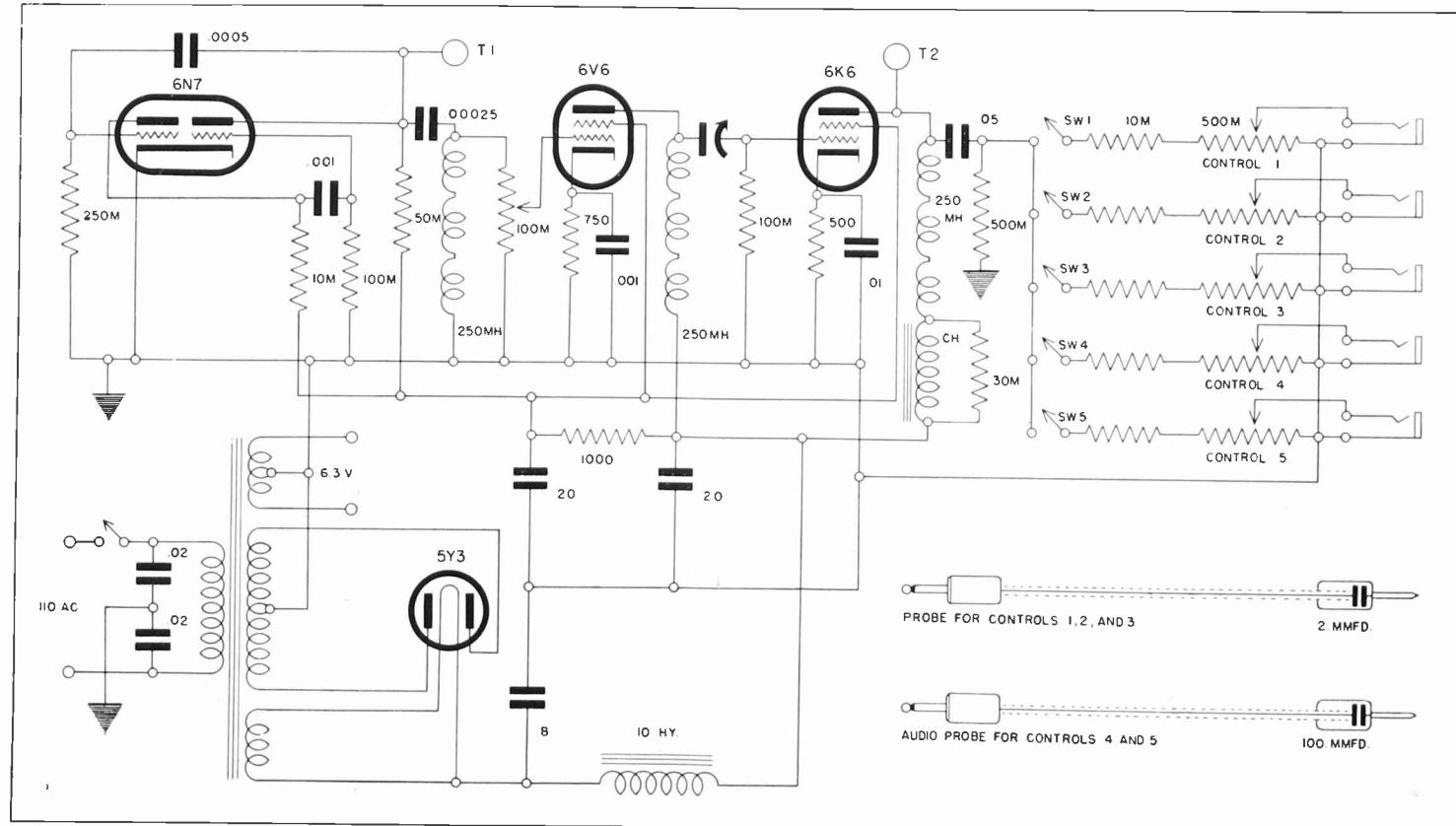


Fig. 1. The complete multivibrator circuit with compensated amplifier and 5 output channels, each having a level control and switch.



"Here's How"

VOLUME CONTROL *Contest*

Pays \$500⁰⁰ in WAR BONDS

Do you know how to make a sick radio sit up and sing? Would you swap a few minutes' time for a \$100 U. S. War Savings Bond? O.K. . . if you live within the boundaries of the United States—you're qualified. Not only one, but FIVE, \$100 Bonds are offered! Let's go!

Nobody knows better than you how important the radio is to a democracy at war. And nobody knows better how difficult it is sometimes to get a radio into working order . . . what with the difficulty of getting exact replacement parts, etc. The question is: HOW DO YOU DO IT? IRC is going to pay a \$100 Bond each for five answers. Don't you agree one of them might as well be delivered to YOU?

HOW TO WIN A BOND!

All that's required is a simple account, told in your own way, and your own words, describing:

How you were able to replace a volume control and get the set working satisfactorily—when you couldn't obtain the volume control you would ordinarily have considered necessary for that particular make and model of radio.

Name the make and model instrument you were working on. Tell what the VOLUME CONTROL trouble was. Describe exactly what you did and why, whether you made certain mechanical changes in the substitute control and/or electrical changes in the circuit.

IRC suspects that in these times radio service men are displaying more ingenuity and inventiveness and resourcefulness than most of us have any idea of. We'd like to uncover some of these stories.

It's the IDEA that Counts

Remember, no one expects you to submit a literary masterpiece. Your spelling makes no difference; grammar doesn't matter. Just "let yourself go" and tell us how you licked the volume control problem you faced (it may have been as simple as filing down a shaft, or making a special shaft), and send the story in.

You May ALREADY Have Won a Bond

What we mean is that some Volume Control job you've already done may be the one to cop one of those Bonds. It may be only a matter of putting down the detailed facts and mailing your entry!

IDEAS to be Shared

In entering this contest you have the satisfaction of knowing that worth-while ideas will be publicized for the entire service profession. You yourself will benefit from the information made available by the results of this contest. This exchange of ideas is certain to help you keep radio sets going, through the use of standardized controls. These same sets might otherwise be kept out of service and become lost jobs for you.

The Judges

Judges, whose decision will be final as to the five winning entries, include IRC's Chief Engineer, Jesse Marsten, and two "outside" experts—Joseph Kaufman, Director of Education of the National Radio Institute, and William Moulic, Service Editor of "Radio Retailing Today." If, in the opinion of the judges, winning ideas of equal merit are presented, duplicate awards will be made. It is understood, of course, that all ideas submitted become the property of IRC.

WHAT HAVE YOU GOT TO LOSE?

Don't say, "Aw, the Volume Control job I'm thinking of was too easy—any good radio man would have done the same as I did." Remember this: ANY job looks easy when you know the answer. . . . And besides, even if someone else did have the same idea, HE may not tell us about it. So get busy yourself—surely a crack at one of those \$100 Bonds is worth some trouble! All entries must be in IRC's hands by April 10, 1943 when contest closes.

FILL OUT THE COUPON

—and send it in with your entry this week—TODAY if possible. Don't put it off. Five men are going to be richer by a \$100 Bond—make one of them YOU!



Uncle Sam's Men, Too

If you're now in Government service, in or out of uniform, you're still eligible in this contest. Maybe the job you did was handled before you went into the service.

CLIP THIS—FILL IN—SEND IN WITH YOUR ENTRY

INTERNATIONAL RESISTANCE COMPANY

401 N. Broad St., Philadelphia, Penna.

RSD

- Gentlemen: Here is my entry in your \$500 U.S. War Savings Bonds Contest.

MY NAME _____

COMPANY _____

ADDRESS _____

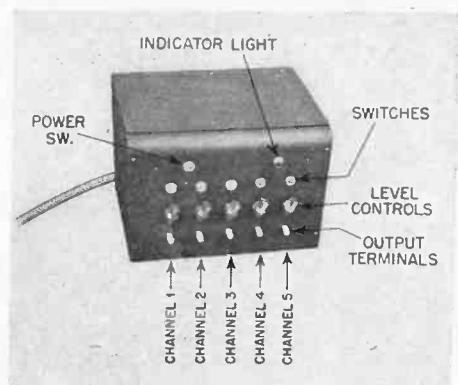
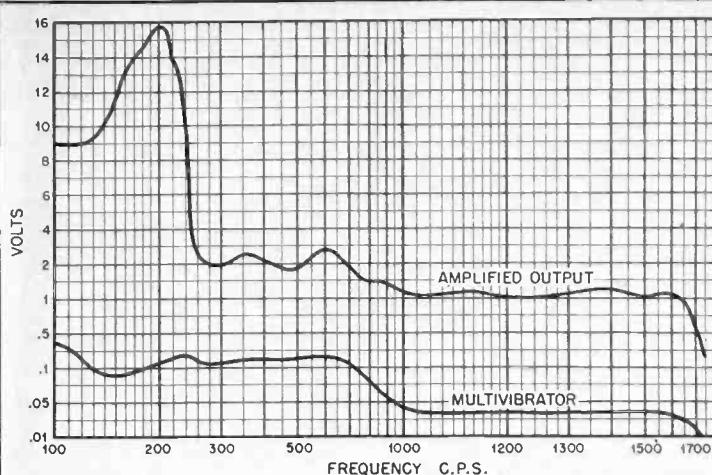
CITY. _____ STATE. _____

MY REGULAR DISTRIBUTOR IS _____

fier. These are measured at T_1 and T_2 respectively.

No tuning for frequency is necessary when using the multivibrator, since frequencies from audio to well below the broadcast band are all present. For best results, any voltage injected into a receiver should have a voltage equal to the normal signal voltage at the point of injection. The gain control on each channel permits the adjustment of the voltage to the correct value. It is also necessary to couple the input voltages very lightly, so that detuning effects will not be noticeable. For

Curves of voltages obtained from the multivibrator alone and from the output of the amplifier.



Showing the simplicity of the panel and controls of the shop-built multivibrator.

this reason, an amplifier is used to step up the multivibrator voltages. Then, very small coupling condensers may be used in the ends of the

test leads which are to be used on tuned circuits.

The multivibrator should have at least five outputs, and more may be added. In fact, several dozen outlets may be supplied from one amplified multivibrator.

How It Works

Here is how it operates: Connect Channel 1 to the antenna, No. 2 to the converter control grid, No. 3 to the I.F. Grid, No. 4 to the high side of the volume control and No. 5 to the output tube grid. (It will be observed that channels 4 and 5 have .0001 mfd. coupling condensers to provide more voltage for audio stages.) All terminals should be soldered on, so that the chassis may be bent or moved to promote the intermittent operation.

To put the device in operation, turn on the radio and multivibrator and switch on channel 1, the antenna channel. Set the volume control of the receiver at normal level. Adjust the gain control on channel 1 to some point which produces a normal volume of signal from the speaker. Turn off channel 1 and turn on channel 2. Adjust 2 to the same volume as 1. Compare them by switching on first one then the other. Never operate with more than one channel feeding into the receiver at a time. Set channels 3, 4 and 5 in the same manner, using 1 as the reference.

Now turn on channel 1 and let the set play until it cuts out. Now, turn off 1 and turn on 2, if no signal is heard go to 3 then 4 and so on until some channel does bring back the signal. When this channel is found, the general location of the trouble is known, and it may be possible to spot the 5 channel inputs near the trouble spot to further localize the trouble, if necessary. There is a minimum danger of accidentally starting the set before the trouble is localized, since only normal signal voltages are placed on each test spot. No terminals are attached after the set quits.

This type of apparatus seems to fill a definite need, and probably will come into favor with many servicemen who do not wish to tie up the signal tracers on intermittents. Like all types of tests for intermittents, this one is not suitable for *every* type of intermittent trouble. It will work effectively on any intermittent that cuts out or down, without going into oscillation, or getting noisy. It is good for locating audio distortion which creeps up after the set has been on for a while, and will isolate audio and R.F. distortion in some cases. This is possible since the character of the tone from the loud speaker is very similar whether it was introduced into the set as R.F., broadcast or audio frequency.



"This is Corporal Smith going on the air—correction—going in the air!"



INTELLIGIBILITY

Built to Civil Aeronautics Administration specifications, CAA-515, the Electro-Voice Model 7-A microphone is widely used for airport landing control and is highly suitable for many other sound pick-up applications.

The smooth frequency curve, rising with frequency, gives extremely high intelligibility even under adverse conditions. Desk mounting incorporates easily accessible switch which can be operated by thumb of either right or left hand. Microphone may be moved without danger of pressing this switch.

SPECIFICATIONS

SWITCH: Push-to-talk Acro-switch, SPDT, for relay operation; positive action; slight pressure required for actuation; 1/16" over-travel; connections terminate on terminal strip in base.

OUTPUT IMPEDANCE: 25 ohms.

CABLE: Eight feet, 4 conductor, shielded, overall rubber jacket, equipped with MC4M connector.

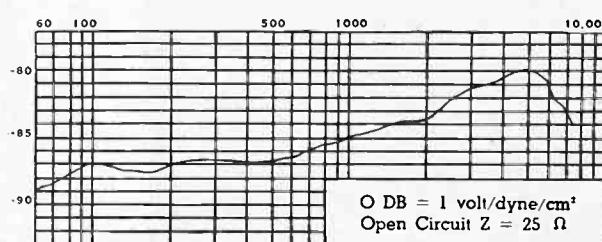
DISTORTION: Not exceeding 5% for sinusoidal sound waves from any direction from 100-4000 cps, up to 50 dynes/cm².

INSULATION: Leads from the moving coil are insulated from the microphone housing and stand, and are capable of withstanding 500 volts RMS, 60 cps.

STAND TUBE: Wear resistant, 1/8" XXM bakelite.

CORROSION RESISTANCE: The entire microphone is completely inhibited against corrosion and will successfully withstand a 20% salt spray atmosphere for 100 hours at 95° F.

NET WEIGHT: 3½ lbs.; Shipping wt.: 5 lbs.



This Model 7-A Desk Mounting Communication Microphone supersedes our previous Model S-7. Our Engineering Department may be able to assist you with your microphone problem. Electro-Voice Manufacturing Co., Inc., 1239 South Bend Avenue, South Bend, Indiana. Export Division: 100 Varick Street, New York, N. Y., U. S. A. — Cable Address: "Arlab"

Electro-Voice MICROPHONES

The Cause and Correction of INTERMITTENTS

Part 2

By H. F. Gulliver

In car sets and all sets subject to considerable vibration, much care should be taken to inspect all condensers suspended on long leads.

3. I-F AND R-F PLATE WINDINGS: Trouble here is usually easy to detect without any test equipment. The trouble in this area is almost always due to acid corrosion, which has eaten through the wire in one or more spots. After the open occurs, a small arc occurs between the ends, sealing the ends again, temporarily. This arc may short several turns together. In most cases this corroded area does not form a solid path and can be broken down by simply shorting the plate to ground, throwing a heavy surge of current through the suspected winding. In most cases the winding will open completely at once or there will be a considerable sound of static type noise from the loud speaker. If this surge results in a solid path being formed, it will probably be best to replace the transformer since the acid is still there and will eat through again. To check for shorted turns check the r-f voltage loss through the transformer.

This type of treatment has one advantage, no time is lost waiting for the set to cut out.

4. AUDIO TRANSFORMERS: Both interstage and outputs respond to the same treatment as r-f plate windings, and the cause of troubles is the same.

5. CONDENSERS—FILTER: Filter condensers are separated from papers since the construction is a little different and the chemicals used are very apt to create corrosion troubles not present in paper types. If you have ever taken apart an open dry electrolytic, you found that it was either dry as powder, or the lead was eaten off. When that lead

was being eaten through, it very likely was intermittent. When a filter condenser dries out the r-f resistance goes up and the set may go into oscillation, possibly intermittently at times. In both instances the hum goes up, either permanently or intermittently. If the hum is intermittent, the quality no doubt will suffer in most cases, but we still can not pin these symptoms down to just filter condensers, since intermittent hum may come from paper condensers, tubes or high resistance leakage in sockets, etc. However we can measure the a-c ripple voltage at the output screen terminal. This measurement is made when the set is humming, and made with a v.t.v.m. If the screen ripple exceeds .3 volt the filter is inadequate. Now, a condenser may be shunted across the individual sections. This shunting action will almost certainly temporarily cure an intermittent filter, but if the screen ripple has dropped we have the proof that it is the filter that is intermittent. There is one very rare exception to this test: i.e., when the filter choke has intermittently shorted turns, removing most of the inductance.

\$1.00 PAID FOR SHOP NOTES

Write up any "kinks" or "tricks-of-the-trade" in radio servicing that you have discovered. We will pay \$1 in Defense Stamps for such previously unpublished "SHOP NOTES" found acceptable. Send your data to "Shop Notes Editor," RADIO SERVICE-DEALER, 132 W. 43rd St., New York City. Unused manuscripts cannot be returned unless accompanied by stamped and addressed return envelope.

We feel that some reader may be thinking, "Why in blue blazes doesn't he just check the capacity of the filter sections first thing?" The answer: "Too many capacity checkers temporarily heal the intermittent filter when they are used. Then the set checks OK—goes home, and returns before long for a free job."

Another quick check for most electrolytics is to gently pull the leads, twist the terminals or lean the can over to one side, observing by meter or ear the variations in a-c ripple, if any.

6. CORRODED AND DIRTY WIPING AND FRICTION CONTACTS: These are old offenders, well known to most all servicemen. The list, to refresh your memory, includes antenna terminals, sockets, volume controls, short-wave switches, wipers on condenser gangs, push-button switches, local-distance switches, etc. Clean them with carbon tet and oil with Lub-Rex.

In this same category fall tube shields—held on by friction. If they are loose the least bit, they should be bonded with a wire soldered to shield and chassis.

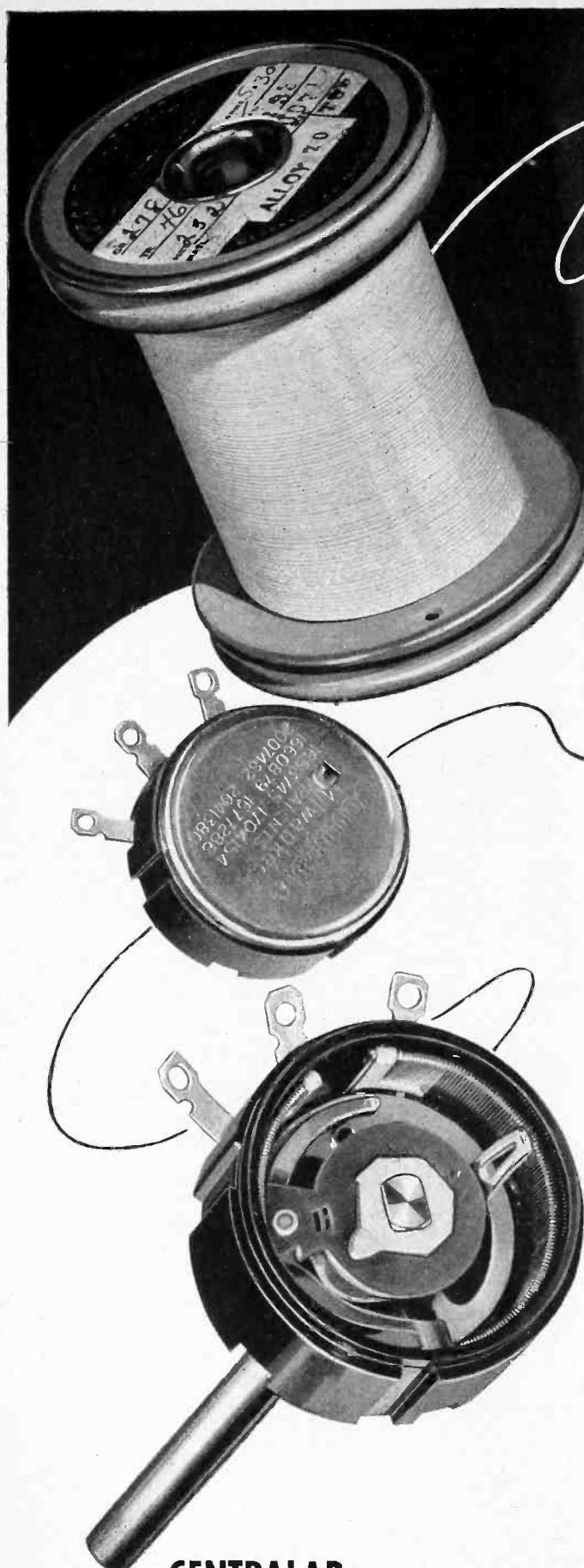
A few coil shields are held by friction and should be bonded or tightened.

By now you realize that we think it quickest and best to go over these places and make sure they cannot be intermittent, rather than wait to prove it is one of them that is.

Other Possible Intermittents

There is still one friction contact, or rather spring contact which makes no little trouble: Your old friend, the bias cell. Put in a new one or change it to cathode bias if it seems erratic.

7. SHRINKAGE OF FIBRE AND OTHER INSULATING MATERIALS



Wire Wound Radiohms by **Centralab**

Our Army, Navy and Air Force is using electronic equipment in which Centralab Wire Wound Radiohms play an important part.

Available in single or tandem type . . . with or without switch . . . for use as potentiometer or rheostat . . . in resistance values up to 10,000 ohms. Total rotation 300°. Switch type requires 40° for switch throw. Linear taper only . . . rated conservatively at 3 watts . . . temperature rise of 100 ohm unit is 28°C. at 3 watts, 40°C. at 4 watts . . . with load carried over total resistor.

CENTRALAB: DIV. OF GLOBE-UNION, INC., MILWAUKEE, WIS.



ALS (all of which we shall call fibre): (Also in the same class are the die cast metal parts which warp or expand with age) Any set over two years old may have this sort of trouble and we have seen a few newer sets in which the insulation has shrunk excessively. Among the places to look are: Volume controls, bleeder resistors, tuning gangs, sockets, trimmers, switches. Whenever a rivet was placed through fiber, and this same rivet was expected to hold tight some electric contact, you may expect trouble when the fiber lets the rivet loosen. This rivet may hold a tube shield base, or a lug for a filament or cathode ground—almost anything. Volume controls where the wire was wound on a fibre strip, or where the terminals were made in fibre may get intermittent, due to the loose contacts or wire element. Bleeders with terminals just riveted on are bad actors, if the rivet is through fibre. We are thinking of some old Atwater-Kent and Stewart-Warner sets that were very bad. Bleeders within a metal shell, with the wire wound in fibre, and the insulation from the metal provided by fibre or heavy paper are frequent offenders. Move the lugs a little, see if any noise results. Bolted terminal strips in power packs are bad actors.

Tuning gangs sometimes used a piece of heavy fibre to hold the stator plates, and this material shrank, letting the stator short against the rotor at times. Some trimmers used insulation that shrank and let the elements get out of line and loose, resulting in intermittent operation.

In all of the above troubles the riveting can be tightened, with a small hammer or it can be crimped with pliers, or best of all soldered.

8. FIELD COILS: These have usually two types of troubles—shorted or open windings. We are still speaking of intermittent troubles. Field coils intermittently open usually have acid-eaten breaks which have arced, and can be found like audio transformers with the same trouble. Shoot a jolt through them. Or an audio voltmeter can be connected across the winding to measure the noise resulting from such a break. A d-c voltmeter will often record varying voltage too. Shorting fields may be found with a d-c voltmeter.

9. MECHANICALLY LOOSE OR SHORTING WIRES AND SOLDER JOINTS: Most of these can be located by visual inspection, and by twisting the chassis. Car and portable radios which have parts

mounted on rubber, are very apt to have the leads to these parts broken inside the insulation. Test all such leads with a good, firm pull. They may come apart. Any connections made under bolts may become loose from vibration. If a wire is found which was never soldered, it's two to one you will find that the same fellow left another one or two off. Antennas, both car and home, being out in the weather and wind get intermittent and should be the first thing to suspect.

10. TUNING GANG TROUBLES: Metal particles in the plates, metal fuzz which seems to grow from the plates under certain conditions, loose plates in either the stator or rotor assembly, are a few of the troubles. Visual inspection usually will be adequate, but where that is not easy, try about 250 volts of d-c terminated with a .1 mfd. condenser, to apply voltage across the gang (unhooked of course) while it is rotated. Any foreign particles or shorts will show up with a flash. This same flash will burn up many small particles. Break down of the trimmer mica also shows up if present.

11. MISCELLANEOUS TROUBLES: And this could be book length if it were to cover every trouble that ever occurred up to now. So let's just mention some of the things we often see.

Low filament voltage in portables, plus a fluctuating line voltage is sure to produce intermittent operation, since the oscillator will cease when

the line voltage drops. Check the filament voltage across the oscillator with 120 volts on the line. It should be 1.4 volts if it is expected to hold up well enough at 100 to 110 volts. This trouble can be quickly located by dropping the line voltage to 105 volts. If the set won't function over the entire dial but will at higher line voltage, and if the oscillator tube checks OK, look for low filament voltage and raise it.

26 type tubes also cause the volume to fluctuate with line voltage, and there is not much to do about it either.

Mice—now probably none of your customers have mice in their homes (and neither you nor they would mention it if they did) but we will just mention that it is our experience that when a mouse gets down some vital part of a radio most anything is apt to happen, from total failure to intermittent operation or poor tone. About all you can do is look for the signs and check resistances to chassis. We could tell some stories about mice and radio troubles but probably the editor wouldn't print them, for we don't know any nice words which are suitably descriptive.

And when the little devils chew the wires loose in I-F's, take the insulation off the wires, and then remove the paper from the cone—well!

12. SPEAKER VOICE COILS and leads get intermittent. Both can usually be located by moving the
(Continued on page 23)



"Confound it Corporal, this is serious! You cut in just when they asked the \$64 question and you made me miss the answer!"

TECHNICAL SERVICE PORTFOLIO

SECTION XXVII

LOUDSPEAKER BAFFLES

ONE of the problems which faces all radio men as a result of war conditions is that of obtaining the best possible results from radios which are now in use. For it is no longer possible simply to sell a new and better radio to a critical customer and take in trade a receiver which is not giving the sort of reproduction that he demands. While there are methods of improving the audio-frequency response of practically any radio, none of these will be of much use unless the speaker itself performs at full efficiency. The ability of any loudspeaker to reproduce low frequencies depends, as we know, not only on the design of the speaker but also on the type of baffle with which it is used. And, it is often possible to connect a good speaker, with a suitable baffle, to an inexpensive midget receiver and obtain better reproduction than can be had from a large console receiver

with a similar speaker and an unsatisfactory baffle. Because a properly designed baffle will always improve reproduction, even from a relatively inexpensive loudspeaker, and because no critical war materials are required in the construction of such baffles, this article is devoted to a discussion of a large variety of baffles which make for improved reproduction.

Baffles

An ideal baffle would be about 14 feet square. If such a baffle were used, and the loudspeaker mounted at its center, the distance from the front of the speaker to the back would be 28 feet, and its cutoff frequency would be around 20 cycles. Such a device would be ideal for use in a ten-acre lot, but any serviceman who is able to convince a housewife that this size baffle is just the thing for her parlor is wasting his time in the radio business. The public wants radios which are nice to look at and of a size comparable to that of the average chair (we are considering only console radios, of course.)

The next best bet is to mount the speaker in one of the walls of the room, preferably near the ceiling or some unobstructed portion of the floor. If the opening for the speaker is covered with a loosely woven grille cloth this type of speaker installation is not at all unsightly. However, as most of us know, few people are willing to tolerate having the walls torn open for the sake of better radio reception, therefore, the aim in most

modern loudspeaker baffle designs is to approximate, in a relatively small space, the results secured with large and unwieldy but efficient baffles.

A loudspeaker functions by moving a body of air. When the speaker cone moves forward, it pushes and compresses somewhat the air in front of it. At the same instant the air behind the speaker cone becomes rarefied, as in a vacuum. Thus the motion of a loud speaker cone over one complete cycle is a combination of pushing forward of the air over one half of the cycle, during which the air to the rear of the speaker becomes rarefied and, over the other half of the cycle precisely the reverse action.

When these movements of the speaker are not interfered with, best reproduction results. The purpose of the baffle is to prevent the air which is pushed forward when the speaker cone moves in a forward

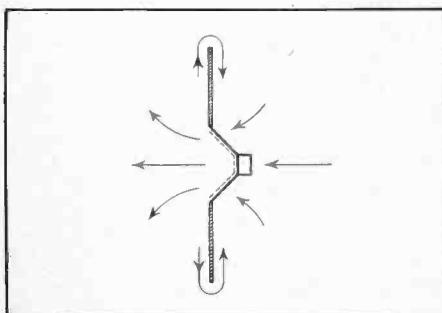


Fig. 1. The arrows show the direction of air movement when the speaker cone moves forward. The dotted lines show position which the speaker cone assumes.

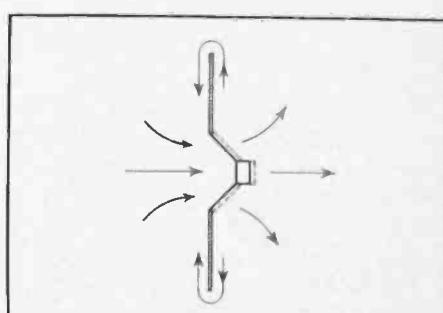
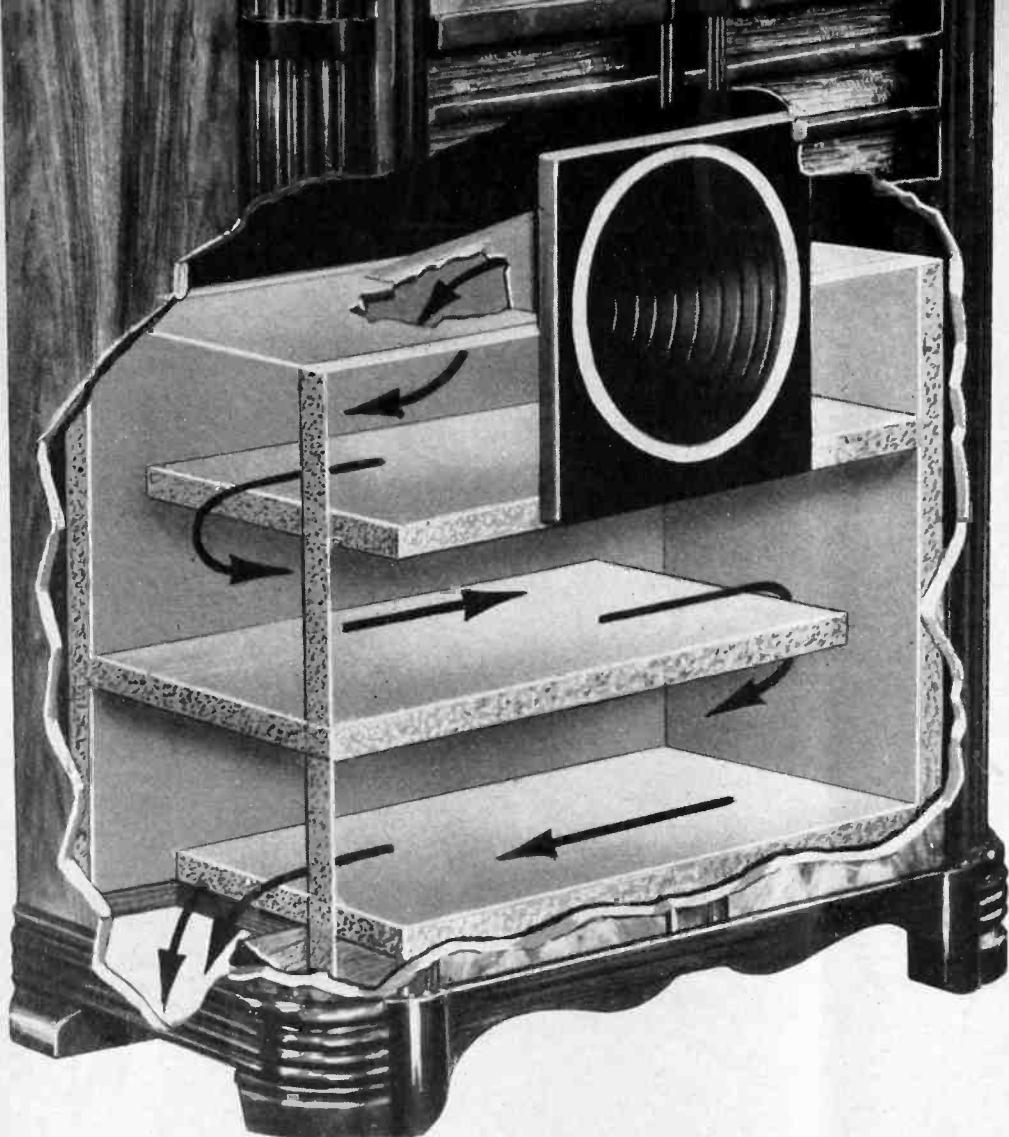


Fig. 2. This diagram is similar to Fig. 1 but shows the direction of the air movement over the half-cycle when the cone is moving in the opposite direction.



A cross-sectional photograph of the Stromberg-Carlson Labyrinth

direction from coming around the rear of the speaker and opposing the movement of the cone to the rear over the next half cycle. And of course the same interference can result when the speaker moves toward the rear and pushes back a column of air which interferes with the forward motion of the speaker. These forward and backward motions and the paths of the interfering air waves are shown in Fig. 1 and 2. The larger the baffle, the longer time it will take for waves to travel from the front of the speaker to the back, and vice versa.

Cut-off Frequencies

The velocity of sound is approximately 1126 feet per second at 68° F. Therefore a 1126-cycle sound wave will complete a single cycle in 1/1126th of a second, exactly the same time as it takes for the sound to travel one foot. During this cycle the sound wave, and also the loudspeaker cone, will be moving in one direction for one-half the cycle (from

the negative peak to the positive peak) and the speaker cone will consequently be pushing air in one direction for one-half the cycle. In this half cycle, the sound will travel 6 inches. And, if the distance from the front of the cone to the back of the cone is 6 inches, the sound wave from the front of the speaker will reach the back 180° out of phase with the back wave and thus will oppose completely the back wave. This is called the cutoff frequency. For any other frequency, cancellation will not be complete, but response at the lower frequencies will be progressively less and at higher frequencies greater than the cutoff. The cutoff frequency for any given baffle size may be determined from the formula

$$f = V/2D \text{ or } f = 1126/2D$$

D = distance from center of front of cone to center to back of cone

f = cutoff frequency in cycles per second

V = velocity of sound at 68° F.

A baffle usually has more than one

cutoff frequency. In fact, the only baffle which would have a single cutoff frequency is a circular one with the speaker at its center, because this is the only shape in which the distance from the front to the back of the baffle is the same no matter which path the sound travels. In a square baffle the distance along the diagonals will of course be greater than at any other point along the edge. In order to minimize the effect of the cutoff frequency, the speaker is frequently placed at some point other than the center of a square baffle, as shown in Fig. 3. When the speaker is so placed, a large number of paths of varying lengths is formed around the baffle for the sound waves. The result is that no sharply defined cutoff frequency occurs and the speaker response is thus made more uniform over the operating frequency range. In Fig. 4, an eccentrically shaped baffle is employed to emphasize this effect. The baffle shown in Fig. 5 is rather more practical to construct and serves the purpose.

The preceding discussion is rather theoretical, in that we are neglecting the fact that the loudspeaker and the baffle are not hanging in free air in an open space. When placed in an ordinary living room, an entirely new series of conditions is added which affects the speaker operation and the functioning of the baffle. For example, if the baffle stands in a corner of a room with one edge resting on the floor, then we find a large number of additional paths for the sound waves to be present. There will be reflection from the floor and the walls, absorption of the higher frequencies by rugs and hangings, and areas within the room where some frequencies are accentuated and others cancelled. In fact, we must always bear in mind that our pri-

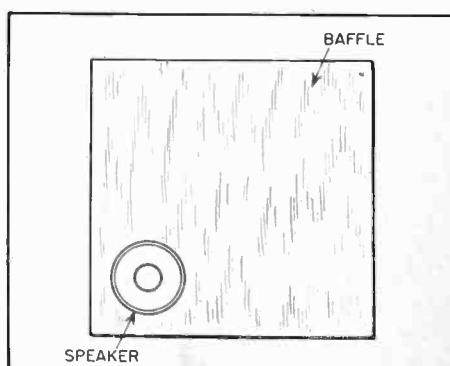


Fig. 3. By placing the speaker cone off-center in the baffle, more uniform response is obtained over a wide frequency range. This is especially the case when the speaker is used in large rooms or outdoors.

mary concern is not theoretical considerations of cutoff frequencies as such, but rather how the given speaker with its baffle is going to work in the room in which it must be used. Just how much difference where you stand in a given room makes as to the reception of a given frequency may be easily found by moving about a room while listening to a receiver in which considerable hum is present in the speaker output. You will find some places where the hum seems to be very loud; others where it is completely absent, due to cancellation effects similar to those mentioned in discussing the speaker baffles but resulting, in this case, from the direct and reflected paths of the radiated sounds in the room.

However, these considerations do not mean that we should neglect the fundamental theories concerning baffles which we have already discussed. No matter how much room conditions may alter reproduction, we will always find that a speaker in a good baffle will sound better than one in a poor one. One method of overcoming the cutoff frequency cancellation effects which we

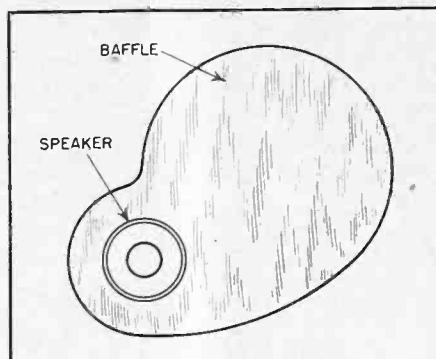


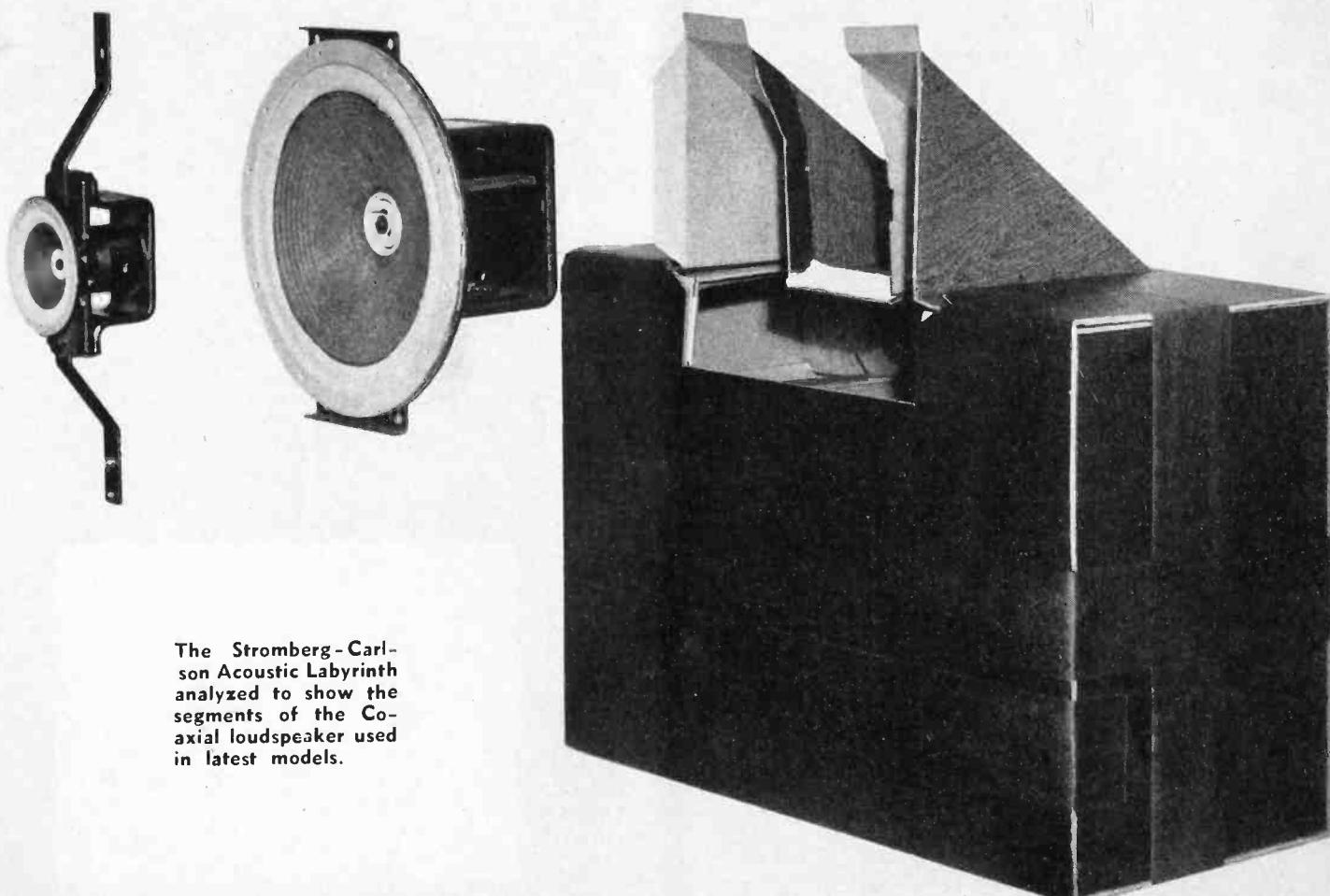
Fig. 4. This unusual shape accomplishes results similar to the baffle shown in Fig. 3, and does it more effectively because of the increased number of paths for the radiated sound wave.

have been talking about is to enclose the speaker in a wooden box lined with felt or some other sound-absorbent material. If there are no openings in this box there is no way for the sound from the front of the speaker to get around to the rear; thus this constitutes, in effect, a baffle of infinite size and is therefore called an infinite baffle. An example is shown in *Fig. 6*. If there were

no drawbacks to this type of baffle, there will be no need to search further for an alternative, because this is about the simplest way of avoiding cutoff frequency cancellation. However, unless the box is very large, the fact that it is air-tight tends to impede the movement of the cone in a manner similar to that which occurs when a stiff spider or similar center portion of a cone is employed. This causes a reduction in sensitivity and likewise affects the frequency response.

Overcoming Frequency Cancellation

A method of overcoming these faults is shown in Figs. 7 and 8, the Jensen Bass Reflex speaker and enclosure. In this enclosure a vent is provided directly beneath the speaker so that a path for the air to escape when compressed by the speaker movement is provided. This vent is so placed and so proportioned that the sound which issues from it is in phase with that which comes from the speaker itself, over a portion of the low frequency range, and



The Stromberg-Carlson Acoustic Labyrinth analyzed to show the segments of the Co-axial loudspeaker used in latest models.

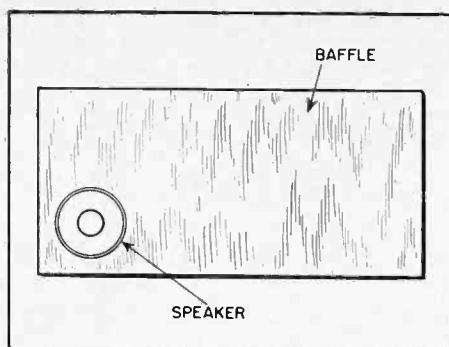


Fig. 5. The rectangular form of baffle, with the speaker off-center, is a most practical and effective arrangement for uniform response over a wide frequency range.

therefore serves to emphasize rather than to cancel the lower frequencies. In order to accomplish this effect the sound waves from the rear of the cone have to go through a sort of phase inversion. The advantages of this type of enclosure are an increase in low-frequency output, less distortion at low frequencies, and none of the added stiffness of cone diaphragm action, such as results when a baffle of the type shown in *Fig. 6* is used. The purpose of the felt blocks shown in *Fig. 7*, is to absorb the higher frequencies which do not undergo phase inversion and therefore are not wanted.

The baffle represented in *Fig. 9* shows the fundamental principle of the Stromberg-Carlson acoustic labyrinth. As shown, the path from front to rear of the speaker is lengthened by a series of interposed barriers. In the commercial model of this baffle, the top and back of the cabinet are closed off so that the only path for the radiated wave from the back of the speaker is through the labyrinth and out a vent in the bottom of the cabinet.

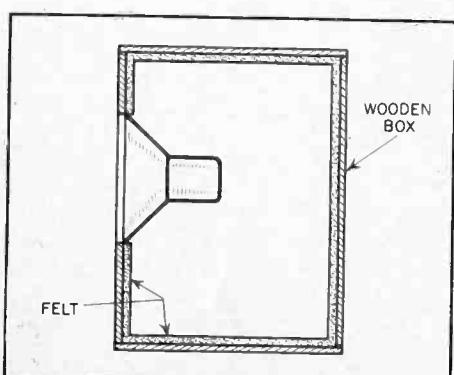


Fig. 6. This enclosure has been called an "infinite baffle" because there is no path from the front of the speaker to the rear for the sound wave to follow.

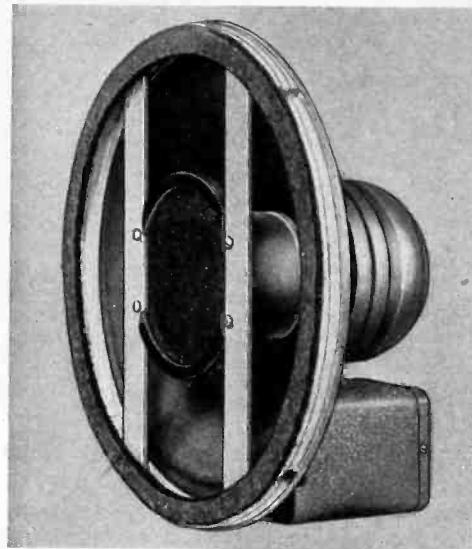
tom of the cabinet. The barriers of the labyrinth are lined with sound-absorbent material to prevent resonances and radiation of out-of-phase higher frequencies. The cabinets and barriers are so proportioned that its radiation is a maximum from the vent at the natural period of the speaker. Under this condition the objectionable peak which would otherwise result is reduced so that a more uniform response is obtained. At lower frequencies, the increased length of the sound path created by the labyrinth provides better response.

Another variation of the infinite baffle idea with vents is shown in *Fig. 10*. This type of baffle is known as the RCA Magic Voice. A number of tubes of varying length serve as outlets in a cabinet which otherwise completely encloses the speaker. These tubes are so designed that they serve to reinforce the speaker output in much the same manner as the bass reflex type and perhaps a little more effectively.

Still another type of baffle is the Columnaire model shown in *Fig. 11*. This baffle was employed in the Westinghouse and G. E. Grandfather Clock model radios some ten years ago but enjoyed only a short life. This baffle is simple in principle and should give good results when carefully made. We do not know why it is not more popular unless perhaps because it is hard for people to get used to having the sound come out the top of the radio rather than from the front. One drawback in this design is that extremely high frequencies, which travel in a straight line beam cannot directly reach the listener. Thus they are subject to greater attenuation than would otherwise occur in more conventional baffles.

Horn Type Baffles

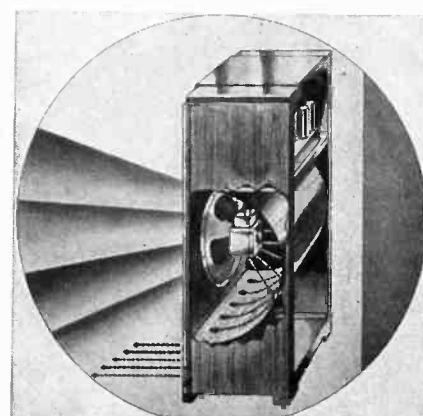
In many motion picture theatres and outdoor p.a. systems the horn type of baffle shown in *Fig. 12* is widely used. The dynamic speaker is enclosed completely by the padded box in much the same manner as the infinite baffles shown in *Fig. 6*. However, the speaker diaphragm works into the opening at the end of an exponential horn, rather than in free air as in all the other types shown. The result is a better impedance match between the speaker diaphragm and the sound radiating channel formed by the horn. In electrical systems a good impedance match results in better transfer of



The Cinaudagraph Cinaxial Speaker with a flat response curve from 45 to 10,000 c.p.s.

electrical energy than otherwise occurs. In acoustical systems the result is the same; there is better radiation of sound energy. The efficiency of this system is further improved by the fact that it is directional. In motion picture theatre installations one or more of these speakers may be used, directed at such angles as will afford best reproduction throughout the theaters. Often this results in the speakers being pointed toward the floor of aisles or toward the ceiling, rather than toward the audience. In outdoor work the horn is directed toward the audience in all cases.

The Diagram, *Fig. 13*, represents one of the most unusual baffles ever devised. So far as we know it has never been produced in commercial



Projected cross-sectional view of the RCA Magic Voice infinite baffle.



The Jensen Bass Reflex Speaker phases the sound as it is distributed.

quantities but models have been exhibited and demonstrated many times. For a time a more elaborate version of the speaker was in use in one of the largest and finest churches in the country. This speaker is known as the Wolf Resonator. As shown, the speaker is fastened to a baffle and inverted over a large enclosure which has been partly filled with water. The sound waves are directed toward the water and are conducted and reflected by it. A large vent at one end provides an

exit for the sound. This peculiar design is extremely effective in producing non-directional response. It is difficult, indeed, to tell just where the sound is coming from when it is installed in a large room or auditorium. Just what theoretical basis there is for the results is not altogether clear. But it works. Perhaps we should emphasize the fact that commercial models don't look exactly like the diagram we show, but the principle is the same. The larger units make use of many speakers mounted on a single large baffle.

Precautions

No matter what type of baffle is used, there are characteristics common to others. Certain precautions in construction must be observed. Thin wood is unsatisfactory for good baffles. Board at least $\frac{5}{8}$ to $\frac{3}{4}$ of an inch thick is desirable. Celotex may be used, but good results may be obtained from ordinary wood at less expense provided care is taken in the construction. The speaker must be firmly fastened to the baffle, making certain that the cardboard or felt rim around the speaker dishpan is in place between the speaker and the baffle. Each bolt should be supplied with two large flat washers, one to be placed under the head of the bolt and the other between the speaker and the lockwasher and nut which should hold each of the four points of the speaker to the baffle. Even when a thoroughly tight mounting is provided it will often be found after a few months that some loosening has taken place, causing metallic rattle.

Similar care must be taken to see that the baffle rests firmly on its supports, because the vibration transmitted by the baffle board will cause rattle at any loose junction to which it connects. This will be particularly evident at the resonant period of the baffle—one of the principal reasons why a large thick board (with a resultant very low resonant frequency) is desirable.

In many cases it will be found possible to mount the speaker in a closet door, and often this works out very well. Usually the better way to do this is first to mount the speaker on a small baffle of Celotex or similar sound-absorbent composition and then to fasten this baffle, with the speaker in place, over a hole in the closet door. It is advantageous to have clothes in the closet when the speaker is in operation—they tend to

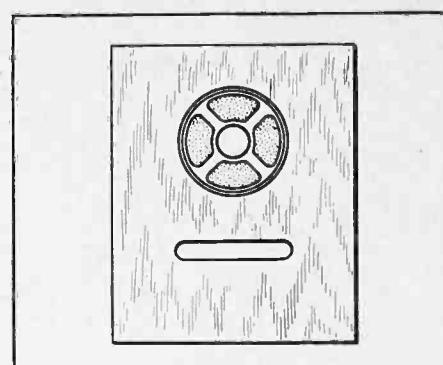


Fig. 8. Back view of the bass reflex speaker, with the back cover removed.

dampen the high frequencies radiated from the rear of the speaker and improve reproduction.

If a baffle of the enclosed type is constructed, make certain that the top, sides, front and back are firmly joined. This can be satisfactorily accomplished only if long screws are used in the assembly—nails just won't do. To cover the opening of a baffle use monk's cloth or brown burlap, which are not hard to obtain. The latter is most suitable for covering the front of speakers, the former for deadening sound reflections in rooms. If burlap is used, it should be stretched tightly over the opening. This opens the weave and allows more free passage of sound waves. It is also possible to use a decorative silk cover provided it is fastened loosely over the speaker opening. Ordinary speaker grille cloth is ideal from an acoustic viewpoint, but is none too decorative from an esthetic angle.

Eliminating Residual Hum

When planning to add a better

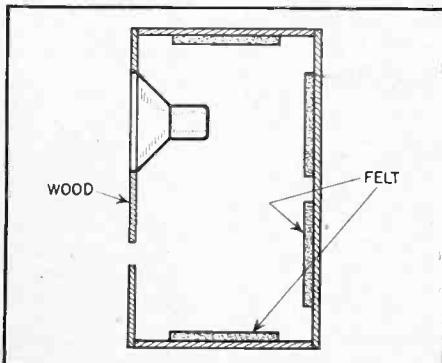


Fig. 7. Side sectional view of the bass reflex type of baffle. A vent beneath the speaker relieves the air pressure within the enclosure.

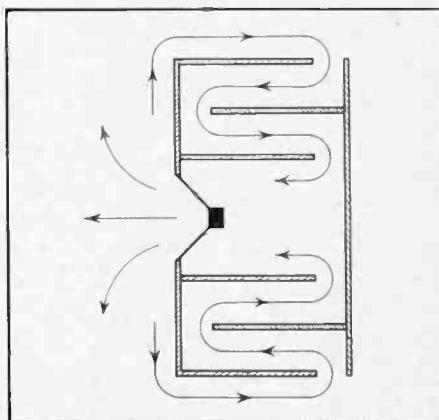


Fig. 9. The fundamental principle of the acoustic labyrinth is shown here.

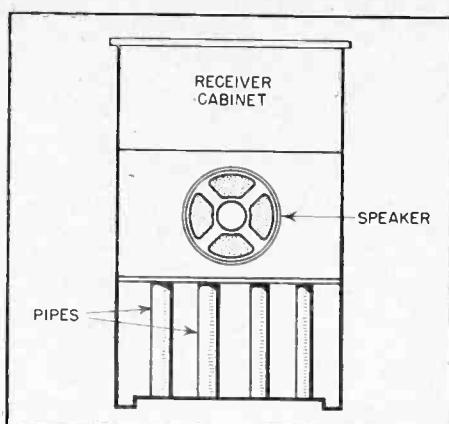


Fig. 10. The RCA Magic Voice type of cabinet uses pipes of varying sizes to produce better frequency response from the speaker.

baffle to an existing speaker; when the chassis is of the midget variety, remember that it is the custom never to use any more filter capacity than is necessary to render the hum reproduction unobjectionable. As a result, when we improve the speaker response by using a better baffle, we find that not only have low frequency musical tones been brought to life but also a wholly unsuspected amount of residual hum. Usually this can be quite simply corrected by adding one or two eight-mike electrolytics to the power supply filter network, but, in any event, don't forget to take this contingency into consideration when figuring on such a job.

To reproduce low frequencies well requires considerable power, particularly if the room in which the speaker is installed is large. The

lower the frequency, the greater the movement of the speaker cone—and to move this cone takes electrical power. The output tubes—push-pull is preferable—should be capable of delivering at least five watts power for even passable low-frequency reproduction, even though the average power used will be considerably less than this. Otherwise distortion will be evident on sudden low-frequency peaks. To utilize this power efficiently, and without overloading, the speaker itself must be good and husky—a twelve to eighteen inch cone, with a proportionately large voice coil, is best for low-frequency reproduction.

For high frequencies, the large, heavy voice coil of the big speaker is none too good. For this reason, a small speaker, with a small, light voice coil which can respond without appreciable lag to the highest audible

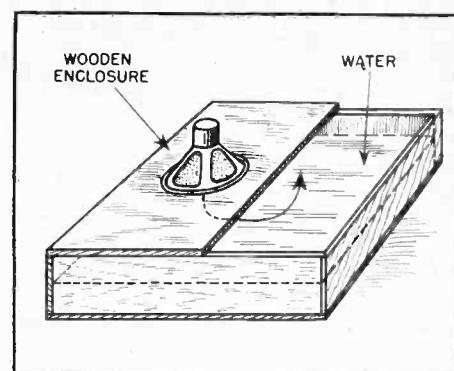


Fig. 13. The Wolf Resonator is most unusual in design but very effective in producing non-directional response.

of the low-frequency speaker by wedging inserts between the voice coil and pole piece so the speaker is inoperative. Then try various values of coupling capacity to the high-frequency speaker and note the output. Don't use more capacity than necessary to give appreciable high-frequency output.

Phasing

Speakers mounted on the same baffle should be phased. This is done by connecting a $1\frac{1}{2}$ -volt battery across the voice coil of one speaker and noting whether the voice coil moves in or out when the battery circuit is closed. Then the battery is similarly connected to the second speaker, making certain that the same polarity of the battery is maintained. The voice coil should then move in the same direction. If not, the voice coil leads to one of the speakers should be reversed where they connect to the output transformer secondary. Phasing is not so important when capacity coupling, as

(Continued on page 28)

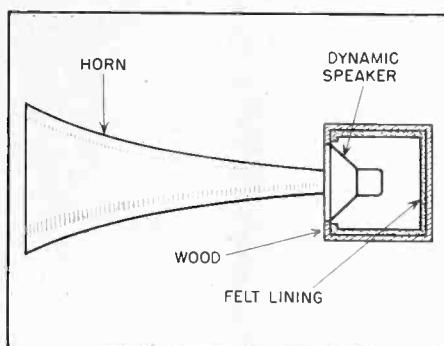


Fig. 12. Many theatres and p.a. speakers are mounted in a combination of infinite baffle and horn. The directional effect improves efficiency.

frequencies is desirable. Both the low and high-frequency speakers should be mounted on the same baffle, close together and with the high-frequency speaker preferably above the low frequency one. If the receiver is not already equipped to supply energy to the high-frequency speaker, the output tube may be coupled to the speaker transformer by means of a small condenser, one terminal of which should connect to the output power tube plate—just one plate if push-pull tubes are used—and the other terminal to the primary of the high-frequency speaker output transformer. The other terminal of the speaker transformer may connect to ground or B plus, whichever is most convenient. The capacity of the coupling condenser so used should usually be of the order of .001 to .01 mfd. To select the proper value, block the cone

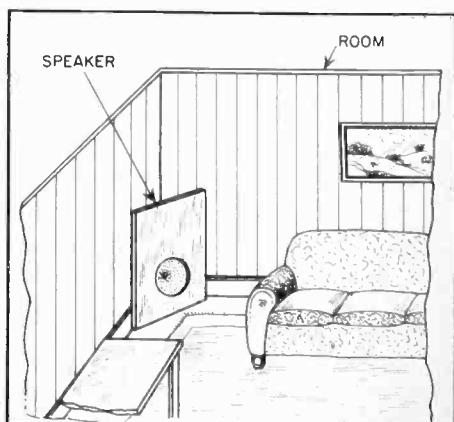


Fig. 14. When the baffle or console radio is installed in a corner of the room, best results are obtained.

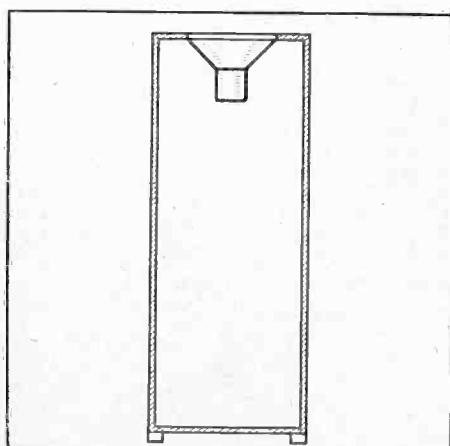


Fig. 11. The Columnaire concentrates the equivalent of a large baffle in a unit which requires a minimum of floor space.

"Intermittents"

(Continued from page 16)

cone in and out when the set is playing. At some place the tone is apt to get ragged, or the set stop completely. Replace the voice coil leads if they are at fault, and if the trouble is in the voice-coil winding itself, it surely will be just at the start or finish turns or leads to the flexible cone leads. Most of those may be repaired—or a new cone installed.

There is also the possibility of a metal chip in the voice-coil slot, which is shorting the coil to ground (one side of the coil being grounded permanently).

13. *TRIMMERS*: Wax in any trimmers can cause a great deal of trouble, since the amount of wax will vary every time the set warms up and the wax melts. The wax, having a different dielectric constant than air, detunes the circuit. If the trimmer is adjusted cold it will be off again as soon as it gets warm, and if it is readjusted warm it will be off as soon as it cools. The only remedy is to remove the wax and fix it so no more wax can get in the trimmer. We find that by packing some cleansing tissue just back of the trimmer, the wax will be absorbed before it can get to the trimmer.

14. *ERRATIC CAR RADIO VIBRATORS* are responsible for many intermittent car radios. A nearly worn out vibrator produces an erratic drain from the car battery, indicated on an ammeter, or the positive high voltage may be checked for stability. Try a new one, then if everything is lovely and the buffer condenser is good, your troubles are probably over. It's a pretty good idea to look and see if the old vibrator just has some leads broken.

15. *WATER-LOGGED OSCILLATOR COILS* are easily located by checking either the r-f voltage across the tuned circuit, with the v.t.v.m., or by checking the grid-leak d-c voltage, with v.t.v.m. Low or unstable voltages indicate some oscillator trouble, and if everything else seems OK, substitute a new coil and measure again. It is usually not necessary to wait for these oscillators to cut out since low voltages are positive indications of erratic operation. In a few cases, increased oscillation may be obtained by increasing the feedback voltage, but



Here—there—everywhere Ken-Rad is in the service Directing the courses of our warships keeping our precious merchantmen informed discovering hidden enemies sighting and firing guns Yes Ken-Rad tubes are in service—on and under the seas—in the air—smashing along with the tanks everywhere—the heart of communications • You may have to wait a while But Ken-Rad will be back with you again—even better than before Our armed forces come first now You understand . . .

KEN-RAD

RADIO TUBES • INCANDESCENT LAMPS • TRANSMITTING TUBES

OWENS BORO • KENTUCKY

this may lead to too vigorous oscillation if the coil ever gets dried out. Most positive cure is to use a new coil. In a few cases, such as 15 tubes, 36 tubes, etc., the oscillation may be stepped up by decreasing the cathode resistance about 50%. These circuits are first detectors and oscillators combined.

Last but not least is the rubber insulated wire in some sets. This oxidizes, gets either hard and cracks off, or with a little heat gets soft as putty and shorts to anything it may be pulled against. Replace it all the

first time trouble occurs.

This discussion of intermittent troubles has run almost entirely to routine and quick checks of common troubles, with a minimum of elaborate equipment being used. Next month the author promises to go into the search for those elusive troubles, using any and all equipment available in the best of shops. All procedures described, now and later, have been used for a considerable time and with good results. They are not plain theory.

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TENTATIVE WPB "VICTORY" LINE

of Replacement Tubes and Parts

THE WPB program for production of civilian replacement tubes and parts is nearing completion by Chief Frank H. McIntosh and staff of the Domestic and Foreign Radio Section, WPB Radio and Radar Division.

There will be tubes of the types largely needed for maintenance and repair of radios in public use. The tube program will be authorized first, because of the present shortage and also the time-lag in production, with a proposed authorized program of about eleven million tubes during the first quarter of 1943 (We hope, Editor.) The WPB order is now being drafted to assign production quotas to various tube manufacturers, covering about 117 proposed types, but production of other important types will also be authorized, within a range of a total probably of 150 types.

The WPB "Victory" replacement and repair program contemplates a requirement for purchasers to turn in a used tube when securing a new tube, and also all possible repair of replacement parts. Also contemplated is a new procedure for distribution of replacement tubes and parts through distributors and service-dealers to dispense with PD-1X applications of distributors. The replacement components will bear a "Victory" label, but manufacturers will be permitted to imprint their own identification numeral symbols.

Radio set owners probably will be required to turn in an old tube or part when buying a new one, but there will be a simplified system for the trade to secure new replacement components from manufacturers. A limitation or "L" order will restrict future replacement parts production to the "Victory" types of authorized parts, but there will not be such rigid restriction of tube types.

Following are the tentative WPB lists of 117 tube types, and also of parts types which have thus far been completed:

Tentative List of 117 TUBE TYPES AS BEING CONSIDERED BY WPB

Type	Type	Type
0Z4G	6K6GT/G	14A7/12B7
1A5GT/G	6K7GT	24A
1A7GT/G	6K8GT	25L6GT/G
1C5GT/G	6L6G	25Z5
1H5GT	6L7G	25Z6GT/G
1LA4	6N7GT/G	26
1LB4	6Q7GT	27
1LC6	6R7GT	30
1LD5	6SA7GT/G	34
1LE3	6SC7GT	35/51
1LH4	6SD7GT	35A5
1LN5	6SJ7GT	35L6GT/G
1N5GT	6SK7GT/G	35Z3
1P5GT	6SQ7GT/G	35Z5GT/G
1Q5GT/G	6U5/6G5	36
1T5GT	6V6GT/G	37
1V	6X5GT	38
2A3	7A4	39/44
2A5	7A6	41
3Q5GT/G	7A8	42
5U4G	7B5	43
5V4G	7B7	45
5X4G	7C5	47
5Y3GT/G	7C6	50L6GT
5Y4G	7C7	50Y6GT
5Z3	7F7	56
6A7	7H7	57
6A8GT	7J7	58
6B7	7N7	70L7GT
6B8G	7V7	71A
6C5GT/G	7Y4	75
6C8G	12A8GT	76
6F5GT	12J5GT	77
6F6GT/G	12K7GT	78
6F8G	12Q7GT	80
6H6GT/G	12SA7GT/G	83
6J5GT/G	12SJ7GT	84/6Z4
6J7GT	12SK7GT/G	117L7/M7GT
6K5GT	12SQ7GT/G	117Z6GT/G

Here is a list of the tentatively proposed types of "Victory Parts" as revised January 22nd, 1943, by the American Standards Association. We urge our readers to examine these lists and advise us (send your recommendations to Mr. S. R. Cowan, publisher of RADIO SERVICE-DEALER) whether or not you deem modifica-

tions, deletions or additions to the proposals are advisable.

In considering the list of capacitors, particular attention should be paid to their adequacy for servicing vibrator power supplies for farm type battery receivers.

It is realized that volume controls other than those listed may be needed for certain receivers manufactured in large quantities. In requesting the addition of any such special controls will you please describe the type of circuit in which they are used, since, in some cases involving tone compensation, a listed control may be used if the tone control feature is omitted and replaced by fixed resistors.

The coils listed are necessarily limited because of the specialized designs necessary in many receivers.

Tentative List of "VICTORY" REPLACEMENT PARTS AS BEING CONSIDERED BY WPB

Dry Electrolytic Condensers	CAP. MFD.*	RATED VOLTAGE
	100	25 volts
	10-10	50 "
	20	150 "
	20-20	150 "
	40-40	250 "
	10	450 "
	10-10	450 "
	40	450 "

* Dual units to have separate sections

Paper Tubular Condensers

CAP. MFD.	RATED VOLTAGE
.00025	600 volts
.002	600 "
.005	600 "
.01	600 "
.02	600 "
.05	600 "
.1	600 "

Transformers, Chokes, Coils

Primary Windings—Units for domestic service to have 117 volt primary. All units to be designed for 50-60 cycle service.

Standard Units			High Voltage Winding Rating			Filament Windings (all center tapped)		
Transformer	Volts	Milliamperes	Volts	No. 1 Rating Amperes	No. 2 Rating Amperes	Volts	No. 3 Rating Amperes	
A	325-0-325	70	2.5	9.0	5.0	3.0	—	3.0
B	325-0-325	120	2.5	12.5	2.5	3.5	—	—
C	210-0-210	50	6.3	2.0	5.0	2.0	—	—
D	300-0-300	70	6.3	3.0	5.0	3.0	—	—
E	300-0-300	120	6.3	5.0	5.0	3.0	—	—
F	350-0-350	200	6.3	6.0	5.0	3.0	—	—

Tentative List of VICTORY PARTS

(Continued from previous page)

Audio

1. Interstage.

- a. 3:1 ratio small transformer with 10 ma d-c maximum primary current.
- b. Universal with 1:1, 3:1, 6:1 ratios possible. 10 ma d-c maximum primary current. Mounting space about 2-3/8 in. high x 2-7/8 in. wide x 2-3/8 in. deep, 2-3/8 in. mounting center.
- 2. Driver. Universal type with 1:1, 1.5:1 or 6:1 ratios possible. 35 ma d-c maximum primary current. Mounting space about 2 in. high x 3-1/8 in. wide x 1-7/8 in. deep, 2-13/16 in. mounting center.
- 3. Output. (All universal types, tube to voice coil)
 - a. 4 watts maximum audio power. 50 ma d-c maximum primary current. Mounting space about 1-5/16 in. high x 2-3/8 in. wide x 1-1/16 in. deep. 2500 to 15000 ohms primary impedance to 2, 4, 6, 8 and 15 ohm voice coils.
 - b. 8 watts maximum audio power. 70 ma d-c maximum primary current. Mounting space about 1-9/16 in. high x 2-7/8 in. wide x 1-5/8 in. deep. 2500 to 13000 ohms primary impedance to 4, 6, 8 and 15 ohm voice coils.
 - c. 15 watts maximum audio power. 90 ma d-c maximum primary current. 2500 to 13000 ohms primary impedance to 4, 6, 8 and 15 ohm voice coils.

Note: All windings to terminate in 3 inch wire leads except voice coil windings, which will have terminal lugs. Power transformers to be core and coil construction. Universal mounting brackets to be available as separate item. Audio transformers and choke to be open channel frame construction.

Chokes

- 1. 6 Henries. at 50 ma maximum d-c, 300 ohms resistance.
 - 2. 15.0 Henries. at 120 ma maximum d-c, 350 ohms resistance.
- (It is felt smaller chokes can best be replaced with the least use of critical materials through substituting resistors and increasing the size of the filter capacitors.)

Coils

Antenna and R-F Coils.

Compact universal type coils with adjustable iron core and without shield cans to be available.

I-F Transformers.

- 1. 456 kc, cartwheel type, with trimmer
- 2. 175 kc, standard type in shield, 1-1/4 sq. by 2-1/2 high
- 3. 262 kc, standard type in shield, 1-1/4 sq. by 2-1/2 high
- 4. 456 kc, standard type in shield, 1-1/4 sq. by 2-1/2 high

Slipover Primaries.

Units with following O.D.'s to be available:
1/2 in.; 3/4 in.; 7/8 in.; 1 in.; 1-1/4 in.

Oscillator Coils.

Unshielded adjustable iron core coil with inductance of approximately 90 to 220 microhenries to be available, so as to be suitable for all i-f frequencies from 175 to 470 kc with usual tuning capacitors.

Volume Controls

Untapped Composition Type.

Resistance	Taper
10 M ohms	reverse
25 M "	reverse
250 M "	audio
500 M "	audio
1 Meg	audio
2 Meg	audio

Tapped Composition Type.

Overall Resistance	Tapped Resistance
500 M ohms	150 M ohms
1 Meg.	300 M "
2 Meg.	15 M and 500 M ohms
2.25 Meg.	500 M and 1 Meg.

Wirewound.

Resistance	Taper
10,000 ohms	linear

Notes: Controls to be furnished with fixed 1/4 inch steel shaft with .156 inch flat or with fixed shaft of split, knurled type. Shaft length 3-1/8 inch beyond 3/8-32 bushing, 3/8 inch long. Controls to be of "midget" or "junior" type, approximately 1-1/8 inch in diameter. No nuts, washers, ground terminals or bias resistors are to be furnished with controls. All controls to be suitable for use with adaptable switches.

Volume Control Switches.

Single pole, single throw
Double pole, single throw
Single pole, double throw
4 pole, single throw, shorting

Note: Switches to be of adaptable type and have U.L. rating of not less than 1 amp, 250 v and 3 amps, 125 v.

Resistor Type Line Cords

180 ohms
350 ohms
600 ohms

POST WAR PLANNING BEGINS

»» The Sales Managers Club, Western Group, is the first organization in the radio industry to become actively interested in post-war planning. At the regular meeting held January 12, 1943, Dr. Louis Wirth, Professor and Assistant Dean of the Sociology Division, Department of Sciences, of the University of Chicago, and Chairman of Region No. 4 of the National Resources Planning Board, talked on post-war problems as they affect industry generally and the radio industry in particular.

Dr. Wirth analyzed the radio parts industry as one which was interdependent and not self-sufficient; essentially a "young industry." As a result of its dependency the industry members must, in order to determine its post-war program, look to other branches which deal more directly with the consumer market.

In the judgment of Dr. Wirth, the first step in post-war planning is to determine and agree upon objectives that would give society the benefits of modern mass production, employers the

benefit of the retention of the maximum number of employees, and to the employees themselves, high standards of living by virtue of higher rates in pay so that they can purchase the products manufactured.

Dr. Wirth's inspiring talk convinced the members of the Sales Managers Club that planning now for the post-war will prevent an economic chaos. His suggestion will be followed.

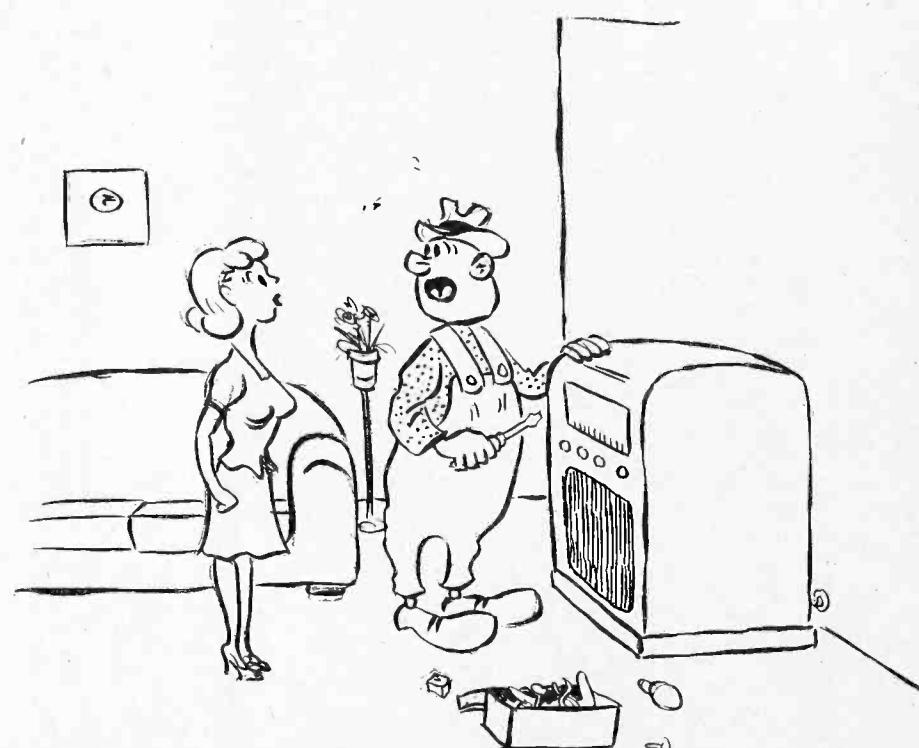


CLAROSTAT RECEIVES "E"

»» The Army-Navy "E" for excellence in production was awarded Clarostat Mfg. Co., Inc., Brooklyn, N. Y., on Nov. 13th with impressive ceremonies held in the Grand Ballroom of the St. George Hotel, followed by a dinner and entertainment for several hundred honored guests, officials and employees.

The organization is supplying components mainly to the Air Force, and many Clarostat products are standard equipment in our fighting planes, especially giant bombers such as those which bombed Tokyo.

The presentation was made by Major H. R. Battley, Regional Press Relations Officer of the U. S. Army Air Force. The award was accepted by John J. Mucher, president of the company, while the "E" emblem pins, presented by Lt. T. W. Dewart, USN, for each worker, were accepted by Samuel Nastri, speaking for the employees.



"There's nothing wrong with this set, Lady! It just quit because it got fed-up with a lot of speakers who keep promising that 'soon replacement radio parts and tubes will be available for civilians again'!"

Shop Notes

Data presented as "Shop Notes", contributed by service-dealers as a result of practical experience, is carefully considered before acceptance. We believe it correct but we assume no responsibility as to results.

Card 1

PILOT LIGHT BULBS

(Substitution Methods)

To substitute a 12.6 volt .15 amp. bulb for a 6.3 volt .3 amp. bulb shunt the 12.6 volt heater with an 84 ohm 8 watt resistor and cut out 21 ohms of line cord or ballast resistor.

To substitute a 35 volt .15 amp. bulb for a 50 volt .15 amp bulb (35L6 for a 50L6) insert a 100 ohm 3.5 watt resistor in series with heater string.

Submitted by L. H. McMurray

R.M.A. STANDARD COLOR CODE FOR TRANSFORMERS

Card 3

Primary	{ Start	Black
	{ Tap	Black & Yellow
	{ Finish	Black & Red
Rectifier Plate	{ Start	Red
	{ Tap	Red & Yellow
	{ Finish	Red
Rectifier Filament	{ Start	Yellow
	{ Finish	Yellow
Amplifier Filament	{ Start	Green
	{ Finish	Green

NOTE: When original transformer is employed in a half-wave circuit (rectifier plate winding not tapped) simply tape up un-used lead (red and yellow) on substitute.

ZENITH 6D2615

(Eliminating Hum)

When there is a bad hum on stations yet the receiver operates in otherwise normal manner, the complaint can be corrected as follows:

The cause is usually rosin on the connection of control grid wire of first tube where it connects to the terminal common to loop and tuning condenser. The loop tuned perfectly but the only transfer of energy to the tube was through the high capacity of the rosin. To remedy, simply resolder the connection, get rid of the solder excess.

Submitted by H. F. Gulliver

INTERMITTENT TUBES

Card 7

In the last year or two a great many intermittent sets have been traced to defective contact in tube grid caps. It is not always necessary to replace the tube, and under present conditions that is not desirable if repair can be effected.

These intermittent tubes can be found by placing the set in operation, and then tapping the grid cap with a plastic handle tool. Do not use fibre rods for this purpose, as they are sufficiently conductive to cause a pop in the set, which may not be due to a bad cap.

Hold the tube upside down and drain off all solder with the iron. Scrape the connecting wire which comes up through the hole in the cap until it will tin thoroughly. Use paste flux and solder grid cap on again.

Submitted by R. W. Cutts

6F6 — 6K6 — 6V6 G/GT

(Substitution Method)

To substitute a 6V6 g/GT tube for a 6F6 or 6K6 shunt the original 410 ohm bias resistor with a 1200 ohm 1 watt unit to lower the 6V6 cathode bias to 260 ohms.

Submitted by L. H. McMurray

Card 4

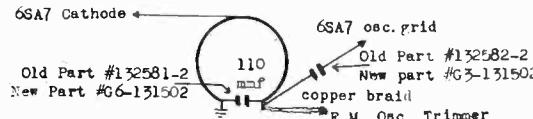
CROSLEY CHASSIS #59

(Replacing F. M. Oscillator Coil)

In some instances, due to rough handling or excessive vibration, the small ceramic condensers employed in the F.M. oscillator coil become loose, cracked or broken. Exact replacement condensers are unobtainable at this time but very small, close tolerance silver mica replacement condensers are.

By using these condensers the F.M. oscillator coil assembly can be repaired in the field and eliminates the need for replacing the entire coil and condenser assembly.

The schematic below shows how repair is to be made. To insure stability, dress lead to 6SA7 (cathode) as close as possible to ground side of coil.



Card 6

G. E. LB 530 PORTABLE

(Hot, smelly transformer)

These sets use a 2 volt rechargeable battery and frequently develop hot, smelly transformers because acid, spilled from the battery, has entered the dry rectifier eating the oxide coating from the plates thus causing them to "short." The shorted rectifier results in transformer overheating and loss of charging current.

To remedy, replace or repair rectifier plates. Neutralize all spilled acid with soda water. Replace AC transformer if it draws over 3 watts with rectifier disconnected.

Submitted by H. F. Gulliver

Card 8

NOISY VOLUME CONTROLS

If you cannot obtain a new replacement control, in many cases the old control can be repaired satisfactorily by applying one of the new white cream solutions being marketed under divers trade names.* To repair controls, proceed as follows: Dismantle the control and apply solution lightly to the resistor surface and also to the collector ring. (This last is most important as this is frequently the source of trouble and not the resistor element itself.) If necessary remove the shaft to lubricate this part. Generally it can be reached with a toothpick. Before disassembling a control turn it to "On" position, or enough to trip the switch. *Walscolube and Lubriplate are recommended.

Submitted by R. W. Cutts



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« More leading independent radio service-dealers subscribe to “RSD” than to any other publication devoted to radio-electronic maintenance. The reason is simple: *only* “RSD” meets the present-day needs of servicemen for timely technical data to help them repair radios faster, more efficiently and at lower cost — especially without exact duplicate parts or tubes. Most Signal Corps instructors subscribe to “RSD”. Send us your subscription order today and let “RSD” relieve your headaches during the months to come.

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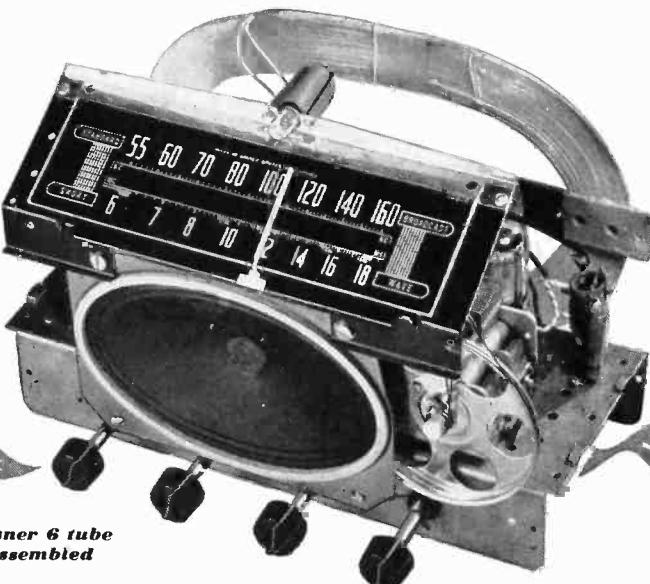
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Rear view of 6 tube chassis, assembled . . .



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ments without materially disturbing performance of the circuit under analysis. Series EV-10 will prove an invaluable electronic measuring and test standard for the progressive engineer-industrial, laboratory, school and university.

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LOUD SPEAKER BAFFLES

(Continued from page 22)

described here, is used to the high-frequency speaker, because, in actual operation there will always be a phase shift due to the condenser coupling. However, this method is simple and effective, which is more than can be said for the complex networks usually employed for the purpose.

When the speaker baffle is located in a corner of the room, near the floor, as shown in Fig. 14, best reproduction results. When near the floor, the floor itself limits the sound radiating angle, loads the speaker better and assures more efficient operation. If two speakers are used, then the high-frequency speaker, when placed above the low-frequency one, operates with less damping from sound absorption by rugs and hangings.

The old, high-boy style of radio cabinet is now out of favor with most housewives who are up on such things. While many have already swapped in receivers in such cabinets for more modern types, others are still tolerating them but would like to make a change. One woman whom we know solved the problem by simply calling in a carpenter and having the cabinet legs cut off. A little stain on the short stumps which remained, plus the addition of glides, made a more modern, more compact, and better-sounding radio. So if someone asks you what to do about a similar eye-sore, tell her about this. But don't try to sell anyone on such a job who is not already convinced—she might not like it. You know how women are, sometimes.



and Eight d-c Voltage Ranges at 1000 ohms per volt from 0-3 to 0-6000 volts. Seven d-c Current Ranges, 0-600 Microamperes to 0-12 Amperes. Eight a-c Output Ranges to 6000 volts. Eight Decibel Ranges from —26 to +70 db.

Available as an accessory item to Series EV-10, there is an RF-10 vacuum tube probe which provides direct means for measurement of supersonic, r.f. and u.h.f. voltages.

Series EV-10 and RF-10 are described completely in the 1942 catalog of the Precision Apparatus Company. This may be secured direct from the manufacturer at 92-27 Horace Harding Blvd., Elmhurst, Long Island, N. Y.

Oscillation

(Continued from page 3)

fort to localize trouble by substitution methods is employed. Often, in cases of motorboating, it will be found that the frequency with which the motorboating occurs is affected by the value of grid leak shunted across the power tube input. Many are apt to jump to the conclusion that the trouble must therefore be in this circuit. This is not the case. Using a lower resistance grid leak reduces the response to low frequencies and consequently the ability to amplify the motorboating frequency. If the grid leak is sufficiently decreased in value, the motorboating is stopped, but so likewise is the ability to amplify low frequencies and the response of the receiver suffers. In such cases, it should be remembered that the source of the trouble is always in the plate—not the grid—circuit. When better filtration is employed, the trouble is corrected, and the performance of the receiver is improved.

When a tube is oscillating, grid current is always present. However, it is awkward and impractical to insert a meter in the grid circuit to determine if grid current is present. In fact, in attempting to do so the oscillation may be eliminated, only to return when the meter is removed from the circuit and the leads are replaced. However, oscillation also affects the plate current. If the grid circuit is grounded through a condenser, no change in plate current will result unless the tube is oscillating. As a method of localizing oscillation, this is more practical, since a meter may be inserted in the plate return circuit without disturbing the functioning of the circuit. If a cathode resistor is employed, the same result may be achieved, and more easily, by simply measuring the cathode voltage when the grid is grounded and when operating ungrounded. Any change in voltage, if appreciable, indicates oscillation.



Ohmite Again Expands—Another large expansion in factory space and production facilities has been made by the Ohmite Manufacturing Company, Chicago, to permit more production of Ohmite units for use in planes, tanks and ships, communications, electronic and control equipment, in industry and research.

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JOBs GIVEN BLIND PEOPLE

» The Universal Microphone Co., Inglewood, Cal., according to its President, James R. Fouch, is employing blind men and women in certain types of precision assembly. Transportation is furnished daily by the Inglewood branch of the U. S. Employment Service, and the state board of rehabilitation extends advisory service.

Instead of inaugurating a separate department for blind workers, Universal does not segregate but places them on the assembly line next to other workers. This is said to be a new departure in employing the sightless, because it makes them less conscious of

their handicap when they mingle with others instead of being placed in a room by themselves.

SYLVANIA CHANGES

» Appointment of Don G. Mitchell as Vice President in charge of Sales of Sylvania Electric Products Inc. was recently announced.

Mr. Mitchell will plan and direct the distribution and merchandising of all Sylvania products.

Henry C. L. Johnson, Advertising Manager of the Radio Tube Division, has received a leave of absence from the company to be recommissioned in the United States Navy.

Shop Notes

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BELMONT 686-B

(Gain Data)

Signal Analyzer, Signal Generator and Receiver tuned to 600 KC. Analyzer probe on antenna terminal. Adjust attenuator on Signal Generator to give 1.0 reading on analyzer. If receiver is operating properly, reading should be as follows:

ANT.	1.0	600 KC
6L7 grid	1.5	600 KC
6L7 plate	46.0	465 KC
6L7 plate	560.0 osc. freq.	1065 KC
6K7 grid	12.5	465 KC
6K7 plate	2250.0	465 KC
Diode plate	1400.0	465 KC

Diode DC volts 17.5 reading at vol. control.

6F6G plate 100 volts AC at 400 cps*

*(rack tuning condns. going to peak)

Submitted by Robert Boudreaux

Card 1

CROSLEY 148

(Open Voltage Divider)

33,500 ohm 10 watt resistor tapped at 8500 ohms—wire-wound no longer available. Connected from B plus to screen to cathode. Separate screen of I.F. tube and screen of Det.-Osc. tube. Connect a 50,000 ohm 1 watt carbon resistor from B plus to screen of I.F. tube and by-pass an .05 mfd. condenser from screen to ground. Repeat procedure with Det.-Osc. tube and job is complete. Thus two 1 watt carbon resistors furnish the screen voltage and replace a 10 watt wire-wound resistor.

Submitted by Edward N. Christner

35Z5 — 35Z4

(Substitution Method)

By shorting across the heater tap and the heater of a burned out 35Z5 it can be used as a 35Z4. Or, if you eliminate the dial light it can still be used as a 35Z5. Or, if you add a 7 watt 110 volt dial light and socket it can be used as a 35Z5.

Most 35Z5 tubes burn out at the heater tap or at the heater closest to the tap, leaving one side connected. Refer to a base diagram and short circuit the heater to the heater tap with a piece of fine wire. A continuity meter will indicate which side of the heater is open.

Submitted by Charles Goode

Card 5

CROSLEY 7H3

(Changing Dial Tuning Ratio To Faster, Standard Tuning Ratio)

Remove entire dial assembly from chassis by loosening 2 hub set screws. Then loosen set screws in hub of small driving wheel on knob shaft, remove keeper on rear and pull shaft forward until large center idler wheel drops out completely. Engage small driving discs now with large front gear wheel (painted white on front side).

Before pushing knob shaft all the way back place a bushing of proper length over the shaft between the driving wheel and the rear of the bracket to keep the knob shaft from pushing back through the bracket.

Replace keeper and remount the dial. If you wish to change the fishing reel handle remove it and bolt a $\frac{1}{4}$ " x $\frac{1}{2}$ " bushing to the end of the shaft using a 6/32 round head machine screw.

Submitted by R. W. Cutts

Card 7

GENERAL ELECTRIC-E86 AND OTHERS USING 5Z4 RECTIFIERS

(Substitution and Replacement Data)

Many receivers using 5Z4 rectifiers for original equipment have comparatively low voltage by-pass capacitors, since with the cathode type rectifier there is no high voltage surge during the warm-up period.

If these tubes are replaced with 5Y3 filament type rectifier there will be 400 volts or more across all bypasses during the warm-up time. Then, as some of the screen bypasses are only 200 volt rating, it is obvious that trouble will follow.

Solution: replace with 5V4G or else change all capacitors to 600 volt rating.

Submitted by Ralph W. Cutts

Card 2

1A5G

(Substitution Method)

If a 1A5G power tube of a 1.4 volt receiver burns out and a replacement is not available immediately, a satisfactory temporary replacement can be effected by installing a 1N5G provided a wire is connected from pin No. 5 to the grid cap and you short the grid bias resistor in the receiver.

Submitted by Wade Gass

Card 4

PHILCO MODEL 91 SERIES 23X

(Remedy for inconsistent tracking and to eliminate hiss)

To remedy inconsistent tracking over the broadcast band, to give satisfactory volume and to almost completely eliminate a pronounced tube hiss as a station is tuned in; make the following changes:

Shield individually the r.f. tube, the 1st Det.-Osc. tube and the i.f. tube. Then place a 1500 ohm 1 watt resistor, by-passed by a .1 mfd 200 v. condenser, in the cathode circuit of the Det.-Amp. and a 3000 ohm 1 watt resistor, by-passed by a .05 mfd 200 v. condenser in the cathode circuit of the audio amplifier just following the Det.-Amp. Equally important, take a 14" length of insulated wire and solder one end to the grid clip of the r.f. tube and the other end to the antenna clip of the receiver.

Submitted by T. R. Allen

Card 6

SHIELDING G AND GT TUBES

When you can obtain a G or GT tube equivalent to a metal tube that is no longer available, a very effective shield can be made for the glass type tubes at practically no cost or effort.

Simply tear up an old electrolytic condenser and unroll the metal foil. Wrap some of this foil around the glass tube skin tight. This becomes the shield.

Then wrap one or two turns of clean, fine copper wire tightly around the foil at the base of the tube and solder it so it stays in place. Solder the other end of the copper wire to the ground pin of the tube, or fasten under a screw to ground, as the case may be.

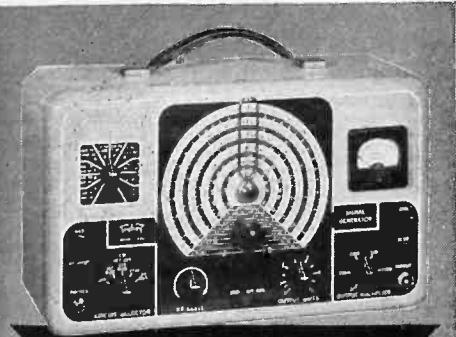
Be careful, when shielding grid-cap type tubes that the metal foil does not come in contact with the grid cap itself. If no condenser foil is available heavy foil can still be gotten from some types of tobacco package.

Submitted by Robert L. Hester

TRIPPLETT

Combat Line

TESTING EQUIPMENT



The Toughest Test in History

Miracles must be done in minutes in mechanized warfare. And Triplett Testers, built to the needs of war, are valued tools with America's armed forces.

Here are a very few of Triplett Combat Line Testers. There are many! Each different in adaptation to each specific purpose; unfailingly alike in precision performance under the toughest test ever devised.

After Victory the values of Triplett wartime experience will be evidenced by advanced technical superiority and by precision performance that might well seem miraculous today.



A WORD ABOUT DELIVERIES

Naturally deliveries are subject to necessary priority regulations. We urge prompt filing of orders for delivery as expeditiously as may be consistent with America's War effort.

TRIPPLETT ELECTRICAL INSTRUMENT CO.
BLUFFTON, OHIO

SPRAGUE ANNOUNCES FREE ADVERTISING SERVICE FOR RADIO MEN

» A unique free classified advertising service announced by Sales Manager Harry Kalker of the Sprague Products Company, North Adams, Mass. is devoted to helping radio servicemen and dealers find the tubes, parts, or equipment they need during the shortages of these wartime days.

Known as the Sprague Trading Post, this Sprague effort takes the form of full page advertisements appearing in leading national radio periodicals and made up almost entirely of classified "Swap or Sell" advertisements from servicemen and dealers themselves. There is no charge to servicemen for this service.

"Our sole aim," says Mr. Kalker, "is to devote our regular advertising



HARRY KALKER

budget to doing what we are convinced is a highly important and essential war-time job. We want to use it to co-operate with our friends throughout the radio profession in helping them get the things they need, and to dispose of the things they do not need and which would come in mighty handy to some other serviceman who is having a tough time keeping radios working on his sector of the home front."

Servicemen or dealers who wish to have free classified advertisements in the Sprague Trading Post are requested to send them in promptly, keeping them down to 50 words or less. Ads may be sent in, either on the serviceman's business letterhead, or on regular forms that may be obtained from their local Sprague distributors.

Emergency ads for urgently needed equipment will, of course, receive preference, although all classified advertising that seems to Sprague officials to fit in with the spirit of the Trading Post plan will be scheduled for appearance in one or more leading radio trade publications at the earliest possible moment.

"HOT OFF
THE PRESS"

SYLVANIA SERVICEMAN SERVICE

by
FRANK FAX



As you know, we've been busy revising and improving our technical data to help you keep radios informing and entertaining the home front.

Hot off the press is a new revised edition of the Technical Manual on Sylvania Radio Tubes. This is the basic up-to-the-minute stuff—in detail. You'll want it just as much as the Correlation for Substitution Chart, the Characteristics Sheet and other free technical helps. I can recommend it even to those who already have earlier editions of the same publication.

For only 35 cents you get 275 pages of technical "know how." More than 400 types of tubes—their characteristics, operating conditions and circuit application—are covered. In addition, there are definitions, typical circuits, charts, graphs and illustrations.

Before you send for it, you might take a look at what is offered below. Maybe your jobber was unable to supply you with this or that free technical or sales help. For a full shipment, write to Frank Fax, Dept. RS-2, Sylvania Electric Products Inc., Emporium, Pa.

WARTIME PROMOTION ITEMS



A winner of the 1942 American Direct Mail Association Contest for the best wartime jobs.

1. Blackout button
2. First aid index
3. War Bond poster
4. Radio and caretaking
5. Air raid precautions folder and window poster
6. Direct mail letter

REGULAR ITEMS

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

SYLVANIA
ELECTRIC PRODUCTS INC.

RADIO TUBE DIVISION
Formerly Hygrade Sylvania Corporation

STANCOR

TRANSFORMERS

First Choice of Servicemen!



STANDARD TRANSFORMER

CORPORATION
1500 NORTH HALSTED STREET... CHICAGO

WAR MEMO:

The aims behind the War Bond Payroll Savings Plan are worth repeating over and over:

1. To help pay the stupendous production costs of winning this war.
2. To siphon into production channels that portion of America's *current income* which would otherwise flood the Nation with inflationary cash.
3. To create individual backloggs of financial security for use during the industrial readjustment after the war.
4. To create a Nation-wide saving habit which will serve the interests of both Capital and Labor after the war.

Keep after that "10% of gross payroll goal"! Buy War Bonds to the limit yourself—encourage your employees to do likewise!



RELAYS by GUARDIAN

★ "Relays by Guardian" are widely used in Thermatrols . . . Pyrometers . . . and dozens of other electrically operated instruments. But the war has brought thousands of new uses. For instance . . .

B-8 New Lightweight Solenoid Contactor

Built to U. S. Army Air Force specifications for aircraft engine starting motors. With variations the B-8 meets intermittent duty specifications of B-4, B-6A and B-7A Contactors. Contacts, rated at 200 amps, will not chatter on voltage drops caused by starting current surges. "Pull-in" voltage is 6 v., compared to 18 v., on contactors with which the B-8 is interchangeable.

Write for B-8 and SC-25 Contactor Bulletin



GUARDIAN **ELECTRIC**
1637 WEST WALNUT STREET
A COMPLETE LINE OF RELAYS SERVING AMERICAN WAR INDUSTRY

Book Review

MANUAL OF SIMPLIFIED RADIO SERVICING, published by Allied Radio Corporation, Chicago, Ill., written by J. G. Tustison, Major, U. S. A. Signal Corps. Paper cover, 40 pages, 5" by 3 1/4" size; price 10c.

The booklet describes practical field-tested short-cut methods for servicing Electronic and Radio devices with only the simplest equipment and tools. Many methods described are those used by our armed forces for servicing equipment in the field of operations. It is very timely since test equipment is difficult to obtain. Radio servicemen will be able to apply many of the principles and methods in their everyday work. Engineers and instructors of radio theory will be interested in the application of principles for practical servicing of electronic equipment without the use of complex test instruments.

The booklet includes color code information on resistors, condensers, power and audio transformers, IF transformers and speaker lead and plug connections. An additional feature is a conversion table of fractional inches to decimal and millimeter equivalents.



SYLVANIA'S FIFTH TECHNICAL MANUAL

»» A new printing of Sylvania's 5th edition of the Technical Manual is now ready for distribution. One section of the Manual lists all new types of tubes released since the previous issue, and a section pertaining to panel lamps has been added.

Plastic binding has been employed which allows the book to lie flat and remain open at whatever page it is to be consulted, and index tabs are supplied, glued and marked for easy installation on the proper pages.

The new revised Technical Manual sells for the pre-war price of 35c per copy, and may be secured from Sylvania Distributors or direct from Sylvania Electric Products, Inc., Dept. RS-2 Emporium, Penna.



UNIVERSITY APPOINTS SOMERS

»» Fred Somers of 2015 Grand Ave., Kansas City, Mo., has been appointed district representative for Nebraska, Kansas, Iowa and Northwestern Missouri by the University Laboratories, New York City manufacturer of acoustic reproducers and loud speakers.

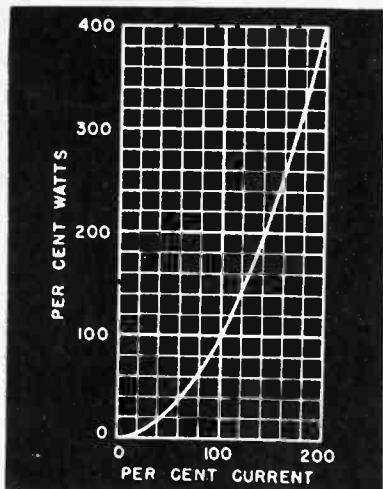


SUBSCRIBE TO RADIO SERVICE-DEALER—\$2 FOR 12 ISSUES

WATTAGE AND CURRENT RELATION IN RESISTORS

» The selection of a resistor for a specific application requires a knowledge of not only the resistance required but also the wattage to be dissipated, as the physical size of the resistor will be largely determined by the latter factor. Another point of importance is the degree of ventilation, as the nominal wattage ratings are based on free air mounting of the resistor.

The wattage to be dissipated in the resistor can be calculated readily by means of Ohm's Law when the resistance and current (or voltage directly across the resistance) are known. It is



important to note that the wattage dissipated in a resistor varies as the square of the current, as stated in the equation: $W = I^2 R$

W = Watts

I = Current in amperes

R = Resistance in ohms

Non-technically stated this means that any change in the current causes a much greater change in the wattage, as graphically illustrated above. Thus, if the current is doubled, the wattage is multiplied by $(2)^2$ or 4; if the current is tripled, the wattage is multiplied by $(3)^2$ or 9. The importance of small changes in current is often over-looked, but it should be realized that if the current is increased by only 10%, the wattage is increased by 21%; and if the current is increased 20%, the wattage is increased 44%. Hence, the actual current must be used in figuring the wattage, and the increase in wattage due to apparently small changes determined, in order to select the proper size resistor.

The above data appeared in the November issue of "Ohmite News," copies of which house organ may be obtained free. Ask to be put on the Ohmite mailing list. Ohmite Mfg. Co., 4846 Flournoy St., Chicago.

*

NEW TRANSFORMER PLANT

» The Langevin Company announces the completion of their new plant at 37 W. 65th Street, New York City in which specialized types of transformers for radio and communication work will be produced.

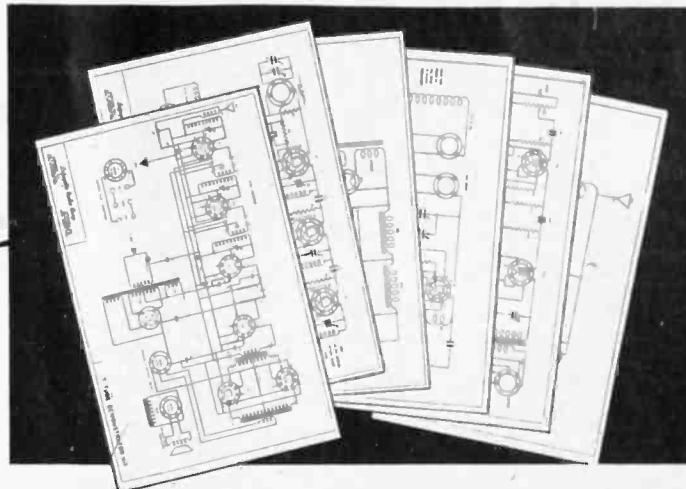
Making "ENDS" Meet

Bringing America closer to Victory by manufacturing Radio Sockets and Connectors for perfect electrical contacts in communication applications is an important wartime job entrusted to The Astatic Corporation. All the engineering skill and precision which formerly went into the manufacturing of Astatic Microphones and Pickups is now utilized and reflected in Astatic Radio Plugs and Sockets, Co-Axial Cable Connectors, and similar equipment for the U. S. Army Air Corps and the Navy.

The ASTATIC Corporation
YOUNGSTOWN, OHIO

In Canada:
CANADIAN ASTATIC LTD.
Toronto, Ontario

ASTATIC



LAFAYETTE WILL SOLVE YOUR RADIO KIT PROBLEMS!

RADIO KITS DESIGNED for your special requirements . . . radio kits carried in stock for immediate delivery . . . replacement parts for the kits you are now using—quick shipments on your orders. Write for diagrams.

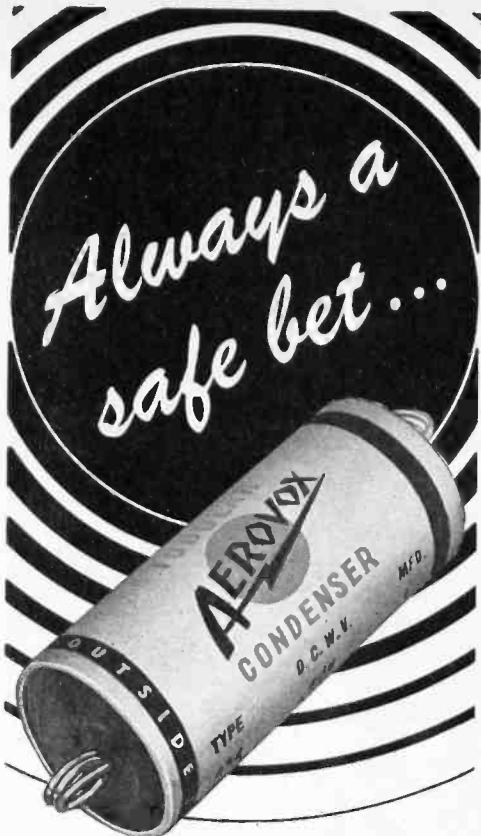
FOR CODE CLASSES: A complete stock of McElroy Telegraph Keys and automatic equipment. If you are just starting a code class, let Lafayette assist you in setting up circuits based on our past experience.

INSTRUCTORS: FREE 130-page general catalog—Write Dept. 2K3, 901 West Jackson Boulevard, Chicago, Illinois.

Nationally known radio, electronic and sound parts from Lafayette's complete stocks are in daily use by technical schools handling Military training courses.

LAFAYETTE RADIO CORP.
901 WEST JACKSON BLVD., CHICAGO, ILL. • 265 PEACHTREE STREET, ATLANTA, GA.

Camera Fans! Photographic Equipment lowest prices. Write for FREE PHOTOGRAPHIC CATALOG!



Yes indeed, these Aerovox paper tubulars Type '84 are thoroughly dependable. Millions of them are in daily use, establishing enviable service records. The non-inductive section is sealed in wax-impregnated paper tube with extra-generous wax-filled ends. Varnished colorful jacket label makes them look as good as they really are. Maximum protection against moisture. Adequate selection of voltages and capacitances.

See Our Jobber . . .

Consult him regarding your wartime servicing requirements. Ask for copy of latest "Victory" catalog. Or write us direct.



NEW CATALOG
OF SOUND AMPLIFYING SYSTEMS

AUDIOGRAPH Sound Systems represent the latest in Public Address equipment—a complete line plus pre-tested accessories.

NEW LOWER PRICES
Outstanding quality and performance at prices that help you meet any competition.

WRITE FOR YOUR FREE COPY

AUDIOGRAPH
THE FIRST NAME IN SOUND
John Meek Industries—Liberty at Pennsylvania Ave., Plymouth, Ind.

NEW RCA SERVICE COMPANY

»» Formation of a separate subsidiary, RCA Service Company, Inc., for the more efficient handling of the technical servicing and installation activities of the RCA Victor Division of the Radio Corporation of America, was announced.



E. C. CAHILL

E. C. Cahill, Manager of RCA Victor's sound equipment activities, is President of the new Company; he will also retain his other responsibilities with the RCA Victor Division. W. L. Jones, former manager of RCA Victor's Service and Installation Division, is Vice President and General



W. L. JONES

Manager of the new Company. There are no changes in either the managerial or the technical staff of the RCA Victor service organization, which is now incorporated in its entirety within the new Company.

*

BUY WAR STAMPS

"Every dime and dollar not vitally needed for absolute necessities should go into WAR BONDS and STAMPS to add to the striking power of our armed forces."

—President Roosevelt



IN WAR BONDS

* * * * *

New Goal for Payroll Savings Plan!

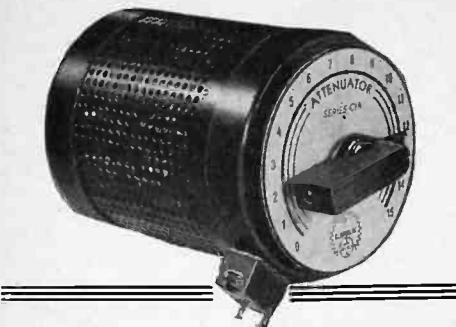
Along with increased war production goals go increased costs :: extra billions which must be raised, and raised fast, to win this war.

That means we must raise our sights all along the line, with every firm offering every American with a regular income the chance to buy more War Bonds. YOUR help is asked in encouraging employees to put at least 10 percent of their pay into War Bonds every payday, through the Payroll Savings Plan. For details of the Plan, approved by organized labor, write, wire, or phone Treasury Department, Section T, 709 12th St. N. W., Washington, D. C.



U.S. WAR SAVINGS BONDS

This space contributed to
America's All-Out War
Program by
RADIO SERVICE-DEALER



ATTENUATORS

★ For distortionless control of loud-speaker volume, Clarostat offers the Series CIA constant-impedance output attenuator. 25-watt dissipation at any setting. Linear up to 45 DB in 3 DB steps. Constant input and output impedance because of compensated ladder-type network. Infinite attenuation at end position. With or without power switch. Also in Series CIB, 10-watt, smaller size.

★ Ask our jobber about these and other controls.



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

For VICTORY Buy United States War Bonds and Stamps

POLYMET
CONDENSER CO.
699 EAST 135th ST.,
NEW YORK, N.Y.

JOBBERS & DISTRIBUTORS

If you can furnish us with your suitable ratings,* we can supply your condenser needs.



CONTINUOUS DEPENDABLE SERVICE

* Ratings A3 and higher on P.D.1x Forms supplied.

MEISSNER WINS ARMY-NAVY "E"

»» Meissner Manufacturing Company, Mt. Carmel, Illinois, has been awarded the Army and Navy "E" for excellence in production. The award was presented to The Meissner Company at their plant on December 4th.

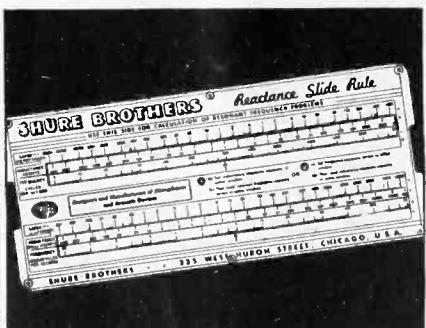


James Watson, Pres., Meissner Mfg. Co., Cap. Robert Henderson, and G. V. Rockey, Meissner's Vice Pres. examine the 5,000,-000th Meissner coil produced since "Pearl Harbor."

Among those who participated in the award were Major W. G. Mee and Major Robert Orr representing the United States Army. Captain Robert Henderson and Lieut. Crabtree representing the United States Navy.

NEW SHURE REACTANCE SLIDE RULE

»» A handy new Reactance Slide Rule that speeds up the solution of reactance and resonant frequency problems has been devised by Shure Brothers, manufacturers of microphones and acoustic devices.



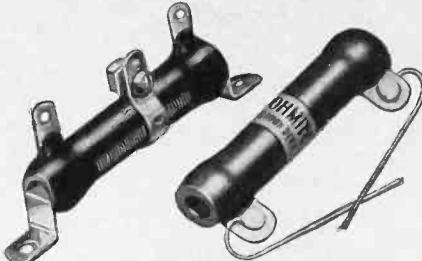
This accurate Slide Rule saves time solving resonant frequency problems, capacitive reactance problems, inductive reactance problems, coil "Q" problems, and dissipation factor problems.

This new Reactance Slide Rule is available for 10c in coin or stamps to cover the cost of handling and mailing. Write Shure Brothers, 225 West Huron St., Chicago, Ill.

CROSLEY GOES "ALL-OUT"

Expanded plant facilities of The Crosley Corporation are being strained to the limit to handle the tremendous volume of war production that has been assigned to it, Powel Crosley, Jr., president of the Corporation, told company stockholders at their annual meeting.

OHMITE
RESISTORS
for Permanent Performance



It's the way Ohmite Resistors are designed and built that makes them so reliable for today's critical service on the war front, and the home front. These sturdy, wire-wound units stay accurate, prevent burnouts and failures—insure permanent performance under the toughest operating conditions from the arctic to the tropics.

This is your best assurance in maintaining the service of existing equipment or in developing new devices to defeat the enemy and build for tomorrow's peace.

Send for These Handy Aids



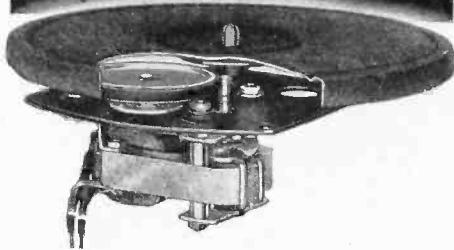
Ohm's Law Calculator—Helps you figure ohms, watts, volts, amperes—quickly, easily. Solves any Ohm's Law problem with one setting of the slide. All values are direct reading. Available for only 10c. (Also available in quantities.)

Quick-Reference Catalog
18. Free—Gives helpful information on Ohmite stock resistors, rheostats, chokes and tap switches for all types of applications.

Authorized Distributors Everywhere
Ohmite Mfg. Co., 4846 Flournoy St., Chicago

BE RIGHT WITH
OHMITE
RHEOSTATS • RESISTORS • TAP SWITCHES

GENERAL INDUSTRIES Smooth Power MOTORS



There are innumerable places where smooth-power motors are required in this mechanized war; and General Industries is making them by the tens of thousands. Not only motors but electronic and other precision devices of many types.

We are looking forward to the glad day when we can turn again to production for peace-time needs and give undivided support to our jobbers and service men.



THE GENERAL INDUSTRIES CO.

Dept. 17 • Elyria, Ohio

WANTED RADIO ENGINEERS and TECHNICIANS

In critical war industry. Here is an excellent opportunity for several competent men in research and production engineering on Government contracts. You will work with a company well known in the radio industry, located in a pleasant Michigan city.

Write full particulars of your experience and enclose photo.

GUY C. CORE CO.

Advertising—Reynolds Bldg.,

Jackson, Michigan.



Leslie J. Woods, pioneer in the radio industry, who has just been appointed vice president and general manager of the National Union Radio Corporation, manufacturers of radio tubes and electronic devices.

★

NELSON AWARDED MEDAL

»» On Saturday, January 16th, the Poor Richard Club of Philadelphia paid tribute to Donald Nelson, Chairman of the War Production Board by presenting him the Gold Medal of Achievement for 1942.



W.P.B.'s Donald Nelson pauses at exhibit of International Resistance Company prior to receiving Poor Richard Gold Medal of Achievement.

Among former recipients of this coveted annual award have been such outstanding men as Will Rogers, Alfred Sloan, Jr., Capt. Eddie Rickenbacker and David Sarnoff—to mention but a few.

★

NON-PRIORITY ITEMS OFFERED BY PHILCO

»» Philco Corporation has issued a catalog of its new products Thomas A. Kennally, vice president in charge of sales, announces.

Via the new catalog, dealers can place orders with their distributors without waiting for a salesman to call "This catalog is going to help dealers during a very trying time," Mr. Kennally explained. "We covered the

TUBE DISTRIBUTORS

SWAP tubes with me and help the war effort by saving just that much more critical material.

Equalizing your unbalanced stock and mine will assist dealers stocks in going further.

We have prepared a mimeographed list of tubes we can let you have in exchange for some of your slow movers. Tubes are in individual cartons. There are a good many fast movers on our list.

Mail a post card today requesting this valuable "Swap List".

W. R. BURTT

308 Orpheum Bldg. Wichita, Kan.

United States looking for products made of non-critical materials for distributors and dealers to sell. Approximately 25 new products have been made available, including: Fire-King glassware, Cram world globes and maps, American flags, collapsible shopping wagons, Kem-Tone wall finish, Pladak airplane model picture knits, Sealake, Philcophones and Philco industrial storage batteries.

★

SYLVANIA AWARDED ARMY-NAVY E

»» Lieut. General Joseph T. McNarney, deputy chief of staff, U. S. Army and Rear Admiral Charles Fisher, director of Shore Establishments, U. S. Navy, on the occasion of the awarding of the Army-Navy E flag to the Emporium, Pa., plants of Sylvania Electric Products Inc., jointly complimented the workers and the management for record breaking production of radio tubes and electronic equipment for war. Ceremonies were held during the afternoon of November 5th on the lawn facing the main plant.

B. G. Erskine, president of Sylvania Electric Products Inc., in accepting the Army-Navy E flag for the company, reminded employees that the E award would fly from the yardarm only so long as the record for excellence was maintained.

We have available a supply of RCA Victor service notes for 1938, 1939, and 1940. If you would like a set—over 200 pages of detailed service data—send 45¢ in cash to cover postage and handling.

"BRANDEX"—a guide to concealed service data on "private brand" sets can be had for 25¢ per copy. It is cross-indexed for Brand-name, Manufacturers outlet, Identification marks, etc. Hurry before the supply is exhausted. Once they are gone there won't be any more.

RADIO SERVICEMEN OF AMERICA, Inc.
RSA Press & Supply Service
414 Dickens Ave., Chicago, Illinois



EVEN war can bring out much that is good.

The gauging of thin mica sheets threatened to be a production bottleneck. Fingers, highly trained by the Braille system, were called upon to replace mechanical gauges and slower vision. The fingers responded.

Today a group of blind employees at SOLAR are gauging mica quicker and more accurately than ever achieved before. They and their "seeing-eye" dogs bring unusual talents to the production front.

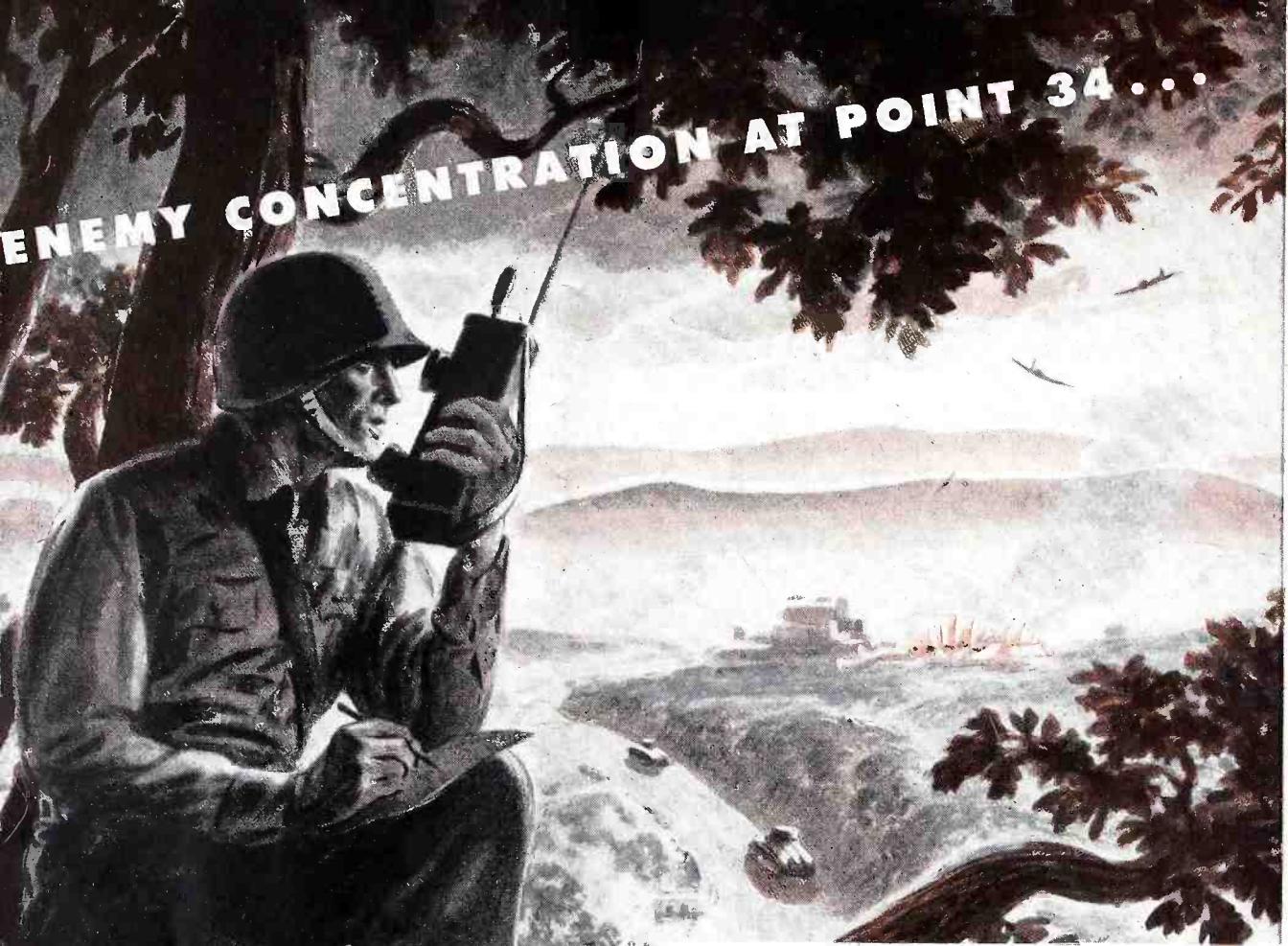
"HANDS THAT SEE"

SOLAR is proud to be a pioneer in drawing upon the untapped reservoir of such able employees. SOLAR "Quality Above All" is well protected by these "hands that see."

Solar **SOLAR**

SOLAR MANUFACTURING CORP., BAYONNE, N. J.
Makers of Capacitors (Mica, Paper and Electrolytic)

— II CAPACITORS II —



... machine guns, mortars and
2 battalions . . ."

When the enemy threatens from some unexpected quarter, the observer must be able to flash the information instantaneously. Communications are vital to the coordination of the offense that ends in victory.

The heart of the communications system—electronic devices of all kinds—depends upon quality radio tubes for unfailing performance. Raytheon tubes are helping to keep flowing the stream of vital information necessary to our armed forces all over the globe.

Service men and dealers everywhere know the dependable qualities of Raytheon tubes.

RAYTHEON
PRODUCTION CORPORATION
NEWTON, MASS. LOS ANGELES
NEW YORK
CHICAGO ATLANTA

RAYTHEON
RADIO TUBES



ED TO RESEARCH AND THE MANUFACTURE OF TUBES FOR THE NEW ERA OF ELECTRONICS