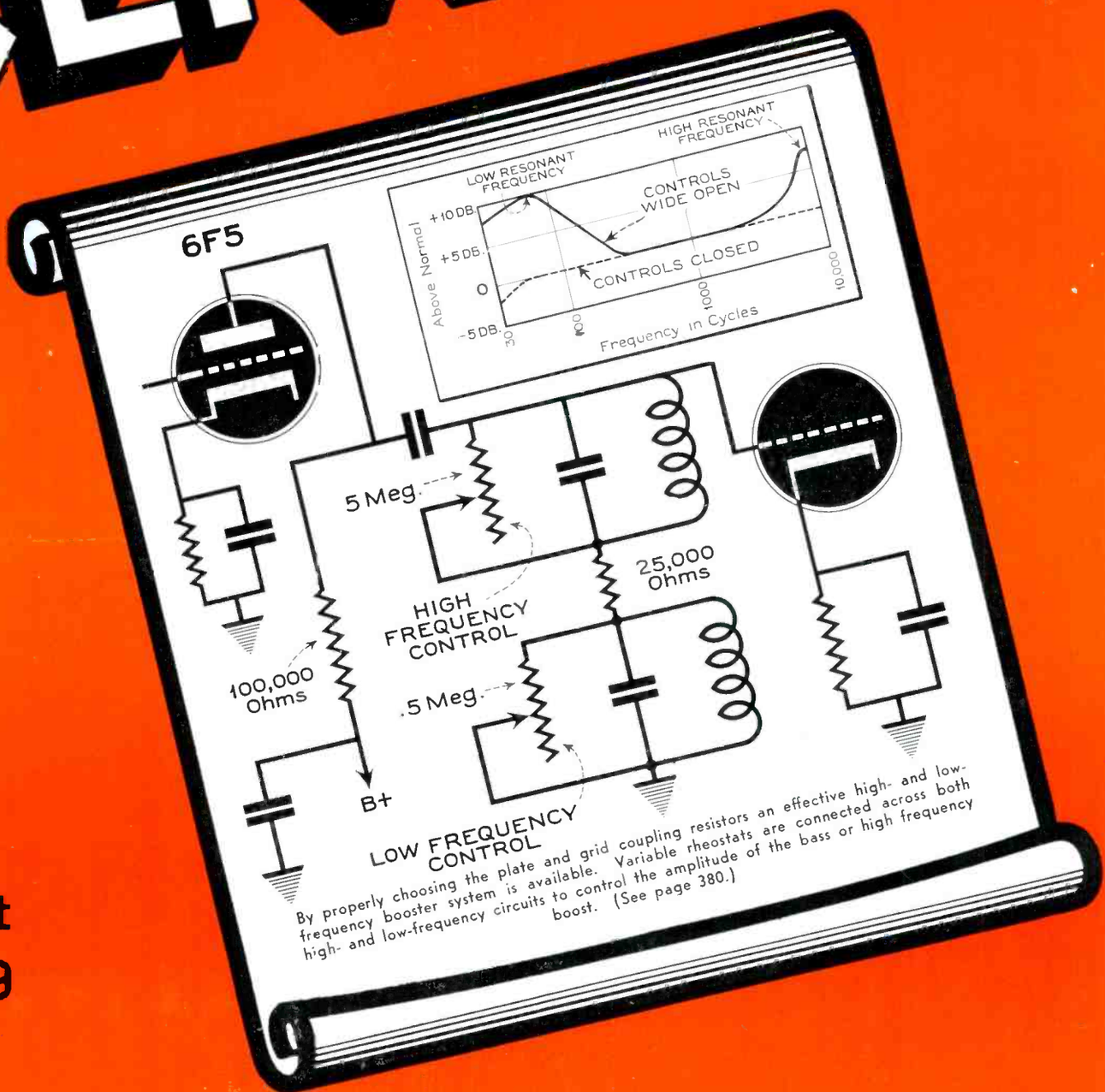
A MONTHLY DIGEST OF RADIO AND ALLIED MAINTENANCE

SERVICE



By properly choosing the plate and grid coupling resistors an effective high- and low-frequency booster system is available. Variable rheostats are connected across both high- and low-frequency circuits to control the amplitude of the bass or high frequency boost. (See page 380.)

August 1939

RADIO — TELEVISION

The Biggest News of the Year

Keeps Pace With Progress! Includes Vital Changes That Help You!

The Greatest Reference Work Ever Published

Special Authorized Service Engineer's Price **75c** *Net*

Changes That Obsolete the 1st and 2nd Editions

Everything you want to know about *23,000 makes and models. All the dope on each set in one book — on one page—in one line.

The startling special low net price of the 3rd Edition MYE is Mallory's contribution to every Radio Service Engineer. Again in one handy book — is up-to-the-minute, split-second reference to vital information you need every day. Proven the biggest help service engineers ever had — it continues to pay for itself over and over on every job you handle.

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Vital changes have taken place in set design and particularly servicing, during the last eighteen months—so that no longer is it possible to use old-time servicing methods. Mallory—alert to every change—foremost in many "original equipment" developments — has kept pace with the industry's progress. That's why Mallory is first to bring you dope on these vital changes so you, too, may profit through their daily use.

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**Approximation. Count indicated accurate as this advertisement was written.*

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Use YAXLEY REPLACEMENT VOLUME CONTROLS

August, 1939
Vol. 8, No. 8

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A Monthly Digest of Radio and Allied Maintenance
Reg. U. S. Patent Office

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Contents

Also publishers of COMMUNICATIONS

ANTENNA

• • • auto radio

The vice president of one of the largest receiver manufacturers in the East has recently stated that auto radio is definitely becoming an all year round business. Seasonal peaks have been levelled off and valleys filled in during the last few years.

We have always maintained that you, the Service Man, are the most logical person in the industry to make auto-radio sales. We also feel that if the set manufacturers would concentrate on helping you sell auto sets they would come closer to saturating the field. There are approximately 28 million automobiles in use in the United States and less than 7 million of them have auto radios. The only answer to this poor coverage must be that merchandising is directed through the wrong channels.

There can be no doubt that the public wants radio . . . 40 million home receivers attest to that. That the public wants reception wherever it goes is evidenced by the spontaneous sales response to battery portables. You can easily prove that they want auto radios as well. The sales are yours for the making.

In the radio industry you enjoy the most advantageous position with respect to customer relations. You are invited into the customer's home and he lends a willing ear to your counsel. You do not have to go around pushing doorbells to gain admission, nor do you have to sit and wait till the custmer is good and ready to pay you a visit. All you need is a good line (of chatter and of sets) and the returns will be like magic.

Of course, when you take on a line of auto sets you should solicit additional customers outside your own service clientele. Make arrangements with local garages and gas stations to tip you off on car owners without sets. Make it worth their while to do so. Obtain lists of all car owners, especially those who have just purchased new or used cars without sets.

Fix up your shop so that you can make auto set installations and repairs easily and efficiently. Play up this feature on your store front and on your business cards, bills, letterheads, etc.

• • • cut-rate service

Cut rate advertising has its lure, but cut-rate service does not pay. The sale of cut-rate service is something which cannot be controlled by either legislation or the grouping together of opposing forces. legislation is in effect in many states which attempts to stabilize certain list prices but there is no law which will force a man to sell his services and time at a given price. Grouping of men in the form of associations is one way to force stabilization of prices, providing the public can be educated to buy from no one but members of the association. However, the forming of an association with the express purpose of maintaining price is prevented by legislation. Furthermore, education of the public is expensive.

The remedy must come from the inside. The cut-rate Service Man or organization must cease functioning as such. In the first place it does not pay. No one can call and examine a receiver for a total fee of 50c. It's not in the cards and is a sure sign of racketeering. If the customer refuses to be convinced the call is a dead loss. If she falls for a phoney line she invariably is a one-time customer, because sooner or later she will learn the truth. It does not pay.

There is another very important fact which must be considered by organizations that make a practice of cut-rate service. It is true that service work is in a chaotic state and that the public is not aware of what is or is not an equitable price for a given job. However, there have been numerous instances where the tactics which usually accompany cut-rate service, such as withholding a receiver until the charge demanded has been paid, have reached the law courts. In every instance the decision has been against the service concern. Furthermore, these decisions and the things which lead up to them have received notice in the public press.

Every local newspaper, when properly advised, will refuse to carry cut-rate advertising. Its general reader public demands protection from fraudulent advertising, and if any such condition is reported the results are usually very unpleasant for the gyp.

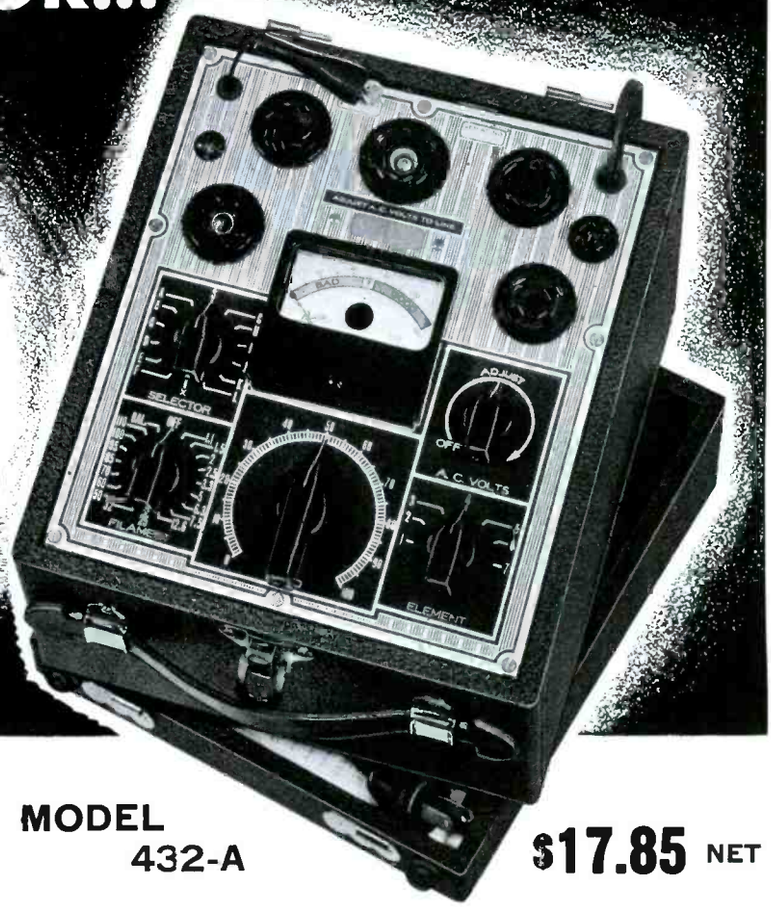
In order to accomplish its end cut-rate advertising must be ambiguous and in its ambiguity it is dishonest. It must be ambiguous because if it is honest the work would show no financial return. If the cut-rate is a price war, the public benefits and the Service Man loses. A service call from a reliable organization is worth at least $2.00 an hour. If you charge less, not with any intention of gouging during the call, you are making a mistake, as any accurate tabulation at the end of the month will show.

Cutting prices in a legitimate fashion may be honest but you are the loser because the cut price does not enable you to service the receiver any faster and you receive less for your efforts. Bear in mind that if you are careless during a service job, because you are working at a cut rate, a dissatisfied customer can cause great havoc among future prospects. The fact that you have charged a cut price is of no consequence then . . . even if you lost money on the job. In large cities you may have an opportunity to last a short while, because your advertising may pull new suckers, but in small communities you might just as well quit, or reform.

Cut-rate servicing just does not pay. The sooner the cut-rate Service Man realizes this fact the better for him and the industry at large. The same applies to price wars. . . . Get your price. If your work is good you'll last and be there to see the other fellow take in his shingle.

YOU ASKED FOR...

Quality AT A Price



HERE IT IS!

MODEL 432-A

$17.85 NET

RED DOT Lifetime Guaranteed Triplett Instrument with Two Highest Quality Sapphire Jewel Bearings . . . Sockets for All Tubes. Filament Voltages from 1 to 110—A Safeguard Against Obsolescence. Separate Line Control Meter. Neon Shorts Test. Etched Panel of Outstanding New Design. Approved RMA Circuit. Rich Black Leatherette Covered Portable Case—Professional in Appearance.

Today's outstanding tube tester value—Checks Loctals, Single Ends, Bantam Jr., Gaseous Rectifier, the New High Voltage Series (including 117Z6G) and others recently announced. Also has Ballast tube continuity test. Direct Reading GOOD-BAD Meter Scale. Will not deactivate 1.4 volt or other type tubes.

Readrite
TESTERS RANGER METERS

MODEL 432-A-742

A combination Tube Tester and Volt-Ohm-Milliammeter. The Volt-Ohm-Milliammeter has the following ranges: AC-DC Volts 0-10-50-250-500-2500 (DC at 1000 ohms per volt); DC Milliamperes 0-1-10-100; Resistance — .5 to 300 with 25 ohms at center scale; 0-100,000 ohms and 1½ megohms. Case similar to 432-A but slightly larger.

Dealer Net Price $26.85

MODEL 739

Pocket Volt-Ohm-Milliammeter with Selector Switch. Molded Case Precision 3-Inch Meter with 2 Genuine Sapphire Jewel Bearings. AC and DC Volts 0-15-150-750-1500; DC MA. 0-1.5-15-150; also high and low ohms scales.

Dealer Net Price **$9.90**

MODEL 612

A universal wide range AC-DC Volt-Ohm-Milliammeter, nominally priced. Ranges: AC-DC Volts 0-15-150-450 (60 ohms per volt); AC-DC Milliamperes 0-15; Resistance 0-20,000 and 0-100,000 ohms; Capacitance range .01 to 20 mfd. Complete with test leads.

Dealer Net Price **$7.95**

MODEL 511

This Handy All Purpose DC Volt-Ohmmeter is a pocket-size instrument with square Readrite meter having full open dial for reading 0-3-30-300 DC Volts and 0-10,000 ohms. Case is black wood, nicely finished. Furnished complete with self-contained three-volt battery.

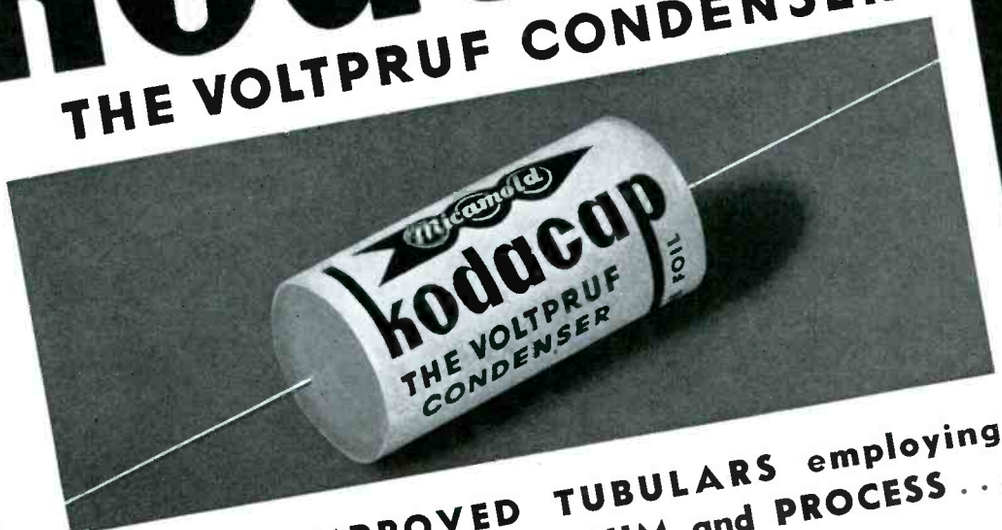
Dealer Net Price **$2.85**

For More Information Write Section 817 College Drive

READRITE METER WORKS, Bluffton, Ohio

NEW Micamold kodacap

THE VOLTPRUF CONDENSER



GREATLY IMPROVED TUBULARS employing a NEW INSULATING MEDIUM and PROCESS . . .

Several months ago, the Micamold Engineering Department completed the development of a process which makes a certain cellulose derivative become a remarkable insulation medium.

Exhaustive tests have proven that KODACAPS have a longer life at much higher voltages than standard tubulars of equal size and cost. On one test a group of KODACAPS, which are somewhat smaller than standard 600-volt condensers, have withstood 1,800 volts for more than 3,000 hours and are still functioning. Tests run in high humidity show KODACAPS to have a life three times as long.

KODACAPS which cost no more than the standard 600-volt tubulars are conservatively rated at 1,000 volts DC and each one is tested at 3,000 volts.

They should find universal application at any point in radio receivers, power amplifiers, etc. . . . and outlast the equipment in which they are used.

AVAILABLE IN STANDARD CAPACITIES AT LEADING DISTRIBUTORS

MICAMOLD RADIO CORPORATION

FLUSHING & PORTER AVENUES, BROOKLYN, NEW YORK

LOOP ANTENNAE

By MARK GLASER
CHIEF ENGINEER
DEWALD RADIO MFG. CO.
and
EDWARD M. GLASER
RESEARCH ENGINEER
KOLLSMAN INSTRUMENT CO., INC.

LOOPS are almost as old as radio itself. Some of the earliest experiments carried on by Hertz utilized a single turn loop for a receiving antenna. So it seems a bit odd that, at this late date, we should be talking about fundamental considerations of loops. But this is because loops have not been generally popular in broadcast receivers until this year. Their principal use has been in direction-finding equipment, mainly on ships and airplanes and at the government operated shore stations, for relaying position reports to ships. In the late '20s some custom-built receivers and a few RCA superhets, which used 199s, appeared with loop antennas. Since then, various models, mostly portables, have appeared each year but not with very general acceptance. The principal reason for this was in the price, which was necessarily high, because the poor response of loops necessitated a very high gain receiver with less efficient stages than are now possible. The battery requirements also were too severe. The 1.4-volt series of low drain tubes introduced last year combined with the efficient design of small loops is making possible the big hit of 1939—battery (self-powered) portables. This year is also seeing the general application of loops to table models and consoles of all types, started by General Electric with their Beam-a-Scope. A convenient point about all loop sets is that they are completely independent of antenna and ground connections.

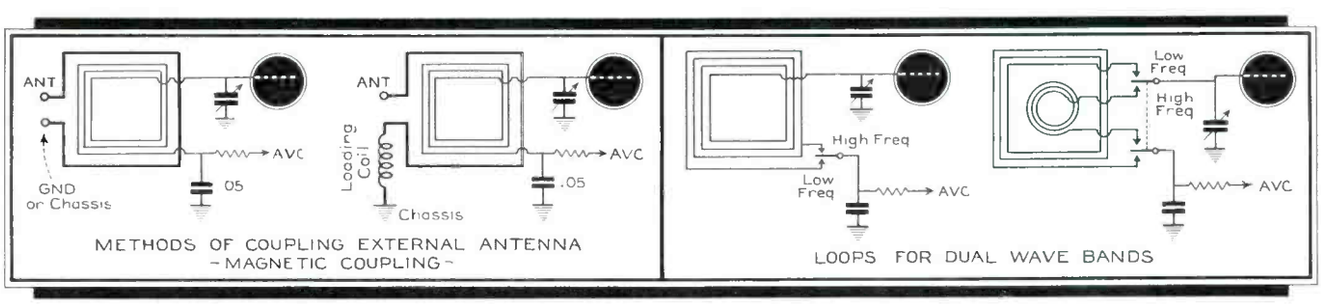
• • • general considerations

Small loops, commensurate with the dimensions of portable sets, have limited pick-up at broadcast station frequencies. This is due to their small size compared to a wavelength—say, 1 foot as against 1000 feet (300 meters equals 1000 kc). Tuning greatly enhances the response, however, and since loops can be built with constant electrical characteristics and are independent of the ground, gang tuning is possible. The pick-up is proportional to the area so a able. However, in many cases, i. e., in square loop would appear most reason-consoles, the space available allows a greater height than width, so these loops are consequently rectangular and so utilize the maximum possible area.

The G.E. Beam-a-Scope (above) has a cylindrical shield of woven material in which the vertical threads are metallic. When a loop does not offer sufficient pick-up (left) an external antenna may be coupled to it. Sets covering more than one band (right) require more than one loop or a single tapped loop.

Loops are made in two general forms: the flat, or "pancake" type, starting with a small turn and ending with a much larger turn, and the helical type with all turns the same size. Fundamentally, they are equally good. Most loops for direction finders are of the latter type and, generally, where the loop is fairly well isolated this is the preferred design. However, when the loop is contained in a small cabinet and placed only an inch or two from the chassis and batteries, the flat type is preferable as it is possible to obtain less distributed capacity. The grid is connected to the inside turn, the outside turn going to the avc bus or low potential input. This minimizes hum modulation as well as stray capacity, if an outer coupling turn is used. Since the loop must track with standard type coils it is essential to keep the stray capacity as low as possible; otherwise either the tuning range will be insufficient or excessively large variable condensers will be required. Well-designed loops used with this year's portable sets have a tuning range limited to 1700 kc maximum with 540 kc at the low end when using at least a 420-mmfd tuning condenser. High distributed capacity also lowers the Q of the loop.

Under ideal conditions, Qs as high as 400 have been obtained using an 85-strand Litz wire. More practical values run 150 to 250 out of the cabinet which drop to about 70 to 120 when mounted in place. The Q varies with the frequency of measurement also. Loops must be mechanically rigid to keep their calibration and must be impregnated to avoid variation with weather changes.



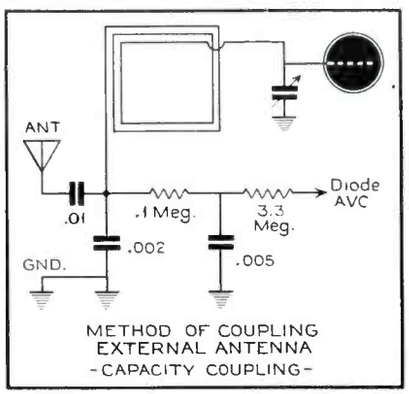
Many loops are wound more or less self-supporting, some with the aid of special acid-free tape. Others are wound on cross-sticks which are treated against moisture. The Litz wire is usually triple cotton covered or a very close spiral wound double cotton covered.

Sets covering more than one band require more than one loop or a single tapped loop. A convenient form of dual loop consists of a large helical loop for the lower frequency band and a small, flat spider web loop for higher frequencies. For low frequencies, such as the aircraft beacon and weather stations, loading coils are often used.

• • • shields

Some loops utilize an electrostatic or Faraday shield, consisting of a cage of parallel wires grounded to a plate or bus at one end, the other ends being left free and unconnected. It is important that there be no closed loops in the shield wires. The Beam-a-Scope has a cylindrical shield consisting of a woven material in which the vertical threads are metallic. There are metal discs at the top and bottom. All the wires are connected to the top disc while only a single wire is connected to the lower one. Thus, the entire shielding system is at ground potential and there are no closed conducting circuits to absorb power from the loop. When exposed to the weather, as in direction finders, the loop wires are enclosed in a metal tubing shield which, in a round loop, resembles a doughnut. With a complete, unbroken shielding shell, the loop would be impervious to any kind of pick-up, so a narrow insulating ring is inserted to break up the turn. Then the shield has no effect on magnetic pick-up but is very efficient electrostatically. However, the distributed capacity is much higher than in loops with the previous type of Faraday shield.

Shields have many advantages. First, they eliminate pick-up from the electrostatic field around many types of man-



METHOD OF COUPLING EXTERNAL ANTENNA -CAPACITY COUPLING-

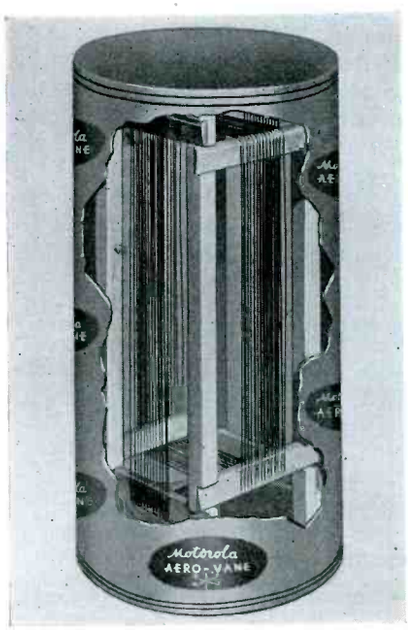
made noise sources, particularly devices that cause sparking, such as electric motors, razors, ignition systems and also high tension leakage, X-ray equipment, etc. This is a very important feature in cities, especially in apartment houses. When a shielded loop receiver is compared with an identical chassis using the flexible a-c, d-c type antenna cord strung around the room, the improvement in the signal-noise ratio is remarkable. The second advantage is the elimination of electrostatic reaction between the loop and various parts of the receiver, reducing the number of headaches to designers and Service Men (we hope). Another advantage is in the reduction of antenna effect which results in improving the directional qualities of the loop.

• • • directional characteristics

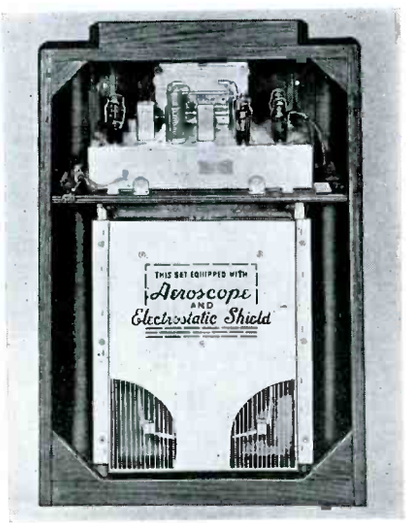
Loops are further classified as fixed and rotatable. Having marked directional qualities, they must be oriented to bring in desired stations at maximum volume or to cut the level of interfering stations. In a portable set, the loop is fixed to the cabinet so the entire cabinet must be rotated. In a table model receiver this may be a bit awkward, but it is still feasible. In a console it is out of the question; so the loop is made rotatable. Motorola utilizes a dual fixed loop with the loops 90 degrees apart. Since there is no weak minimum position with this arrangement rotation is unnecessary for picking up a station, but the reduction of noise by placing the noise pick-up at the minimum position is impossible. The Zenith Wavemagnet, portable shielded loop, is removable from the cabinet a short distance, the object being to place the antenna in the best possible position for reception. Removing the loop from the cabinet must change the Q and the tuning somewhat, but the advantages outweigh the disadvantages. Several trick handbag and sport model receivers having shoulder straps use the straps as loops. No doubt the Q then depends somewhat upon what the victim had for dinner.

The voltage developed in a loop is due to the phase difference in the field of the incoming signal between its front side and back side. Thus, the sensitivity of the loop is greatest when the plane of the loop is parallel to the path of the incoming wave because there will be a maximum of phase difference between the front and back sides. On the other hand, when the plane of the loop is at right angles to the path of the incoming wave, there is no phase difference between the sides so that no voltage is produced. This means that, in the

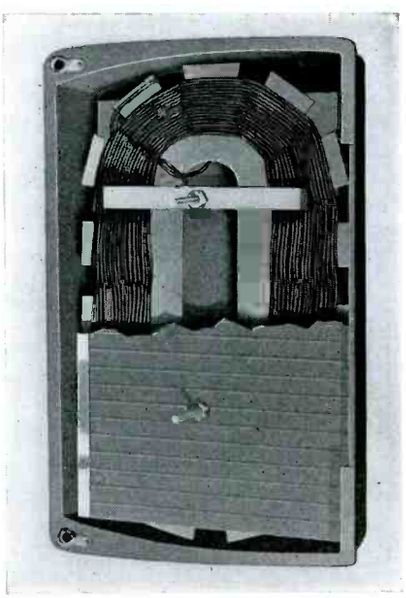
Motorola utilizes a dual fixed loop with the loops 90° apart.

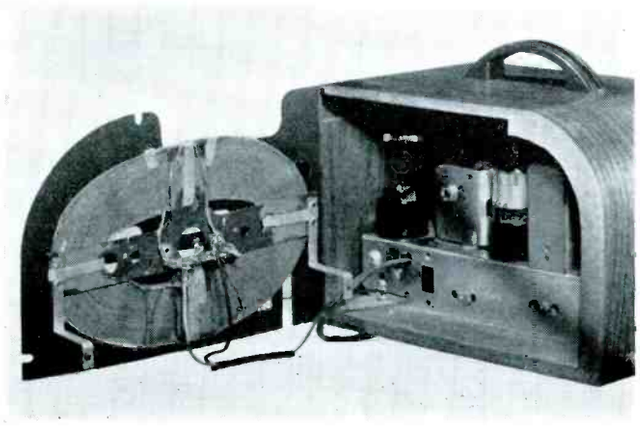


The Admiral Aeroscope employs an electrostatic shield which consists of a cage of parallel wires grounded to a plate at one end.

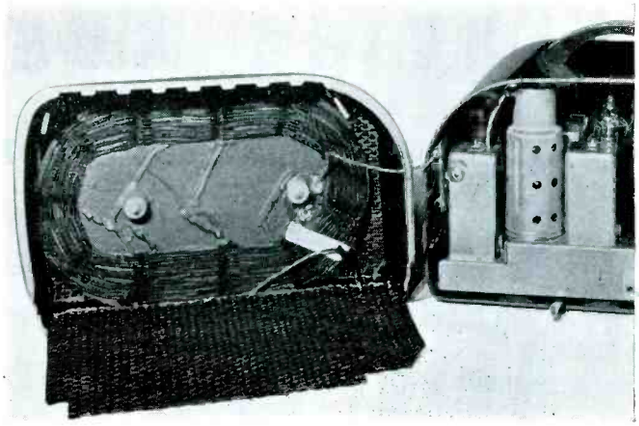


In the smaller Motorola models a flat pancake loop is used.





The flat loop in the Fada table models is fastened to the back board.



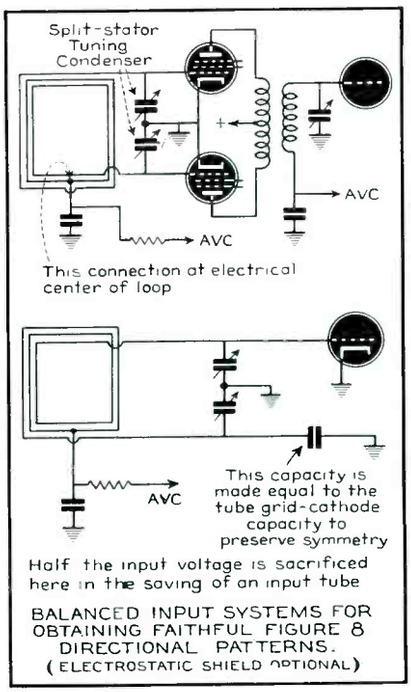
The Zenith Wavemagnet is removable from the cabinet for a short distance.

case of a fixed loop, when either the front or back of the cabinet is facing in the direction of a transmitting station, a minimum or no signal will be produced. Similarly, turning the cabinet edgewise toward the station will develop a maximum volume. In the perfect case the directional pattern produced is a figure 8. To produce anything near a true figure 8, the loop must be balanced to ground. That is, both leads of the loop must be equally above ground potential, the point nearest ground being in the electrical center of the loop. This lends itself to a push-pull input stage, which is found in many direction finders. However, one end of the loop in a broadcast receiver is invariably at chassis potential since it is connected directly or through a condenser. The minima are no longer sharp and 180 degrees apart, but are less pronounced and separated much less than 180 degrees. The directional pattern is a distorted 8 with a small lobe and a large lobe connected by a smooth curve, whereas they are tangent in the perfect case. Nevertheless, the ratio between maximum and minimum is still very pronounced so that, when a nearby station is interfering with other stations, the interference can often be eliminated by placing the local station at a minimum point. Noise arriving from a particular direction can likewise be considerably reduced. Electrostatic shielding of the loop improves its directional qualities, sharpening the minima.

Since there are two minima, it is sometimes desirable to ascertain which represents the direction of the station. This is done by employing a small vertical antenna, called the sense antenna and combining the outputs of the antenna and loop in a definite, critical phase relationship. This produces a cardioid, or heart shaped diagram with a single minimum in the direction of the station. This would be very useful if lost in the woods with a portable, although plotting two or more stations will also tell us which minima are true and which are false.

• • • external antenna

When a loop does not offer sufficient pick-up for satisfactory reception, which might readily be the case in remote locations, an external antenna is coupled to the loop. Most manufacturers recommend between 50 and 75 feet, including the lead-in. Many portable sets have an antenna and ground wire or posts for this purpose. Some merely advise wrapping one turn of the lead-in around the loop and grounding the end. In the latter case, some experimenting will probably be required to produce optimum results. The most common early coupling method consisted of running a turn of wire around the outside of the loop and connecting the ends to aerial and ground. With long antennas considerable hum modulation was often encountered. It was then found that, instead of using a ground connection, returning the coupling turn to chassis, either directly or through a condenser, reduced the hum modulation. Some sets use a loading coil in this chassis return to increase the wavelength of the external antenna, thereby increasing its effectiveness.



BALANCED INPUT SYSTEMS FOR OBTAINING FAITHFUL FIGURE 8 DIRECTIONAL PATTERNS. (ELECTROSTATIC SHIELD OPTIONAL)

Another method of coupling consists of connecting the aerial to a primary of many small turns placed within the loop, the return being to chassis or ground. This provides a high degree of magnetic coupling and a minimum of electrostatic coupling. When this type of primary is placed outside an electrostatic shield, the results are still more satisfactory. A more radical capacity coupling system for the external antenna is used by a few companies, notably Stromberg Carlson. In this method, a 0.002-mfd condenser is inserted in series with the loop on the low potential side, one terminal being grounded. The antenna is connected through a 0.01-mfd condenser to the high side of the 0.002 and to the avc bus. One disadvantage of this arrangement is that the 0.002 is practically in series with the loop tuning condenser and, consequently, limits its tuning range.

• • • servicing loop sets

In calibrating receivers with loops it is advisable to run a shielded wire from the signal generator to a single turn loop radiator having a diameter of 8 to 12 inches with 100 to 300 ohms in series. The usual dummy antenna cannot be used. It is important that there be no magnetic coupling from the signal generator itself.

The recommended method of aligning loop sets is to open the gang condenser all the way and peak the oscillator only. This point is usually around 1700 kc, but the dial reading should, of course, be consulted. Then set the dial at 1500 kc and peak the detector only. Finally, rock or pad 600 kc. The loop must be in its normal operating position when aligning and should be well removed from any metal objects. A signal generator is absolutely essential.

SERVICE CHARGES

By CLINTON W. COX

THE flat rate system of service charges has several advantages over an hourly charge or any other plan that I have seen. To begin with, it can be made up by the proprietor to fit his particular locality and overhead and changes can be made as they are required. Prices can be maintained more easily under customer pressure and there is less danger that off-hand estimates will be completely wrong.

In any organization larger than a one-man shop, this latter advantage is amplified. It has been my experience that more often than not it becomes necessary for an employee Service Man to make up estimates and quote prices without the direct supervision of the management. This condition leaves the shop revenue at the mercy of the employee's judgment, which may not always be the best. Some men may have a "soak the rich" or "never give a sucker a break" complex which is apt to create customer ill will when it is reflected in the price charged by the shop. Use of the chart requires the employee to price each job correctly; he is relieved of the responsibility of price setting and he has no authority to bargain with the customer. Such a procedure should be a long step toward establishing radio service on a business-like basis.

• • • the chart

The classification of receivers is made up according to the original cost, difficulty in handling, rebalancing, etc. The possible repair jobs on each set classification are price grouped according to the probable time required for that particular job and with some consideration as to what would be a fair charge for the job.

• • • key to system

The key to the whole system is the fact that the overhead charge and handling charge are separate from each other and from the individual repair items. There is no need to cover overhead, lost time, delivery costs, etc., with large prices on individual items. Thus, no matter how many items are involved in a repair job, it is always possible to arrive at a total service charge which is bound to be fair to both the customer and the shop. Nor is the customer who brings his set to the shop penalized with a charge that should be made to his neighbor who expects delivery and installation service.

IT IS our intention, in this and in future articles, to feature the practices and opinions of individual Service Men on the all important subject, "Service Charges". These articles will not necessarily express our own views. They will, rather, be as varied as possible and will be presented impartially, in the Service Man's own words without editing.—EDITOR.

• • • for example

An 8-tube all-wave receiver is brought to the shop by the customer. It needs a by-pass condenser, a resistor and a rebalancing. To arrive at the total service charge we have the following:

Overhead charge	$1.50
Rebalance	1.50
Replace condenser	.50
Replace resistor	.50
Total service charge	$4.00

In another case we are called to service a broadcast-band superheterodyne which has to be brought back to the shop for a new speaker cone, a filter condenser and rebalancing. The charge:

Overhead	$1.50
Pickup and delivery	1.50
Rebalance	1.00
Filter condenser	1.00
Speaker cone	1.00
Total	$6.00

Each item is separate and cumulative. For each repair that is required the amounts indicated on the chart plus the overhead charge are added to arrive at the total charge. Unrelated items are listed over one price column because it is considered that they require about the same amount of time and may logically command the same price. This makes the chart smaller than it would be if each job had a price column of its own.

Differences in receiver construction, and the variable difficulties encountered in particular jobs, which will cause one job to require thirty minutes, and a similar job to take two hours, will be taken care of by averages if the chart is properly designed, and is based on actual experience.

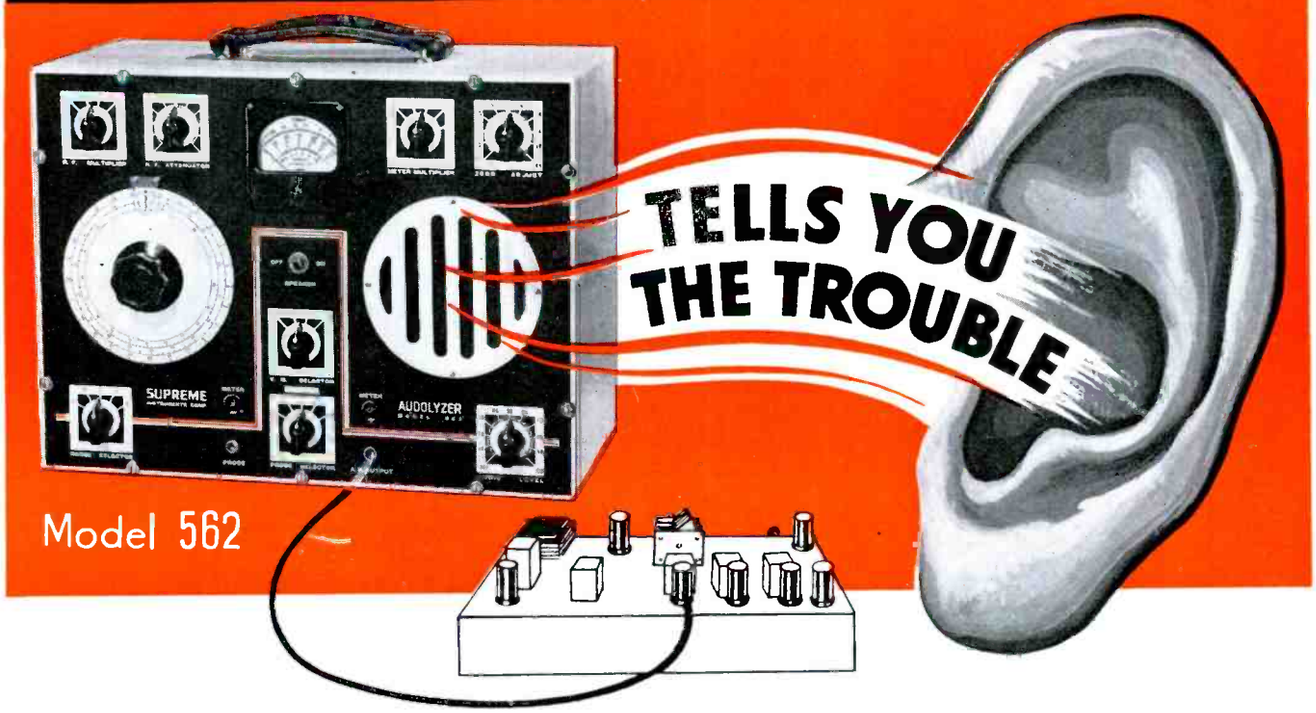
Let me mention that the prices shown are arbitrary, and that this is no attempt on my part to tell other Service Men what to charge for their work. Any shop proprietor or manager should be able to make a suitable chart by examining and analyzing the records of service work done over a period of time. This in itself may be quite revealing, and will probably show the need of standardized prices.

The classification of receivers is made up according to the original cost, difficulty in handling, rebalancing, etc. The key to the system is the separate overhead and handling charges.

TYPE OF RECEIVER	REPAIR ITEMS						
	BASIC CHARGE (OVERHEAD)	PICKUP AND DELIVER OR REMOVE AND INST. AUTO SET. USE HALF THIS AM'T IF DONE IN HOME	REPLACE BY-PASS COND., RESISTOR, COUPLING COND. OR CENTER VOICE COIL	REPLACE FILTER COND., VOLUME CONTROL, TONE CONTROL, DIAL CABLE OR REPAIR TUNER DEVICE	REPLACE POWER TRANSF.	REPLACE AUDIO TRANSF., SPEAKER FIELD, SPEAKER CONE OR FILTER CHOKE	RE-BALANCE LOCATE REMOTE NOISE, FADING, DISTORTION ETC.
T.R.F. MIDGET	.75	1.00	.25	.50	1.50	.75	.50
BROADCAST SUPER MIDGET	1.00	1.00	.25	.50	1.50	.75	.75
ALL-WAVE TABLE SUPER	1.00	1.00	.35	1.00	3.00	1.00	1.50
T.R.F. CONSOLE	1.50	1.50	.50	1.00	3.00	1.00	.75
SUPERHET. BROADCAST CONSOLE	1.50	1.50	.50	1.00	3.00	1.00	1.00
ALL-WAVE CONSOLE TO 8 INCL. 8 TUBES	1.50	1.50	.50	1.00	3.00	1.00	1.50
ALL-WAVE CONSOLE 9 TUBES & UP	2.00	1.50	.50	1.00	4.00	1.25	2.00
ALL-WAVE HIGH FIDELITY	2.00	2.00	.50	1.50	4.00	2.00	2.50
OLD TYPES AND SIMPLE RADIO-PHONO	2.00	2.00	.50	1.00	3.00	1.25	1.50
EXPENSIVE RADIO-PHONO	3.00	3.00	.50	2.00	6.00	2.00	3.00
AUTO RADIO	1.50	1.50	.50	1.00	2.50	1.00	1.00

NOTES: 1. Each item is separate and cumulative. For each repair that is needed, add the amounts indicated to make up the total service charge.
2. Unclassified jobs: Charge $1.50 per hour plus basic and delivery charge.
3. Antenna and other outside work: Charge $2.00 per hour.

The AUDOLYZER



What could be easier than have an instrument which you hook to any part of a radio receiver and have it immediately TELL YOU THE TROUBLE? By using one probe, you can test all circuits from antenna post to the speaker by listening to the signal in the AUDOLYZER. You will hear the signal in the AUDOLYZER'S speaker until you reach the dead stage. Then, no sound from AUDOLYZER means trouble at this point. You can use the AUDOLYZER'S vacuum tube volt meter to measure all D.C. voltages without disturbing receiver's normal operation. 7 D.C. voltage ranges of 0/1/3/10/30/100/300/1000 at 15 megs input. Meter is center-reading type with "plus" and "minus" readings to each side of center, eliminating reversing test leads for polarity changes. Next, you can check receiver's oscillator. Connect probe to set oscillator's output and watch meter. If oscillator cuts out or is weak when receiver dial is rotated AUDOLYZER meter immediately indicates it. To determine unknown frequency of oscillator, I.F. or R.F. signal, use tuning portion of SUPREME AUDOLYZER and AUDOLYZER'S V.T.V.M. as frequency meter. For receiver's oscillator place probe on oscillator output and tune AUDOLYZER for greatest meter swing. Read frequency on AUDOLYZER'S direct-reading dial. For R.F. determination, connect your signal generator to receiver's input and place AUDOLYZER probe on output of R.F. stage under test. Adjust signal generator and AUDOLYZER to same frequency. Adjust receiver trimmer until receiver dial reads correctly. To determine actual signal fed to I.F. stages, connect AUDOLYZER probe to first Det. output, feed a signal into receiver and adjust AUDOLYZER dial until you get maximum swing of its meter needle. Read actual I.F. signal's frequency on AUDOLYZER. Receiver is not de-tuned by these tests. Relative gain or loss of signal strength in any stage, tube or transformer can be determined. You can check A.V.C. circuits for correct applied voltage under actual operating conditions because you have a Vacuum Tube Voltmeter in the AUDOLYZER which instantly indicates this voltage at any place in the set—and its variation under different applied signals—without upsetting the correct operation of the set. You can adjust A.F.C. circuits in the same manner. Distortion is easily noted by ear. Most distortion occurs in the second detector or audio output stages. By placing the probe at any place where the audio signal is normally present, you can hear the signal and instantly determine where the distortion originates. This is also true of any R.F. or I.F. stage. If you have a scope, you can connect it to the AUDOLYZER and see the demodulated audio signal as well. Leaky, shorted or open condensers can quickly be found without unsoldering them from the circuit. Because the SUPREME AUDOLYZER can be electrically divided into two sections, you can use two probes at a time for checking intermittents, working from the second detector's input and output toward the antenna and loudspeaker, or vice versa. The AUDOLYZER can be used to check antenna efficiency, as it is a fine field strength meter. You can check high impedance pick-ups, microphones and other input devices. You can make dozens of other tests with the SUPREME AUDOLYZER which will astound you by their rapidity, simplicity and their ability to find the trouble in the shortest time. You can check the receiver's loudspeaker against that in the AUDOLYZER for distortion. You need the SUPREME AUDOLYZER in your service shop. It will quickly pay for itself and return you a handsome profit in saved time, which means added profitable hours of servicing.

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TONE CONTROLS

(*Fig. 12 on Front Cover*)

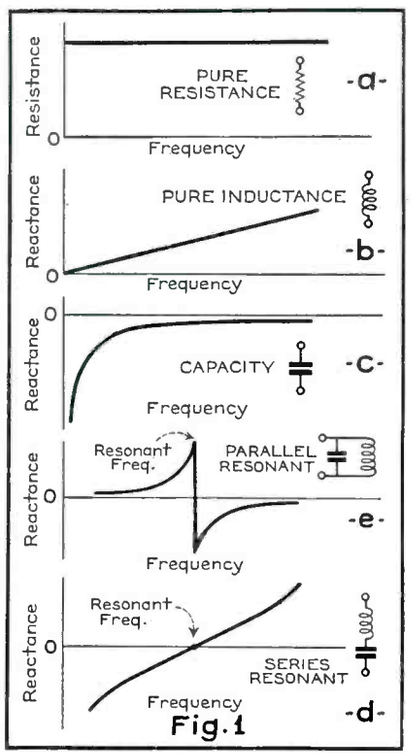


Fig. 1

(4) A system of varying the selectivity of the r-f or i-f stages to control the side-band range of the receiver.

Tone controls can also be classified according to use, such as high or low frequency booster and high or low frequency cutoff. These terms are often used interchangeably, for example, a high frequency cutoff control may be termed a low frequency booster.

• • • circuit components

Figs. 1 a, b, and c show the three fundamental impedance arms. A symbolic representation of the change of impedance of a given arm with frequency is also pictured. Thus, we can see that as the frequency increases the reactance of a pure resistance will remain constant; the reactance of a pure inductance will increase from zero ohms, at zero cycles (d-c) continuously with increasing frequency and a perfect condenser will have an infinitely high reactance at zero cycles, decreasing in reactance as the frequency increases. To the above may be added Figs. 1 d and c which are a series resonant circuit and a parallel resonant circuit, respectively. The characteristics of a series circuit are capacitive reactance below resonance, and inductive reactance above resonance.

The reactance of a parallel circuit at frequencies below resonance is inductive, at resonance the reactance is resistive, and at frequencies above resonance the reactance is capacitative. The resistance effect at resonance is due to the neutralization of the leading inductive current and lagging capacitive current.

By combining these five types of impedance arms in various ways and using some means to control the effectiveness of the arms, the frequency response of an amplifier is controlled. For any given frequency (above zero cycles) increasing the capacity of a condenser decreases its reactance and increasing the inductance of a coil increases its reactance. See Figs. 2 and 3.

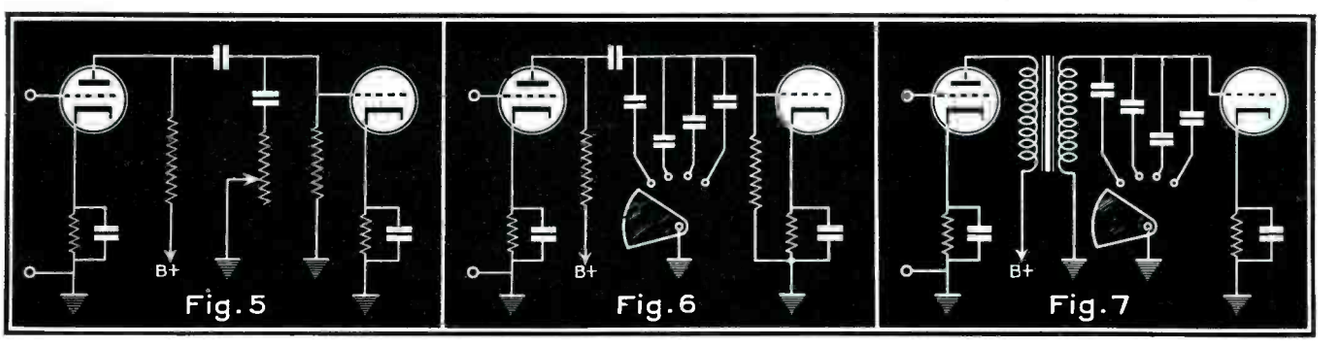
• • • shunt type controls

A capacitative or inductive reactance which is used to control the frequency response of a circuit by variation of the load impedance of the signal source is usually connected across or in shunt with the normal tube load impedance. Keeping other factors constant, the higher the load impedance the greater will be the voltage output from a signal source. This does not mean that the voltage output from a source will increase linearly with increasing load impedance but rather that it will approach the maximum output available.

In Fig. 4 the voltage amplification for a typical triode is plotted against load resistance. From this, it can be seen that, for load resistances greater than ten times the plate resistance, there will be very little increase in gain but for values below ten times the plate resistance the gain of the tube will be rather materially affected by any change in load impedance.

This condition holds true for every type of tube, and is most pronounced with pentodes, or other tubes, having very high inherent plate resistances.

Fig. 5 is the most popular of the shunt type controls. In this circuit, when the variable resistance is set at the maximum position, this keeps the load resistance at a sufficiently high value so that any variation in reactance of the condenser will not affect the gain of the tube. When the control is turned towards the minimum resistance position, the sum of the resistance of the control still in the circuit and of the reactance of the condenser, are in shunt with the normal load impedance, consisting of the plate coupling resistor and the grid coupling resistor. When their combined impedance is sufficiently low so as to affect the gain of the tube the tone control becomes operative. Since at the highest audio frequencies

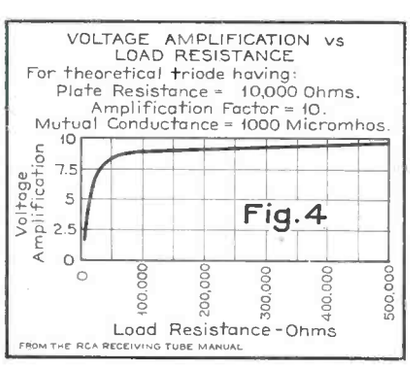


DEPENDING upon their mode of operation, tone controls can be divided into four classes, namely:

(1) A capacitative or inductive reactance, or both, to vary the load impedance of a signal source in accordance with frequency.

(2) A capacitative or inductive reactance, or both, as an arm or arms of an audio signal voltage divider.

(3) An inverse feedback arrangement to increase or decrease the gain of the audio circuits at selected frequencies.



the reactance of the condenser is lowest, the gain at the highest frequencies will be reduced first and as the variable control is turned towards the zero resistance position the gain for frequencies towards the middle ranges will be reduced progressively.

Fig. 6 is another of the shunt type controls used for controlling the high frequency response. In this circuit a fan type switch is used to connect a number of condensers in parallel. Since connecting condensers in parallel is equivalent to increasing the capacity of the shunt condenser, the more condensers connected in parallel the more high frequencies will be cut off, due to a lower total load impedance, beginning at the highest audio frequency with only one condenser in the circuit and proceeding towards the middle ranges as each additional condenser is added. Fig. 7 is a transformer coupled stage in which the reactance of the condenser is reflected back into the primary circuit, to reduce the load impedance, at the high frequencies and, similarly to reduce the high frequency response as more capacity is added. However, if the Q of this circuit is high it is very possible that preceding the falling off of the high frequencies there will be a pronounced rise in gain due to a series resonant condition caused by the condenser and transformer secondary in series. At the resonant frequency the secondary impedance will be low and the coupled impedance will be high.

Figs. 8 to 11 are variations of the above controls, and operate in a similar manner.

Fig. 12 (on the front cover) is a circuit using two parallel resonant circuits. One of these is tuned to resonate at a low audio frequency and the other at a high audio frequency. At the middle frequencies, the high-frequency resonant circuit is below resonance and the low frequency circuit is above resonance, hence both of these will have a low reactance. At the low frequencies the l-f circuit will have a rather high reactance and the h-f circuit will still have a low reactance. Since these three circuits are all in series we find that for low frequencies the effective value of grid coupling resistor is equal to the sum of the reactance of the l-f circuit and the resistor. At the middle ranges the effective grid coupling resistor value is equal to the resistor alone, and for high frequencies the effective grid coupling reactance is equal to the reactance of the high-frequency circuit plus the value of the resistor.

Thus, we obtain a high value of coupling impedance at both the low and high frequencies but a much lower value of grid coupling resistor at the middle ranges. By properly choosing the plate coupling resistor and grid coupling resistor an effective high- and low-frequency booster system is obtained. Variable rheostats are connected across both the high- and low-frequency circuits to control the maximum impedance obtainable and hence the amplitude of the bass or high frequency boost. A frequency response curve is shown in Fig. 13 for this type of control system.

CAPACITIVE REACTANCES (Approx.)

	50 CYCLES	100 CYCLES	500 CYCLES	1000 CYCLES	5000 CYCLES
.0001 Mfd.	35 Meg.	16 Meg.	3.5 Meg.	1.6 Meg.	.35 Meg.
.001 Mfd.	3.5 Meg.	1.6 Meg.	.35 Meg.	.16 Meg.	35,000 Ohms
.01 Mfd.	.35 Meg.	.16 Meg.	35,000 Ohms	16,000 Ohms	3500 Ohms
0.1 Mfd.	35,000 Ohms	16,000 Ohms	3500 Ohms	1600 Ohms	350 Ohms
1.0 Mfd.	3500 Ohms	1600 Ohms	350 Ohms	160 Ohms	35 Ohms

Fig. 2

INDUCTIVE REACTANCES (Approx.)

	50 CYCLES	100 CYCLES	500 CYCLES	1000 CYCLES	5000 CYCLES
.01 Hen.	3.14 Ohms	6.28 Ohms	31.4 Ohms	62.8 Ohms	314 Ohms
0.1 Hen.	31.4 Ohms	62.8 Ohms	314 Ohms	628 Ohms	3140 Ohms
1.0 Hen.	314 Ohms	628 Ohms	3140 Ohms	6280 Ohms	31,400 Ohms
10.0 Hen.	3140 Ohms	6280 Ohms	31,400 Ohms	62,800 Ohms	314,000 Ohms
100.0 Hen.	31,400 Ohms	62,800 Ohms	314,000 Ohms	628,000 Ohms	3,140,000 Ohms

Fig. 3

actance is greatest at the lowest frequencies the extremely low end of the audio band will fall off first. Control of the bass drop is obtained by varying the variable resistor in parallel with the condenser.

This circuit is adaptable to many con-

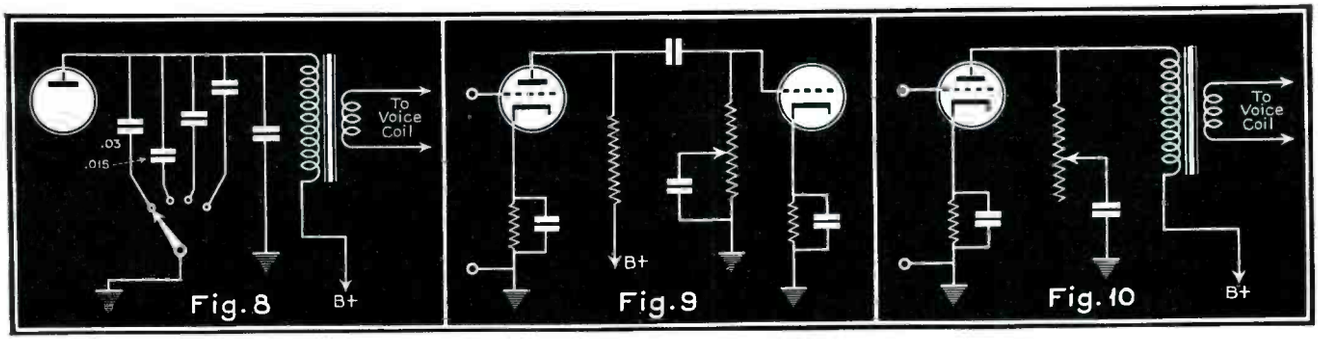


Fig. 8 Fig. 9 Fig. 10

• • • voltage divider types

Fig. 14 illustrates a typical voltage-divider type of tone control. Assuming the response of the amplifier to be flat with the tone control in the minimum resistance position, we will find, upon increasing the control resistance to the maximum, that there is an appreciable decrease in the low frequency response. In this circuit the grid coupling resistor actually consists of two parts. One of these parts is connected between the signal source and the grid and the other part between grid and ground. When a signal enters this circuit part of the signal is developed across the upper arm of the divider and a part of the signal is developed across the resistor between grid and ground. The higher reactance will have the greater amount of signal developed across it. If the condenser has a reactance many times the value of the resistor only a small portion of the signal will be available at the grid of the tube. Since the re-

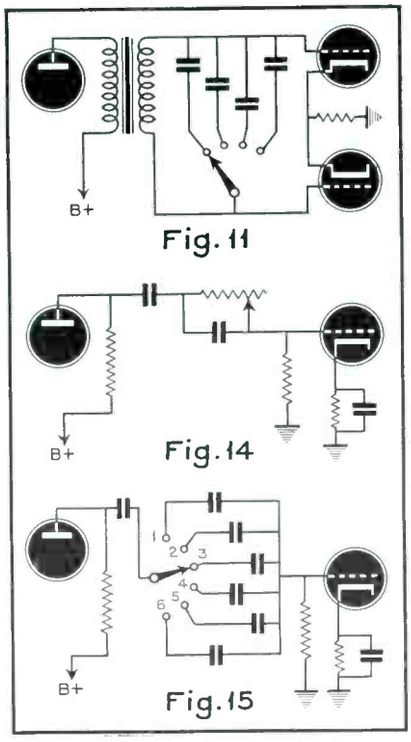
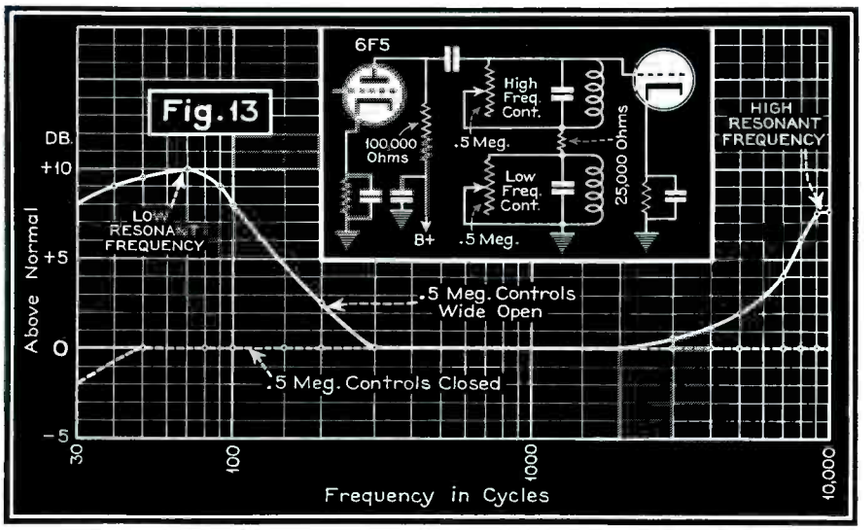


Fig. 11 Fig. 14 Fig. 15

By IRVING GORDY



ditions. First, the condenser may be replaced by any one of the impedance arms shown in Figs. 1 b to e inclusive, to obtain control over any portion of the audio spectrum desired.

Secondly, it can be made as either a cutoff or booster type control merely by adjusting the response of the amplifier to be flat with the control either off or on.

Fig. 15 is a variation of the above control where the degree of bass drop is controlled varying the amount of capacity in the upper arm of the voltage divider.

• • • inverse feedback controls

The recent introduction of inverse feedback[1] to reduce distortion and to equalize the frequency response of an audio system has led to a new and rather unique form of tone control system.

Essentially, inverse or degenerative feedback is merely a system of feeding back a portion of the signal from a high-level point to a lower level point with the phase relations of the two voltages so adjusted that as one cycle of one of the voltages is in the positive portion of the cycle, the other voltage would be in the negative portion of the cycle. As both the incoming signal and feedback signal voltages are introduced into a common circuit, they oppose each other in effect, reducing the effective gain of the circuit. By maintaining the frequency response of the feedback loop flat over the audio spectrum, and having a signal voltage divider of fixed ratio for all frequencies any inequalities in the response of the voltage gain circuit will be compensated by the high amplitude of signal fed back to the low level point for all frequencies having greater gain and a lower amplitude signal being fed back for all frequencies having lower gain. Thus we can see that the gain of the stages covered by the feedback loop is reduced, more at some frequencies, less at others, and an amplifier with essentially flat frequency response results.

The effectiveness of the feedback voltage is constant at all frequencies only if the phase relations of the incoming and feedback voltages are constant. A maximum reduction in gain will be obtained when the incoming and feedback voltages are 180 degrees out of phase, reducing in effectiveness as the phase difference approaches 90 degrees. At that point the effect of the feedback voltage is virtually zero. As the phase difference changes still further, the two voltages are in phase and the effect of the feedback voltage is to increase the gain of the circuit, above normal, and may produce an oscillatory or motorboating condition.

From the foregoing, we can see that two methods are available for controlling the response of an amplifier, namely: Controlling the phase relationships of the incoming and feedback signals, or controlling the frequency response of the feedback voltage signal circuit.

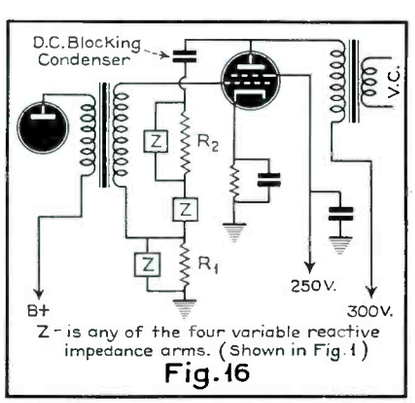
The first of these systems is exceedingly tricky and seldom used. The second method is increasing in popularity daily, because it enables the introduction of bass or of high frequency boosting or cutoff, and also enables compensation for poor frequency response in the remainder of the circuit, outside of the feedback loop.

Fig. 16 is a simple feedback circuit in which R_2 and R_1 constitute a signal voltage divider and R_1 is common to both incoming and feedback voltages. The ratio of arms R_2 and R_1 determine the loss in gain due to feedback. By introducing impedances in this voltage divider, of any of the types shown in Fig. 1, we can modify the ratio of the divider and vary the amplitude of the feedback voltage, which will affect the gain in a manner opposite to the feedback voltage amplitude. As previously explained, however, the introduction of reactances in a circuit varies the phase relationships of the voltages and the result may be such that the tone control becomes more or less effective, depending upon the direction and amount of phase shifting obtained.

Another form of inverse feedback which is used for controlling the frequency response is cathode degeneration. If a single sided self-biased tube is used with an unby-passed cathode bias resistor, this resistor will have the signal currents in both the grid and plate circuits flowing in it at the same time. The voltage variations across this resistor, due to the plate current changes, are impressed on the grid of the tube and result in a loss of gain. To completely eliminate this effect a large capacity condenser is connected across it. An effective high-frequency boosting system or low-frequency cutoff system may be obtained by using a rotary switch and a number of condensers. The switch is used to cut in the condenser across the bias resistor, eliminating degeneration effects in the resistor over those frequencies at which the reactance of the condenser is small as compared with the resistance of the

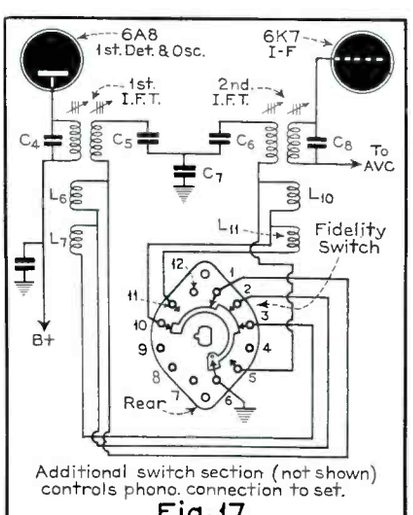
(*Continued on page* 409)

[1] Degenerative Feedback Amplifiers, by Maurice Apstein, SERVICE, February, 1937, p. 98.



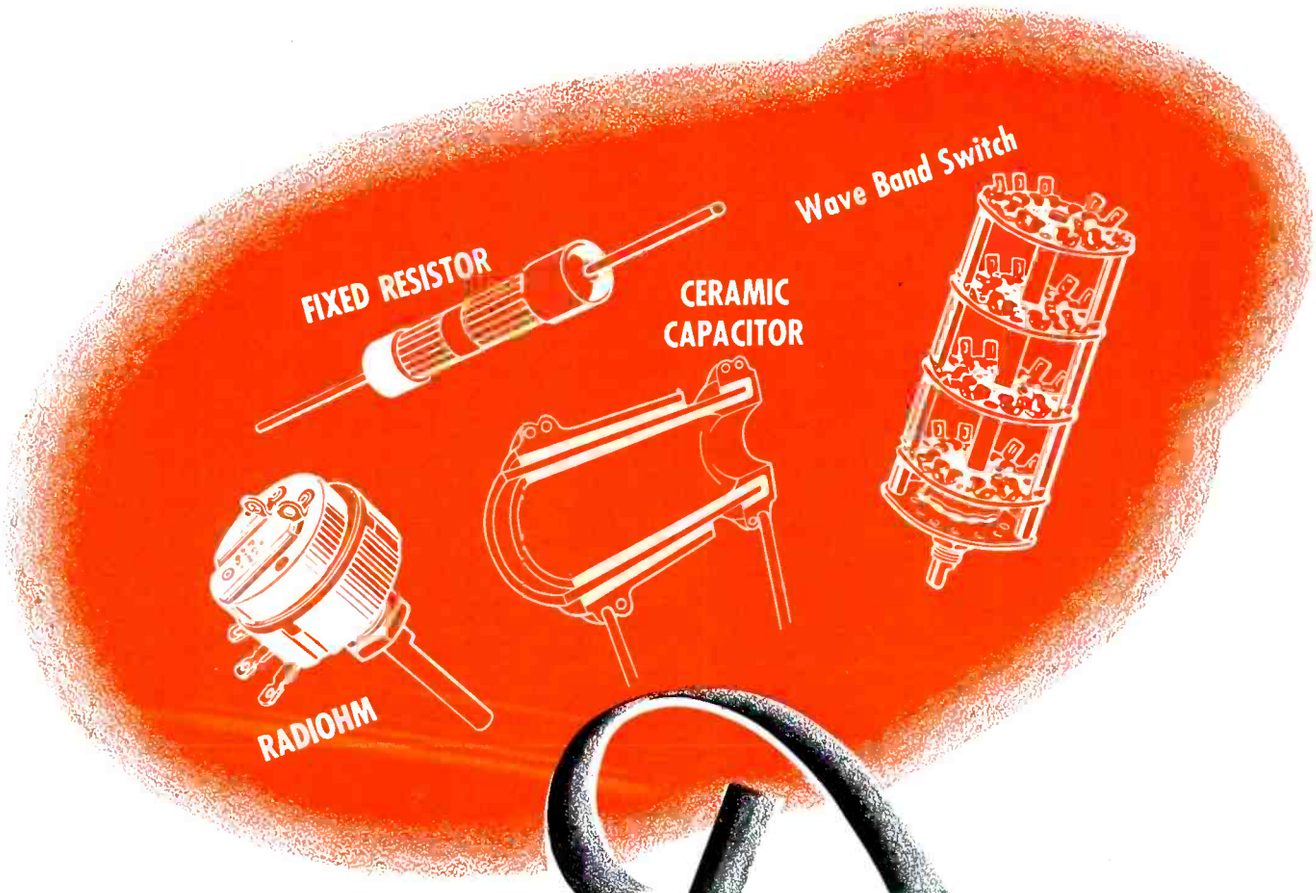
Z - is any of the four variable reactive impedance arms. (Shown in Fig. 1)

Fig. 16



Additional switch section (not shown) controls phono. connection to set.

Fig. 17



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P-A PROMOTES SAFETY

By HARRY PARO
RADIO WIRE TELEVISION INC.

IN THE experience of many municipalities one of the most effective weapons against traffic accidents is the sound equipped safety campaign car. Evidence of this is found in many communities even to the extent that hard-headed business men are digging down in their own pockets to provide their cities with such cars. In Atlanta, Ga., for instance, the results from one such car, owned and operated by the police department, were so definite that the insurance men of that city presented the department with a duplicate car to further its good work.

From the standpoint of the dealer or Service Man this rapidly developing market for p-a equipment is a particularly interesting one. Transactions are invariably with responsible municipal or private organizations and unit sales values run to pleasing proportions. Moreover, even in communities where outdoor sound systems are banned or highly taxed, such regulations do not usually apply to the police or other municipal departments.

The type of equipment best suited to the requirements varies greatly. In practically every case the amplifier may be a standard unit, likewise the loudspeakers, microphone and any other accessories. Perhaps the greatest variation will be found in the power supply requirements. Where a regular police car serves for both patrol and safety campaign work its more or less constant operation will probably keep the battery well charged and this provides an adequate supply source. On the other hand, much of the safety campaigning is done while at a standstill at some busy traffic center and under these conditions the strain on the battery is likely to be too severe unless the engine is left running at a rather high idling speed. In cases such as this a separate gas-driven generator is likely to be more dependable and economical. A separate battery for the sound system is another possibility, but the battery must be charged each night.

Output power requirements will vary, too. However, the most popular for this service seems to be an amplifier providing 25 to 30 watts as this has been found ample to overcome high local noise levels encountered at traffic intersections. In some instances amplifiers capable of operation from either 6-volt or 115-volt a-c sources are favored, particularly the portable type, because such an amplifier can be used for indoor applications as well as mobile.

One of the most effective weapons against traffic accidents is the sound-equipped safety campaign car.

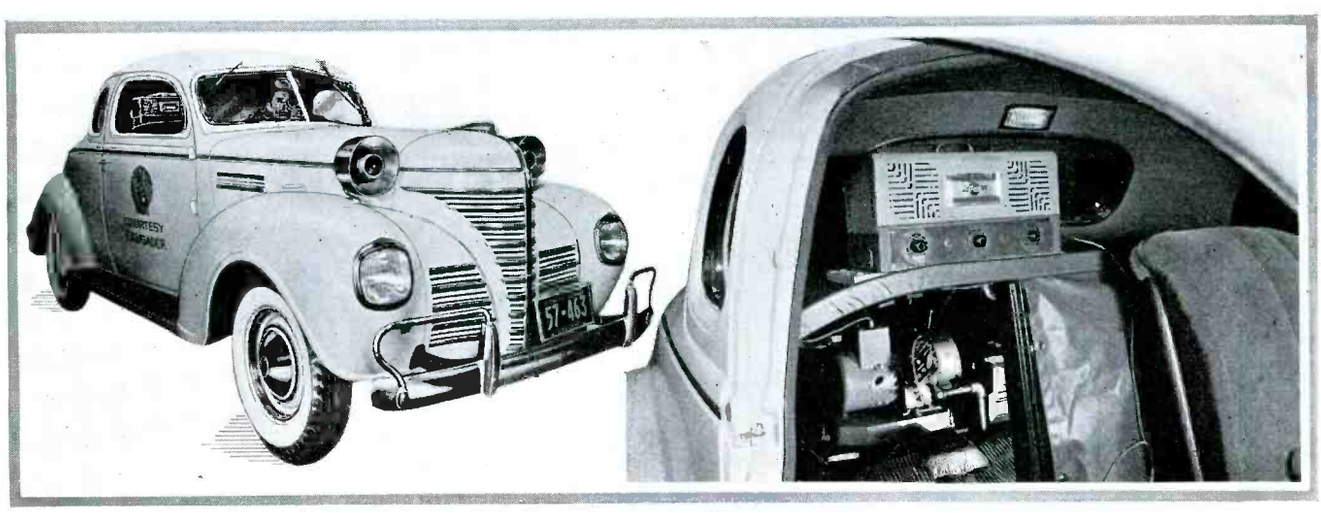
Both the original car of the Atlanta Police Department, referred to above, and the one presented to the city, employ Lafayette Model 458-T, 30-watt portable amplifiers which operate from either the a-c lines or the cars' batteries. The small motor-generator for this latter service and a switching arrangement permits instant change-over from one type of supply to the other. The amplifier is slung behind the driver's seat where the controls are readily accessible from either front seat position. A hand microphone and the two speakers on the car roof, faced in opposite directions, complete the equipment.

This system is used extensively at traffic intersections, calling attention of motorists and pedestrians to traffic infringements at the moment of their occurrence. An equally important use, however, is in periodic addresses to school children during recess time and when the schools let out. A feature of this latter activity is the organization and instruction of junior traffic patrols, the members of which serve as traffic officers at school crossings.

A more elaborate example of safety car and equipment is the Courtesy Crusader of the Shell Oil Co., Inc. This car travels extensively, accompanied by a traffic expert. Its purpose is to aid local police officers with their traffic problems, and to take active part in local safety campaigns.

The car was especially designed for this service, even to the extent of special chromium speaker baffles on the front fenders. To enable the sound system to operate continuously over long periods of time a 300-watt gas-driven generator

(*Continued on page* 403)



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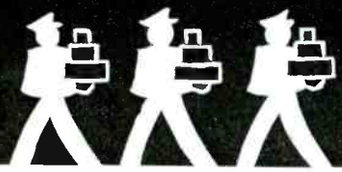

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RETAIL VALUE . . . $34.50

Boys' model: double bar streamlined 18 in. frame, chrome truss rods, light tank with horn, luggage carrier, chain guard, Texas steer handle bar, fine saddle, New Departure coaster brake, balloon tires. Also available in girls' model with similar features. Dealer Deposit $16.00

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Model 81 25-Shot, .22 Caliber Tubular Magazine Rifle. Strong, reliable, bolt action repeater. 24 in. round tapered blue steel barrel, crowned muzzle, Ballard rifling. Feeding mechanism, of simple, positive action, chrome-plated bolt assembly and trigger. Walnut finish, military type full pistol grip stock. Positive thumb-controlled safety. Special receiver peep sight, adjustable for windage and elevation. Globe target front sight, silver bead, quick detachable hood. Removable bolt assembly. Flush take down screw, automatic side ejector, self-cocking action. "Non-slip" shaped rubber butt plate, quick release trigger. Shoots .22 short, long and long rifle; regular or high speed without adjustment. Magazine holds 25 short, 20 long, 18 long rifle cartridges. Dealer Deposit $6.00

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S-839

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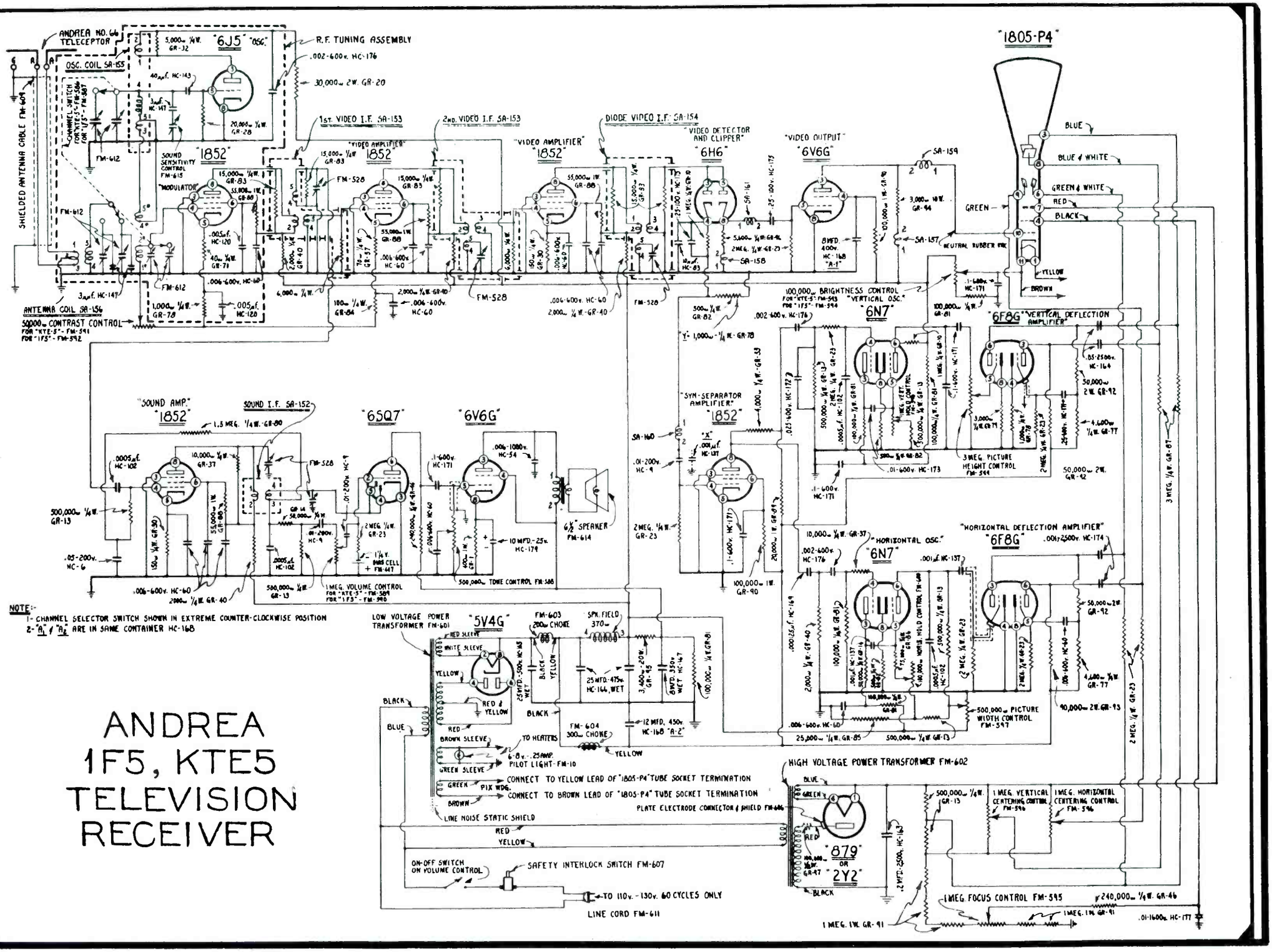

"Trouble-free" PRECISION Performance

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Combination Dynamic Mutual Conductance Tube Tester and 33 Range Rotary Selective AC-DC Multi-Range Set Tester

A complete service laboratory incorporating the "PRECISION" engineered "DYNAMIC MUTUAL CONDUCTANCE" tube tester. Accommodates ALL FILAMENT VOLTAGE REQUIREMENTS from 1.4 through 120 volts. Tests all new Loktals, Bantam Octals, Single Ended Television Amplifiers, Bantam Junior pocket radio and hearing aid tubes REGARDLESS of ARRANGEMENT of FILAMENT or ANY OTHER ELEMENT PIN POSITIONS. Also provides for ballast unit tests, condenser testing and neon continuity facilities.

Set Analyzing Features

★ SIX AC AND DC VOLTAGE RANGES at 1000 ohms per volt: 0-12; 0-60; 0-300; 0-600; 0-1200; 0-3000 volts.

★ FIVE DC CURRENT RANGES: 0-1.2; 0-12; 0-120; 0-600 MA; and 0-12 AMPERES.

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★ ACCURACY of the AC voltage and decibel ranges is closely maintained through individual calibrating controls, adjusted and sealed against laboratory standards. AC ACCURACY 3%; DC ACCURACY 2%.

TUBE ANALYZING FEATURES

★ A DYNAMIC TUBE TESTER employing an exclusive "PRECISION" engineered circuit, which in one operation, effectively tests all radio receiving tubes for both MUTUAL CONDUCTANCE and CATHODE STRUCTURE.

★ TESTS ALL TUBE TYPES: ACCOMMODATES ALL FILAMENT VOLTAGES from 1.4 to 120 volts. TESTS LOKTALS, BANTAM JUNIORS (Miniature Hearing Aid and Pocket Radio Tubes), BANTAMS, SINGLE ENDED, TELEVISION AMPLIFIERS, REGULAR OCTALS (MG, G AND METALS), SPRAYSHIELD AND GLASS TYPES.

★ AUTOMATIC PUSH BUTTON SYSTEM affords extreme flexibility for non-obsolescent free point tube analysis and insures ability to accommodate future tube releases.

★ DUAL FREE POINT FILAMENT TERMINAL SELECTION locates terminals of ALL filaments regardless of any rotating pin positions.

★ VISIBLE FILAMENT CONTINUITY TESTS.

★ SPECIFIC INDIVIDUAL LOADS AND VOLTAGES: (Control Grid, Screen, Plate, etc.) APPLIED TO RESPECTIVE ELEMENTS OF TUBE UNDER TEST.

★ VARYING AC SIGNAL applied to control grids.

★ METER READS IN PLATE CIRCUIT: Indications are entirely dependent upon control action (transconductance) of each of the intervening elements.

★ OPEN ELEMENTS: Meter indication instantly shows up any tube having an open element.

★ TESTS diodes, triodes, rectifiers, tetrodes, pentodes, multi-purpose tubes, gaseous types 0Z3-0Z4 and remote control gaseous types 0A4 and 2A4 regardless of varying filaments or other element positions. Individual tests available for each section of multi-section tubes including visible tests of the fluorescent screen and winking effect on cathode ray indicator tubes.

★ HOT CATHODE LEAKAGE TEST: Sensitive neon method quickly shows up poor cathode structure in accord with leakage specifications of leading tube manufacturers.

★ HOT INTER-ELEMENT SHORT TESTS made ingeniously simple through the use of "PRECISION" Automatic Interlocking Push Button System.

★ NOISE TEST pin jacks incorporated for earphone or amplifier connection.

★ BALLAST TESTS: The regular tube test sockets accommodate all ballast unit tests for open and loose elements and leakage between sections of multi-section ballasts.

★ PILOT LIGHT TESTS for all miniature screw base and bayonet type lamps.

★ BUILT-IN DOUBLE WINDOW ROLLER TUBE CHART provides speedy, easy reading tube references. New charts furnished from time to time at no charge.

★ MICRO-LINE ADJUSTMENT read directly on meter, provided by use of variable heavy duty line voltage control. No arbitrarily tapped transformer employed.

★ PILOT LIGHT (ON-OFF) INDICATOR: FUSED LINE PLUG.

★ TELEPHONE CABLED WIRING EMPLOYED THROUGHOUT.

★ ACCURACY of the tube test circuit is closely maintained by the use of individual calibrating controls, adjusted and sealed against laboratory standards at the factory.

There are more than 15 models in the PRECISION line of Mutual Conductance Tube Testers and Set Testers. Prices range from as low as $29.95

910 P—Same Tube Analyzing Features as series 920 but minus Set Analyzing Features. Modern 3 inch square type meter, D'Arsonval movement of 2% accuracy.

915—Same Tube Analyzing Features only as series 920. An impressive tube merchandiser with 9" square type meter.

922—Has all features of series 920. An impressive tube seller and set tester with large 9" square type meter.

912 P—Same Tube Analyzing Features as series 920 but minus Set Analyzing Features. Large 4½ inch square type meter, D'Arsonval movement of 2% accuracy.

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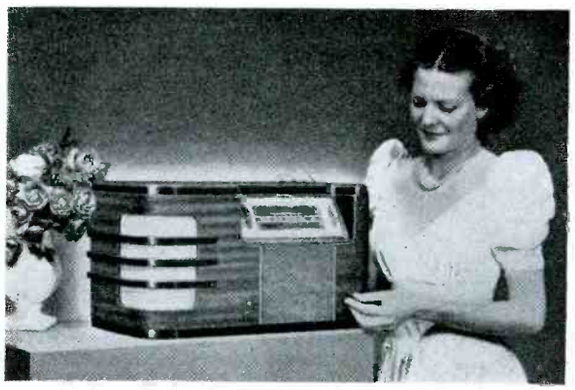
FREQUENCY MODULATION

G.E. HM80 RECEIVER



THE circuit diagram for the G. E. Model HM80 frequency modulation receiver is shown on the opposite page. This is one of the first commercial radios developed for the purpose of receiving frequency modulated signals.

• • • circuit

The antenna feeds a 6K8 converter. This converter produces, by heterodyne action, a 2.1-mc signal corresponding to the mid-frequency of the i-f amplifier. The antenna transformer is center-tapped for use with a balanced transmission line.

A potential for avc is derived from the limiter and applied to the converter and i-f amplifier tubes. Two stages of i-f amplification are required for driving the 6SJ7 limiter tube as indicated in the schematic. The i-f transformers are of the conventional double-tuned construction, suitably damped and over-coupled to provide the proper pass band without appreciable attenuation.

• • • limiter

The carrier limiter which removes noise interference essentially comprises a third i-f stage with a sharp cut-off tube operating at zero initial bias. The grid circuit returns to ground through a by-passed resistor on which is developed a d-c bias proportional to the applied i-f signal. The value of this resistor is chosen to provide approximately symmetrical cut-off at the threshold of limiting because of grid current on the positive swing and plate cut-off on the negative swing. In order to minimize these limiting conditions, both the screen and the plate of this tube are operated at reduced voltage. Under these operating conditions, and with the existing grid contact potential and zero-signal noise input, it is found that a resistance of approximately 330,000 ohms provides optimum operation. The d-c voltage developed is also used to provide avc for the first three tubes. It is thus apparent that, under suitable limiter operation, all amplitude components of noise and modulation can be effectively attenuated. The attenuation, however, can never be infinite because of the grid voltage-grid current characteristic of the limiter tube, whose output even after limiting takes place, is not completely independent of input.

• • • detector

A detector is required to change the frequency deviations of the i-f signal into conventional audio amplitude variations. This is accomplished by a diode discriminator circuit similar to that employed recently in broadcast receivers for providing automatic frequency control. Such a device requires the production of a d-c voltage dependent in magnitude on the deviation of the i-f signal-frequency from its mid-value and having a polarity dependent on the direction of this deviation. Obviously, this is substantially the requirement of the detector in a frequency-modulation receiver assuming provision is made for permitting the developed voltage to vary at an audio rate. The detector circuit shown comprises two series connected diode loads.

This detector circuit differs considerably from conventional circuits heretofore used for detection of frequency-modulated signals. These essentially include a series resonant circuit tuned near the unmodulated i-f midpoint and fed through a relatively high resistance to preserve linearity.

• • • audio

The audio amplifier comprises a 6SF5 first a-f stage followed by a 6Y6G output stage. Also included in the audio circuit are a bass-compensated volume control (R14) and a switch type tone control (S1). Overall audio degeneration is also employed; a portion of the signal is fed back from the voice coil to the 6SF5 cathode. The voice coil voltage is divided by the resistors R15 and R16 to limit the maximum degeneration to about 1 to 4. The condenser, C31, across R16 permits a larger percentage of high frequencies to be fedback, thereby boosting the bass.

• • • alignment

Should i-f alignment become necessary it will require a cathode-ray oscilloscope and a 2.1 mc signal generator with a superimposed 300-kc (plus and minus) sweep frequency. This generator may be made by constructing an oscillator with the tank condenser semi-fixed and a motor-driven variable, with the variable portion of proper capacity to give the 300-kc sweep around the 2.1-mc mid-frequency.

Connect the vertical plates of the oscilloscope across resistor R10 and align transformers L5, L4 and L3 progressively. A 2-mh choke should be connected in series with the high side of the oscilloscope.

With the same oscillator and sweep signal used above, connect the vertical plates of the oscilloscope across resistors R11 and R12. Align transformer L6 for an X-shaped crossover curve. Proper alignment of C12 is indicated when the sides of the curve near the crossover are the closest to a straight line.

Note: Keep the signal input high enough so that the noise limiter is functioning. This point is indicated when an increase in signal input no longer changes the size of the curve.

• • • r-f and oscillator

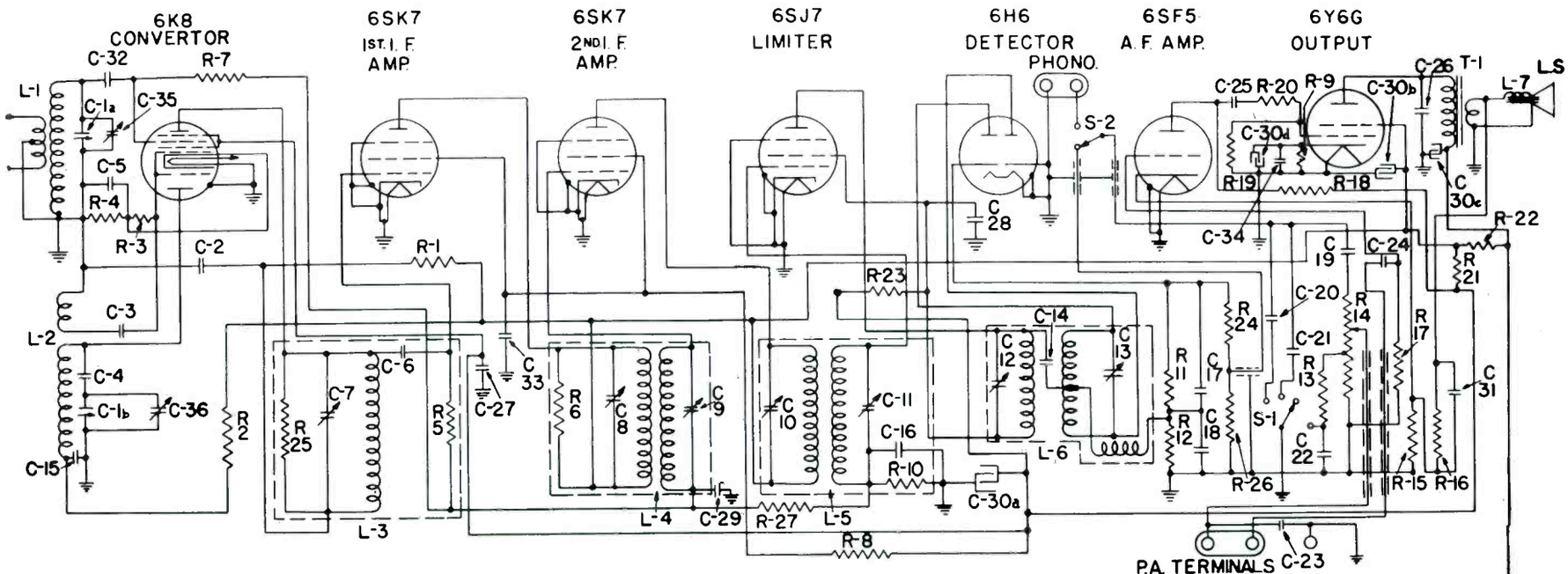
Tracking the antenna and oscillator circuits is easily obtained because of the limited tuning range. The usual trimming condensers are adjusted at the high-frequency end of the band. Padding of the oscillator at the low-frequency end is not required.

Make sure that the dial pointer coincides with the first division on the low-frequency end of the dial scale when the gang condenser is completely closed.

Connect a 0 to 50, or a 0 to 100 microammeter in series with the low end of R10. (A high resistance 0 to 10 volt d-c voltmeter may be used instead.)

Apply an unmodulated signal in the region of 43 mc to the antenna. Adjust the pointer so that it is set to the scale mark of the signal used and peak trimmers C36 and C35 for maximum meter reading.

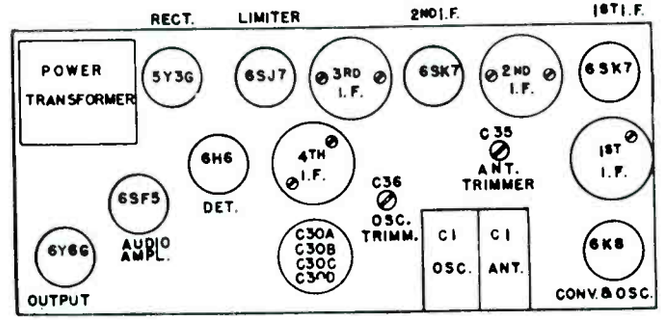
• G.E. MODEL HM-80 FREQUENCY MODULATION RECEIVER •

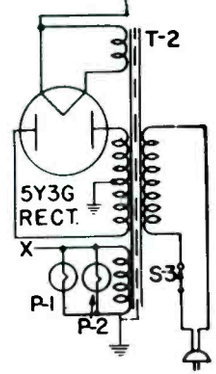


Symbol	Description
C-1	- 20 mmf. tuning condenser
C-2	- .02 mfd. 400 V. paper
C-3	- 47 mmf. mica
C-4	- 1200 mmf. mica
C-5	- .05 mfd. 200 V. paper
C-6	- 500 mmf. trimmer
C-14	- 47 mmf. mica
C-15	- 470 mmf. mica
C-16	- 22 mmf. mica
C-17	- 100 mmf. mica
C-18	- 100 mmf. mica
C-19	- .005 mfd. 400 V. paper
C-20	- .002 mfd. 600 V. paper
C-21	- 470 mmf. mica
C-22	- .002 mfd. 600 V. paper
C-23	- 220 mmf. mica
C-24	- .005 mfd. 400 V. paper
C-25	- .05 mfd. 400 V. paper
C-26	- .005 mfd. 600 V. paper
C-27	- .005 mfd. 400 V. paper
C-28	- .05 mfd. 400 V. paper
C-29	- .05 mfd. 200 V. paper
C-30a	- 20 mfd. 250 V. Dry Electrolytic

Symbol	Description
C-30b	- 20 mfd. 250 V. dry electrolytic
C-30c	- 40 mfd. 250 V. dry electrolytic
C-30d	- 20 mfd. 25 V. dry electrolytic
C-31	- 0.1 mfd 200 V. paper
C-32	- 470 mmf. mica
C-33	- 0.1 mfd. 400 V. paper
C-34	- .05 mfd. 200 V. paper
C-35	- 2-15 mmf. antenna trimmer
C-36	- 7-23 mmf. air trimmer
R-1	- 2200 ohms 1/2 W. carbon
R-2	- 6800 ohms 1/2 W. carbon
R-3	- 47000 ohms 1/2 W. carbon
R-4	- 330 ohms 1/2 W. carbon
R-5	- 470 000 ohms 1/2 W. carbon
R-6	- 47 000 ohms 1/2 W. carbon
R-7	- 470 000 ohms 1/2 W. carbon
R-8	- 4 700 ohms 2 W. carbon
R-9	- 220 ohms 2 W. carbon
R-10	- 330 000 ohms 1/2 W. carbon
R-11	- 100 000 ohms 1/2 W. carbon
R-12	- 100 000 ohms 1/2 W. carbon
R-13	- 120 000 ohms 1/2 W. carbon
R-14	- 2 megohm volume control

Symbol	Description
R-15	- 82 ohms 1/2 W. carbon
R-16	- 220 ohms 1/2 W. carbon
R-17	- 15 megohms 1/2 W. carbon
R-18	- 220 000 ohms 1/2 W. carbon
R-19	- 470 000 ohms 1/2 W. carbon
R-20	- 1500 ohms 1/2 W. carbon
R-21	- 2200 ohms 1 W. carbon
R-22	- 1600 ohms 3-1/2 W. wire wound
R-23	- 2200 ohms 1/2 W. carbon
R-24	- 100 000 ohms 1/2 W. carbon
R-25	- 33 000 ohms 1/2 W. carbon
R-26	- 220 000 ohms 1/2 W. carbon
R-27	- 2.2 megohms 1/2 W. carbon
S-1	- tone switch
S-2	- phono switch
S-3	- power switch - on S-2
L-1	- antenna transformer
L-2	- oscillator transformer
L-3	- 1st IF transformer
L-4	- 2nd IF transformer
L-5	- IF limiter
L-6	- Discrim. transformer





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Units of larger diameter supplied with self-contained feature for universal mounting . . . either vertical or horizontal. All leads at one end.

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Supplied with simple adjustable strap for horizontal mounting. Insulated leads at both ends.

C

These are provided with bare wire leads at both ends. Because of their small size no mounting feature is required.

New P.R. MALLORY & CO. Inc. MALLORY Tubular Condensers cover your every replacement need

Once again, Mallory's constant marketing and engineering alertness provides you with an opportunity for speedier, more efficient condenser replacement—at better profits. The new line of Mallory Tubular Condensers has been developed out of an exhaustive study of all original equipment types. As a result, the line gives you complete replacement coverage on millions of condensers now in use—and the first adequate answer to the problem of replacements for inexpensive compact receivers.

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*NOT *etched construction*

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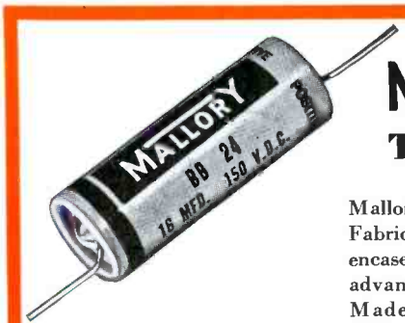
Over a million Fabricated Plate Capacitors are now in use as original equipment and millions more are scheduled to be used this year. Look for them in all modern sets. Mallory FP Capacitors are being imitated in appearance but you can identify them by the number (1) or (3) in a circle. Remember . . . they may be imitated in appearance but they *can't* be imitated in construction and performance.



P. R. MALLORY & CO. Inc. MALLORY Fabricated Plate Tubular Condensers (Type BB)

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CRYSTAL CALIBRATOR APPLICATIONS

By HOLMES WEBSTER

HALLICRAFTERS, INC.

CRYSTAL oscillators, particularly those utilizing the dual-frequency crystals capable of oscillating at either 1000 kc or 100 kc, have come into rather extensive use among Service Men. They do not and cannot entirely replace the regular service signal generator because they do not provide outputs at the odd intermediate frequencies of 465, 456, etc. They can, however, perform many of the functions of the tunable signal generator and perform them better and more accurately, particularly since the modern receiver calls for far greater accuracy of alignment and calibration than did those of even a couple of years ago.

Dual-frequency crystal oscillators were covered rather comprehensively by F. A. Lennberg in SERVICE for April.[1] A discussion of the special dual-crystal units and a circuit was presented for the benefit of Service Men who desired to construct such a crystal calibrator.

• • • frequency standard

Since this comparatively recent date, however, there has been a series of developments in the Hallicrafters Laboratory where the engineers designed the Model HT7 frequency standard.

This standard was developed primarily for use by hams in checking their transmitting frequencies in accordance with FCC regulations, and in calibrating the band-spread tuning dials of their communications receivers, checking general coverage calibration of receivers, etc., all of which are applications calling for better accuracy than that obtainable from the usual low priced signal generator.

A device which can so effectively serve these purposes for the ham can likewise serve the Service Man well.

Two features of the HT7 unit are: (1) that it provides not only 1000- and 100-kc fundamentals, but also a 10-kc fundamental; and (2) a tunable harmonic amplifier is built in so that any desired harmonic can be amplified to high level. Even the harmonics of the 10-kc fundamental are useful up to the thousandth and higher.

In addition to these features, the circuit employed in the 100-kc and 10-kc mode of oscillation is adjustable over a narrow range which permits the *crystal frequency* to be adjusted to zero beat with an external standard such as the standard frequency transmissions of WWV.

The 10-kc output of the Hallicrafters Model HT7 frequency standard has the advantage that precise checks of the receiver calibration in the broadcast band can be made by merely tuning the receiver dial through its range.

The 10-kc output has the advantage in service work that precise checks of receiver calibration in the broadcast band can be made in a matter of seconds. It is only necessary to tune the receiver over this range to check every 10-kc point. This same check can as readily be extended to the short-wave ranges, although here the check of points as close together as 10 kc offers less advantage. All checking with the 10-kc output is simplified by the fact that at every 100 kc the output is much higher than at the in-between points, thus providing a definite and frequent marker which avoids confusion.

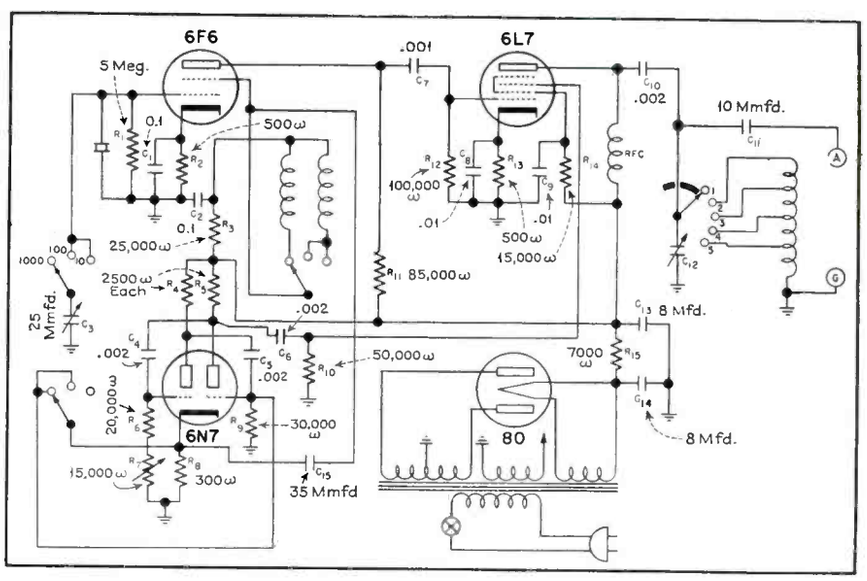
• • • circuit

The circuit of the HT7 is shown in Fig. 1. Four tubes are employed as crystal oscillator, harmonic amplifier, crystal controlled multivibrator and power supply rectifier. The crystal in the 6F6 circuit is one of the standard Bliley dual type with a gang switch for changeover from 1000- to 100-kc outputs—or to 10-kc output.

The oscillator output is capacity coupled to the control grid of the 6L7 harmonic amplifier, the output of which is tunable over a wide range by means of a coil selector switch and the condenser C_{12}.

Another branch of the oscillator output is fed into the cathode circuit of the 6N7 multivibrator, locking its frequency in step with the crystal frequency—but

The crystal in the circuit is a standard dual type with a gang switch for changeover from 1000 kc to 100 kc or 10 kc. The oscillator output is capacity coupled to the control grid of the 6L7 harmonic amplifier, the output of which is tunable over a wide range by means of a coil selector switch and the condenser C_{12}.



[1]Crystal Calibrators, by F. A. Lennberg, SERVICE, April, 1939, p. 164

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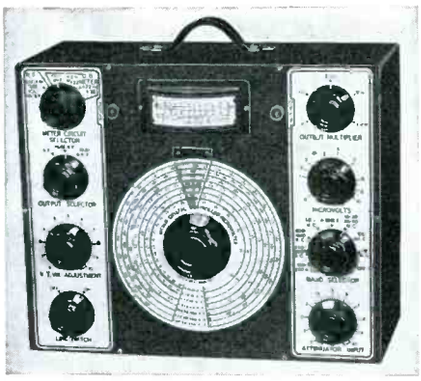
CRYSTAL CONTROLLED MICROVOLTER

Model 19X



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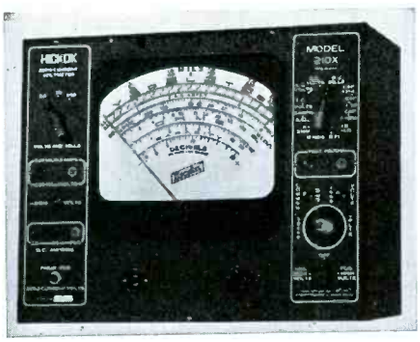
Calibrated output in microvolts (0.5 to 100,000) from 100 KC to 30 megacycles.
Self-contained vacuum tube voltmeter, power level meter and crystal. Over 250 crystal controlled output from 100 KC to 150 megacycles, modulated or unmodulated, with accuracy better than .01%.
Power level meter has three decibel ranges from — 6 to + 38 db.
Gain per stage, selectivity and sensitivity.
Calibrated A.F. output .5 microvolts to 1 volt.

DISPLAY ZERO CURRENT ANALYZER

Model 210X



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Capacity: Three ranges from .0001 to 200 microfarads.
Resistance: Four ranges to 50 megohms.
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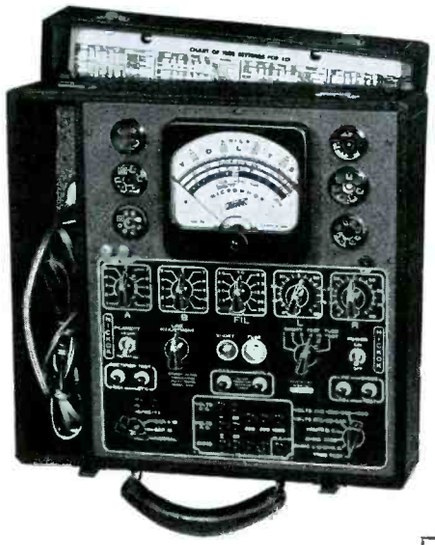

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Set testing section has four uniform ranges of A.C. and D.C. volts, D.C. milliamperes, ohms to 25 megohms. Capacity to 24 microfarads. New electronic rectifiers avoid rectifier troubles.

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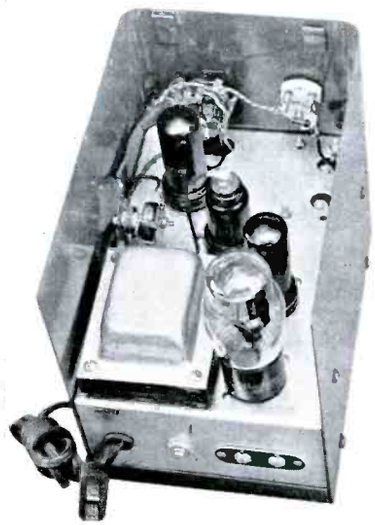
at its 10 subharmonic. The multivibrator output is connected to the injector grid of the harmonic amplifier where it is mixed with the 100-kc output to provide the marker points mentioned above.



Such a unit as this cannot, of course, replace the signal generator in alignment of radio receivers. It can, however, be used for calibrating the frequency of the generator.

The multivibrator is shorted out in the 1000-kc and 100-kc positions of the fundamental frequency selector switch.

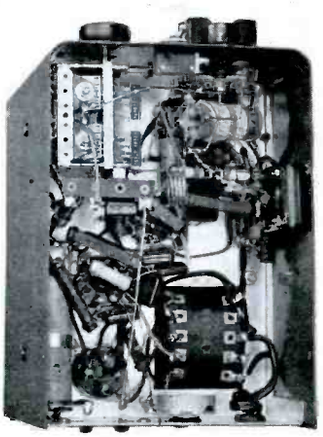
In position 1 of the harmonic-amplifier coil switch, the coils are not in the circuit and the output is therefore that of the untuned harmonic amplifier. This is for use up to about 5000-kc where harmonics are strong enough without tuning. It is primarily at the higher frequencies that the tuned output grows increasingly advantageous. It also serves a definitely useful purpose as an attenuator. Just as a high order harmonic can be built up by resonating the output circuit, so can it be attenuated by tuning this circuit off resonance. Thus the output is variable over a wide range—a distinctly advantageous feature for many applications, particularly receiver alignment.

• • • applications

Such a unit as this cannot, of course, be used directly in i-f alignment because of the odd frequencies involved. It can, however, be used to advantage for calibrating or checking the frequency of a signal generator used for this purpose. This is accomplished by feeding the output of the standard into a receiver, then beating the second harmonic of the signal generator against successive 10-kc points of the standard in the broadcast band. This provides check points at every 5-kc point throughout the intermediate range of the oscillator, which is ample for precise calibration or checking.

Fed into a sensitive receiver, even the 100-kc harmonics are usable for calibration checking purposes up to 60 megacycles and higher. With the forthcoming increasing importance of the ultra-high frequency ranges for television, high-fidelity broadcasting, facsimile and frequency-modulated broadcasting, this is an important item. When a single range of a receiver of the near future may cover a band 30,000 kc wide it is obvious that careful calibration is to be a definite requirement.

In addition to its normal service applications, some of which are touched on in the foregoing, the HT7 finds application in the laboratory as well. When thoroughly warmed up it is capable of maintaining its 100-kc output constant within a cycle or less over a matter of hours. Its harmonics and also the 10-kc fundamental and harmonics provide this same proportionate degree of frequency stability.



When thoroughly warmed up the HT7 is capable of holding its 100-kc output constant within a cycle or less over a matter of hours.

The method of adjusting the 100-kc crystal to precisely that frequency is described in the April issue of SERVICE.[1] The standard frequency transmissions of WWV on 5, 10 and 20 megacycles provide the best standard where the utmost accuracy is required. For most purposes, however, local broadcast stations are entirely suitable, many of them suffering frequency variations not exceeding plus or minus 5 cycles. Stations operating on any channel of the standard U. S. broadcast band may be utilized in making this adjustment, using the harmonics of the 10-kc output.

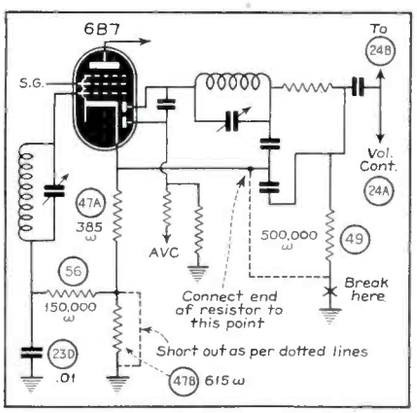
• • • output unmodulated

It will be noted that no provision is made in the HT7 for modulating the output. For its primary intended application among hams modulation is neither necessary nor is it desirable because the sidebands of modulation make it confusing to adjust to zero beat. For the Service Man who insists on employing an output meter for a visual indicator a switch could be added to the standard to permit unfiltered supply to be applied to one or more of its tubes; this would provide 120-cycle modulation when desired. But due to the flattening out effect of avc on audio output some method of measuring relative signal strength ahead of the second detector in a receiver is more desirable. A voltmeter connected across the avc system serves this purpose; or a d-c milliammeter connected in the plate supply circuit to one or more tubes controlled by the avc system will serve equally well. Such visual indicators also have the advantage over the audio-output meter that they provide a means for much more precise zero-beat determinations. At low heterodyne beats in the order of a few cycles such meters fluctuate with the beat. This makes it possible to check frequency differences of less than one cycle accurately and to adjust circuits to exact resonance.

AIR MATE 544267

(United Motors Service, also OLDS 405046, Pontiac 544267, 544289)

Poor sensitivity: Cause excessive noise suppression. Unsolder grounded end of resistor No. 49 (500,000-ohm audio diode load). Short 615-ohm section of Candohm resistor (No. 47-A, -B, -C) by connecting short piece of wire from what was grounding lug of above resistor No. 49 to second tap from front of set. Connect loose end of above resistor No. 49 to front terminal of Candohm resistor (end connected to



Excessive noise suppression can cause poor sensitivity in these sets. The remedy is shown above.

cathode of 6B7 tube). Replace resistor No. 52 (120,000-ohm 42 grid resistor) with 400,000-ohm ½ or ¼-watt unit. Realign. This change requires only a short time to complete and effects a decided improvement in performance. *D. C. Sprong*

THE NEW UTC PLANT

Now housed at 150 Varick Street, New York City.

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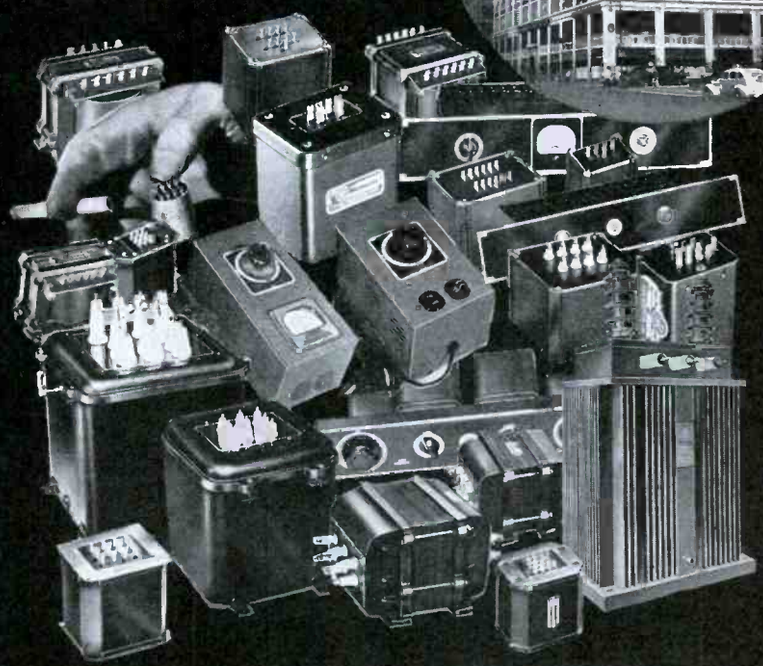

Twenty times the size of the UTC plant in 1933, this new plant is made possible by the wide recognition of UTC achievements in the quality transformer field. It is significant that, on the whole, difficult jobs find their way to UTC —jobs requiring unusual engineering ingenuity; improved design features and materials; advanced production methods. UTC transformer products cover the range from ⅓ oz. aircraft units to 100 KW Broadcast Station components.

Nowhere in the world can one obtain finer transformers than those produced by UTC.

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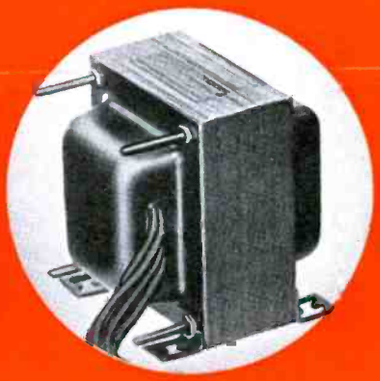
UNITED TRANSFORMER CORP.

Write: ENGINEERING DIV. ★ 150 VARICK ST ★ NEW YORK, N. Y.

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

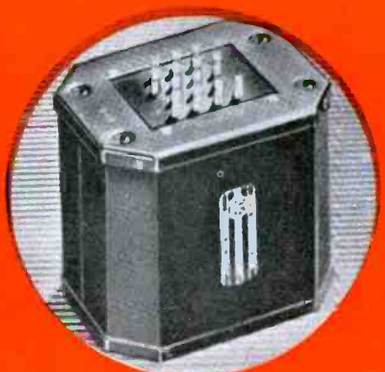
WETPROOF AUDIOS

UTC wetproof audio components are excellently designed for replacement service. In addition to good frequency range, coils are vacuum-pressure treated followed by the UTC Mould Seal process to prevent moisture absorption.



VARITAP

Through unique mechanical and electrical design, five UTC Varitap Duplicate transformers will service as many types of radio receivers as the 15 or 20 units more customarily employed for such service.



PUBLIC ADDRESS

The UTC Public Address Series of audio and power components includes items for any type of PA and Transmitter service. Though of medium price, these units are conservatively designed to assure dependability under the most adverse operative and climatic conditions.

STREET CAR INTERFERENCE

By EUGENE TRIMAN

THERE are three street car interference causes. The primary cause is originated at the street car. The vehicle produces interference in two ways. The minor interference is such because it is periodic and not present in all seasons of the year. This type is a noise as a result of direct radiation due to air ionization at radio frequencies. This radiation is started at the periodic improper contact of the overhead trolley and feed-wire. This type of noise is troublesome only when the trolley wires are covered by ice, sleet, etc. There is also a radiation which comes from under the car and is noticed while passing close to a street car. All other similarly agitated radiation is nulled by the metal side panels of the street car, by metal floor structure and roofing.

• • • major source

The major source of agitation from the street car is the effect produced by the shielding and modulation influence on the signal of the station to which the auto radio is tuned. This is done by the overhead trolley wires. These wires are radically changing in their effective nature at radio frequencies. At one fractional interval they are reradiators of the signal, at another time they are effectively grounded, with variations between one extreme and the other. The change is caused by the insertion and the removal of circuit elements between the wires and the grounded tracks with the running street car as the agent. The circuit elements are devices such as signal buzzers, relays, air compressor motors, and driving motors. Conclusive is the fact that on lines where there are no tracks but rubber-tired street cars, the only noticeable effect that the remaining overhead wires have is to reduce the field strength of radio signals and there is no agitation such as the former's fluctuating conductance of series circuits including flashing commutators and bad wheel to track contact.

With track cars, the problem of quiet reception is solved by the use of receivers with high sensitivity, good avc and squelch action and finally, symmetrical reception characteristics (on selectivity).

Any fairly modern receiver will respond to a treatment which determines the assurance of these requisites without any alteration of the original design. All receivers are troublesome when they slip from the above qualifications. The system follows.

IN ORDER to qualify the method presented and the facts given, let it be known that the described practices were evolved in a city depending for the most part on the electric surface car for transportation. In addition, the city (Cleveland) blesses its radio-minded motorists with as noble a barrage of varied street car interference as ever jolted a grid cap in any radio in any city.

This article is concerned with recalling to mind the nature of the interference encountered, and with what combination of distinct service steps, widely used, one can thereby process a receiver so that it will act favorably in noisy locations.

The method should be a useful one because it at least gives a footing on which to stand when dealing with this perplexing problem.

• • • first step

The first step is of course a determination that the receiver is perceptibly normal in all ways.

This is followed by a careful alignment. The writer advises that the alignment be made with an oscillograph. After the complete adjustment, the avc action is noticed. The voltage should be measured and compared with manufacturer's data. When the data is not given, tune the set to a strong signal and measure the voltage on the grids of the affected tubes. This voltage should be compared with past readings taken on other sets with the same tube complement. It is necessary then to use your own judgement as to whether or not the change is sufficient. Until Service Men are supplied through their usual sources with the avc data, the radio industry will of necessity be required to be satisfied with such judgement as we make on the problem.

As an additional note on the subject, the writer has been advised that it is better to align sets with the avc in action. The theory is that the circuits which include the grids of tubes affected by the avc change in total capacity when and if the avc voltage is removed. This action is caused by the change in capacitance of the grid of each tube with a variation in applied grid voltage. The grid to cathode capacity varies at least 1 mmfd with normal variations which would occur in grid voltage when the avc is removed. A change of 1 mmfd is more than enough to throw the grid circuits or transformer secondaries out of resonance.

If the avc action has been found faulty and corrected, it is advisable to again align the set. It is the final adjustments that give the results we require.

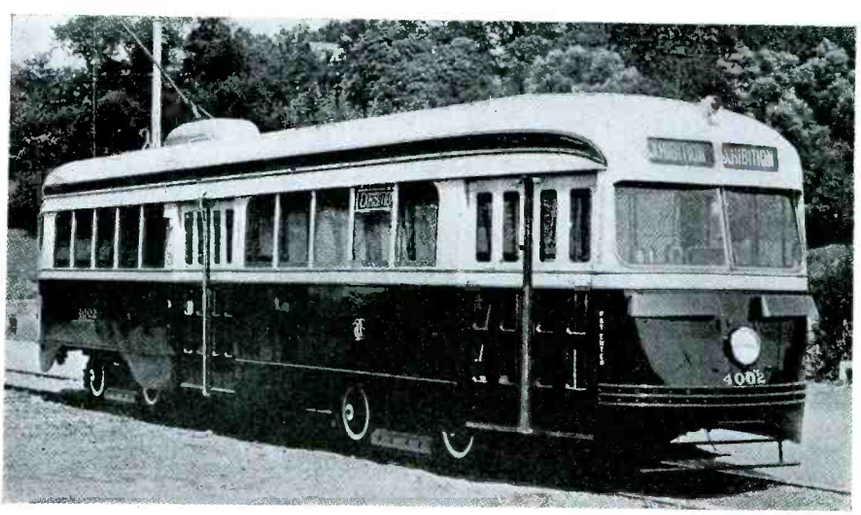
• • • antenna

With the set aligned and avc working properly we turn our attention to the car aerial. Test the aerial for shorts. Tolerate no leakage. If the car is equipped with an aerial other than the vertical type rod suggest installing one of these types to the customer. These aerials are now very low in price and they are unparalleled in performance on street car lines. This can be laid directly to their directive characteristics.

The last step is arrived at upon the installation of the recommended an-

(*Continued on page* 403)

The modern trolley does not radiate interference. This is undoubtedly due to more efficient motors, better switching and ample contact area. The low shield skirts also help reduce interference radiation.



ASSOCIATIONS

RADIO SERVICEMEN OF AMERICA

THROUGH the efforts of President George Duvall, RSA has been able to secure a complete course in the servicing and installation of television receivers. While television will not be available for all chapters for some time, RSA feels that now is the time to prepare the foundations of television training for RSA members.

The plan is to send separate lessons in the course to each chapter approximately once a month. The chapter will hold a round table discussion and study of the material of the lesson, and each member will answer a prepared questionnaire testing his understanding of the subject studied. These quizzes will be returned to the national office for grading. Subsequent lessons will be sent to chapters only after all individual members have turned in their answers to the previous lesson.

In this way, RSA will be able to assure manufacturers that RSA has a trained group of television Service Men, ready when television arrives in each community.

The board of directors authorized, at its June meeting, the granting of honorary memberships "to those individuals, firms, or corporations who have given their active support and inspiration to the promotion of RSA." Certificates and logotypes will be awarded to these honorary members as soon as they are prepared.

The executive committee has awarded honorary memberships to the following at this time: Aerovox Corp., New Bedford, Mass.; Belden Manufacturing Co., Chicago; Crowe Name Plate and Manufacturing Co., Chicago; Lenz Electric Manufacturing Co., Chicago; P. R. Mallory and Co., Inc., Indianapolis, Ind.; Quam-Nichols Co., Chicago; The Radiart Corp., East Cleveland, Ohio; Raytheon Production Corp., Newton, Mass.; Standard Transformer Corp., Chicago; Thordarson Electric Manufacturing Co., Chicago; United Transformer Corp., New York City, and The Webster Co., Chicago.

Arthur Moss has been appointed executive secretary of the recently organized National Radio Parts Distributors Association

RSA is very proud to announce that, beginning in the early fall, a program of complete cooperation between the broadcasters of the country and local RSA chapters will be carried out through a plan developed by RSA and NAB.

The executive secretary of RSA, Joe Marty, Jr., as a guest of the National Association of Broadcasters, addressed the convention at Atlantic City, July 13, on "The Missing Link in Broadcasting." He showed how the Service Man is the "good will ambassador" of the radio industry in the American home. Marty told the complete story of RSA to the four-hundred-twenty American broadcasters represented at the Convention. He pointed out that the Service Men of RSA were in a unique position to help both themselves and the broadcasters. The reaction to his remarks was very favorable, and the groundwork was laid for complete cooperation between RSA and NAB.

• • • newark

We are holding our picnic and outing Sunday, Sept. 10, at Mountain View, N. J. The general public as well as the radio industry is invited to participate. There will be free beer and free soda (for ladies and sissies). Swimming, dancing, music and games will be the order of the day. Prizes will be awarded for various forms of competition. Announcements will be made of the 100-watt public address amplifier, which once again our chairman is loaning us for the purpose.

Mr. Clark, one of our members and a graduate engineer, will give half-hour lectures on every-day mathematics for the Service Man, starting about the middle of August.

Joe Marty, executive secretary, donated a valuable good luck charm to the chapter to be awarded to the member who performs outstanding service for the association. I grabbed off the award, and blushingly admit I deserved it. Remember the by-laws, the vacuum tube voltmeter diagrams and the bulletin boards? It was generally conceded (when the award was given, that whenever a helping hand was needed good ole Scoppy Wald was ever ready to do his share.

W. H. Gnadinger

• • • springfield

The chapter met June 7 to consider the proposed changes in the national bylaws, as outlined by director Stover. A vote was taken on each suggested change. Kenneth Beatty gave a demonstration of facsimile equipment. . . . Something new to most of us, Mr. Crabtree gave a very interesting talk on servicing costs, using data and articles published by National RSA for comparison.

The stag party held at the Leland Hotel May 17 was a howling success. Glen Sillman says poker pays about the same as radio service! When it came to the door prizes, the secretary held the box of names, and the president, Doc Spindel, drew them. The first name out was that of the secretary, and the second was that of the president! So-o-o we started over!

P. S.—Through careful manipulation the liquid refreshments came out even, but the members not so even!

Ray Westerfield, secretary

• • • stamford

The Stamford, Conn., Chapter of the Radio Servicemen of America, Inc., held their regular semi-monthly meeting in Stamford on Wednesday evening at 8:30. J. S. Patterson of the Tung-Sol Radio Tube Co., Inc., spoke on "New Developments in Radio Tubes and How They Affect the Radio Service Man." At the conclusion of the meeting a general open forum discussion was held.

Also attending the meeting as guests were Henry M. Lutters, director for the 18 district, and Irving Einhorn, sales representative for Tung-Sol Radio Tube Co., Inc., in Connecticut.

• • • steubenville

Due to a mixup in arrangements, a joint meeting with the Steubenville Amateur Transmitter Association to hear and see a demonstration of "Resuscitation by Artificial Respiration" did not come off. We hope to arrange a future date with them.

Leonard Roberts, Jr., secretary

One hundred and fifty Service Men have enrolled in the Andrea television course in New York.

• • • washington, d. c.

Movies, and the disposition of the Rider IX manual we won in the new member contest, were special attractions of our meeting of June 6, while the feature of our June 20 meeting was a talk on "Frequency Allocations" by John Creutz.

Phillip Partridge, secretary

PARTS DISTRIBUTORS GROUP

• • • nrpda

The National Radio Parts Distributors Association, organized to present a voice for parts jobbers as a national unit and to cooperate with manufacturers in establishing and maintaining definite standards for distributors, has appointed Arthur Moss, long a well known figure in the industry, as executive-secretary. Temporary offices will be maintained at 5 W. 86th St., New York City. The officers of the association, elected for the current year, are: Walter C. Braun, president; Elliott Wilkinson, first vice-president; A. D. Davis, second vice-president; Alex Hirsh, third vice-president; Aaron Lippman, fourth vice-president; George D. Barbey, secretary, and William Schroning, treasurer.

The first meeting of the NRPDA tube committee was held on Tuesday, July 25, at the Hotel Brittany in New York City. All the Eastern members of the committee and the chairman, Maurice Despres, were present.

The whole tube situation was reviewed and certain problems affecting the replacement market were analyzed. Recommendations will be made shortly after the completion of a national survey. It is the intention of the tube committee to submit their findings to the various tube manufacturers for their consideration.

Arthur Moss, executive secretary

OTHER GROUPS

• • • prsma

How does Bill Kalberer stand the heat of those large cigars he smokes?

Quite a few of the old members were out on July 11 meeting. Some we haven't seen for some time.

Keep your eyes open for those stolen radios belonging to Stanley Craven.

Non-members take note—if you join now the dues are just one-half. Why not take advantage of this opportunity?

All the bouquets and thanks to RCA for their service notes on television.

One of our members, Amil Gumula, has entered the radio parts business at 3515 N. 17 St. Look for his ad next issue. Good luck, Amil.

Prsma News

• • • television course

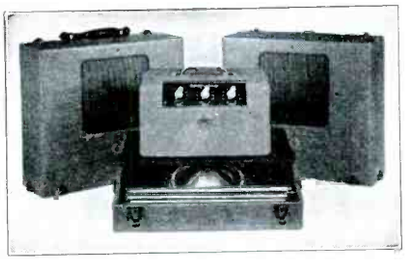
Will there be a widespread public demand for television receivers this fall? One hundred and fifty radio dealers have said: "Yes, absolutely." So confident are they of active television buying that they have enrolled their Service Men in the Andrea course in practical television servicing, being given by Andrea Radio Corp., manufacturers of sight-and-sound receivers, at Hotel White, Lexington Ave., and 37 St., New York City, on Friday evenings, since July 14. This course, of six sessions, is considering the practical problems encountered in the field both as to installation and maintenance. The plan of the course is based on the company's actual experience in manufacturing sets for use in the New York area. During the first part of each session, a lecture is delivered to the entire class by Harold J. Heindel, chief engineer of Andrea Radio Corp. The students take notes on the lecture, on which a written examination is given. Then the class is divided into three groups, each in charge of one of the Andrea television engineers. Each instructor has a television receiver chassis for group instruction. At the first session, only the first assembly stage has been completed. From week to week, as the class meets, subsequent assembly stages are added to the chassis. Thus, the students follow through every detail of the receiver design.

Finally, to clear up any special points, each group concludes with a question-and-answer session, when the students ask their instructor any questions which have come up during the instruction period, or in the course of the week's work

• • • television society

The present increased interest in television, facsimile and other branches of the electronic art is the incentive of a group of Hollywood scientific men to form a national, technical organization to advance the theory and practice of television engineering and the allied arts and sciences. Facsimile will be included in the research to be done by the group, which will include the leading engineers of the country.

Hollywood has one organization which has been local in its operation in its free, public dissemination of a practical knowledge of television reception, known as the Hollywood Television Society. It was formed in 1936 from among students of post-graduate work in television. Among its activities has been the giving of citations to men who have contributed to the television art. Those receiving these honorary memberships have been Dr. Ralph D. Lemert, Harry R. Lubcke, and Dr. Lee Deforest. The founder and executive head of the Society is George H. Seward, Ph.B., a Yale man who is the leading spirit in the new organization which has taken the name of "Television Engineers' Institute of America." Local chapters of the new organization will operate in those localities where there is interest in television.

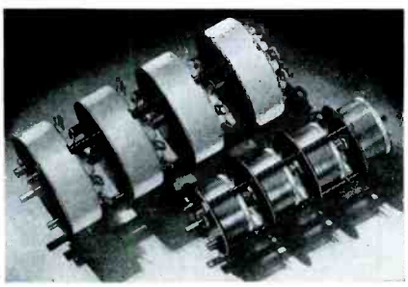


WEBSTER AMPLIFIER

The new 14-watt Webster-Chicago amplifier, No. 814, is mounted on a false bottom of its carrying case, and when lifted out discloses a full length mike stand in three sections. The amplifier has two input controls and a tone control. Output impedances are 4, 8, 250 and 500 ohms. Additional information may be obtained directly from *Webster Co.*, 5622 Bloomingdale Ave., Chicago.

OHMITE TANDEM ASSEMBLIES

Tandem assemblies of 2, 3, 4 or more of the new Ohmite power tap switches are available from *Ohmite Manufacturing Co.*, 4835 Flournoy St., Chicago. These tandem assemblies may be used to switch both sides of a single-phase line or to switch all



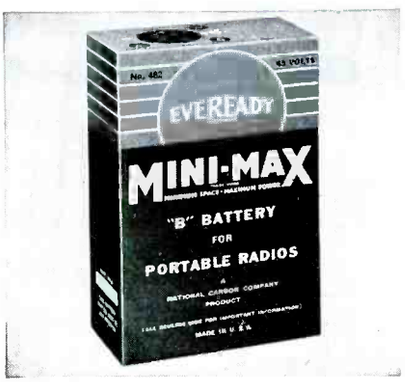
phases of a 3-phase line; to provide simultaneous control of separate circuits and for other applications.

CONSOLIDATED AERIAL BOOSTERS

Consolidated Wire and Associated Corps., 518 S. Peoria St., Chicago, have announced auto-radio aerial booster coils which will fit into present aerial installations without change of fittings to give increased efficiency, it is said.

EVEREADY MINI-MAX BATTERIES

National Carbon have introduced their Mini-Max 45-volt B battery, which they



claim doubles the listening hours over conventional batteries of equal size. These units (No. 482) are designed chiefly for battery portables and similar applications.

Additional information may be obtained from *National Carbon Co., Inc.*, 30 East 42 Street, New York City.

AEROVOX DUAL MIDGETS

Aerovox Corp., New Bedford, Mass., announce the addition of several dual-section numbers to its Dandee line. These are the 8-8 and 8-16 mfd, 450 v; 8-8, 8-16 and 16-16 mfd, 200 v and 20-20 mfd, 150 v and 10-10 mfd, 25 v. The 10-10 mfd, 50 v unit previously added rounds out the line of dual section numbers.

CLARION SOUND SYSTEM

The *Transformer Corp. of America*, 69 Wooster St., New York City, announce

the addition of a new 6-volt, 110-volt sound system to their line. The Model C463 includes a self-contained amplifier and is available with or without phono attachment. Simultaneous operation of the three input channels is provided. Additional information on this and other Clarion sound systems may be obtained directly from the manufacturer.

TRIPLETT TUBE TESTER

The Triplett tube tester illustrated has a 7-in (red dot) lifetime guaranteed indicating instrument with a 6-in good-bad

scale. The illuminated speed roll chart provides thirty-six readings at a single glance, it is said. The tester is available in both portable and counter styles.

Additional information may be obtained directly from *Triplett Electrical Instrument Co.*, Bluffton, Ohio.

METAL-CASED TUBULARS

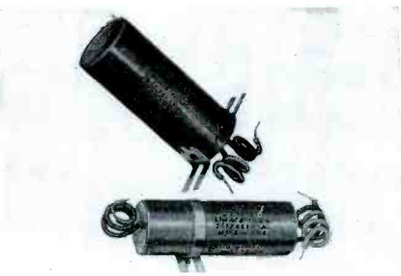
Mallory announces a line of single section tubular condensers, Type BB, made with fabricated plate and housed in hermetically sealed one-piece drawn aluminum cans. An insulating cardboard cover is furnished and all units have bare wire leads. Additional information may be obtained directly from *P. R. Mallory & Co., Inc.*, Indianapolis, Ind.

RCA TUBE TESTER

The new RCA tube tester, available in either counter or portable models, will check the performance of every standard tube now available and has built-in adaptability for new types likely to be introduced in the future, it is said. The unit tests, in addition, pilot lamps, Christmas tree bulbs and flashlight bulbs. Spare sockets are provided for future types. Additional information and prices may be obtained from *RCA Manufacturing Co., Inc.*, Camden, N. J.

MALLORY TUBULARS

A new line of Mallory cardboard tubular condensers is said to give complete replace-



ment coverage on millions of condensers now in use. Over 50 ratings, with common anode, common cathode and separate sections are available. Additional information may be obtained directly from *P. R. Mallory & Co., Inc.*, Indianapolis, Ind.

C-D CAPACITOR BRIDGE

The Cornell-Dubilier Model BN capacitor bridge is designed to measure all types of capacitors ranging from 0.00001 to 50 mfd on a Wien bridge. The balance con-

dition is indicated on a 6AF6G tuning-indicator tube. A 12A7 tube is used as a rectifier and amplifier. Additional information may be obtained directly from *Cornell-Dubilier Electric Corp.*, S. Plainfield, N. J.

MICAMOLD KODACAP

Micamold Radio Corp. has developed a new type tubular condenser through the use of a specially processed cellulose derivative as the dielectric. The new material

TABLE I

-AVERAGE LIFE OF GROUPS OF CONDENSERS AT 1800 V. D.C.-

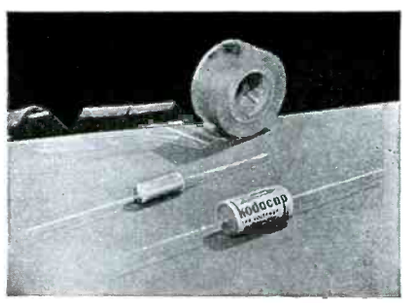
New material without processing	540 hours
Process A	950 hours
Process B	1450 hours
Process C	2150 hours
Final Process	Over 3000 hours

Note: Kodacaps made by final process also had average life of over 1000 hours at 3000 V. D.C.

is said to be extremely uniform and homogeneous and is substantially non-hygroscopic.

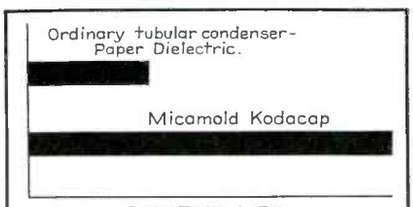
If the cellulose material is used without proper processing a condenser of fair characteristics results. Tests, as indicated by Table 1, however, show the improvement after suitable treatment, according to the manufacturer.

The results of a number of tests in the Micamold laboratory under conditions of



high humidity have been summarized in Table No. 2, where a comparison is shown between the relative life of a good tubular condenser and a Kodacap.

The Kodacap condensers are rated at 1000-volts d-c, working voltage and 3000



RELATIVE LIFE
UNDER HIGHLY HUMID CONDITIONS

TABLE II

volts, test voltage. They are somewhat smaller in size than an average 600-volt tubular. It is believed that the Kodacap should find application as a universal replacement in receivers, amplifiers and similar apparatus.

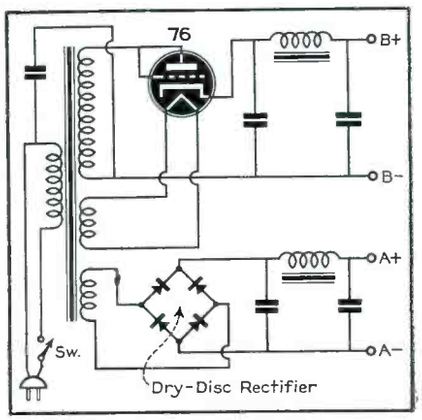
TUNG-SOL TUBE DIAGRAMS

Tung-Sol Lamp Works, Inc., Newark, N. J., have issued a small size, spiral bound, tube-base diagram booklet for easy identification of tube types. Copies may be obtained for 10c, directly from Tung-Sol.

GENERAL TRANSFORMER PORTA-POWER

The GTC Porta-Power is designed with A and B voltage sources to replace the batteries in portable receivers of from four to six tubes.

The A supply is obtained from a full-



wave copper sulfide rectifier filtered by a condenser input filter. The filter consists of two condensers and a low resistance choke. A terminal voltage of 1.5 volts exists with a load of 200 ma. This drops to 1.2 volts as the load is increased to 300 ma.

The B supply employs a 76 tube operated as a half wave rectifier. The rectifier operates into a condenser input filter of the conventional type. The B supply voltage is 90 volts with a 13-ma load. This increases to 101 volts as the load is reduced to 8.5 ma. The total power consumption is 7 watts (approx.).

The A and B circuits are isolated both electrically and magnetically. This is de-

sirable because of the various methods employed to bias the output stages of the portable receivers.

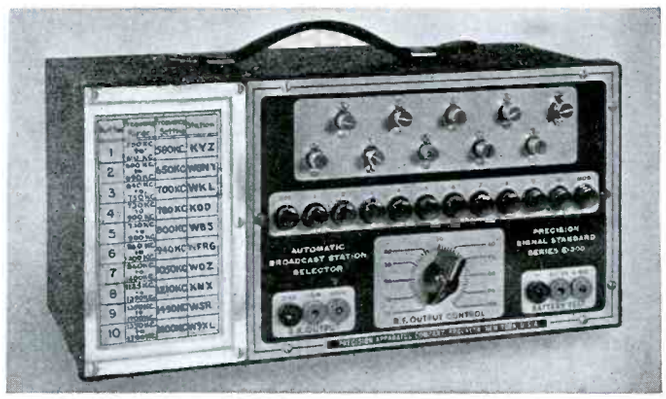
For convenience the power switch is located in the line cord. This is necessitated since the unit is usually placed inside the receiver case, and any switch provided on the unit itself would be inaccessible.

STROMBERG-CARLSON 400 SERIES

Mounting call letter tabs: When mounting the station call letter tabs on the 400 series receivers it is suggested that *rubber cement* be used rather than any other kind of glue, paste or mucilage. Place a drop of rubber cement on the escutcheon and then push the call letter tab in place.

If this is done, the call letter tabs can be easily removed, using a small knife blade in case a change is desired.

The Precision signal standard is designed as a broadcast station substitute during the presetting of push-button tuning.



PRECISION E300 BC SIGNAL STANDARD

THE Precision Series E300 automatic broadcast signal standard has been primarily designed to provide suitable signals at various points throughout the broadcast band for setting up the station buttons on push-button operated receivers. The presence of broadcast stations, on the air, is thereby rendered unnecessary. Through the use of the signal standard, it is usually possible to preset the station selector channels on the service bench before the receiver is delivered and installed.

The E300 is a compact battery operated, portable instrument incorporating a stable air-tuned, compensated 1N5G electron-coupled oscillator and a 1E4G 400-cycle modulator. Ten push-button broadcast station selector channels are provided. The individual friction locking Trim-Aire condensers permit front panel adjustment of each of the channels to zero-beat with any desired combination of broadcast stations normally received in the locality.

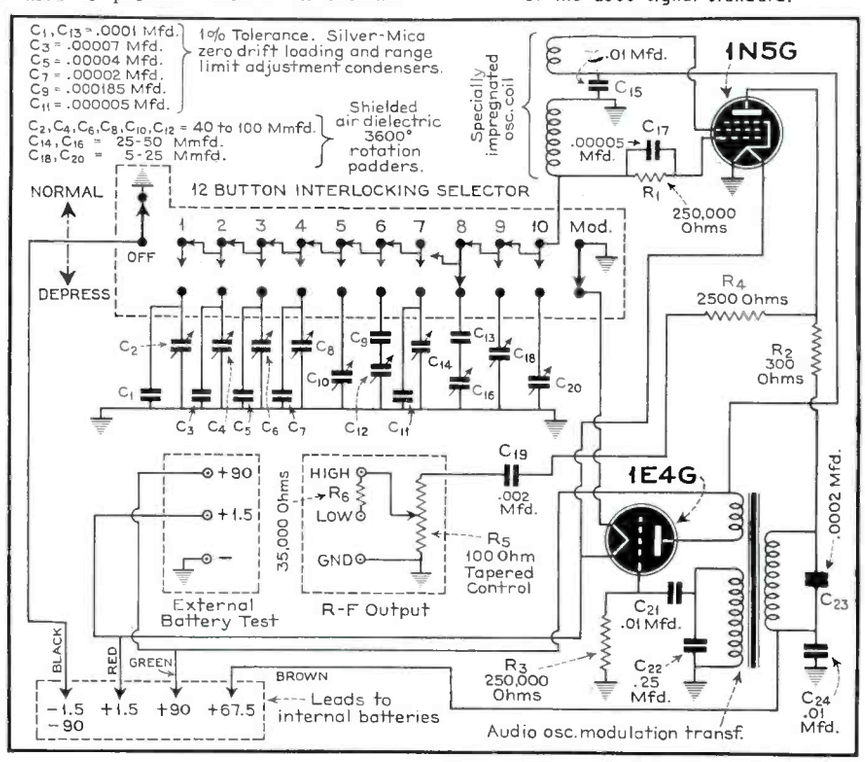
A three-winding modulation transformer is used to prevent reaction on oscillator frequency in either position of the modulation button.

• • • specifications

Finish: Black oven baked crinkle finish on steel case with carrying handle. Aluminum front panel.
Controls: 10 push-buttons with individual trimmers on front panel, r-f output attenuator, off and modulation buttons.
Power supply: One 1½-volt and two 45-volt batteries, self-contained.
Power consumption: 100 ma total A and 1½ ma (approx.) B.
Frequency range: 550 to 1600 kc.
Modulation: 400 cycles, audio fixed at 0 or 50%.
Output attenuator: Tapered wire-wound potentiometer.
Output impedance: Hi: 100 ohms, max. Lo: 35,000 ohms fixed.
R-F oscillator: 1N5G.
A-F modulator: 1E4G.
Dimensions: 12-in. long by 6-in. high by 6-in deep.
Weight: 11½ lbs (approx.) with batteries.
Price: $24.95 (net, less batteries).

G. N. Goldberger

A 12-button interlocking selector is used to provide complete push-button control of the E300 signal standard.



STREET CAR INTERFERENCE

(*Continued from page* 396)

tenna (if possible). Now, what have we done? We have systematically assured several definite things. By alignment with accent on symmetry we have guaranteed that, when properly tuned, the receiver will have a maximum of station signal voltage to operate on. At this point the writer suggests that the collapsible type antennas be considered as contributing to the condition in no small degree. Next, by measuring and correcting the avc action we have guaranteed that the maximum avc voltage will be present when the receiver is properly tuned to the station. Finally, by the preliminary checkup of the apparent condition of the set, we have eliminated any case where the receiver lacked sensitivity or tone quality. We now turn to our final cause of street-car interference.

• • • owner's job

The owner can introduce noise into the receiver by mistuning the receiver (if it is not equipped with pushbuttons), by trying to get unreasonably distant stations, and if he already has a telescopic antenna, he may introduce interference by operating the antenna fully collapsed which in many cases is too low for good reception. A prevalent notion among owners of these antennas is the fallacious idea that the aerial will reduce interference when it is fully collapsed. While the fact is true that the direct potential strength of the signal induced in the antenna is determined to a great degree by its physical height, we must not overlook the fact that we have avc in the set which does not act because of too small an antenna pickup. Therefore it is well to tune in a local station, the weakest local station, on the set and to adjust the rod type collapsible aerial until there is absolutely no hiss when the receiver is tuned to exact resonance. The position found in collapsing the antenna to this point is the lowest position which the aerial may be operated in the vicinity of car lines. Bear in mind when doing this that the location of the automobile should be taken into consideration.

The auto radio owner should then be given a diplomatic talk on tuning the radio properly, on not trying to get distant stations when on street car lines and finally, the proper, minimum length he should operate the antenna. In following the given system, one can be sure of at least keeping the most rabid radio fan as a satisfied customer.

P-A PROMOTES SAFETY

(*Continued from page* 389)

is utilized for the power supply, delivering 115 volts a-c. This is mounted in the luggage space which is provided with ventilators and is accessible from inside the car by means of a removable bulkhead and seat section.

The amplifier employed is a standard 115-volt a-c Lafayette model, mounted on the shelf behind the seat. The microphone is mounted on a breast plate worn by the driver to leave his hands free for operation of the car. The power plant is so muffled by the walls of the luggage space that the sound of its engine cannot reach the microphone.

The cordial reception which this car receives from police officials, Boards of Trade and other local organizations along its route provides definite evidence of the existing appreciation of the value of such activities in promoting safety—and therefore of the potential market for sound equipment which is offered to the Service Man who goes after it.

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AUTO-RADIO DATA

(Continued from June)

Oldsmobile
United Motors Service

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
393884	4	*	*	*	262
393885	6	*	*	*	262
405045	6	*	*	*	262
405046	4	*	*	*	262
405047	5	*	*	*	172
405062	5	*	*	*	172
405063	4	*	*	*	. . .
982006	6	*	*	*	262
982007	6	*	*	*	262
982008	6	*	*	*	262
982043	6	*	*	*	262
982044	6	*	*	*	262
982045	8	*	*	*	262
982083	6	*	*	*	262
982084	8	*	*	*	262
982085	6	*	*	*	262

Packard Automobile
Philco Transitone Corp.

Model	Tubes	Year	Gear Ratio	Dial Direction[1]	I-F
A	6	1934	*	*	260
B	6	1934	*	*	260
H122	7	1935	*	*	260
T5	6	1935	*	*	260
T14	6	1936	*	*	260
1417	6	1937	*	*	260
1421	7	1937	*	*	260
1422	6	1937	*	*	260
1426	6	1937	*	*	260
1430	6	1937	*	*	260
1432	*	1937	*	*	260
1517	6	1938	*	*	260
1530	6	1938	*	*	260
1535	7	1938	*	*	260
1617	6	1939	*	*	470
1635	7	1939	*	*	470

Philco
Philco Transitone Corp.

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
3	7	1933	16/1	CCW	TRF
5	5	1932	16/1	CCW	460
6	5	1932	16/1	CCW	260
7	4	*	*	*	175
8	6	*	*	*	260
9	6	*	*	*	260
10	6	1933	10/1	CCW	260
11	6	1934	16/1	CCW[3]	260
12	5	*	*	*	175
12-122	6	*	*	*	260
700	6	1934	10/1	CCW	260
800	6	1934	10/1	CCW	260
802	7	*	10/1	CCW	260
805	5	1935	16/1	CW	260
806	6	1935	16/1	CW	260
807	6	1935	16/1	CW	260
808	7	1935	16/1	CW	260
809	6	1935	16/1	CW	260
816	6	1936	16/1	CW	260
817	6	1936	16/1	CW	260
818, 818K	6	1936	16/1	CW	260
819	7	1936	16/1	CW	260
826	6	1937	16/1	CW	260
827K	6	1937	16/1	CW	260
828K	7	1937	16/1	CW	260
829	7	1938	16/1	CW	260
920	5	1938	[2]	—	260
921, 922	5	1938	[2]	—	470
936	6	1939	*	*	470
938K	7	1939	*	*	470

Plymouth
See Chrysler listing.

[1]CW denotes clockwise rotation. CCW, counterclockwise. By clockwise rotation is meant that receiver is being tuned to a higher frequency when the dial scale or pointer rotates in a clockwise direction when viewed from the front of the control head.
[2]No remote control is used.
*Information not readily available.

(To be continued)

BOOK REVIEWS

FUNDAMENTAL ELECTRONICS AND VACUUM TUBES, by A. L. Albert, published by The Macmillan Company, 60 Fifth Avenue, New York City, 1938, 422 *pages, price* $4.50.

The title of this book is somewhat misleading inasmuch as less than 18 percent of the book is devoted to what might be called fundamental electronics. The remainder of the book is devoted to the elucidation of vacuum tubes and their affiliated circuits. As is proper for any text presenting a survey of vacuum tubes the preponderance of space is devoted to thermionic vacuum tubes.

The treatment is mainly descriptive, the emphasis is placed upon why vacuum tubes behave as they do rather than on mathematical analysis. Accordingly, this book offers an excellent introduction to vacuum tube theory. A knowledge of elementary algebra should prove sufficient to understand the relatively few equations that appear.

The author adopts the desirable custom of employing both italic and bold face type to emphasize important words and phrases.

Well worthy of comment is the author's brief but much needed discussion on precautions to be observed in using the term "decibel."

Several minor criticisms might be made of this work. For example, the explanation of triode plate-circuit square-law detection is for a signal in which the carrier and one side band are suppressed, a treatment which would hardly clarify the operation of such detectors for the reader unfamiliar with such action. Occasionally, as on pages 348-350, the author uses small letters in the text to refer to capital letters in the diagram referred to.

Several minor errors were also noticeable. On page 145, line 1 should read "close to" and not "to close." On page 349, the paragraph starting on line 20 should read "As was shown on page 123." On page 346, Fig. 12-7, the phrase, "on the curved portion of the plate voltage—plate current curve" should read "on the curved portion of the grid voltage—plate current curve."

Professor Albert has done an excellent job. It is the reviewer's opinion that Fundamental Electronics and Vacuum Tubes is one of the best surveys of vacuum tube theory that has thus far appeared.

R. L.

RADIO FACSIMILE, Volume 1, *published by RCA Institute Technical Press, 75 Varick Street, New York City,* 1938, *353 pages, paper covers, given free as a complementary book dividend with a subscription to the RCA Review at* $1.50 *a year.*

Although this book is not the only book devoted to facsimile, it is, to the best of this reviewer's knowledge, the only one available in English. Covering as it does the work done by RCA engineers in the field of facsimile, this volume is an important contribution on the subject.

It is comprised of a collection of random papers by various authors, and should not be considered an integrated textbook which starts from fundamental principles and develops the subject step by step.

The volume is broadly divided into four general sections: (1) Historical development of facsimile, (2) Status of radio facsimile in 1938, (3) Radio facsimile communication methods and equipment, (4) Radio facsimile broadcasting. Each of these major four sections is further subdivided and contains several papers devoted to specialized aspects of facsimile. The treatment accorded the subject in these papers varies greatly, ranging from the purely descriptive and requiring no previous knowledge of the subject to those which require a certain amount of mathematical background.

Particularly recommended to the communication engineer desirous of obtaining more information about facsimile is the paper, A Narrative Bibliography of Radio Facsimile by J. L. Callahan, on pages 112 to 128.

The only error observed appears on page 107 in figure 25. A δ (delta) should be substituted for the S which appears in the figure.

R. L.

Theory and Applications of Electron Tubes, by H. J. Reich, published by McGraw-Hill Book Co., Inc., 330 W. 42 St., New York City, 1939. 670 *pages, price* $5.00.

There has long been a need for a text which bridged the gap between Chaffee's "Theory of Thermionic Vacuum Tubes" and other books which deal with this subject. Prof. Reich's "Theory and applications of Electron Tubes" admirably closes this hiatus.

Although encyclopedic in scope, covering as it does practically the entire field of electron tubes, each subject is discussed with remarkable detail. An extensive bibliography is given for each topic covered, thereby enabling the reader to further pursue any particular field in which he is interested. When the tremendous amount of information available within the covers of this book is considered in conjunction with the price asked for it, it will be readily conceded that "Theory and Applications of Electron Tubes" is an outstanding bargain in technical books.

The reader totally lacking mathematical training should find this an extremely useful reference book, since the author gives clear and detailed descriptions of the physical theory underlying electron tube operation.

Problems are given at the end of most of the chapters. The author, however, is apparently possessed of that mental aberration which so commonly afflicts college professors, namely, that the supplying of answers to the problems would inevitably lead to the moral degradation of the reader inasmuch as he would be tempted to peek at the solution prior to working the problem. This omission of answers considerably lessons the value of the book for purposes of self-study and is, in the reviewer's opinion, the only major defect in an otherwise remarkable book.

This book is unqualifiedly recommended to any and everyone interested in electron tubes.

R. L.

HIGHLIGHTS

IRC CATALOG

A new type of catalog released by the International Resistance Co., 401 N. Broad St., Philadelphia, Pa., lists the complete line of IRC products available through the jobbing trade and includes a number of new items and developments in IRC units. Copies may be obtained directly from IRC.

JEFFERSON TRANSFORMER GUIDE

A new 32-page replacement transformer guide for Service Men has been issued by the Jefferson Electric Co., Bellwood, Ill. Data on a large number of receivers are included with the replacement power and audio transformers and filter chokes. The guide is available directly from Jefferson.

ERWOOD SOUND COMPANY

John and Joe Erwood have announced the organization of the Erwood Sound Equipment Co., at 224 W. Huron St., Chicago. A complete catalog, illustrating and describing their line will be available shortly. Write directly to Erwood.

AEROVOX BROCHURE

Aerovox Corp., New Bedford, Mass., have issued a four-page brochure illustrating and describing their line of motor starting capacitors and capacitor selector. Copies may be obtained directly from Aerovox.

THORDARSON CATALOG

The fall-winter edition of the Thordarson Transformer catalog, No. 400, introduces many new transformers for the Service Man, amateur, and public-address engineer. Also included are the automatic voltage regulators which feature control limits capable of holding the supply or output voltage within plus or minus 1% of the desired value. Copies are available from Thordarson Electric Mfg. Co., 500 W. Huron St., Chicago.

WEBSTER CATALOG

The Webster Co., 5622 Bloomingdale Ave., Chicago, have issued a 24-page catalog illustrating and describing their amplifier systems, intercommunicating equipment, sound reproducers and baffles. Copies may be obtained directly from Webster-Chicago.

SHURE CATALOG

Shure Brothers have issued a new catalog, No. 152, which covers the complete line of crystal, dynamic and carbon microphones, crystal pickups, friction-lock floor stands, etc. Copies may be obtained directly from Shure Brothers, 225 W. Huron St., Chicago.

WHOLESALE RADIO MERGER

Radio Wire Television, Inc., formerly known as Wholesale Radio Service Co., is one of the companies included in the merger to form the newly organized Radio Wire Television Corp. of America. John E. Otterson, one-time president of Winchester Arms, Electrical Research Products, Inc., and Paramount Pictures, has been named president of the new company. J. R. West, president of Wire Broadcasting, Inc., prior to the merger, and A. W. Pletman, president of Wholesale Radio Service Co., were simultaneously appointed vice-presidents. Concurrently with the change in name, the company announced a broadening of its service policy to include all branches of communications.

STANCOR CATALOG

Standard Transformer Corp., 1500 N. Halstead St., Chicago, have issued a 32-page complete catalog, No. 140A, listing the Stancor line of transformers for the Service Man, amateur, broadcast engineer and laboratory. Copies may be obtained directly from Stancor.

HOFMANN REPRESENTATIVES

C. L. Hofmann Corp., Pittsburgh, Pa., manufacturers of the Duratron Vest Pocket Hearing Aid, announce the appointment of manufacturers' representatives in the key cities throughout the country. These representatives will handle the sale of Duratron aids through parts distributors. For additional information write directly to the manufacturer.

HICKOK CATALOG

Hickok Electrical Instrument Co., 10514 Dupont Ave., Cleveland, Ohio, have issued a catalog, No. 12, illustrating and describing their new radio and television test equipment. Copies may be obtained directly from Hickok.

NATIONAL UNION CALENDARS

National Union plans to supply its dealers with full color, art-mount calendars in a choice of four subjects for the 1940 season. Service Men may have their choice of any one or an assortment of four full color reproductions of oil paintings mounted on a two-tone background complete with 1940 calendar pad and the dealer's name, address and phone number at a small cost.

TELEVISION COMPONENTS

Jefferson Electric Co., Bellwood, Ill., announce new units particularly designed for use in television receivers. These include high voltage power transformers for use with the electrically deflected 5-in tube and the magnetically deflected 9- and 12-in tubes, respectively; filter choke of 8600 ohms resistance, 1800 henries at 1.5 ma, d-c; oscillation (horizontal and vertical) transformers for blocking oscillator circuits; output transformers for use in conjunction with scanning yokes, and a scanning or deflecting yoke for use with magnetically deflected picture tubes supplying horizontal and vertical deflection in conjunction with output transformers.

Catalog 391 R illustrates and describes these units. It may be obtained directly from Jefferson.

ASTATIC MICROPHONE

The Astatic Model DN dynamic microphone incorporates the Astatic Unitary moving coil system which is said to improve the sensitivity and assure a long trouble-free life for a dynamic microphone. The Model DN has its coil-diaphragm lo-

cated on a rigid ring; the coil terminals are also mounted on the ring. Dowel pins on the magnetic structure guide the coil system to exact concentricity in the air gap, it is claimed.

The DN is available in 50, 200, 500 ohm or high impedance models. Additional information may be obtained directly from *Astatic Microphone Laboratory, Inc.*, Youngstown, Ohio.

PLUG-IN SHAFT CONTROLS

International Resistance Co., 401 N. Broad St., Philadelphia, Pa., have announced a line of Special Standard Type CS metallized controls. These are similar to the Type CS standard controls, with the exception that they accommodate plug-in shafts which make it possible to position the flat at any degree of rotation. By inserting the replacement control behind the panel and attaching it before the plug-in shaft is driven in place the removal of other parts, as is sometimes necessary under crowded conditions, is eliminated.

The new Special Standard controls are made in 14 ranges and tapped types from 10,000 ohms to 2.0 meg.

IRC plug-in shaft A is packed with each Special Standard control and is designed for ordinary usage where a definite flat location is indicated. Shaft B, which may be ordered separately, is for use where either a slotted or tongued shaft is required.

Full details of these units as well as the IRC midget and wire wound controls are included in the IRC volume control replacement guide which is free to readers of SERVICE.

LOOP ANTENNA

A self-contained loop antenna has been announced by the *Burlington Laboratories, Inc.*, 1617 N. Damen Ave., Chicago. Two vacuum cups are provided for attaching to

any broadcast receiver. Adjustments are provided so that the loop may be matched to any t-r-f or superheterodyne receiver, it is said. Additional information may be obtained directly from the manufacturer.

ARCTURUS 3Q5GT

Arcturus type 3Q5GT is a filament type beam power output tube with a center point connection to the filament which makes possible either a series or parallel arrangement of the two halves. The filament voltage is 2.8 volts for series operation and 1.4 volts for parallel operation. The filament current is 0.05 amp for series and 0.1 amp for parallel filament operation. Additional information may be obtained directly from *Arcturus Radio Tube Co.*, Newark, N. J.

JACKSON ANALYZER

The Jackson Model 660 Dynamic signal analyzer is said to enable complete dynamic testing for all receiver circuits. R-f and electronic voltmeters are provided for r-f, audio, a-c and d-c measurements. Additional information on this and other Jackson instruments may be obtained directly from *Jackson Electrical Instrument Co.*, 129 Wayne Ave., Dayton, Ohio.

SHURE MICROPHONE

The communications type crystal microphone illustrated is offered by Shure Brothers for amateur and commercial

phone communications. The new Model 70ST has a built-in r-f filter which is said to protect the unit from burn-outs. The output level is 26 db below one volt for a 10-bar speech signal.

Additional information may be obtained directly from *Shure Brothers*, 225 W. Huron St., Chicago.

BROWNING OSCILLATOR STANDARD

THE Browning Laboratories have recently announced a 100-1000 kc oscillator standard. The electron-coupled circuit employed is said to be extremely stable and may be readily set on the exact frequency by beating with station WWV. Adjustments are provided for the 100 and 1000 kc oscillators. These adjustments are independent of each other. A switch is incorporated in the BL2FS standard for selecting either frequency.

The BL2FS standard consists of two stable E-C circuits mounted together with a band switch in a shield can. Large silver

The Browning BL2FS consists of two stable E C circuits mounted together with a band switch in a shield can.

cap condensers are connected across each coil. Adjustment of frequency is made by means of brass plunger screws inserted in the coils and held rigidly in position.

TONE CONTROLS

(*Continued from page 382*)

bias resistor, and thus increasing the gain of the circuit at those frequencies.

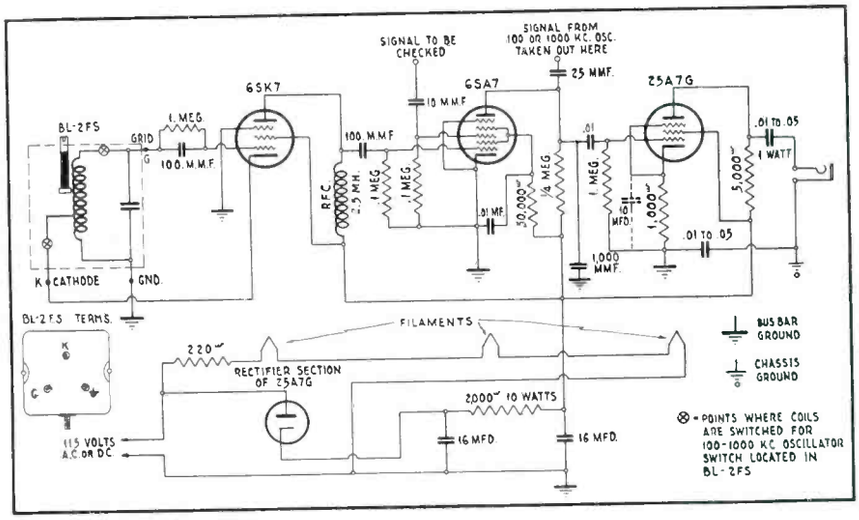
• • • variable selectivity controls

The high-frequency response of a receiver is limited by the sharpness of its r-f and i-f selectivity. These high-frequencies are present in the carrier side bands and the extent to which the receiver's tuning cuts these side bands will determine its maximum high-frequency response. Many modern sets employ some electrical or mechanical means for variation of their selectivity to permit more or less side-band cutting.

In the RCA HF1 high-fidelity receiver, for example, band width control is obtained by means of a switch which increases or decreases the number of coupling coils in the i-f transformers.[2]

[2]Input I-F, RCA Victor HF1, SERVICE, April, 1938, p. 11.

The Browning oscillator standard is essentially an electron coupled tube circuit and depends, for its stability, upon the design of the various components used in its construction.



Index to Advertisers

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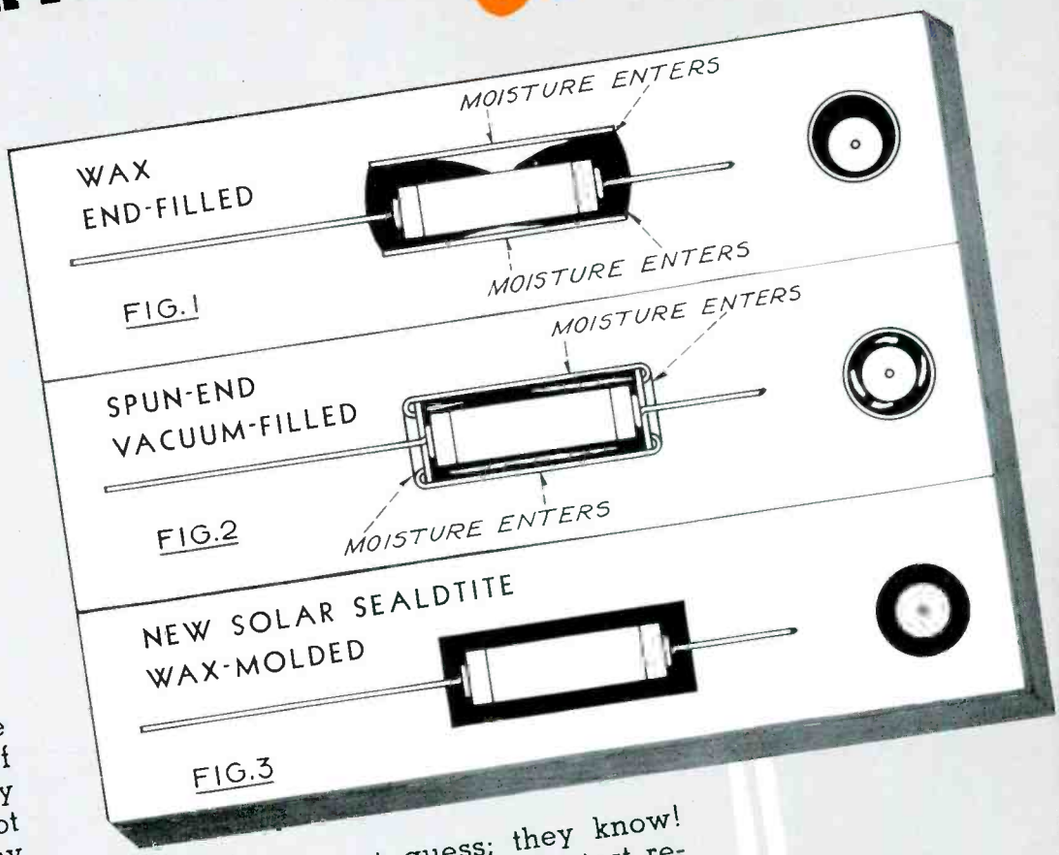

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- ★Tests Loktal tubes
- ★Tests OZ4
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- ★Tests for noise
- ★Tests open elements
- ★Individual element test
- ★Large WESTON Meter

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