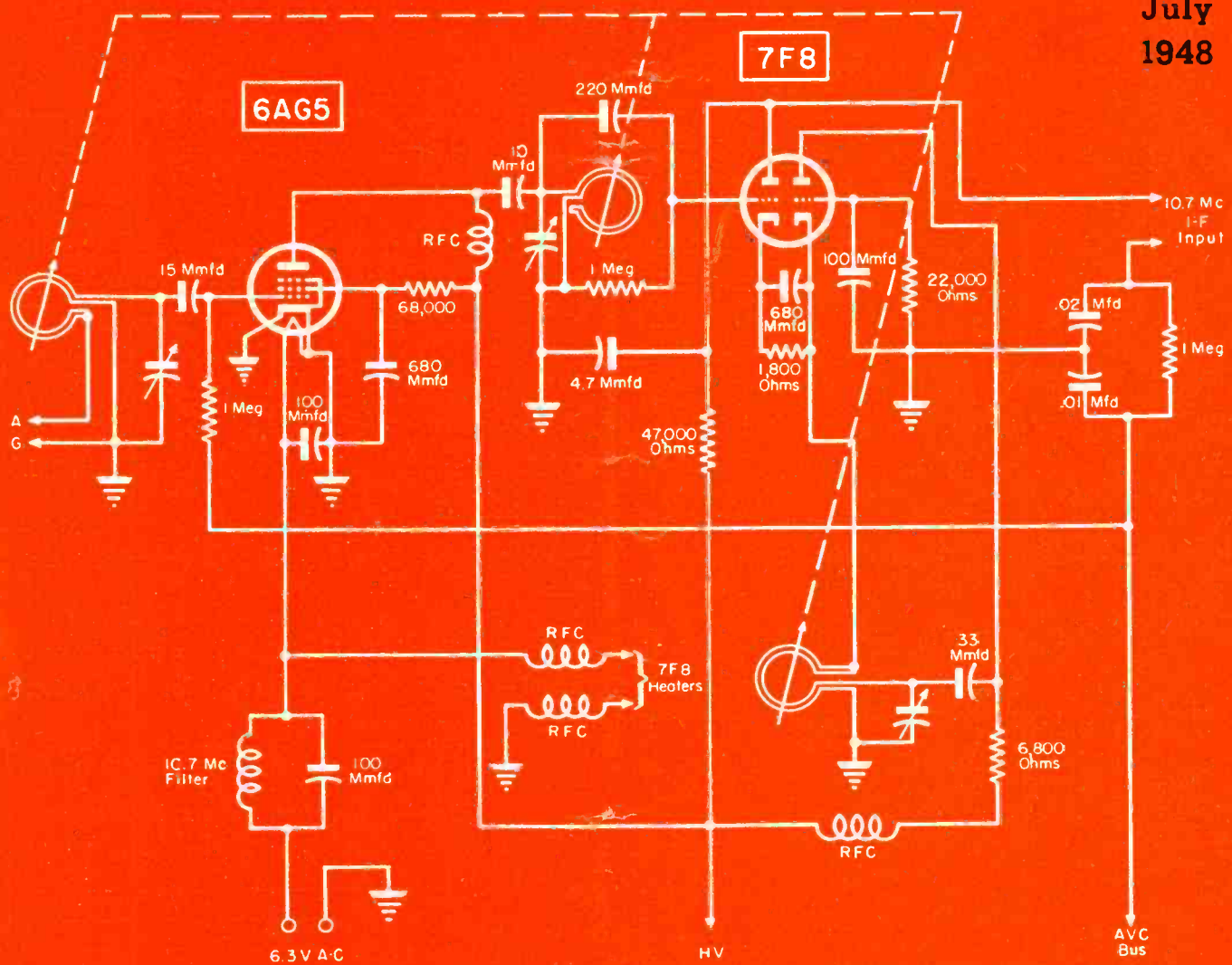
RADIO • TELEVISION • ELECTRONIC

SERVICE

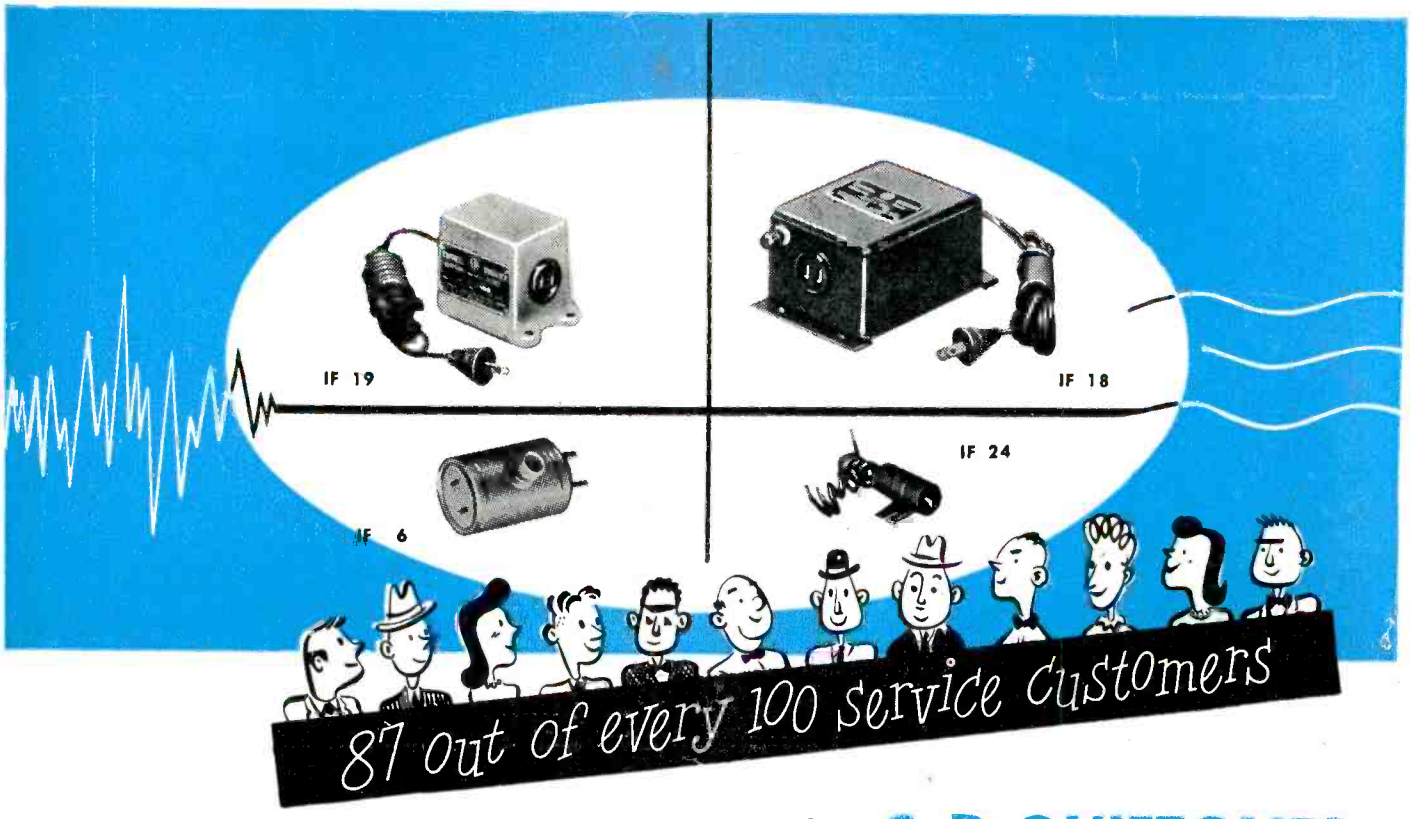
July
1948



Two-tube f-m input unit using an eggbeater type tuning unit.

[See page 2]

THE TECHNICAL JOURNAL OF THE RADIO TRADE



are prospects for C-D QUIETONES

new profits for service-men

*MOST MAN-MADE INTERFERENCE can be eliminated — *but your customers don't know it.*

Tell them . . . show them — using their own sets as demonstrators . . . and you'll discover that C-D Quietone Noise Filters are the surest-selling, steadiest-moving accessories in the entire radio repair and service field.

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other classification.....

Vol. 17, No. 7

RADIO · TELEVISION · ELECTRONIC
SERVICE

July, 1948

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Editorial Director

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Advisory Editor

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VOL. XVII (17)

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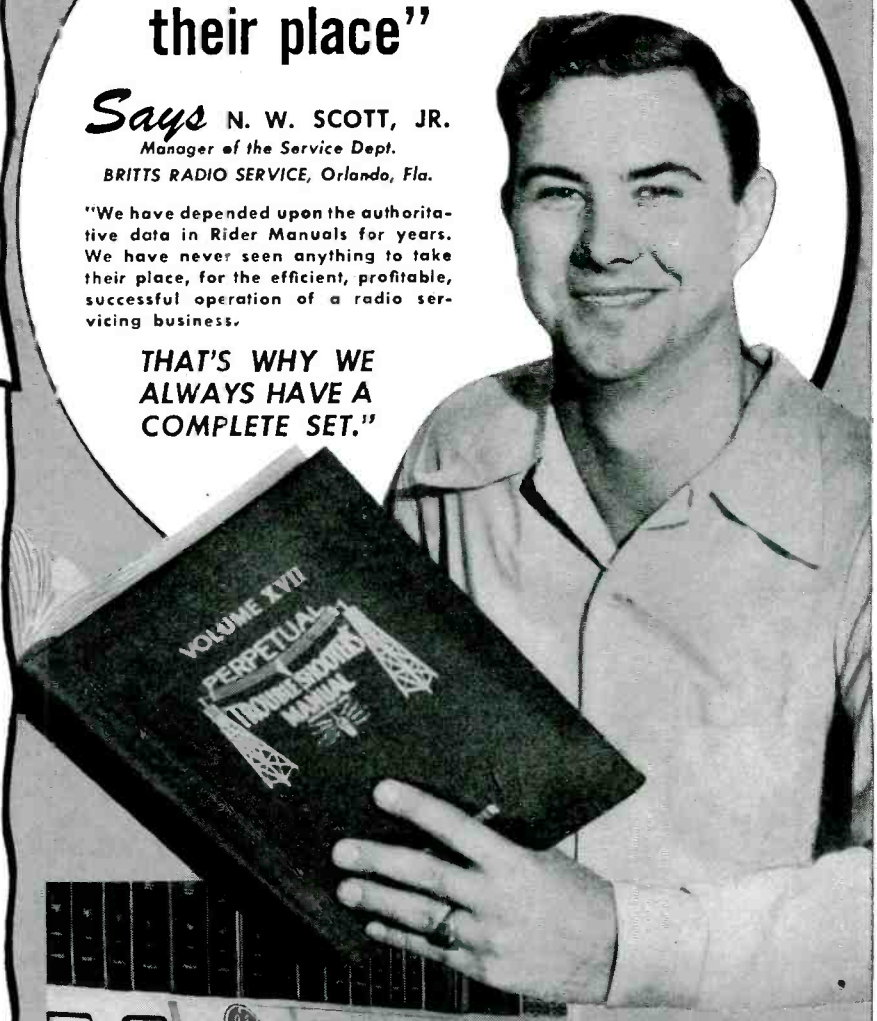

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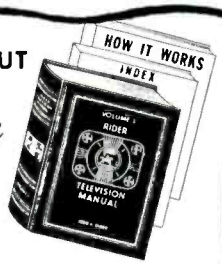

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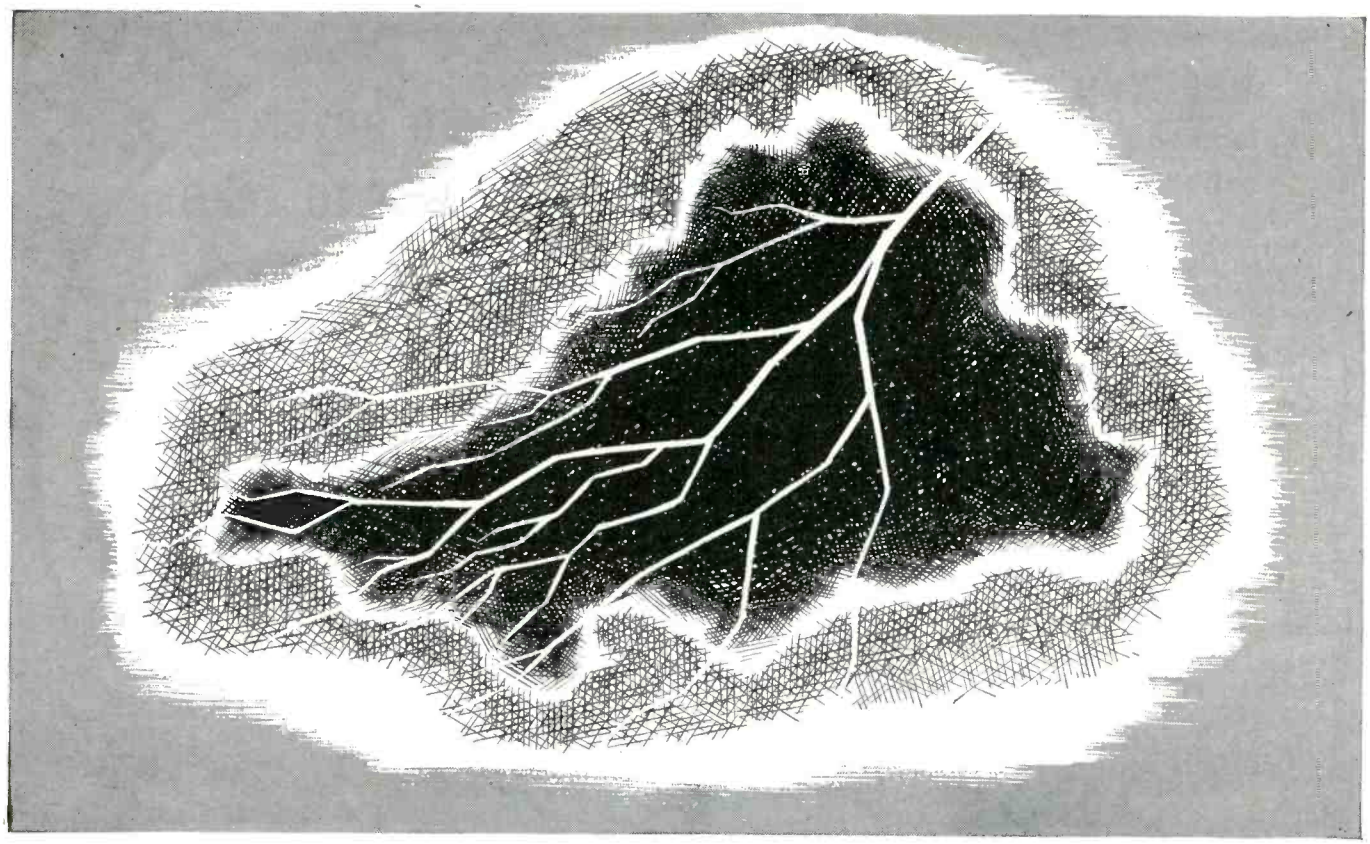

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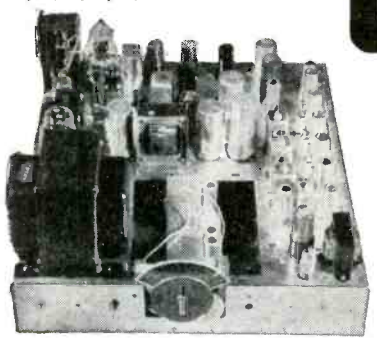
DUMONT INPUTUNER



The Dumont Imputuner tunes continuously from 44 to 216 megacycles without a break, covers all 13 channels as well as FM, amateur, and aviation channels. For ease and convenience of operation no band switching of any kind is required when tuning from channel to channel with the imputuner system. Just one simple operation to reach any desired station.

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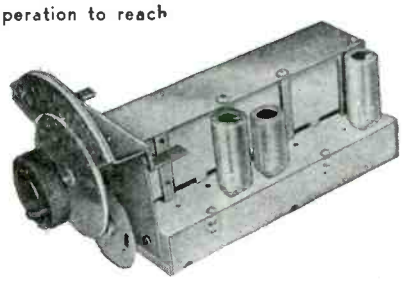

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52 Sq. In.	75 Sq. In.	120 Sq. In.

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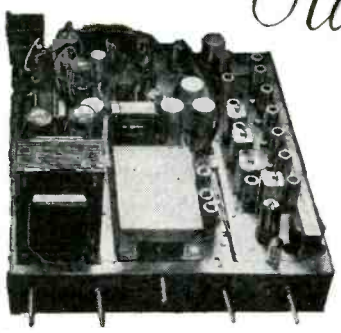
NOW AVAILABLE WITH THE STANDARD MODELS— FM RADIO AT A SLIGHT ADDITIONAL COST OF $7.95.



All Television Assemblies are complete and include: 29 RCA Tubes, plus CR Tube — Heavy duty RCA 6.8 oz. slug PM speaker — Specially designed dipole antenna, with 60-ft. lead-in—complete pictorial charts for placement of components and schematic diagrams for wiring supplied with assembly.

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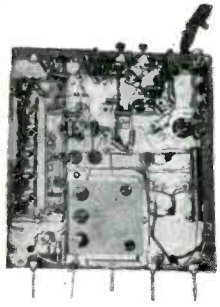

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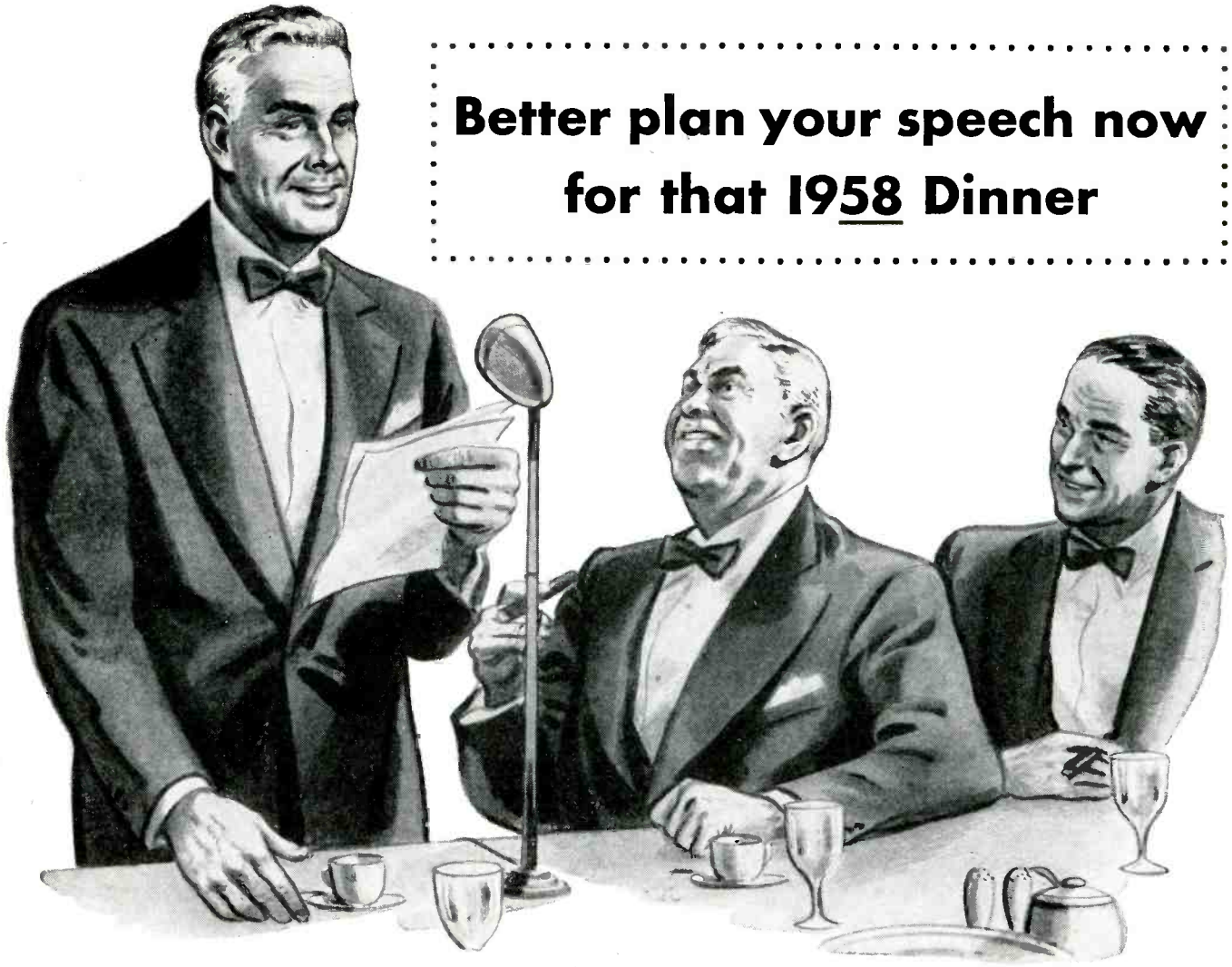
Guaranteed All Television Assemblies are guaranteed to operate to your satisfaction when simple directions are followed.

TELEVISION ASSEMBLY CO.

540 BUSHWICK AVE.
BROOKLYN 6, N. Y.

Better plan your speech now for that 1958 Dinner



Ten years can be a mighty short span in the history of a business. *Yours* for example.

When the time comes to address your fellow executives at the "Annual Banquet" in 1958, will there be a decade of outstanding company progress for you to review?

One way to make sure of a prospering business tomorrow is to make certain *today* that your employees are buying U.S. Security Bonds regularly—on the Payroll Savings Plan. The Payroll Savings Plan is a "look-ahead" plan for both management and employees. It builds up an employee group with a sense of extra security...with a tangible stake in the nation's future...a group bound to shun dollar-destroying philosophies. At maturity, the Bonds pay $4 for every $3 invested.

P.S.P. is paying off *today*, for every Security Bond dollar built up in the Treasury retires a dollar of the national debt that is potentially inflationary. Records of the companies that actively maintain the Payroll Savings Plan show improved employee attitudes. Absenteeism and accidents have dropped as the individual's feeling of security grows with regular Bond buying.

The whole plan of action for use within your company has been mapped out. Just call your Treasury Department's State Director, Savings Bond Division.

The Treasury Department acknowledges with appreciation the publication of this message by

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This is an official U. S. Treasury advertisement prepared under the auspices of the Treasury Department and the Advertising Council.

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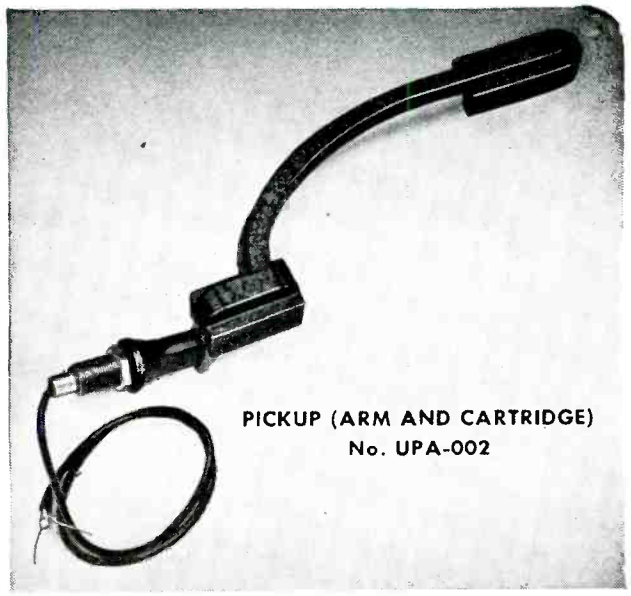
NEW MARKETS!
NEW SALES!
for the



PICKUP (ARM AND CARTRIDGE)
No. UPA-002

VARIABLE RELUCTANCE CARTRIDGE

THESE three new General Electric units open up greater and greater sales possibilities for the Variable Reluctance Cartridge.

Tailored for this fast-moving unit, they fit a ready-made market. Installation problems are simplified, labor is reduced to a minimum, and performance is improved.

Order today—get sales rolling.

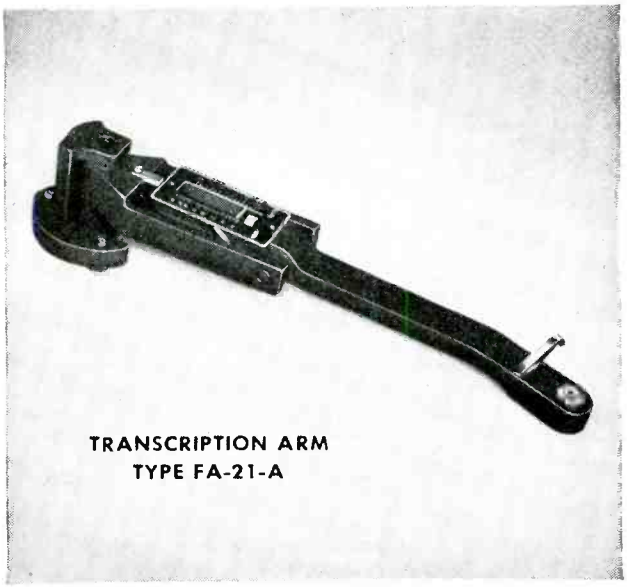
PICKUP (ARM AND CARTRIDGE) . . . No. UPA-002

For 10 and 12 inch records

This inexpensive Pickup has an immediate appeal for the serviceman, high fidelity enthusiast and experimenters—in fact, everyone who owns a record player.

This arm can be used with any record player without automatic changer and provides excellent response with absence of undesirable resonance.

A mounting template is supplied with each Tone Arm.



TRANSCRIPTION ARM
TYPE FA-21-A

TRANSCRIPTION ARM . . . TYPE FA-21-A

For Professional Use

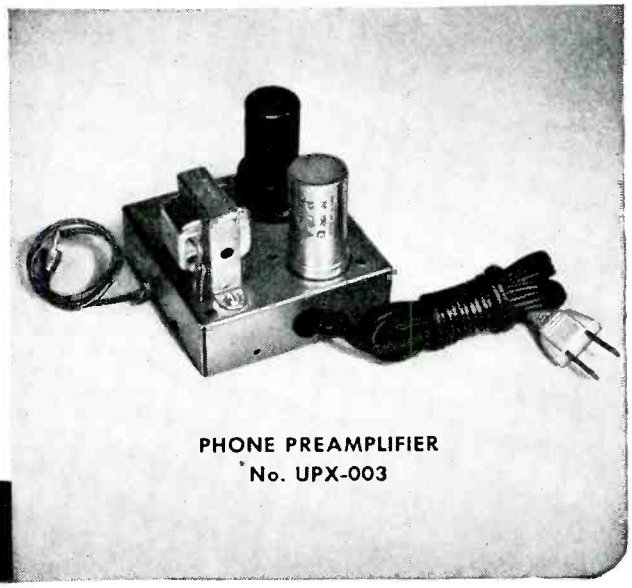
Broadcasters, sound laboratories, recording studios and wired music services will welcome this unit to simplify turntable problems.

It's easy on the operators—easy to spot in correct groove—no instability worries.

PHONO PREAMPLIFIER . . . No. UPX-003—with RECTIFIER

(For 117 volts, 60 cycle)

This self-contained preamplifier solves a tricky, laborious, installation problem for the busy serviceman. Installations can be made quickly, easily, profitably. The unit is ready to operate when attached to the set—just plug it into the nearest available outlet.



PHONE PREAMPLIFIER
No. UPX-003

For complete information on these three units write: *General Electric Company, Electronics Park, Syracuse, New York.*

169-G7

GENERAL ELECTRIC

HUNDREDS OF SERVICEMEN CASHED IN ON SYLVANIA'S SPRING PROMOTION

NOW... SYLVANIA OFFERS THE RADIO SERVICEMAN ANOTHER PROFIT-BUILDING PLAN FOR THE FALL!

Shown at the left is one of Sylvania's national ads to appear in Life, The Saturday Evening Post, Collier's, Radio Best... during September, October, November and December. This series of ads is designed to sell *you* and *your* dependable radio repair service to *your* prospects.

HERE'S HOW YOU TIE UP WITH AND CASH IN ON THESE ADS... ...in 5 different ways!

1. 4 POSTAL CARD MAILINGS—ONE FOR EACH MONTH

Sylvania supplies these cards in 3 colors, imprinted with your name and address. You pay only the postage on each card. You send them to your customers and prospects!

2. 4 WINDOW DISPLAYS —ONE FOR EACH MONTH

Sylvania supplies you FREE 4 big, colorful displays. Each one is tied in with the national advertising using the same illustrations and copy. You put them in your window to attract customers!

3. 4 WINDOW STREAMERS—ONE FOR EACH MONTH

Sylvania gives you FREE these four 2-color streamers. They are also tied in with Sylvania's national advertising. You attach these to your window as another means of attracting new customers!

4. 8 NEWSPAPER AD MATS—TWO SIZES FOR EACH MONTH

Sylvania sends you FREE 2 ad mats for each month—one- and two-column by seven inches. Use them in your local or neighborhood papers and classified telephone directory.

5. RADIO SPOT ANNOUNCEMENTS—SEVERAL FOR EACH MONTH

Sylvania also provides FREE several radio commercials for each month for the radio serviceman who uses radio advertising. Call or see your local radio station for rates.

THIS 4-MONTH ADVERTISING PROGRAM PACKED IN ONE HANDY KIT

Covering the months of September, October, November and December, this hard-hitting sales promotion program is packed in one big kit. You pay only the postage on the government postal cards you mail. Sylvania supplies everything else without charge.

YOU CAN IDENTIFY YOURSELF WITH THIS DECAL

Put this decal on your door, windows and truck. It is reproduced in Sylvania's national ads and identifies *you* as the radio serviceman described in Sylvania's national advertising.

Learn how you can participate in this Fall advertising program. Write Sylvania Electric Products Inc., Advertising Department, Emporium, Pa., or see your Sylvania Distributor.

SYLVANIA ELECTRIC

RADIO TUBES; CATHODE RAY TUBES; ELECTRONIC DEVICES; FLUORESCENT LAMPS, FIXTURES, WIRING DEVICES; PHOTOLAMPS; ELECTRIC LIGHT BULBS

Preventive Maintenance

ONE OF THE MOST IMPORTANT phases of Servicing and, unfortunately, one of the most neglected . . . *preventive maintenance* . . . has become the focal point of an outstanding Servicing program, conceived by the Federation of Radio Servicemen's Associations of Pennsylvania.

For the first time, there'll be an all-out effort to sell the public on the advantages of preventive maintenance and show Mr. and Mrs. Set Owner why it will pay to have their receiver checked and repaired *before* it goes dead.

Receiver owners will be told and shown how a set of new tubes can completely revitalize the receiver. Volume-control replacement will be another major item on the preventive maintenance schedule. There are countless receivers with defective controls which should be replaced, but are just overlooked. Emphasis on the importance of this replacement before the control goes completely bad will be a featured topic in the campaign. Consumers will also be told how other components such as electrolytics and trimmers should be inspected, at least once a year, to insure maximum receiver efficiency. Service Men will point out that it will be wise to check up on contacts that may have corroded or are about to snap, speaker cones which may have dried up, weather-beaten antenna joints, tattered line cords, loosened socket terminals and numerous other possible points of defect in the set which if detected and corrected in the early stages will not only improve operation but avoid set stoppage and its resultant inconvenience, often prevent damage to other components and thus reduce replacements and actually minimize repair costs.

Many receivers, gathering dust because of minor troubles, will, undoubtedly, be brought back to life in this enterprising campaign.

As outlined at a FRSAP meeting in Philadelphia, the campaign will begin in September and probably run for a month, with the program being inaugurated by the Governor of Pennsylvania.

The 1800-odd members of the associated groups in the state organization will participate in this unique effort to sell preventive maintenance. Each organization will operate as a local unit, but will have the benefit of coordinated planning of procedures and promotion. An active on-the-air program is being planned for local broadcasting stations now cooperating with the associations. This effort will be tied into a direct mail and, perhaps, local newspaper program.

Congratulations to FRSAP for an outstanding plan, which we are sure will be eminently successful.

TV Receivers and Ignition Interference

TELEVISION RECEPTION INTERFERENCE caused by auto ignition was the subject of a recent exhaustive study by the RMA Engineering Department and the Society of Automotive Engineers. The tests were conducted on a number of new and old cars and the latest model television receivers at Marlton, N. J., approximately 15 miles from Camden, where a signal strength of 500 microvolts per meter at 7½ feet above the ground could be obtained from WFIL-TV in Philadelphia.

Cars used included a 1944 Ford with no suppressors, 1946 Plymouth with no suppressors, 1946 Plymouth with a distributor suppressor, 1946 Plymouth equipped with sufficient suppression for satisfactory operation of a two-way radiotelephone installation operating in the 40 to 50-mc band, 1941 Pontiac with no suppressors, 1940 Oldsmobile with no suppressors, 1941 Ford with no suppressors and the same 1941 Ford with eight special built-in spark-plug suppressors. Receivers used during the tests included a Philco model 1000, RCA 630TS, GE 803TV and Motorola 7" tv table model.

The tests showed that interference from ignition systems causes a tolerable black or black and white streak in the received picture at an interference level varying from 6 to 69 microvolts. The average limit of tolerable interference was approximately 33 microvolts. It was found that the receivers did not lose synchronization when subjected to a tolerable limit of interference. The tests also indicated that the character and duration of the interfering signal as viewed on the picture tube screen determines to some degree whether the tolerable level is a low or high value of interference. It was also found that the immunity of the sound channel to interference was better than the picture channel and actually could be neglected in arriving at the tolerable limit of interference for the picture channel.

Special spark plugs with built-in ignition suppressors were found to reduce the radiation from the ignition system by an appreciable amount. In tests conducted with such suppressors, the tolerable interference moved from a distance of 200 feet from the antenna to approximately 70 feet.

During the tests a 1948 Chevrolet was also checked. This car did not have suppressors but did have some ignition changes as suggested by the RMA and automotive engineers. The results were very satisfactory, passing the 35 microvolt-per-meter interference value at a 50-foot distance from the antenna, the value agreed upon as a level of tolerable interference.

A round of applause to RMA and the Society of Automotive Engineers for their critical study and useful report on this tricky problem.

Microgroove Records

THE RECENT DEVELOPMENT of the long playing microgroove records has prompted the design and production of several interesting slow-speed and dual-speed record changers. Admiral, for instance, has announced a 33 1/3 and 78 rpm changer for their new models. Crosley will also include a dual-speed changer in their new models. Webster-Chicago has announced a 33 1/3 rpm model which will be known as the *Matinee*.

Complete details on these new type changers will appear in an early issue of SERVICE. Watch for this discussion.—L. W.

Servicing A-C/D-C Models... Old And New

Fig. 1. A typical circuit of an a-c/d-c/battery power supply. R_1 is a surge resistor having a 25 to 50-ohm value; R_2 and R_3 are 2000-ohm filter resistors; C_1 a 20- to 40-mfd, 150-volt capacitor; C_2 a 30- to 50-mfd, 150-volt capacitor and C_3 a 100 to 200-mfd, 25- to 50-volt capacitor.

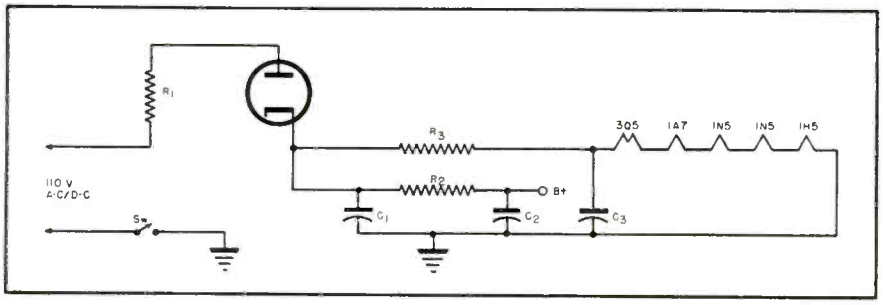
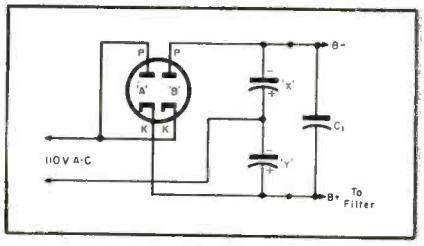


Fig. 2. A typical voltage-doubler circuit. Tube may be 25Z5 or 6, 117Z6 or any dual diode with separate cathode connections. Capacitors *X* and *Y* are the doubling units and have a value of 15 to 20 mfd at 150 volts. C_1 is the input filter, which has a 20 to 50 mfd value at 250 or 300 volts.



THE A-C/D-C type of design, employed in the majority of receivers being used today, features a variety of circuit innovations which merit close study for effective servicing work.

In the early model tube line-up we usually had a 6D6, 6C6, 6D6, 43 and 25Z5. The filament voltage added up to 68, with the remaining line voltage being dissipated by a ballast tube or third wire flexible resistor incorporated in the line-cord. These sets usually didn't have too much *hop*, but they were the dream sets of their day, and many are still around in working condition.

The super het models followed with the 12--volt series of r-f, i-f, oscillator-mixer and second detector tubes, and the 35- and 50-volt power amplifiers and rectifiers, making possible the elimination of the ballast tube or resistor. Filament current in the older sets was .3 ampere, with a total drain for the set of about 40 watts. The newer types use a .15-ampere filament, with a total drain of only 20 to 25 watts. More efficient tubes followed, with tremendous increases in mutual conductance, making it possible to build exceptionally high-gain a-c/d-c models.

Power Supplies

Most a-c/d-c circuits use a half-wave rectifier, such as 35Z3, 35Z5 or 35Y4, the diode sections of 70L7, 117L7, 117Z3 or 117Z4-6, and in the latest models, the dry-disc selenium rectifier. The pilot light is wired in across a special section of filament on 35Z5 and similar tubes, or across a tapped section of the ballast tubes, if used. Some sets use a 110-volt pilot lamp, similar to a Christmas-tree lamp. Pi-type filters are common, using 30 to 50-mfd capacitors at 150 working volts, with a small separate choke, speaker field, or resistor of around 2000 ohms being used as the choke. Due to space limitations and economy, the resistor is found more often than any of the others. Good results may be had with these *brute-force* filters, if all components are in good condition. When measuring voltages at the tube in half-wave rectifier circuits a rather unusual condition will be noted. The plate voltage is the line voltage, usually considered as 117 volts. Measured at the tube plate with conventional voltmeter, this will be 117 volts. However, the output d-c voltage at the rectifier cathode will be around 135 volts, when measured with a high-resistance voltmeter or d-c vtvm. The higher voltage reading appears because the line voltage indicated on meter is the *rms* value of the a-c wave—the voltage measured at cathode is the actual peak voltage of the wave, 1.414 times *rms* value. The large filter capacitor across the input to the filter system is charged up to the peak voltage, then recharged by the next pulse of current before it has time to discharge, thus making the d-c voltage apparently more than the a-c supply.

Incidentally, this reading also serves as an excellent check on the efficiency of your input filter capacitor. If the voltage measured across it is 140 or nearly that much, the tube and input capacitor are all right. Voltages less than 120 indicate trouble; weak tube, low or open filter or excessive load. If this capacitor opens up entirely, the voltage will drop to about 50 volts or less. On some of the a-c/d-c battery type sets, where the filament current of the battery-type tubes is supplied from the rectifier, the condition of this input capacitor is highly critical, as a drop of only 10 to 15 volts can lower the filament voltage enough to cause trouble. You should also check up on leakage between sections of dual or triple filter capacitors on these sets.

In some types, switching from *a-c/d-c* to *battery* position causes a high-voltage section to charge up from the *B* batteries, then discharge through the leakage, and a burnout of the filament of the power tube. If half or all the 3Q5 or similar tube is burned out, it is advisable to check for the foregoing trouble before inserting a new

Locating And Remedying Troubles Encountered In Tube And Dry-Rectifier Type Power Supply And Voltage Doubler Circuits. Hunting And Curing Oscillation, Hum And Tracking Problems. Checking And Replacing Speakers.

by JACK DARR
Ouachita Radio Service
Mena, Arkansas

tube. This can be done by connecting a 90-volt or higher meter across filament string and turning on the a-c/d-c to battery switch. A severe surge will be noted if leakage exists. The whole unit should be replaced, never single sections. A higher voltage-rating capacitor should be used if possible, as the higher-voltage types do not give this type of trouble.

Open circuits in filament filter capacitors will show up as a hum which cannot be removed by shunting the high-voltage filters. Filament filters run from 20 to 100 mfd, at 25 to 50 volts. In the usual circuit arrangement a 2000-ohm resistor is connected from the rectifier cathode to the top end of the filament string, in the case of a 9-volt string, of four 1.4-volt and one 3-volt tubes. Filters are connected from top of the string or center-tap of 3Q5 filament to *B*—; Fig. 1. Occasionally you will find the filament dropping resistor split into two sections, with a capacitor on the center-tap.

Voltage Doublers

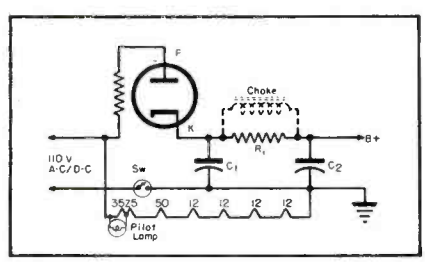
Some sets use a voltage-doubling circuit to increase the available plate voltage. In this instance a dual-diode rectifier tube, such as 25Z5-6 or 50Y6 is used with separate cathodes for each diode. A dual electrolytic is used as the actual *doubling* element in the circuit; Fig. 2. In operation, on the first half-cycle, plate *A* and cathode *B* become positive, causing current flow in diode *A*. This causes capacitor *Y* to charge to the peak voltage. On the second half-cycle, plate *A* and cathode *B* become negative, causing current flow in diode *B*, and charging capacitor *X* to the peak voltage. The voltages across the combination of these two capacitors are additive, since they are connected in series. They may be discharged through the filter system and the load with a resultant voltage of twice the supply voltage. These capacitors have no filtering action, a standard pi-type filter being used following the doubler. Common values for the doubler capacitors run from 15 to 30 mfd per section, at 150 working volts. Input filters run from 20 to 40 mfd, at 250 volts. Extreme caution must be exercised when replacing these filters, as it's easy to forget and insert a 150-volt capacitor, which won't last too long. Both doubler capacitors should be replaced, matching stock units as closely as possible. Polarity must be watched, since they are connected in series. *Four-lead* duals may be used, if the capacity is equal, to save space, which is usually at a premium in these little sets. Measured voltage across each doubler capacitor should be equal. About 10 volts deviation is all that is permissible. The rectifier tube also must be just right to work properly, checking carefully for equal omission from each half. If all capacitors are right, and the system won't work with a new tube, the tube may have to be changed again. In one case, three new tubes refused to work, but replacement with an identical tube of a different brand cured the trouble.

Low volume and sensitivity are symptoms of doubler-trouble, rather than excessive hum. As long as the input filter is still good, the hum level will not be too high, regardless of voltage. Voltage output at filter input should be at least 250 volts, on a d-c vtvm.

The Dry Rectifiers

In many of the newer models dry-disc selenium rectifiers are being used.

Fig. 3. Typical half-wave rectifier circuit. C_1 and C_2 are 20- to 50-mfd units (150v). R_1 is a 2,000-resistor used as a choke in the filter circuit and *CH* may be the 450-ohm speaker field or a small separate choke.



Action of these is identical with the half-wave tube types, and they may also be used in pairs for voltage-doubling. A small surge resistor is usually connected in series with the plate (negative) lead of the rectifier, to avoid injury from voltage surge. These are also found in tube rectifier circuits. A dead short in the filter system will cause these little resistors to pop out like a fuse, thus saving the rectifier from damage. No higher than ¼ watt resistors should be used when replacing these. Value is not too critical, from 35 to 50 ohms being common.

The selenium rectifier may be installed in place of a tube, in sets not originally equipped with them. For 117Z6, etc., no alteration is necessary. The dry rectifier can be mounted in an old octal tube base, connecting negative lead to plate pin and positive lead to cathode pin. The 35- and 50-volt types may be replaced by adding resistance to the filament string to compensate for the voltage drop formerly in rectifier filament. This will provide the extra advantage of *quick-starting*. Sets using a 35Z5 and line-cord resistor may be changed by using the rectifier and disconnecting the resistor section of line cord entirely.

Alignment, Tracking, Oscillation and Hum Troubles

Hum-hunting in these receivers is sometimes quite a problem. Open output filter capacitors cause most of it, while cathode-leakage in power-tubes and hum pickup from grid-leads add their share. Leads must be dressed close to chassis, especially volume-control leads. Long leads from pilot-lights should be avoided. Coupling to first audio tubes or to the loop can induce hum.

Motorboating and r-f/i-f oscillation may usually be traced to low capacity or high-power-factor output filter capacitors, since these usually do double duty, serving as the r-f return for the i-f stages, etc. Open or low units may be checked by shunting with good unit, but a capacitor with high power factor must be removed for test, as shunting these sometimes fails to give

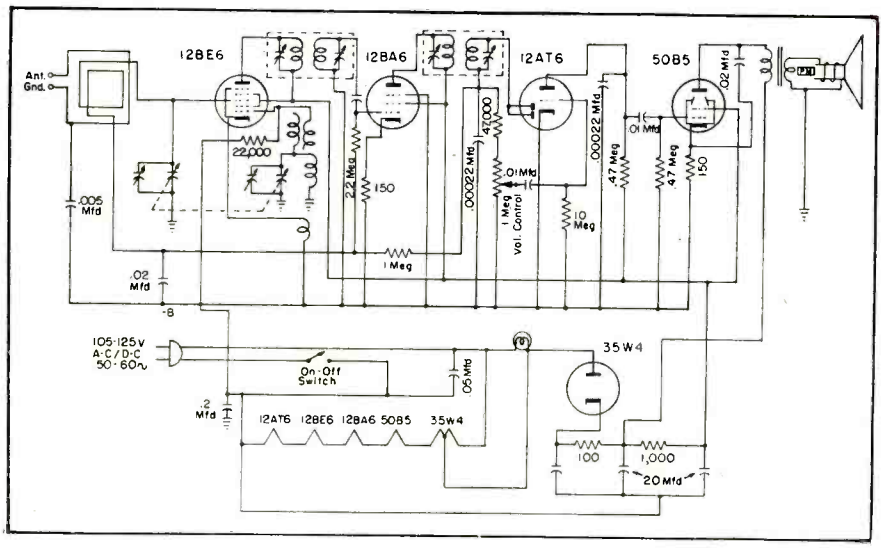


Fig. 4. A typical a-c/d-c receiver using tapped filament connection.

a correct indication. Incidentally, all voltage measurements on any a-c/d-c set are made with reference to *B*— or the common ground return, which is not always the chassis. Some of the early models returned all circuits to the chassis, but UL requirements are that the chassis should be isolated from the line, the return for r-f circuits, such as the tuning capacitor, etc., being made to the chassis, which is returned to *B*— or a common ground bus, through a combination of a paper capacitor, about .05, and a 250,000-ohm resistor across it. A quick way to locate *B*— is to find the negative lead of the filter capacitors, or the line switch, as the *ground* side is usually the one broken. The most accessible one should be used. Sometimes neither one is!

Extreme caution should be used when making connections for voltage measurements, etc., as some astonishing potentials exist between adjacent parts, and the slip of a test prod may blow tubes, capacitors, or at the least a pilot light. Be careful in moving parts to get at others, as some of these sets are built with an amazing lack of insulation on leads. Spaghetti should always be used when making replacements. Incidentally, customers should be cautioned against any kind of ground on an a-c/d-c set. They should be told that the set has a perfect ground when it is plugged into the line, which is true, so that a ground is unnecessary.

Alignment of r-f and i-f is conventional, except for the loop antenna point. When aligning r-f, antenna and oscillator stages, the loop must be in the same position with respect to the chassis that it will occupy when the set is replaced in the cabinet. Changes in loop position will alter the alignment, as they are usually very close to the chassis when mounted. When tuning the loop, all wires, tools, and especially outside antenna leads should be kept away from the loop itself. As long an insulated alignment tool as possible should be used. Keep hands away to avoid signal pickup from your body. Otherwise you'll have some optimistic ideas about performance. Receivers should operate without any kind of external coupling to the loop, unless you are in an area of very low signal strength.

Some sets include connections for external ground and antenna. This is usually a single turn of wire around the outside of the loop. If this is not present, it may be added. Weave it through the loop supports, and bring both ends outside the cabinet. An antenna may be connected to one end and ground to the other. There is apparently no polarity here. The loop can be realigned after adding this ex-extra turn.

Some of the better receivers use a padder to provide adjustment at the low (550 kc) end of the band. If this is not present, and mistracking is evident, as shown by a signal tracer, or by low volume at that end, one may be added in most cases. You might try adjusting plates of oscillator tracking capacitor. This will necessitate realignment at the high end, of course. If pickup is very bad, you should check to see if the loop shows signs of tampering. Sometimes turns have been added or removed.

In areas of low signal strength, such as a rural district many miles from the nearest transmitter, the smaller four and five-tube sets may not work too well due to their low sensitivity and selectivity. If the customer is willing to give up the convenience of the loop antenna, a good iron-core adjustable antenna coil may be substituted for it and an outside antenna used. This installation will provide a very decided gain in both sensitivity and selectivity. No external ground need be used and the ground end of the primary can be returned to the chassis. The external antenna lead must be brought in through a mica or ceramic .001 to .005 mfd/600 volts, supported so that the antenna wire cannot come in contact with the chassis. This isolates the external antenna, and prevents damage to the coil or the set should the antenna become grounded.

Speakers

Speakers for most of the new models are p-m types, with the resistors taking the place of the field as a choke. Some still use the electrodynamic, with a field of around 450 ohms. The p-m may be substituted for the e-m and vice versa by making the proper provisions for the field. Watch out for polarity of hum-bucking coils when installing the e-m, as the hum level is none too good at its best!

Tapped Rectifier Filaments in A-C/DC Sets[1]

In Fig. 4 appears a circuit of a typical a-c/d-c receiver using a loop and featuring the tapped rectifier filament connection, which has many advantages.[2]

The dial lamp and one section of the rectifier filament form a parallel combination which acts as a pair of fuses in the event of either a rectifier tube failure or a capacitor failure.

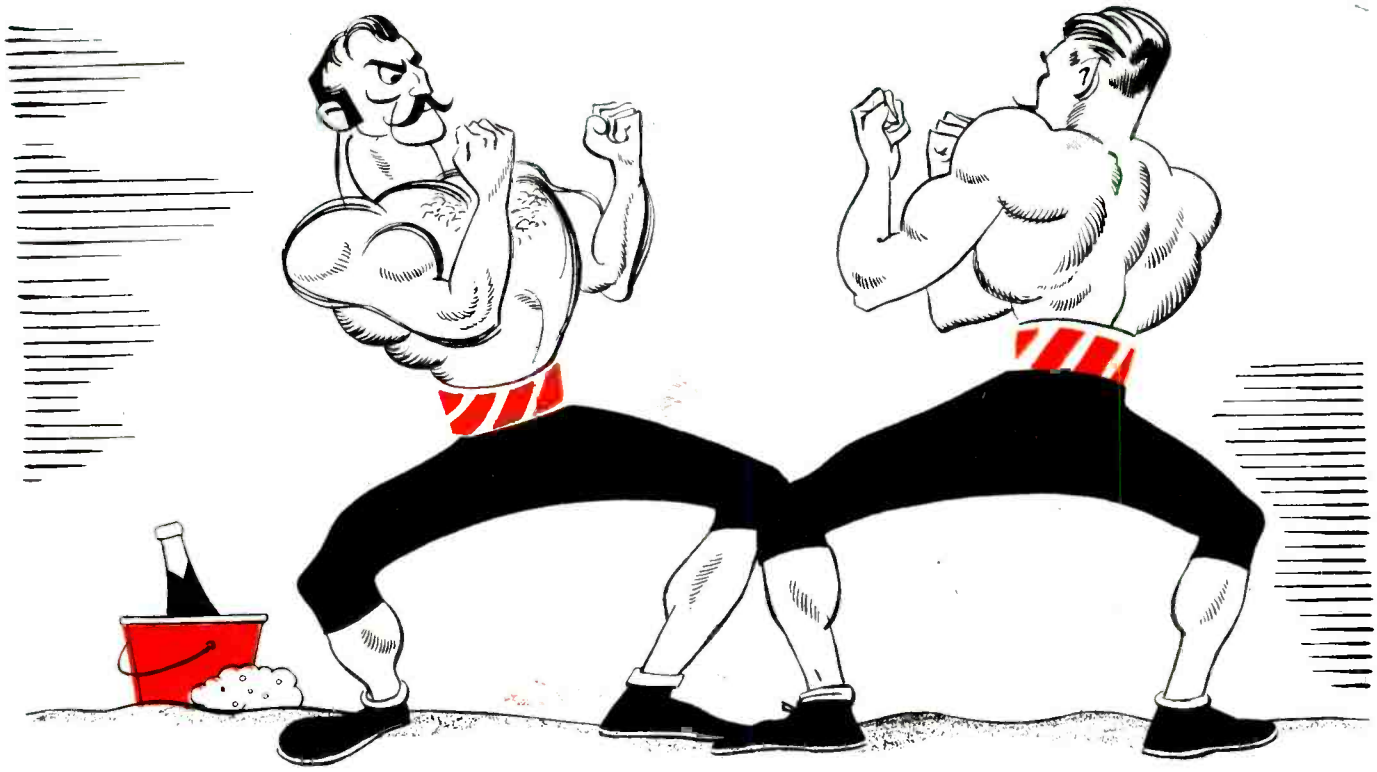
Normally, where a rectifier tube failure occurs first, the short-circuited rectifier tube allows line voltage to be impressed upon the electrolytic capacitor connected to its cathode causing the capacitor to fail and become a fire hazard.

Where the capacitor failure occurs first, the full line voltage is momentarily impressed upon the rectifier

(*Continued on page* 38)

[1]Data courtesy Engineering Department, Pyramid Electric Company.

[2]In a recent ruling, the Underwriter's Laboratories, referring to this circuit, declared: "Fire hazard is not considered to be involved in a capacitor or inductor located within a chassis of noncombustible material and connected to the power-supply circuit through a tapped rectifier tube filament (35Z5 or equivalent type), with or without a parallel connected panel lamp, and which will not pass a current of 600 milliamperes for more than one minute; or in a capacitor, similarly located, connected between the power-supply circuit and the chassis of an appliance which is not provided with means for grounding the chassis and which employs the tapped rectifier filament, with or without the parallel connected panel lamp."



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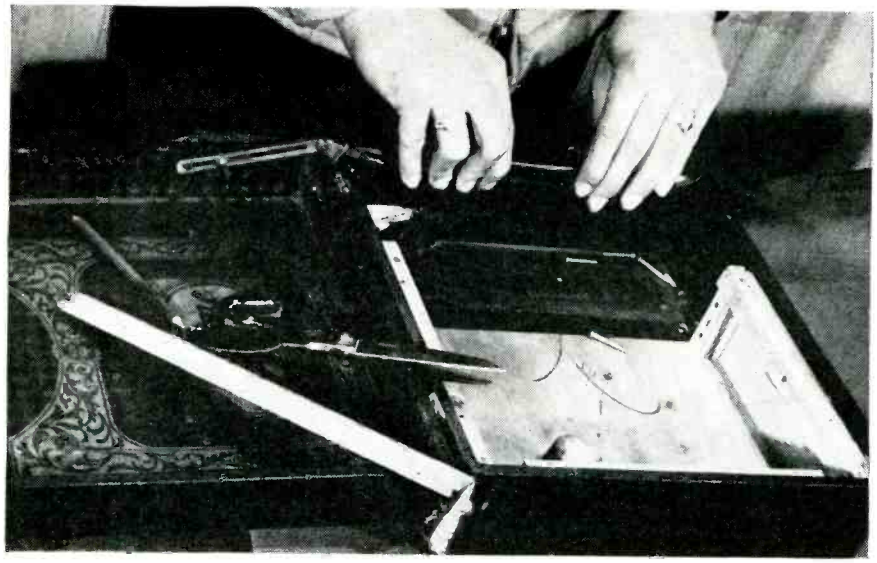


Fig. 1 (left). Cutting fabrikoid or imitation leather to recover phono case. Sufficient material should be left over to cover the edge of the case.

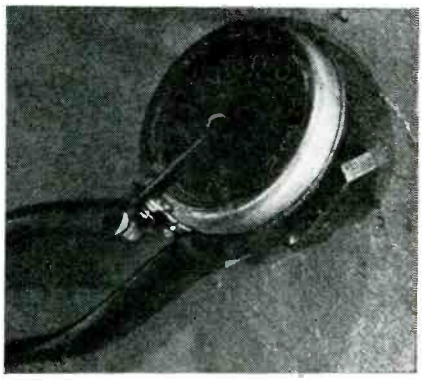


Fig. 2. Mica head used in spring-driven motor phono unit. Illustrated is a unit in good condition, and it will be noted that the mica is clear and the joint firm. This head uses a knife edge for its needle holder.

Repairing Mechanical Phonographs

WHILE THE SPRING-DRIVEN phonograph is by no measurement an electronic device, it has been accepted as a member of the family and the consumers naturally turn to their radio Service Man when something goes wrong with their portable phonograph.

The mechanism is fairly simple, and uses a governor similar to that used by some of the older types of electric motors.

The mechanical phonograph in use today is essentially a portable device, which means that it suffers a great deal of physical abuse. It is sat upon, kicked, filled with sand, bread crumbs, and old beer bottle caps. The Service Man's first task is usually to remove the sand and debris, and to make repairs to the case.

Corners that have come apart can be reglued, and reinforced with internal metal corner brackets. Loosened leatherette covering can be glued down with collodion cement, and if necessary, an entire new cover can be fashioned from this material which is available by the yard. Leather goods stores, automobile upholsterers, and luggage manufacturers usually have some on hand. When possible the new cover is laid on top of the old covering to provide additional strength.

A worn covering can be glued smooth, washed clean with soap and water, provided the leather covering is a waterproof type. After cleaning, the case can be given a coat of clear lacquer, or spar varnish.

The sound box or head, which is the works that holds the needle, and the accompanying diaphragm should be inspected carefully.

If the head has been dropped, the driving arm, which connects the needle to the center of the diaphragm, may have been torn loose. In this case no sound will be produced. If the drive arm is loose, there will be more rattles than music.

Sometimes the drive arm can be refastened to the diaphragm. Often a new head will have to be used. In any case, the needle must drive the diaphragm through a solid mechanical connection.

The diaphragm itself should be inspected for breaks, tears and malformations. If the diaphragm is of metal, one or more of these conditions may exist without the drive arm tearing loose and stopping the sound entirely.

Some heads will play fairly well with wrinkles in the diaphragms, others will not. The final analysis will be in the playing.

However, all malformations of the diaphragms will result in some change in the phonograph's tone, usually in a reduction of the lows, and an accentuation of the highs.

Generally speaking, it is best to leave the wrinkles alone.

Where the diaphragm is of mica, you will find, in addition to tears, white spots. These spots are caused by a separation of the layers of mica, causing rattles and blasts.

Any sound head can be replaced with any other sound head, or box, that can be made to fit. If the head can be made to stay on the throat, and hit the record properly, it will work satisfactorily.

Pivot points should be inspected carefully. The needle holder has two projections, one on each side, which rest in cup-shaped depressions formed in set screws. This arrangement permits the swing of the needle point to move the drive arm, and actuate the diaphragm.

Some heads use a spring and knife-edge arrangement, others use a spring and pivot. But the principle involved is the same.

Pivot points should be checked by backing the set screws off, and looking at the points. If they are broken or bent, they will have to be replaced; if not, cleaned and replaced. No oil should be used. The side play or end shake of the pivots should be about

Fig. 4 (right). Checking the vertical travel of the turntable with a piece of chalk; ¼" travel is permissible.

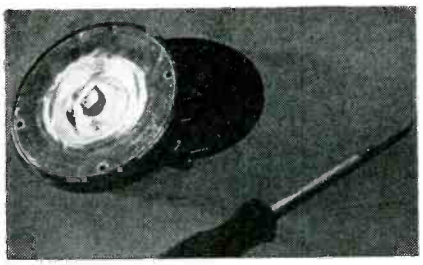
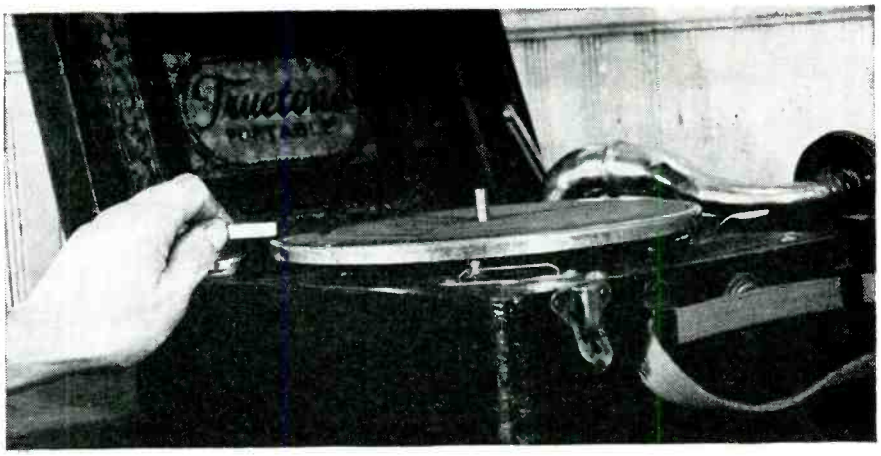


Fig. 3. Here we have a diaphragm which has been abused and is torn and wrinkled. This diaphragm should be replaced as it will rattle and distort.



Assortment of Repair Hints For Spring-Driven Phonograph Units, Whose Increased Popularity Now Offers New Income Opportunities For The Service Man.

by MAX ALTH

.003". The set screws should be brought *slowly* up to the points; do not bring them up and back them off, as this puts several thousand pounds of pressure on the points and may easily deform them. The screws should be brought up slowly. When the side movements of the pivots are barely perceptible, you will have the correct adjustment.

Where other arrangements are used adjustments should be made so that the needle can drive the diaphragm without friction, and without excess freedom that will cause rattles.

The spring sometimes used in conjunction with the needle holder and driving arm can be ignored so long as it is fast, and not visibly malformed or broken. However, its tension should be such that the needle is vertical to the plane of the record; that is, when the needle is observed from a head on position.

The fit between the sound head and the tone arm should be as tight as practical. This is to load the diaphragm as much as possible. If the replacement head leaves a large gap between itself and the tone arm, this gap should be filled with something solid like lead, which can be easily melted into the aperture.

The tone arm should be free in its side movements and vertical movements. Horizontal stiffness will sometimes cause the needle to jump out of its groove as the arm tends to hold the needle in one position. Vertical stiffness will prevent the needle from following the vertical travel of the record, which is considerable on portable phonograph turntables. This will cause a variation in volume and tone. The needle may jump its groove, and sometimes prevent the record stop from working.

When the tone-arm action is stiff, it should be taken apart and the high spots in its bearings polished down with some fine sandpaper, and then oiled. Usually the machine is not at fault. Gum or candy will probably be found in the slip joint.

Turntable Levelness

A certain amount of hill and dale action is to be expected in the turntable, but anything more than a quarter of an inch is excessive and should be corrected. In this operation the table is lifted and a check made on the drive pin; this is a short pin running at right angles through the spindle. Then locate the high spot by holding a piece of chalk near the top edge of the table. The high spot will hit the chalk. The table should be picked up again and replaced, to see whether or not the high spots are due to the spindle being off vertical. If this is so, the motor mounting bolts should be adjusted, removing or adding washers as the need may be.

The table itself may be leveled by upending on a hardwood plank and tapping with a mallet.

By this time the table should be able to run free and clear of all obstruction.

Automatic Record Stop-Checks

Action of the automatic stop should be nice and smooth. If it grabs, that is, stops the record too abruptly, the needle will go skidding across the record, scratching all the grooves.

A little light machine oil can be used on the small leather brake. If it is too hard, cut another from a piece of soft leather.

If the machine has been exposed to a great deal of salt air, it is possible that the inside edge of the turntable is corroded, so that a roughened surface is presented to the brake, causing it to grab. A smooth sandpaper finish is the remedy.

In checking the spring motors the first test can be with a dance record. If there are no noticeable wows, its speed may be considered steady. A

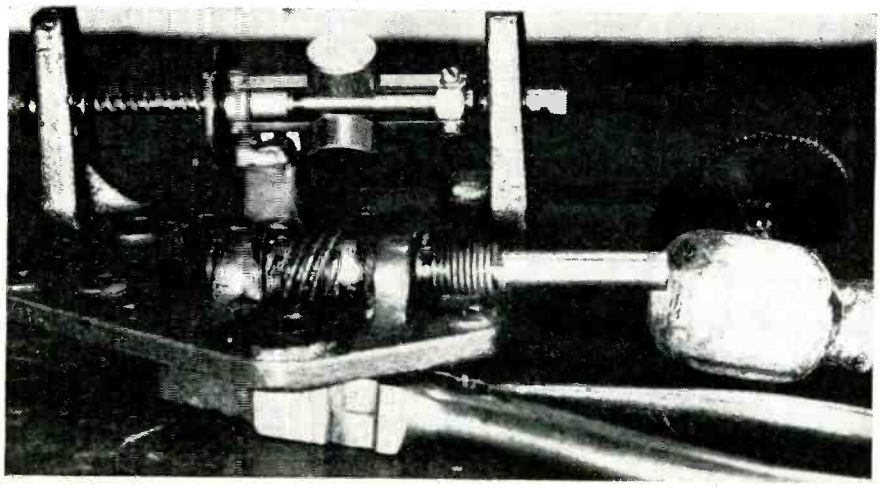


Fig. 6. Rear view of the governor mechanism.

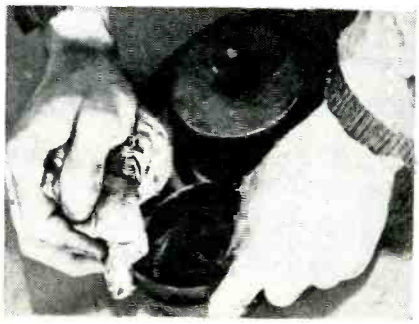


Fig. 5. Returning the spring to its case by walking it in, slipping circle after circle of the spring inside the case. No attempt should be made to insert the entire spring at one time. It's wise to use a rag to save wear and tear on your fingers during this operation.

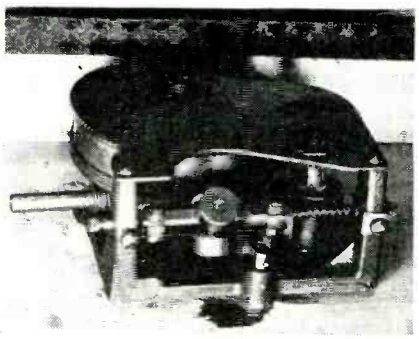
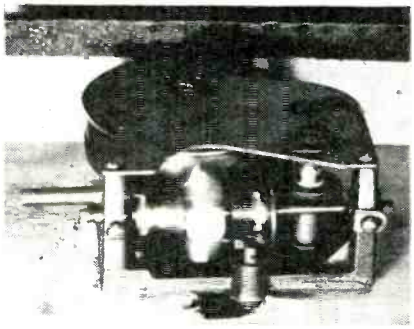


Fig. 7. The governor at rest indicating the space between the brake disk and brake shoe.

Fig. 8. When the balls are spun, they pull the brake disk up against the brake shoe as shown here.



mechanical phonograph cannot be expected to play a slow classical number without noticeable wows.

Phono Volume

If the sound box is working correctly, and the sound arm fits tightly, the volume will depend upon two factors: State of the record, and the size of the horn. The size of the horn is fixed, but the state of the record varies, and considerably.

A record will produce noticeably less sound at almost every playing. This is due to the great weight of the needle on the record. It literally grinds the sound groove out. There is a definite difference in a record after ten playings; easily noticed by ear. When demonstrating the volume of a repaired phono player, use a new record.

The spring motor driving the turntable can suffer two possible afflictions. It can break, or it can lose its temper and become too soft to drive the table for the full length of the record.

When the latter happens, the works should be checked to make certain that excessive friction is not overloading the spring, and preventing it from operating it proper.

If the spring has actually lost its temper, there is nothing to do but replace it. Retempering is much too messy a job.

If the spring is broken, and it usually breaks near one of its ends, the spring can be repaired. To do this the spring is taken out of its case (partially), discarding the broken end, and pulling several inches of the new end out of the case. Heat in a gasfire to a dull red, and cool slowly in air. This will remove the temper of the end, and then a new hole for the fastening bolt or stake can be drilled. The edges of the broken end can be ground smooth, and curved to refit the spring case. It is not necessary to retemper the end of the spring. Oil the spring to replace the oil driven off by the heat. Then when replacing the spring, take care to prevent the soft end of the spring from assuming an abnormal shape which might throw the entire spring out of line, and cause the end of the spring to jump free of its stake or bolt.

The loss of a few inches of spring will not seriously interfere with the motor's playing time.

The gears should be cleaned by washing in carbon tet, or kerosene, and regreased with a light grade of automobile grease, or any one of the special phonograph greases now on the market.

After the motor has been cleaned and reassembled, its speed should be checked by playing a record. If the wows are objectionable, the governor should be inspected, assuming that everything else is working properly.

The governor consists of two or more metal balls mounted on flat springs in such fashion that they are rapidly revolved when the motor operates. This causes them to fly apart and pull a metal brake disk up against a leather brake shoe, the position of which is set by the speed lever, and which position governs the speed of the turntable.

The faster the balls spin the greater is the centrifugal force exerted, and the greater the pressure on the brake. Since the speed of the governor is many times a multiple of the turntable the leverage is with the governor, and a light pressure on it can stop the powerful spring motor.

When the rapidly spinning brake disk meets the brake shoe, the resultant drag on the motor slows it down slightly causing the brake disk to recede, and effect an equilibrium.

Now if there is any friction or looseness in this action, other than the needed braking action, oscillation will be set up. The brake disk will bounce in and out, and the turntable will wow.

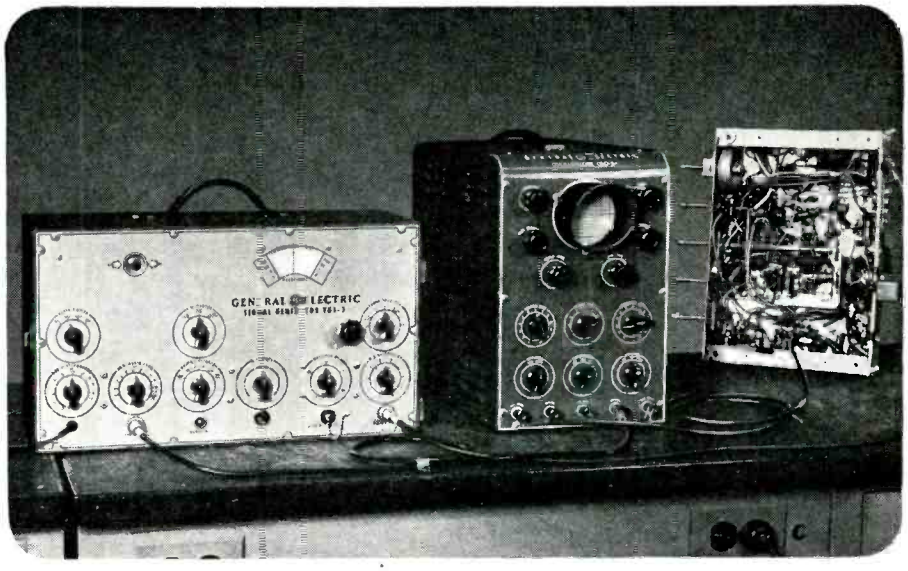
It is difficult to spot the exact cause of the oscillation, so the best thing to do is to clean and polish all the working surfaces, and to adjust so that there is a minimum of free movement. No. 400 sandpaper should be used to polish the disk and shaft, following with a cleaning and oiling with a light grade of machine oil.

The little brake shoe should be checked too. If it has developed a hard surface, another piece, cut from a soft piece of leather, should be used. This should be soaked with oil.

If excessive wow exists after the foregoing check, the chances are that

(*Continued on page* 38)

A MATCHED TEAM for



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Both RF and modulation are indicated on a dual purpose indicator tube.	Length of trace can be expanded to several times the tube diameter, giving the same advantage as larger tubes.
High level output into 50 ohm network to minimize standing waves.	Heavy case is an inherently good shield from magnetic fields, provides rugged protection.
Extremely wide sweep deviation to permit study of response curves beyond band pass range.	Normal deflection polarity: vertical is positive up, and horizontal is positive to the right.
Lines up any FM or AM receiver, stage by stage by visual alignment methods.	Due to its sensitivity, it can be used with the YGS-3 Signal Generator for single stage alignment.
Wide frequency range—100 KC to 150 MC on fundamentals for AM output and, up to 200 MC for FM output.	Exceptionally low price for this versatile unit of exceptionally high quality.

GENERAL ELECTRIC

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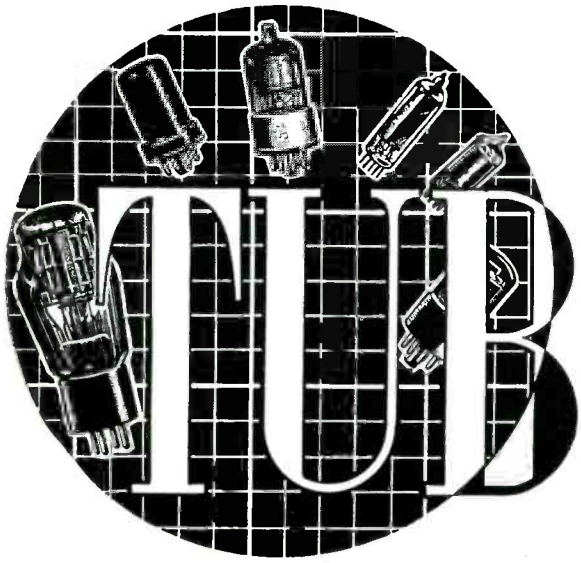


TUBE News

Tube Complements of Nine TV Receivers . . . RCA, Philco, G. E., Emerson, Belmont, Hallicrafters, Motorola, Crosley and Admiral

by L. E. STEWART

Mfgr.	RCA Victor							Philco		General Electric			Emerson	Belmont	Halli-Crafters	Motorola		Crosley	Admiral
MODEL	621 TS	630 TS & CS 8T530	641 TV	648 PTK	721 TV	730 TV	741 PCS	48-1000	48-2500	801	802 803	901			T54	VK-101	VT-71	307TA 9-408	30A14 15&16
PICTURE TUBE SIZE	7"	10"	10"	5" PROJ.	10"	10"	5" PROJ.	10"	4" PROJ.	10"	10"	5" PROJ.	10"	7"	7"	10"	7"	10"	10"
TOTAL TUBES USED	21	30	41	48	21	30	41	26	29	24	26	43	28	22	23	29	16	30	29
NO. OF MINIATURES	10	15	22	23	12	17	16	9	10	1	3	4			5	11	8	15	16
6AG5	3	4	4	4	3	3	4	6	6			1	3		2	5	4	4	3
6AH6														2					
6AK5												2		2					
6AL5	1	3	5	4	2	3	3	2	3				1	2	1	1	1	3	3
6AT6	1	1	1	2	1	1	2											1	
6AU6	1	2	3	4	1	2	2			1	1	1	2	2		2	2	2	5
6BA6	1	2	5	5	1	2	2						1	2		2		2	1
6BE6			1	1		2					2								
6C4															2				
6J6	3	3	3	3	3	3	3	1	1				3			1		3	4
12AT7																	1		
12AU7					1	1													

Mfgr.	RCA Victor							Philco		General Electric			EMERSON	BELMONT	Holli-Crafters	Motorola		Crosley	Admiral
MODEL	621 TS	630 TS & CS 8T530	641 TV	648 PTK	721 TV	730 TV	741 PCS	48-1000	48-2500	801	802 803	901			T54	VK-101	VT-71	307TA 9-408	30A14 15 & 16
NO. OF METAL TUBES	1	4	6	8		2	8			8	8	14	1		8	7	1	4	1
6AC7		1	1	1			1			4	4	4				1		1	
6AG7												1				1			
6H6	1			1			1			1	1	2	1		2	1			
6J5		1	2	4			4									2		1	
6SA7										1									
6SC7											1	1							
6SG7										1	1	2							
6SH7		1	1	1			1					1			6	1		1	
6SJ7																			1
6SK7		1	1	1			1									1		1	
6SQ7			1			2											1		
6SV7										1	1	3							
NO. OF GLASS TUBES	9	10	12	16	8	10	16	18	18	14	14	24	16	10	9	10	6	10	11
1B3GT/8016	1	1	1	3	1	1	3	1	3	1	1	4	1	1	1	1	1	1	1
5U4G	1	2	3	4	1	1	4	2	2	1	1	2		1		2		2	1
5V4G	1	1	1	1	1	1	1						1			1		1	1
5Y3GT						1				1	1								1
6AL7GT												1							
6AQ7GT										1	1	1							
6AS7G				1			1	1	1	1	1	1							
6BG6G	1	1	1	2	1	1	2	1	1	1	1	2	1			1		1	1
6F6G			2	2			2												
6K6GT	1	4	3	2	1	2	2	1					2	2				4	2
6L6G												1							
6S8GT													1			1			
6SL7GT								2	2	2	2	4		1			1		
6SN7GT	4	1	1		3	3				3	3	3	5	4		1		1	2
6V6GT				1			1		1	2	2	4		1		3			1
6X5GT															1				
6X6G																			1
7AD7									1										
7B4								1	1										
7B5								2	2										
7B6								1	1										
7C5								1											
7F8								1	1	1	1	1							
7W7								2	2										
12SN7GT															5		2		
25L6GT															1		2		
25Z6GT													5		1				
CATHODE-RAY	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
5TP4				1			1					1							
7DP4	1																		
7JP4														1	1		1		
10BP4		1	1		1	1		1		1	1		1			1		1	1
TP400A									1										

[Courtesy Renewal Sales Section, RCA Tube Department]

Tube Functions: *A familiarity with tube functions always accelerates servicing. In tv receivers the variety of tubes makes this knowledge even more important. In the new G.E. 803 model, for instance, with its 26 tubes, we have the 6AU6 serving as a tv r-f amplifier, 7F8 as a tv converter-oscillator, 6AC7 as a first video i-f amplifier and a 6BE6 as a second converter. Then we have two 6SG7s in the first and second audio i-f amplifier stages, a 6AQ7GT as an audio discriminator amplifier, 6V6GT in the audio output, and two low-voltage rectifiers, a 5Y3GT and a 5U4G. In the second and third video i-f amplifier stages are a pair of 6AC7s and another 6AC7 is in the video amplifier. A 6AL5 serves as a video detector and d-c restorer. The 6SN7GTs are used in three stages: clipper-horizontal synchronous amplifier, vertical multivibrator and horizontal multivibrator. In the horizontal discriminator and d-c amplifier, and horizontal discriminator and vertical synchronous amplifier are 6SL7GTs. A 6V6GT serves as a vertical sweep output amplifier, a 6BG6G is used as a horizontal sweep output amplifier and a 6AS7G is used for horizontal damping. The 8016/1B3GT is used for high voltage rectification, and a 6BE6 serves as a broadcast mixer.*

Fig. 1. Experimental model of the *eggbeater* type tuner showing how the three inductors have been ganged up with a non-metallic shaft.

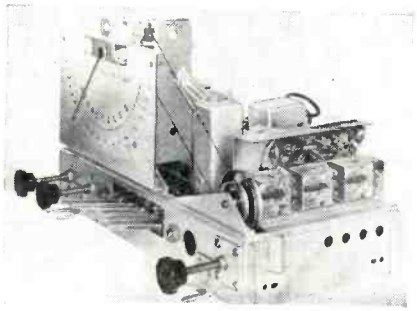


Fig. 2. Construction of the contacts on the eggbeater tuner. These are beryllium copper stock, silver plated and backed up by flat silver steel springs.

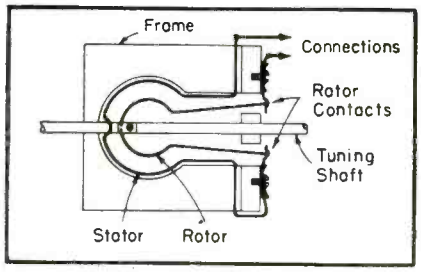
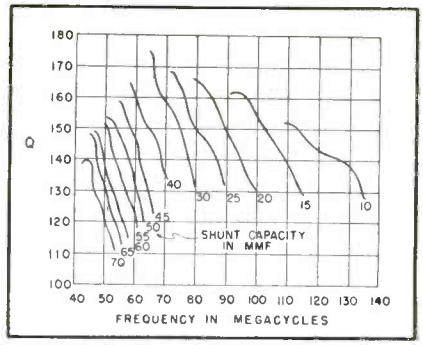


Fig. 3. Curves of the Q versus frequency with various values of shunt capacity.



F-M Tuner Using Eggbeater Type Unit

[*See Front Cover*]

by JAMES F. GORDON

Research Engineer
Bendix Radio Division of
Bendix Aviation Corp.

ONE OF THE PROBLEMS introduced when the f-m band was changed to the 88 to 108-mc region was the production of a simple means for tuning the r-f and oscillator sections of the receiver. Many unique methods have been developed, but in many instances some electrical or mechanical compromise has been necessary to produce a device that was practical from a production standpoint.

In seeking the proper answer to such problems, it often happens that an outmoded principle again becomes useful in an environment which differs considerably from its original application. This is the case with the *eggbeater* type tuner used in the circuit shown on the cover this month.

The *eggbeater* is a modernized version of a high-frequency variometer in which the physical shapes of the stator and rotor resemble the time honored kitchen utensil of the same name. The tuner is a simple device, is easy to produce and quite light in weight. Because of its low inertia, it is non-microphonic and is not easily detuned by shock or vibration.

The Q of the variable inductor in the circuit is nearly constant over its range. The Q is dependent upon the supporting material, physical shape and electrical resistance. By careful design and the use of polystyrene supporting frames, the Q of these inductors was made to exceed one hundred.

Ganging of the three inductors used in the experimental model shown in Fig. 1 was effected by means of a common non-metallic shaft to reduce electrical coupling between circuits. Both the fixed and moving inductors used in the model were made from phosphor bronze wire which was heavily silver plated. The ends of the rotor wires have spherical tips which fit into contact sockets. The contacts are fashioned from beryllium copper stock, silver plated and backed up by flat steel springs; Fig. 2. While silver plate was used on the contacts employed in the experimental model, platinum or rhodium plate would be more desirable for long service in production equipment. The steel springs are necessary to maintain constant contact with the ends of the rotors which, as they turn, change somewhat in physical length and tend to pull away from their contacts, at the extreme position. This would cause noisy tuning under some conditions.

When unloaded, the rotors have a slight tendency, due to their spring-like characteristics, to seek the neutral or center dial position. However, the normal dial drive friction is sufficient to prevent creeping. The *eggbeater* tuner is comparatively stable thermally and, after the normal receiver warm up period, will stay tuned over long periods.

In early models, it was found that the use of a light phenolic tuning shaft introduced a slight angular inaccuracy in the rotor position farthest from the driven end. This condition is only important if the oscillator section is at that location. To eliminate possible calibration inaccuracies due to this characteristic, the oscillator section was placed at the driven end. Reset calibration is then within the accuracy of the dial and pointer at all times. The total angular displacement of the tuning shaft was set at 155°. Dial calibration was found to be more linear throughout than could be accomplished with ordinary variable capacitance tuning.

The curves of Fig. 3 show the Q versus frequency, with various values of shunt capacity, for a given physical structure, rotated through 155°. It will be noted that the frequency range covered remains approximately constant with angular rotation. This fortunate circumstance contributes considerably to ease of tracking between the oscillator and r-f sections.

Since circuit Qs at the higher frequencies are largely a function of the input admittance of the tubes in conventional circuits, very large inductor Qs would not be maintained even if the figure of merit of the inductor itself were relatively high.

In the experimental model, the trimmers were of the compression type and mounted on the polystyrene supporting framework.

The *front end* of the receiver employs a type 6AG5 r-f stage and a type 7F8 dual triode oscillator-mixer

(*Continued on page* 38)

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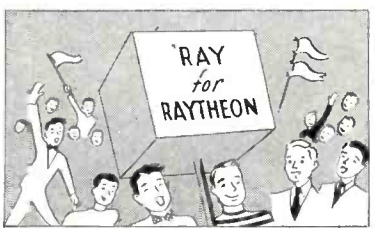

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TV Picture-Tube

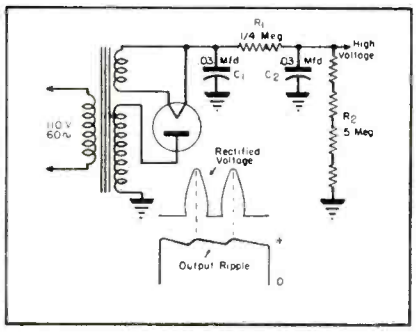


Fig. 1. Transformer high-voltage supply.

IN OUR ANALYSIS of the characteristics of high-voltage tv systems, last month, properties of picture tubes and their power requirements were discussed.

It was pointed out that a transient or flyback voltage supply is a part of the horizontal deflection output circuit and utilizes a transient voltage generated in the horizontal deflection coils to supply the high-voltage potential for the picture tube. A typical transient voltage-supply circuit was shown to illustrate this point.

Now, during the horizontal trace period a sawtooth of current builds up in the deflection coil and therefore a field is built up around the deflection coil. During the retrace period the deflection output tube is generally cut off, the rapid change in plate current causing the magnetic field to collapse and a high-amplitude single-alternation transient voltage to appear across the deflection coil. Were it not for the damping tube used in the secondary of the output transformer, this transient voltage would produce the series of damped oscillations, occurring at the resonant frequency of the deflection coil and the distributed circuit capacity. This one alternation, however, has a peak amplitude in the thousands of volts and can be used, if properly rectified, to develop a high d-c voltage.

The purpose of the horizontal sweep output transformer is to present the proper loading for the tube from the low impedance of the deflection coils. In so doing, the transformer *turns ratio* from primary to secondary is stepdown. This means that going from secondary to primary the transformer is actually stepup and the transient voltage developed in the secondary is further increased in amplitude by the stepup of the transformer and, consequently, the high-voltage pulse is still greater in amplitude in the primary of the output transformer. A higher boost in amplitude is also obtained by using an extended primary winding so there is a greater stepup between secondary and primary, the plate being tapped on at some point along the primary where the proper impedance match is made to the deflection coil.

The top of the primary winding is attached to the plate of a high-voltage rectifier tube which rectifies the transient voltage, which is now filtered to produce an essentially constant high-voltage d-c potential. It is important to note that the transient voltage itself is extremely short in duration and occurs during a portion of the horizontal retrace period. The actual spacing between pulses is relatively long and therefore if a d-c voltage is to be obtained the charge on the filter capacitor must be held during this interval. The actual frequency of any ripple voltage that might be apparent is the repetition rate of the horizontal sweep system, approximately 15,750, because one transient pulse is developed for every sweep period. It is apparent, therefore, that the ripple frequency is relatively high and rather small value capacitors can be used to do the filtering, a typical size being 500 mmfd. The time constant of the filter capacitors and resistor is sufficiently long to prevent any serious discharge of the filter capacitors during the interval between transient pulses. Fortunately, it is no difficult task to do this because the actual current required from the voltage source is extremely small and therefore the resistive component of the discharge circuit extremely high. Actually the second filter capacitor of the high voltage system is the capacity that exists between the second anode coating on the inside of the picture tube and the grounded outside coating which is external to the glass of the picture tube, the glass serving as a dielectric. The effective capacity between coatings is approximately 500 mmfd. A considerable charge can be retained on this capacity and although it is not dangerous it is often surprising and causes one to drop and injure the picture tube. It is wise to always ground the second anode momentarily to the outside coating before picking up the tube.

The heater potential for the high-voltage rectifier is obtained by means of a small few turn pickup coil which is also wound on the core of the horizontal output transformer. The energy inducted into the winding by the fast changing magnetic fields is sufficient to excite the heater of the high-voltage rectifier tube. The pick-up loop is, of course, properly insulated for high-tension voltages.

Transformer Type High-Voltage Supplies

Two transformer supplies excited by 60-cycle power mains are shown in Figs. 1 and 2. If any amount of current were necessary at the extremely high voltages required the

Fig. 2. A transformer high-voltage supply using a voltage doubler setup.

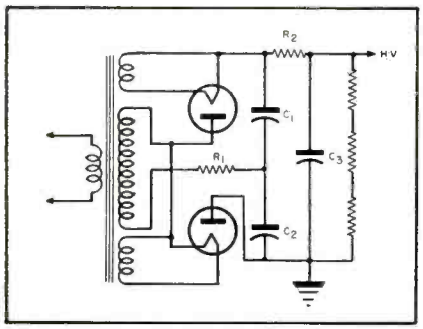
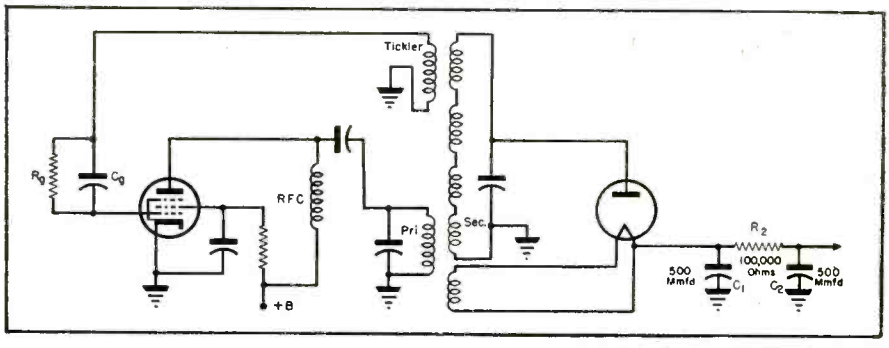


Fig. 3. An oscillator high-voltage supply system.



Voltage and Signal Systems

How The Horizontal Sweep Output Transformer Works . . . Picture Tube Coating Capacity Effects . . . Transformer-Type High-Voltage Supplies . . . Filter System Designs . . . Oscillator High-Voltage Supply Characteristics . . . H-V Pie-Wound Oscillator Transformer Design Features . . . Pulsed H-V System Operation . . . Beam-Relaxor Horizontal-Scanning Properties.

by EDWARD M. NOLL*

Instructor in Television
Temple University

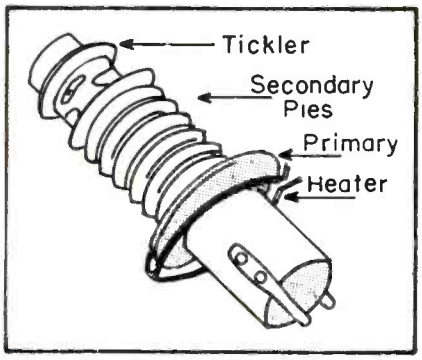
transformer would be massive. Fortunately, only a small current is necessary and although it is a high-voltage transformer, it need not be excessively bulky. Consequently, the windings are constructed of small diameter wire and if, for any reason, a partial short is placed across the transformer, the windings open up. Many receivers use a safety resistor to limit the current, such as resistor R_1 in Fig. 2, which prevents excessive secondary current in case of a partial or complete short across the high-voltage output of the power supply. One must be extremely cautious when working on the high voltage supply excited by the 60-cycle power mains because the current capabilities of such a system are very high. And, in addition, an appreciable charge is stored in the filter capacitors because they must be of a large capacity to effectively filter the low frequency, 120 or 60-cycle ripple frequency.

The simple high-voltage supply shown in Fig. 1 consists of a half-wave rectifier and a simple R-C filter. When so little current is drawn from the supply half-way rectification and simple filtering is all that is necessary to remove the ripple frequency. Actually the ripple component looks similar to a sawtooth wave as shown in Fig. 1, because capacitors C_1 and C_2 charge when the rectifier conducts and discharge when the rectifier is non-conducting or doing the opposite alternation of the applied 60-cycle sine wave. Every attempt is made to keep this ripple under one per cent of the d-c output voltage by properly choosing a long-time constant $R\ C$ filter which does not permit the capacitor to discharge appreciably during the non-conducting alternation of the rectifier, in accordance with the current required. The time constant of the $R\ C$ filter must be high in comparison to the period of the wave which it must filter. Of course, a given time constant can be formed with a large R and a small C, or a large C and a small R.

The choice of R and C depends on the current required and the regulation expected. For example, if the current requirements are extremely light the R of the time constant circuit is very large and for a given time constant a relatively small value of C is required. If the current requirements are higher or if better regulation is desired with a change in the brightness adjustment, a heavier load must be placed on the high-voltage power supply. This is accomplished by reducing the value of the bleeder resistor or the R of the time constant. In this arrangement, of course, a larger C must be used to produce an equivalent time constant, and the current capabilities of the entire system must be somewhat higher.

The power supply filter of Fig. 1 is called a double-section filter because of the addition of an input capacitor, C_1, and a series resistor R_1. In this filter system the initial peak charge is placed on C_1 and the discharge voltage which is mainly developed across R_2 is also filtered by capacitor C_2. Consequently the proper amount of ripple filtering can be obtained with the use of component parts of smaller value and size. The system of Fig. 2 uses a voltage doubler output method in which capacitors C_1 and C_2 are charged on opposite alternations of the input sine wave. Consequently, in this circuit, the ripple frequency is 120 cycles and the components of the $R\ C$ filter can be made smaller in value. Thus it is ideal when very high potentials are desired and an extremely high voltage can be obtained which is double the sine wave peak output of the secondary of the transformer.

Fig. 4. R-f transformer assembly used in high-voltage tv power supply systems.

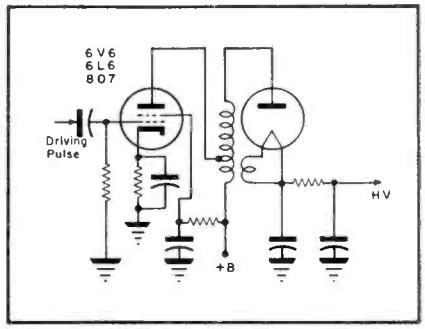


Oscillator High Voltage Supply

Another safe and practical means of generating the high voltage required for picture-tube operation is the use of a low-frequency oscillator and the

(*Continued on page* 36)

Fig. 5. Pulsed high-voltage supply system.



*From a forthcoming book, *Television For Radiomen*, to be published by Macmillan.

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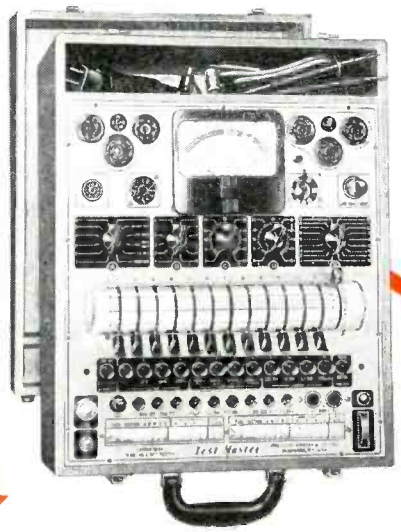

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TV Antenna Installation

Judging Specific Application Features of The Various Types of Antennas Which Can Be Used For TV Installations... Solving Reflection Problems ... Locating Multiple Reflections And Eliminating Them In The Receiver ... Analyzing Signal-To-Noise With Test Setups To Secure Maximum TV Receiver Efficiency.

by **IRA KAMEN**

Commercial Radio Sound Corp.
New York City

L. HOGBEN, IN HIS WIDELY READ BOOK *Mathematics for the Million,* reports the apocryphal encounter of Diderot, the great encyclopaedist of the French Revolution, with Engler, foremost mathematician of his time. Diderot had completely captivated the nobility of the Russian Court with his brilliance and glibness, and the envious Tsarina decided to embarrass him publicly. Diderot was confronted by Engler who proclaimed dramatically that he had mathematical proof of the existence of God: "A + B"/N = X; therefore, God does exist," he pronounced. "What have you to say to that?"

Diderot was confused, frightened, absolutely unable to reply. He left the Russian Court in a huff and returned immediately to France, because when faced with an algebraic equation, he was helpless. He could not proceed to think or argue successfully.

Possibly, the greatest stumbling-block to a clear understanding of tv antenna installation fundamentals is this very fear of mathematics and the consequent desire to avoid those questions with which that is concerned.

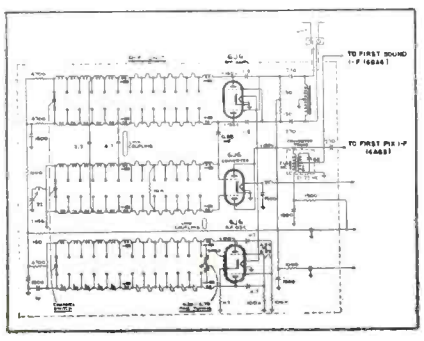
It is the purpose of this paper to present the basics of tv antenna installations in a simple form, divorced from Greek symbols and complicated formulas.

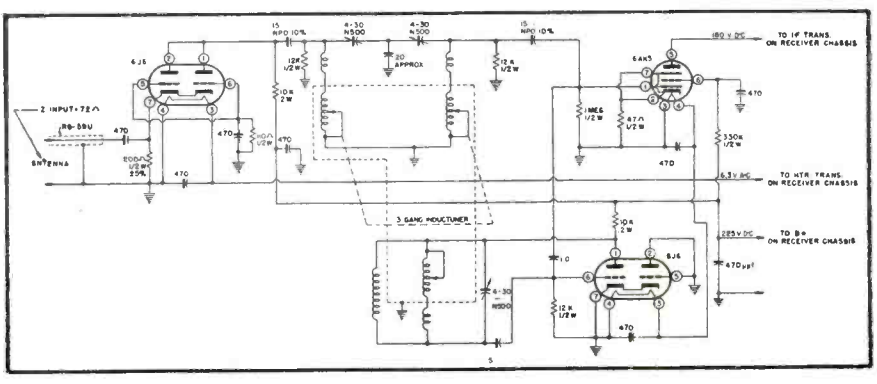
In a fundamental tv antenna installation there are three elements: (*1*) antenna, (*2*) transmission line, and (*3*) tv receiver.

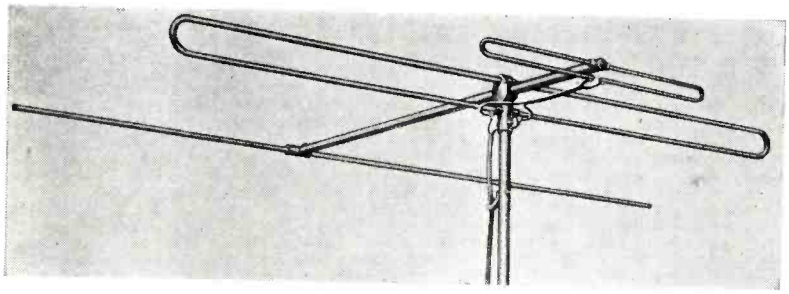
The function of the antenna is to pick up transmitted signals which are relatively free from interference and reflections (so-called *ghosts*) and of sufficient strength to energize the tv receiver. These antennas take various forms to provide the characteristics necessary to meet specific tv installation requirements.

The function of the transmission line is to act as the transfer device between the antenna and the tv receiver. Current types of tv receivers use balanced inputs of approximately 300 ohms or

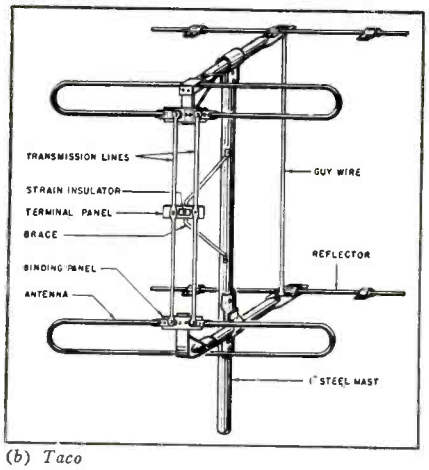
Fig. 1. Input circuits of the RCA 630TS (left) and DuMont (right) tv receivers.



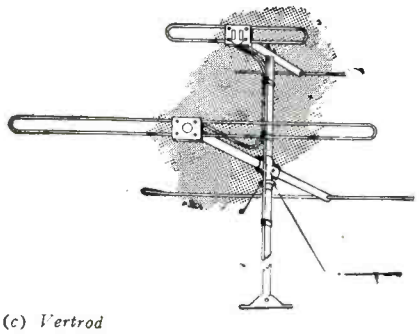




(*a*) *Amphenol*

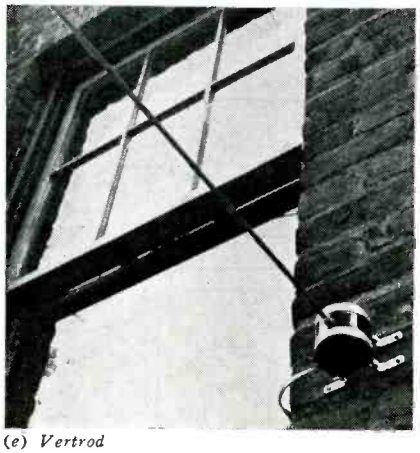


(*b*) *Taco*



(*c*) *Vertrod*

(*d*) *Ward*



(*e*) *Vertrod*

Fig. 3. Various types of tv antennas in use today.

High-gain antenna with two broad-band dipoles with reflector (*Amphenol*).

Stacked folded-dipole reflector type of antenna. (*Taco*)

Low and high-frequency tv antenna arrays. (*Vertrod*)

Folded dipole (*Ward*).

Rod antenna for tv work (*Vertrod*)

unbalanced inputs of approximately 73 ohms impedance; Fig. 1. Therefore, the two transmission cables shown in Fig. 2 are commonly employed in tv installations.

The balanced 300-ohm line has a lower attenuation and costs less than the unbalanced 73-ohm coaxial line.

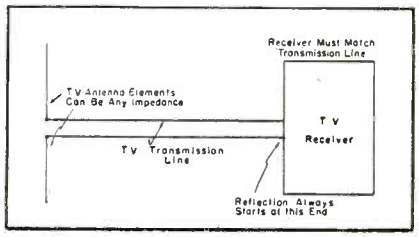
The unbalanced 73-ohm coaxial line is preferred and standardized by many of the manufacturers of higher priced tv receivers because the signal-to-noise ratio is much better with the shielded, lower impedance coaxial cable.

The tv receiver must present a constant 300- or 73-ohm resistance to the transmission line on all channels:

Channel	Mc
2	54 to 60
3	60 to 66
4	66 to 72
5[1]	76 to 82
6	82 to 88
7	174 to 180
8	180 to 186
9	186 to 192
10	192 to 198
11	198 to 204
12	204 to 210
13	210 to 216

Matching is the most important factor in a tv installation, for when the tv receiver input matches the impedance of the transmission line the incoming signal is completely absorbed by the receiver and, as a result, there are no reflections or standing waves on the transmission line. The antenna impedance is only important from the standpoint of power transfer. When the antenna impedance matches the line maximum power is transferred.

Fig. 2. The importance of matching is illustrated here.



Performance Specifications

For normal tv reception the following factors can be used as a guide:

(*A*) The tv signal level shall be not less than 500 microvolts, as specified by the FCC, as the minimum for satisfactory reception.

(*B*) The picture quality when viewed from the proper distance shall not be affected by reflections induced into the tv antenna.

(*C*) The signal-to-noise ratio shall be high enough so that the interference does not mar the picture to an objectionable degree.

Now let us see how we can make a tv installation conform to these performance specifications:

(*A*) There are quite a few types of antennas which can be used in primary signal areas: (*1*) Dipole, (*2*) dipole and reflector, (*3*) folded dipole, (*4*) wideband arrays, (*5*) unipoles, (*6*) indoor antennas, (*7*) stacked dipoles (straight and folded), (*8*) fanned elements, and (*9*) conical.

The dipole and dipole-reflector antennas are usually mismatched to 300-ohm transmission lines to obtain a broadband (50-200 mc) response characteristic. The impedance of a dipole antenna at resonance is 73 ohms and somewhat less when a reflector is added, depending upon the spacing of the reflector with respect to the dipole. This antenna impedance increases at those frequencies above and below the resonant frequency so that at some off-resonant point, the antenna will match the transmission line, which compensates for the inefficiency of the dipole at the off-resonant frequencies.

Folded dipole arrays have an impedance of four times a straight dipole and approximately match a 300-ohm balanced line. This antenna provides a relatively broad-band characteristic. To make this type of antenna more efficient over the complete tv band, it is possible to have a double assembly of folded dipoles in which one folded dipole is broadly resonant in the low tv band (44-88 mc) and a smaller folded dipole broadly resonant in the high tv band (174-216 mc). It is also possible to combine simple dipoles; however, the mismatched to 300-ohm

1 Four-mc separation provided so that channels *4* and *5* can operate in same area without cross modulation.

line would be relatively high and considerable signal would be lost due to the mismatch.

Wideband arrays are usually more efficient than a tuned dipole over the whole tv band. The antenna shown in Fig. 3*c* can be adjusted so that the high-frequency smaller elements can be directed to a different angular position with respect to the larger elements. This permits a finer adjustment of the array for both low and high channel reception. A network, incorporated in this array, prevents the larger low-frequency elements from operating in the high-frequency band, thereby contributing to the efficiency of the adjustment of the high-frequency elements. Wideband arrays are preferred by manufacturers of higher priced tv receivers where the price of these antennas are incidental in the cost of the overall installation. Often it is less expensive to install one wideband array than two inexpensive simple type of antennas to obtain complete tv frequency coverage.

The unipole or rod antenna acts much the same as a dipole—except one pole is imaginary. The rod shown in Fig. 3*e* has a network in the base which permits its connection to 300- or 73-ohm transmission lines.

This rod antenna, designed to replace indoor antennas, can select a stronger signal outside. Tv set owners constantly complain that when they approach an indoor antenna they change the contrast of the picture, a body-capacity effect. To the installer indoor antennas are usually a costly experiment since they work satisfactorily in only a limited number of cases. Of course, where outdoor antennas of any type are prohibited nothing else can be done except to use the indoor antenna. Incidentally many indoor antenna installations are also effected in the summer when window screens are installed between the indoor antenna and the tv stations. Window mounted rods do not have the inherent indoor-antenna defects and also have a higher signal-to-noise ratio. The rod type antenna illustrated can be used with coaxial line when higher signal to noise is required. It has a universal base which permits orientation of 180° in the vertical and horizontal plane. This is a handy feature for the installer as the polarization of the transmission waves twist from horizontal toward vertical polarization over a distance or after it has been reflected from a fixed structure. Window rod antenna installations are also preferred in private homes where a rooftop antenna is considered unsightly or impracticable to install.

Stacked arrays have higher gain than single array antennas and can be furnished for connection to 73-ohm coaxial and 300-ohm transmission lines. The impedance of these units vary with frequency and with the spacing of the antenna elements. Their main aplication is in weak signal areas where the signal-to-noise level must be raised.

Reflection Problem

(*B*) To meet the performance specification on reflections, we must first understand the nature of reflections.

Tv signals are transmitted at a frequency range where the signals act like light and are reflected by steel structures. These reflected signals are always weaker than the direct signal as there is a loss each time the signal is reflected. Both the direct and the reflected signals contain the full transmitted pattern, as shown in Fig. 5. The reflection shown in this illustration may be caused by either of three types of reflection, as shown in Fig. 6, since there will be an appreciable time and phase delay between the direct and any of the reflected signals. These reflected signals may be either black or white, depending upon the polarity of the signal and may vary from a signal as strong as the transmitted signal to a level where it is barely noticeable.

The reflection problem can usually be remedied by the application of the proper antenna and its correct orientation.

In some cases, the careful orientation of a straight or folded dipole will be satisfactory to discriminate against a reflection. The addition of a reflector to a straight or folded dipole will usually eliminate the *1* or *2* type of reflections shown in Fig. 6. The addition of the reflector concentrates pickup in the desired direction, much the same as a reflective mirror focuses light on an object, the reflector element concentrating the direct signal in the desired direction and focusing it on the dipole.

The most difficult reflections to eliminate are those which come from the same direction as the transmitted signal, as shown by reflection *3* of Fig. 6. Adding a director element to a dipole and reflector array narrows the pickup angle still further so that the source ghost (reflection *3*) can be attenuated

(*Continued on page 39*)

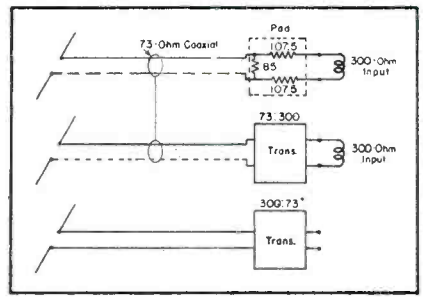


Fig. 4. How pads and trifilar transformers are used in 72-ohm and 300-ohm lines. Transmission line in 300:73 ohm input is a 300-ohm line.

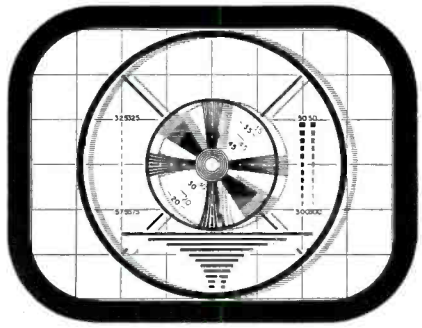


Fig. 5. Picture tube pattern with multiple images or ghosts due to signals reflected from tall buildings, etc. (*Courtesy Belmont Radio*).

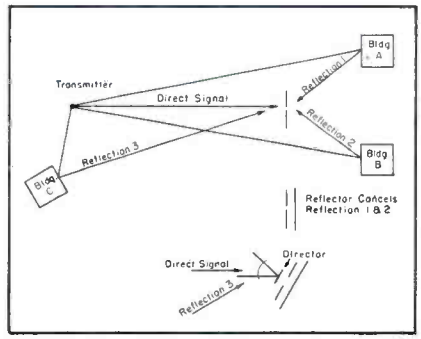
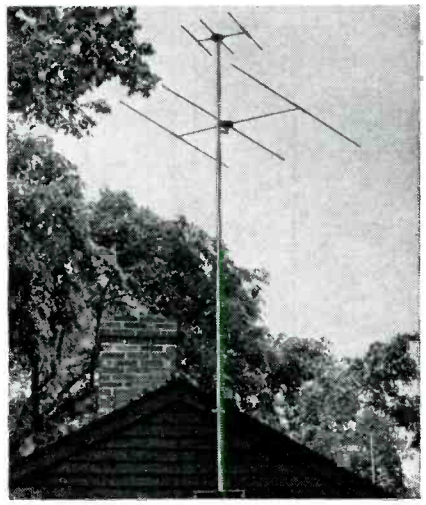
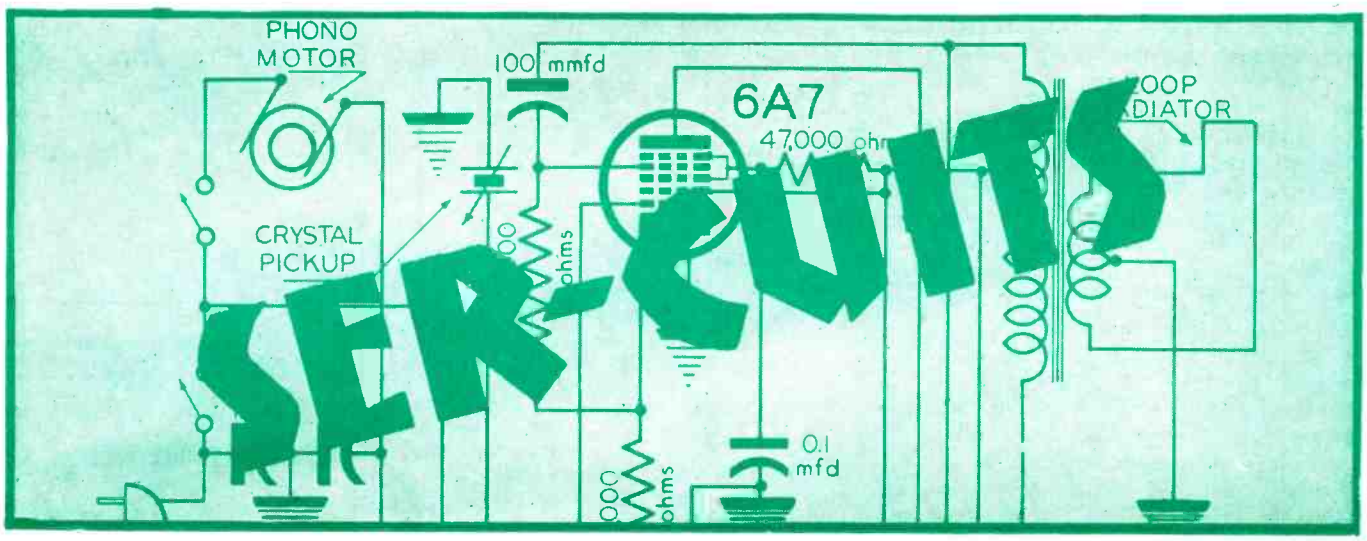


Fig. 6. Reflected paths of signals.

Fig. 7. A two-array tv antenna setup. (*Courtesy Workshop Associates*).





Circuit Analyses of Current Types of Battery And Three-Way Portables Using Tube And Selenium-Rectifying Systems.

THIS SUMMER will probably see more portables around than ever before. Types will run from the tiny personals to the small table model sizes.

Many of the models are using the 1R5/1T4 tube setup. An example of this type of receiver is shown in Fig. 1; RCA 8BX5. In this model, the 1R5 serves as a converter, 1T4 as an i-f amplifier, 1U5 as a second detector/a-v-c/a-f amplifier, 3V4 as a power amplifier and 117Z3 as a rectifier.

The undistorted power output of this model, when used with a-c, is .15 watt, while the maximum is .25 watt. The output is slightly lower on battery operation. Incidentally, the current consumption on *A* battery (7½ v) is 60 ma and of the *B* battery (75 v) 10 ma.

A-C/D-C or Battery Use

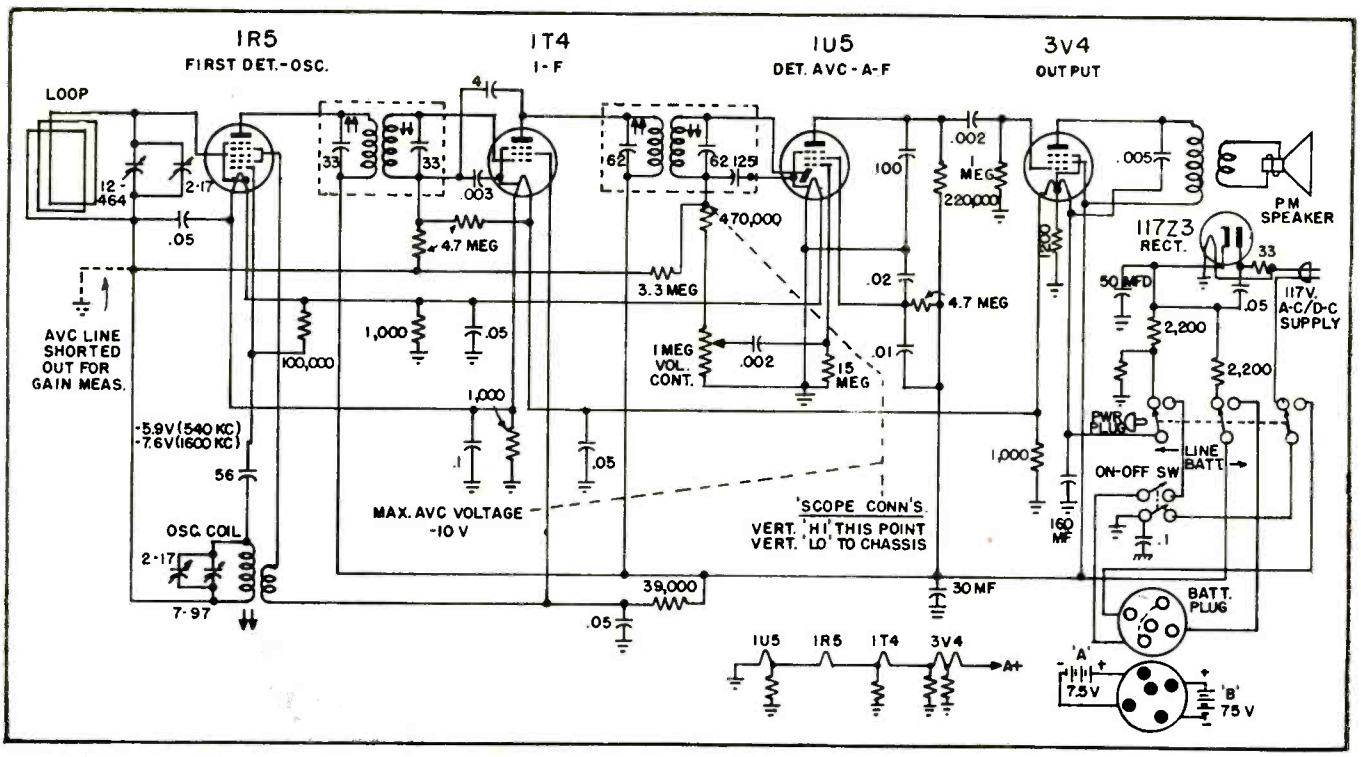
This receiver will operate on a-c, d-c or batteries. On battery operation, the tube current will be found to be 20% lower than when used on the line. Of course, the 117Z3 rectifier is out of the circuit for battery operation.

Fig. 1. RCA 8BX5 a-c/dc/battery portable.

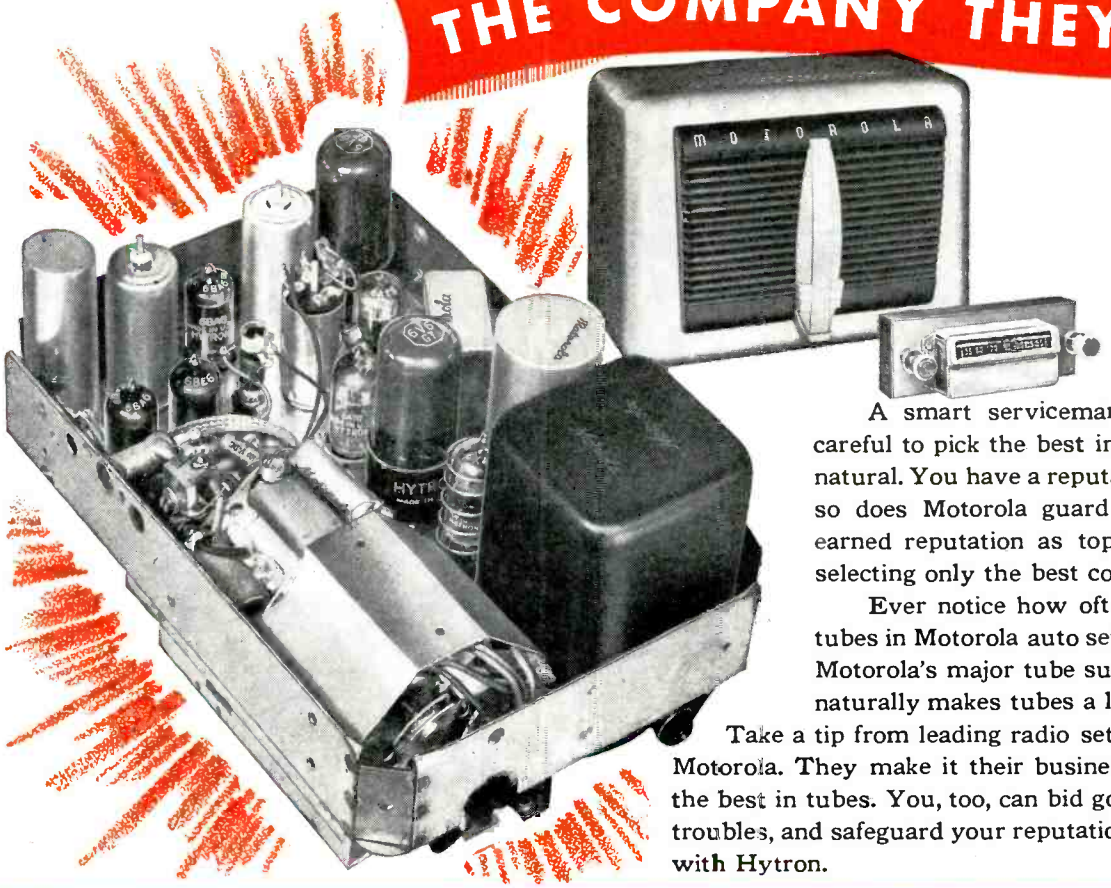
Westinghouse H-185/H-195

In Fig. 2 appears another portable using the 1R5 as a converter, 1T4 as an i-f amplifier and the 1U5 as a detector, a-v-c and first a-f amplifier. In this receiver, however, a 3S4 is used as a power output amplifier.

The *A* battery consumption of this



TUBES ARE KNOWN BY THE COMPANY THEY KEEP



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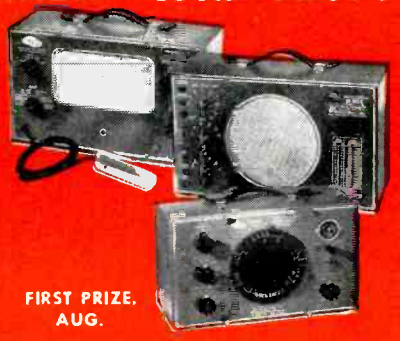

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FIRST PRIZE, OCT.
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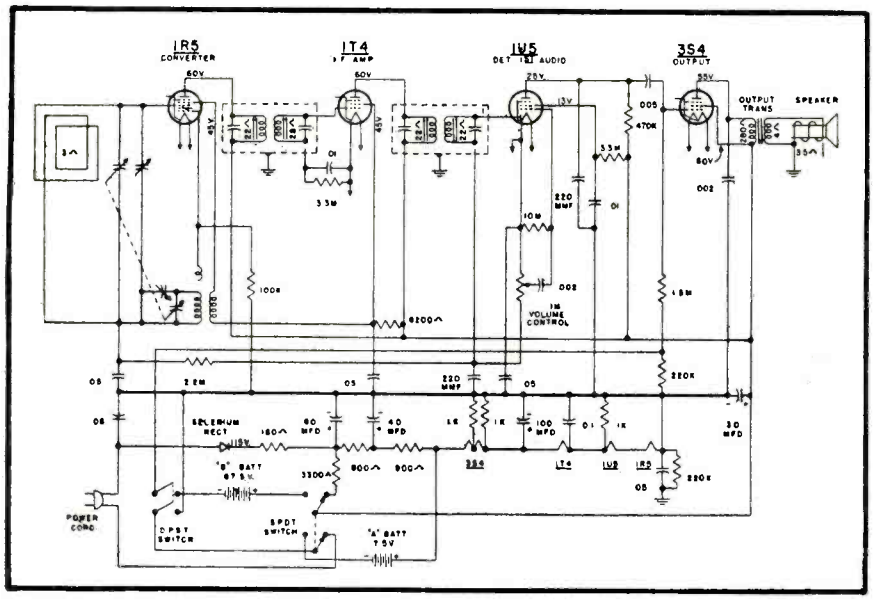


Fig. 2. Westinghouse H-185/H-195 three-way portable.

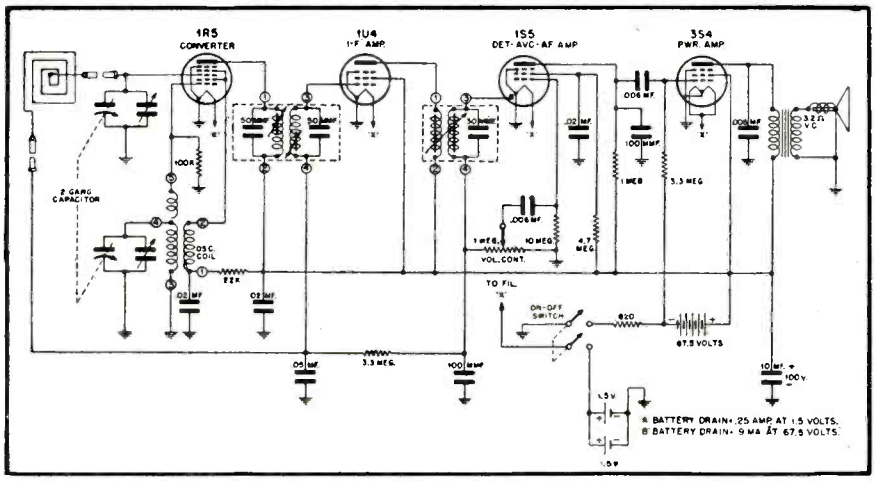
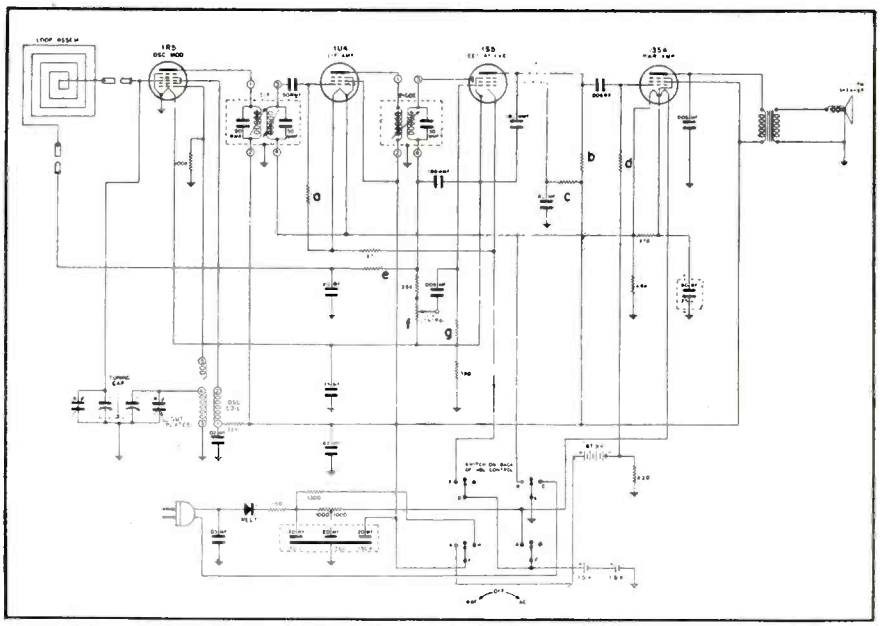


Fig. 3 (above). Motorola 48L11 battery-operated portable circuit.

Fig. 4. Circuit of Motorola 48L11 three-way portable using a selenium rectifier. (Resistor values: *a*, 10 megohms; *b*, 1 megohm; *c*, 4.7 megohms; *d*, 3.3 megohms; *e*, 3.3 megohms; *f*, 1 megohm; and *g*, 10 megohms.



model is .05 amp and *B* battery consumption is .01 amp.

Undistorted power output when used on a-c is .08 watt, and when used on battery .02 watt.

Like the previous model, this receiver also can be used on a-c or d-c. The *B* battery voltage for this model is slightly lower than the previous type, being only 67½ v.

Motorola Portables

In Figs. 3, 4 and 5 appear the circuits of three types of Motorola portables. The Fig. 3 model (48L11) is a battery-operated type, which uses a 1R5 converter, 1U4 i-f amplifier, a 1S5 detector/a-v-c/first a-f and a 3S4 power amplifier. Slotted iron core i-f and diode transformers are used.

Motorola suggests, when aligning this receiver, that a low range output meter be connected to the voice coil terminal and receiver chassis, and the receiver volume control set to maximum. For greatest accuracy the out-

Fig. 6*a*.

	Capacitors	
C_1	105 mmfd, 5%, -.00075 temp. coeff. ceramic	
C_2	.01 mfd, 400 volts, paper	
C_3	.0015 mfd, ceramic	
C_4	140 mmfd, 3%, silver mica	
C_{5a}	486 mmfd, (max.) a-m r-f)	
C_{5b}	15 mmfd (max.) f-m r-f)	Gang Cond.
C_{5c}	15 mmfd (max.) f-m osc.)	
C_{5d}	143 mmfd (max.) a-m osc.)	
C_6	22 mmfd, 5%, ceramic	
C_7	7 mmfd, ±1 mmfd, -.00047 temp. coeff. ceramic	
C_8	.01 mfd, 400 volts, paper	
C_9	35 mmfd, 5%, ceramic	
C_{10}	105 mmfd, 5%, -.00075 temp. coeff. ceramic	
C_{11}	7 mmfd, ±1 mmfd, -.00047 temp. coeff., ceramic	
C_{12}	.0015 mfd, ceramic	
C_{13}	.01 mfd, 400 volts, paper	
C_{14}	.01 mfd, 400 volts, paper	
C_{15}	.005 mfd min., ceramic (disc)	
C_{16}	.01 mfd, 400 volts, paper	
*C_{17}	100 mmfd, mica	
*C_{18}	100 mmfd, mica	
C_{19}	.01 mfd, 400 volts, paper	
C_{20}	.005 mfd min., ceramic (disc)	
C_{21}	105 mmfd, 5%, -.00075 temp. coeff., ceramic	
C_{22}	4 mfd, 150 volts, electrolytic	
C_{23}	105 mmfd, 5%, -.00075 temp. coeff., ceramic	
C_{24}	.002 mfd, 600 volts, paper	
C_{25a}	30 mfd, 350 volts	
C_{25b}	30 mfd, 350 volts	Elect.
C_{25c}	20 mfd, 25 volts)	
C_{26}	.01 mfd, 400 volts, paper	
C_{27}	.2 mfd, 200 volts, paper	
C_{28}	.001 mfd, 600 volts, paper	
C_{29}	.005 mfd, 600 volts, paper	
C_{30}	500 mmfd, 10%, mica	
C_{31}	.005 mfd, 600 volts, paper	
C_{32}	.01 mfd, 400 volts, paper	
C_{33}	.1 mfd, 400 volts, paper	
C_{34}	.01 mfd, 400 volts, paper	
C_{35}	200 mmfd, 20%, ceramic	
C_{36}	.01 mfd, 400 volts, paper	
C_{37}	.005 mfd, 600 volts, paper	
C_{38}	2½ to 6 mmfd, trimmer, silver ceramic	

*Part of encased diode filter unit. This unit consists of R_{12}, C_{17}, C_{18}.

Fig. 6b.

Resistors

R_1	390 ohms, 1/4 watt
R_2	470,000 ohms, 1/4 watt
R_3	22,000 ohms, 1 watt
R_4	1 megohm, 1/4 watt
R_5	47,000 ohms, 1/4 watt
R_6	47,000 ohms, 1/4 watt
R_7	15,000 ohms, 2 watt
R_8	470 ohms, 1/4 watt
R_9	470,000 ohms, 1/4 watt
R_{10}	27,000 ohms, 1 watt
R_{11}	470 ohms, 1/4 watt
*R_{12}	47,000 ohms, 1/4 watt
R_{13}	220,000 ohms, 1/4 watt
R_{14}	220,000 ohms, 1/4 watt
R_{15}	15,000 ohms, 2 watt
R_{16}	27,000 ohms, 1/4 watt
R_{17}	390 ohms, 1/4 watt
R_{18}	27,000 ohms, 1 watt
R_{19}	6,800 ohms, 1/4 watt, 5%
R_{20}	6,800 ohms, 1/4 watt, 5%
R_{21}	120,000 ohms, 1/4 watt
R_{22}	100,000 ohms, 1/4 watt
R_{23}	47,000 ohms, 1/4 watt
R_{24}	2 megohms tone control (includes on-off switch SW_2)
R_{25}	1 megohm volume control (tapped at 500,000 ohms)
R_{26}	10 megohms, 1/4 watt
R_{27}	22,000 ohms, 1/4 watt
R_{28}	470,000 ohms, 1/4 watt
R_{29}	470,000 ohms, 1/4 watt
R_{30}	390 ohms, 1 watt

*Part of encased diode filter unit. This unit consists of R_{12}, C_{17}, C_{18}.

put of the receiver should be kept at approximately .05 watt (.05 equals .40 volt on output meter) throughout alignment by reducing generator output (not receiver volume control) as the stages are brought into alignment. The oscillator trimmer frequency is 1,620 kc and the antenna trimmer is 1,400 kc.

The Fig. 4 circuit is a three-power model, a-c/d-c/battery (58L11), using

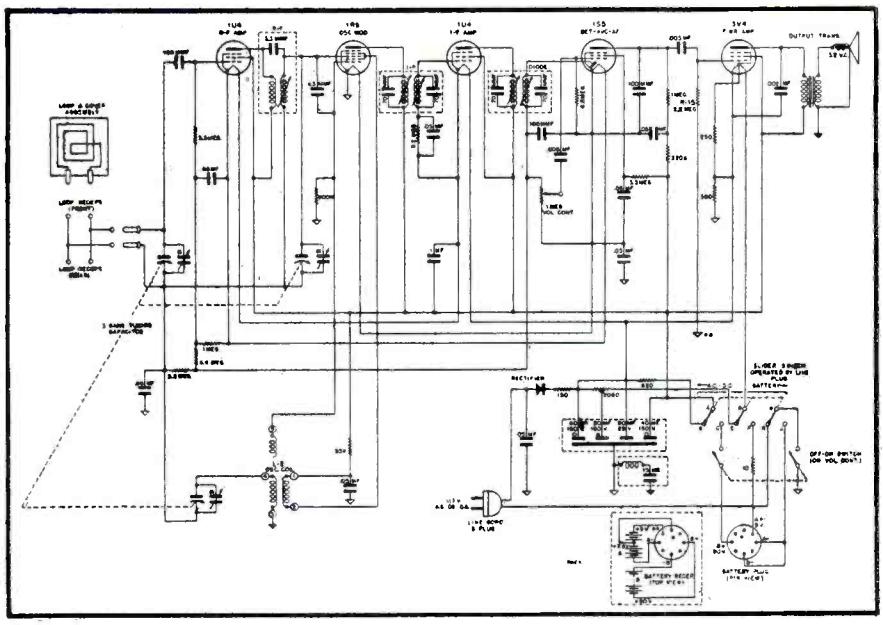


Fig. 5. A five-tube three-way portable with a selenium rectifier; Motorola 67L11.

the same tube setup as the previous model, and a selenium type rectifier.

For battery operation two 1½ v *A* cells are used and one 67½ v *B* battery.

The method of alignment is identical to that used for the previous model.

In Fig. 5 appears another three-way type Motorola (model 67L11) which, however, has a slightly different tube setup. A 1U4 is used as an r-f amplifier, 1R5 as a converter, 1U4 as an i-f amplifier, 1S5 as a detector/a-v-c/first a-f amplifier and a 3V4 for power amplification. The selenium cell is used in this model, too, for rectification.

This model uses a detachable loop antenna.

If these receivers are to be aligned, when they are operating on a-c, an isolation transformer[1] should be used between the receiver and power line. If no isolation transformer is used and hum is encountered during alignment, the ground side of the signal generator should be connected to *B*— instead of the receiver chassis.

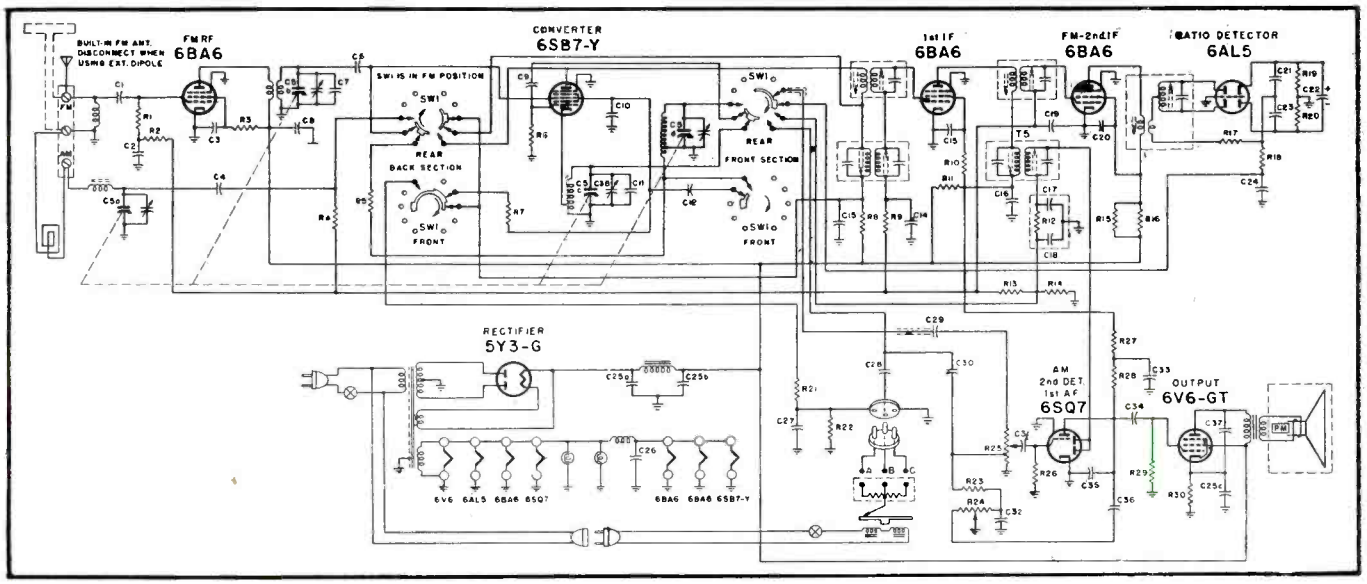
[1]See November, 1947, and April, 1948, issues of SERVICE for characteristics of isolation transformers and their construction.

Admiral 8C11-8C17

In Fig. 6 appears a circuit of an f-m receiver using a ratio detector; Ad-

(*Continued on page* 41)

Fig. 6. Circuit of f-m/a-m phono receiver made by Admiral; chassis 8C1 used in models 8C11 to 8C17. Resistor and capacitor values appear in Figs. 6*a* and *b*.



Servicing Helps

Admiral Cartridge Circuit Details . . . Crystal Pickup Compensation Circuits . . . Power Microphones . . . Radio-Phono Switch Applications . . . Speech Equalization Methods

by P. M. RANDOLPH

MANY HAVE inquired about the design of the pickup cartridge used in the Admiral receivers.

The pickup cartridge (Fig. 1) uses a new principle; it is not a crystal, magnetic, or capacitive device. The pickup element is made of special rubber which is a high resistance electrical conductor (R_1 and R_2). The resistance varies as the length of the rubber is changed. A Monel metal needle, osmium tipped, is clamped to the center of the resistive rubber, as shown at *B*. As the needle moves back and forth in the record groove, it alternately lengthens the rubber on one side and shortens the rubber on the other side.

A d-c voltage is applied at *A*. The voltage drop from *B* to *C* varies as the resistance changes due to the *back and forth* movement of the needle. The varying voltage drop is in reality an alternating voltage of audio frequency. This voltage is applied through the coupling capacitor (C_c) to the grid (*G*) of the audio amplifier tube.

In trouble shooting, if a loud hum is heard when the needle is touched with finger, circuit from *B* to *G* is not open or shorted. If hum is not heard, circuit from *B* to *G* should be checked. If hum is heard, voltage across outer terminals on bottom of cartridge should be checked. Generally it should measure from 80 to 100 volts d-c.

•

Compensating Circuits

Three types of compensating circuits can be used with the RCA crystal pickup,[1] 209X1.

When the pickup is used with an audio amplifier, the output of the crystal is applied to the grid of the first audio amplifier tube as shown in Fig. 2. Care must be taken to prevent a large d-c grid bias voltage from appearing directly across the crystal, since if this precaution is not taken, the crystal may be damaged.

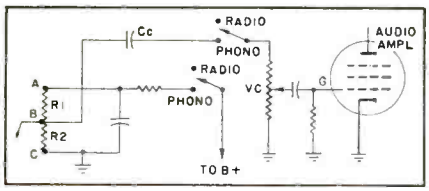


Fig. 1. Basic circuit for the Admiral cartridge.

Fig. 2. Typical circuit for a crystal pickup operating through a compensation circuit.

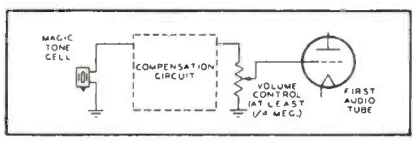


Fig. 3. Compensation circuit where R_1 increases the low frequency response, and an increase in C_1 increases the high-frequency response.

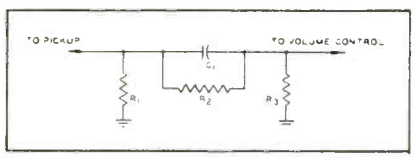


Fig. 4. Another type of compensation circuit where R_1 also increases the low-frequency response and an increase in R_2 increases the high-frequency response.

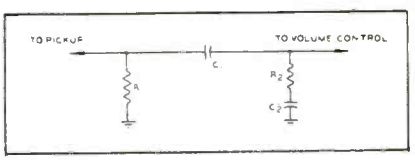
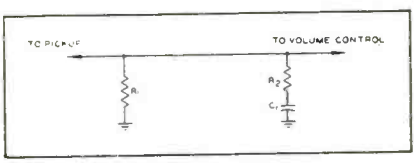


Fig. 5. A third type of compensation circuit where R_1 is used to increase the low-frequency response and R_2 to increase the high-frequency response.



Various types of compensation circuits, as shown in Figs. 3, 4 and 5, provide differing tonal quality. In general, decreasing the shunt resistance across the pickup decreases bass response and increasing the shunt resistance increases bass response.

In the Fig. 3 compensation circuit, increasing R_1 increases low-frequency response. Increasing C_1 increases high-frequency response, and increasing R_3 with respect to total value of R_2 plus R_3 increases the output.

The Fig. 4 circuit illustrates the increasing of R_1 which increases low-frequency response, while increasing of R_2 increases high-frequency response. Decreasing C_1 increases output.

The third compensation circuit, Fig. 5, shows how an increase of R_1 increases low-frequency response, and increasing R_2 increases high-frequency response.

[Data courtesy RCA]

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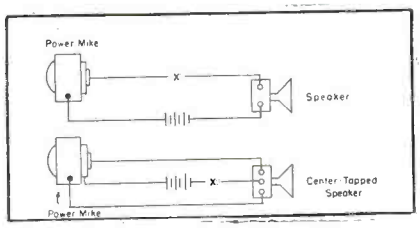
Power Microphone

WITH THE development of a new type of power microphone,[2] it has become possible to achieve substantial power output, without an amplifier. The system, demonstrated at the recent Parts Show in Chicago, used a microphone, battery of 6, 8 and 12 volts and a loudspeaker. Up to 40 watts output were provided with the 12-volt setup.

The microphone featured a specially treated carbon as the current carrying medium. To prevent any deteriora-

[1]Output at 400 cps, 1½ volts approx. Impedance at 400 cps, 200,000 ohms approx. Needle pressure (with Magic Tone Cell), 1.4 ounces.

[2]University.



Figs. 6 and 7. In Fig. 6, top, appears a hookup for a single-button power microphone which does not use an amplifier. The Fig. 7 circuit is for a double-button power mike.

tion of this treated carbon, the internal chamber of the mike was hermetically sealed and an atmosphere of inert gas introduced during assembly. This precluded the possibility of arcing and consequent packing and over-heating.

Typical circuits for this microphone appear in Figs. 6 and 7. No volume control is necessary, since due to the characteristic avc action of the *power mike* the sound system will not overload. In addition, the mike has a characteristic "threshold"; it will not respond to any sound input until it reaches a level approximately equal to that of a normal whisper at a distance of 2". If for special applications, it is necessary to reduce the output of the microphone a simple variable rheostat of about 30 ohms in series circuit may be used. For low-powered use the audio output may be reduced by dropping the battery voltage.

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Radio-Phono Switch

IT IS OFTEN desirable to install a switch which will permit instant changeover from radio to phono. Since it is necessary to maintain and isolate the bias and other d-c voltages, the alteration may become quite tricky.

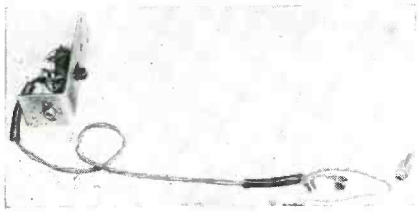
To simplify this installation, a complete record-player switching unit[3] can be used; Fig. 8.

When connecting the switch to sets that operate on both a-c and d-c, it is necessary to isolate the cable shield from the chassis. This can be done by connecting the shield to the chassis through a .25-mfd 300-volt capacitor. Care should be taken that the shield

(*Continued on page* 42)

[3]RCA 240.

Fig. 8. RCA radio-phono switch.



ASSOCIATIONS

MRSMA

TELEVISION AND ANTENNAS were featured topics during two recent meetings of the Mid-State Radio Service Men's Association of Pennsylvania.

F. H. Miller of General Electric appeared at one meeting, which was held at the William Penn High School, and covered a variety of television problems for the boys.

At a subsequent meeting, Mr. Finneberg of Ward presented a very interesting talk on antennas used for f-m, television and other purposes.

ARSNY

Tv was also a major subject at a recent meeting of the Associated Radio Servicemen of New York. The featured speaker was Al Saunders, who is head of the Saunders Radio and Electronic School of Newton, Mass., and who recently prepared a series of tv lessons for Howard Sams.

A large turnout listened to the unusually interesting Saunders' presentation covering tv circuitry and characteristics of the components used in receivers. Saunders detailed the procedures which can be used to achieve maximum servicing efficiency. He also pointed out some of the peculiar installation, servicing and consumer relation problems which are met and how they can be solved.

Harry Anis, ARSNY's corresponding secretary, reports that there are over 400 men in the association today and membership is increasing daily.

Quite an unusual *information-pool* type of plan was recently inaugurated by ARSNY. Any member who has a problem can call on some member of the association for help at no cost to him. This cooperative program has accelerated many servicing calls providing in many cases immediate solutions to problems which had been met by others in the field.

The ambitious spot-announcement program which ARSNY has worked up is now in full swing.

A thirty-week schedule of 18 one-minute announcements began in the middle of May. From Monday to Friday there are two announcements a day and on Saturday and Sunday there are four announcements.

Quite a variety of one-minute spot scripts have been prepared. In a typical announcement the listeners are told that . . . "In just a little while you will want to hear WNEW's (program) because you want good entertainment. But, even the best entertainment won't give you tops in listening pleasure if your radio isn't giving you tops in reception. If your receiver isn't up to par, it may need servicing. For all that radio has to offer, your best bet for radio repairs is the *blue* emblem of the ARSNY. This organization has been formed to provide you with honest and efficient radio repair service. Beware of the *something for nothing* offers. The honest radio Service Man must charge a fair price for the work he does and the service he renders. Your *Associated Radio Servicemen* will charge you only for what he gives you and what's more, he will give you only what your radio needs. So look for the *blue* emblem in your Service Man's window or store. It means that he is a member of ARSNY and that organization stands behind his integrity and his work."

About $720 worth of time is being given to ARSNY by WNEW, in return for which WNEW has suggested that receivers be aligned so that WNEW is received propertly and if a push-button receiver is being repaired, one of the buttons be set for WNEW. In addition, WNEW has supplied a quantity of streamers which state that WNEW is the ARSNY station.

At a recent meeting of the Mid-State Radio Service Men's Association of Pennsylvania, which was sponsored by the Radio Distributing Co. of Harrisburg, Pa., and featured a discussion of antennas. Left to right, standing: Robert Clave, Dale Hilderbrandt, Walter Randall, MRSA vice president T. L. Clarkson, William Clare, William Deardorff, J. Sweeney and George Heikert. Seated, left to right: Don Wallower, George Hardy (MRSA secretary), Wayne Hite, Vance Beachley (MRSA prexy) and Mr. Wolfe and Mr. Finneberg of Ward.

FRSAP

A NOVEL "PREVENTIVE MAINTENANCE" week plan was discussed at a recent meeting of delegates of the Federation of Radio Service Men's Associations of Pennsylvania, and members of NEDA, reps, manufacturers and the press.

According to the program, which is expected to begin in September, a week or month will be set aside for the campaign and the Governor of the State of Pennsylvania will be asked to inaugurate the event with an official statement declaring a *preventive maintenance day* or *week*. The plan has excellent possibilities, comment on which appears on the editorial page of this issue.

Among those in attendance at the meeting were: J. G. Rader, of the Reading RSA, who acted as secretary; Dave Krantz, FRSAP chairman, who acted as chairman of the meeting; Stan Myers, PRSMA; H. D. Keiderling, LVRSA delegate; A. A. Peters, LVRSA; Robert W. Riedy, LVRSA; R. A. Penfield, Sylvania Electric, N. Y.; J. A. Renville, Luzerne County RSA; Dan J. Connor, The Reps, Philadelphia; E. M. Wolfe, Reading RSA; M. Leibowitz, ARSNY; Donald Wallower, Mid-

TEN YEARS AGO

From the Association News Page of SERVICE, July, 1938

THE ANNUAL MEETING of the RSA Board of Directors was held and T. P. Robinson of Dallas, Texas, was elected president. A. J. Theriault of Cleveland, Ohio, was named vice president; Donald H. Stover of Freeport, Illinois, secretary; and Lee Taylor of Chicago, treasurer. . . . Six chapters completed affiliation with RSA. They were Alton and Quincy, Illinois; Fremont and Steubenville, Ohio; Odgen, Utah and Long Island, New York. . . . A slogan *Reliable Service Assured* was tentatively accepted by the RSA Board. . . . A contest which would provide the official slogan was inaugurated, the winner to receive a life membership in RSA, renewable each year. . . . RSA fixed the amount of national dues at $3.00 a year. . . . RSA officials reported that many members of industry had addressed local chapters. Among those who appeared were M. P. Wilder of National Union who spoke on *Television,* Henry Hutchins, of Western Advertising Agency, who spoke on *Get on the Profit Side of Radio,* and Walter Jones of Sylvania who covered the subject of *Tubes and Courtesies.* . . . The Abilene, Texas, Chapter, held its annual banquet in the Gold Room of the Hilton Hotel. . . . A. G. W. Saunders, in a run-off election, was named director of District 20 of the Boston Chapter. . . . Preston Gifford was elected assistant treasurer of the New Bedford Chapter of RSA. . . . Charles H. Yocum delivered a talk on the Weston a-c oscillator before the members of the New York Chapter of the RSA. A. E. Rhine also appeared at this session and read a paper entitled *Making a Profit in Radio Servicing.* Mr. Rhine's talk served as the basis of a series of articles which appeared in the June, July and August, 1938, issues of SERVICE. . . . The Peoria and Freeport, Illinois, Chapters completed plans for a picnic to be held at Starved Rock Park, Illinois. . . . Mr. and Mrs. Fred Degenford became the parents of a bouncing boy. . . . Milton J. Shapiro of Radiart addressed the Westchester RSA members on the subject of *Impedance Matching of Auto Radio Antennas* and *Automatic Voltage Regulators.*

State; Mark Houtz, Mid-State; T. L. Clarkson, Mid-State; F. E. Anderson, Raytheon Mfg. Co.; Al Steinberg, NEDA; R. G. Devaney and Frank P. Gerhard of PRSMA, and ye editor.

TV Voltage Systems

(*Continued from page 23*)

voltage stepup characteristics of a tuned transformer. Such a basic oscillator high-voltage supply is shown in Fig. 3. In this type of supply a beam power tube or a power pentode is used to generate strong oscillations. For best stability and a constant output over a substantial range in frequencies a feed-back system using a tickler winding is used as the oscillating method.

The resonant frequency of the oscillation is set by the primary of the transformer and feedback to the grid is through the tickler winding, grid bias being developed by the grid current flow through R_g and sustained by capacitor C_g. The primary and secondary windings are generally overcoupled to obtain a broad bandwidth and in case of frequency drift due to heating or change in supply voltages, the output will remain essentially constant in spite of the frequency change. A high-voltage half-wave rectifier is placed across the secondary of the transformer and rectifies the resonant voltage developed across the secondary. Again a simple *R C* filter is used to remove the ripple frequency. The oscillators are designed to operate generally in the range somewhere between 50 and 300 kc. Consequently, with the relatively high frequency used, very little filtering is required. The oscillating high-voltage supply is again a very safe high-voltage system because of the small size of the filter capacitors and the fact that any load placed on the output of the high voltage will cause the oscillator to stop operating or decrease the output voltage to a safe value.

To obtain a substantial voltage amplification in the tuned transformer it is necessary that the secondary be lightly loaded and therefore have a high impedance as compared to the impedance of the primary winding. Fortunately, the television picture tube again draws only a very small current and does not contribute an appreciable load to the secondary of the tuned transformer. Other factors which insure a high voltage across the secondary is the proper choice of winding for the transformer and the proper choice of wire. In many of these high-voltage oscillating transformers Litz wire is used because of its inherent low resistance and substantial inductance. Consequently, it is possible to construct a winding which has an extremely high inductance by using many turns of wire and at the same time the resistance and consequent power loss will be low, if the wire used has a very low resistance. Of course, the smaller the wire the closer it can be wound and again the more inductance the winding will have. It is evident, therefore, that Litz wire is ideal because of its small diameter, high inductance and low resistance. Inasmuch as the impedance of the secondary varies as the square root of the inductance over the capacitance, every attempt is made to keep the distributed capacity at a minimum and the inductance high. Therefore, the secondary is resonant to the proper frequency with the distributed circuit capacity and no physical capacitor is shunted across the secondary. In addition, rectifier tube and component parts chosen must have a minimum of capacity. Again, as with the transient voltage supply the heater potential for the high-voltage rectifier is obtained from a small winding mounted on the transformer.

The secondary winding of the transformer is generally a pie-winding of five to six pies and in some cases, even the primary is constructed in a pie-winding arrangement. The layout of a typical pie-wound coil is shown

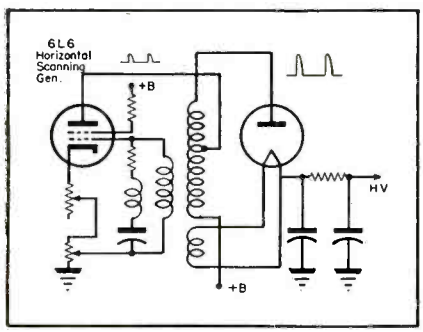
in Fig. 4. The secondary is made up of a series of five pie-windings, each pie-winding universally wound with 5 to 10 turns per layer. The separation between pies is generally a little greater than the pie width. Too great a pie width increases the distributed capacity and too narrow a pie width reduces the mechanical stability of the winding structure.

To analyze the advantages of a pie-wound secondary, let us assume a pie-wound secondary consisting of five pies and having a total output voltage of 5000. This means that the voltage developed across each pie will be 1/5 of 5,000 or 1,000 volts. Consequently, each pie can be designed for a 1,000 volts difference of potential. If the entire secondary was universally wound, or layer upon layer, the latter turns of the winding would be reasonably close to the beginning turns and consequently would have to be designed for a breakdown potential of 5,000 volts. Inasmuch as the start and finish of the pie-wound secondary are very well separated only the breakdown of the individual pie must be considered.

Likewise, the distributed capacity is not felt between the early windings of the secondary and the final windings, but again just between the windings of the individual pies, the distributed capacity of each pie adding in series causing a lower distributed capacity to exist between the start of the secondary winding and its termination.

Another system for generating a high transient voltage which can be rectified and used as a high voltage d-c potential is the pulse type high-voltage supply shown in Fig 5. In this supply the grid of the pulse amplifier is driven by a short positive pulse such as might be obtained from the grid of a block tube oscillator. This sharp pulse drives the pulse amplifier to saturation causing a sharp change in plate current which develops a high voltage transient in the inductor and is stepped up to a high peak voltage by the auto-transformer connection. The top of the winding is again connected to a high-voltage rectifier which obtains its low-current heater voltage from the same auto-transformer by mutual coupling. A simple *R C* filter is used in the output circuit.

Fig. 6. A beam-relaxor type of circuit developed by Farnsworth.



An ingenious high voltage supply is that associated with the beam-relaxor horizontal-scanning generator developed by Farnsworth. In this circuit, Fig. 6, no sawtooth oscillator is required, the deflection amplifier functioning itself as an oscillator. The beam relaxor oscillator develops a short positive pulse in the plate circuit, which is stepped up in amplitude by the auto-transformer arrangement of the secondary and supplied to the plate of a high voltage rectifier. A simple *R C* filter is used to remove ripple.

In summation there are a number of methods which can be used to generate a high-voltage low-current source, and although the d-c potential is in the thousands of volts these supplies are relatively safe with the ex-

(*Continued on page* 38)

A-C/D-C Servicing

(*Continued from page* 12)

tube, short circuiting it and imposing full line voltage across the capacitor. The defective capacitor then draws a large current and becomes a fire hazard.

When the tapped connection is used, these fire hazards are eliminated. Both the filament of the panel lamp and one section of the filament of the rectifier tube become fuses, each one opening up in turn.

The distribution of short circuit current between the panel lamp and the tapped section of the rectifier filament, will depend upon the relative resistance of each.

Which one of the two opens up first depends not only on the current passing through it, but also on its individual fusing characteristic. However, after one filament has opened up, the whole current is transferred to the other, causing it also to open.

Where the lamp is not used, and connection is made to the center tap of the rectifier filament, one-half of the filament acts as the fuse.

Mechanical Phonos

(*Continued from page* 16)

the springs holding the balls have changed their temper. There is no practical way of determining this, and the best thing to do is to replace. This is why the governor should be the last item to check.

When the machine is returned to the customer its speed should be adjusted. You can adjust the speed arm in relation to the brake in such a fashion as to bring the speed pointer to center scale when the machine is running properly. If you do not do this, the customer will usually have the impression his machine is not working properly.

The speed of the turntable should be explained in terms of pitch. Many people will speed up the record in an effort to speed up the tempo of a dance record.

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F-M Tuner

(*Continued from page* 20)

in a conventional circuit. This arrangement does not provide great improvement in electrical performance over a standard *LC* type tuner except that sensitivity is relatively uniform throughout the whole band.

At higher frequencies somewhat better *Q* was attained by operating the rotors and stators in parallel. Individual sections of these *eggbeaters*, either series or parallel connected, can be employed in transmitters, test oscillators or for any other use where standard LC circuits are normally used. Simplicity and low construction cost make them practical for many such applications.

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TV Voltage Systems

(*Continued from page* 37)

ception of the transformer type driven by excitation from the 60-cycle line.

However, the trend is away from the transformer type toward the safety of the transient voltage and oscillating voltage supply. All of these higher frequency high-voltage systems are practical and effiicient, but must be well shielded to prevent interaction with other circuits associated with the television receiver. Fortunately, some interaction can be tolerated because the generation of the high-voltage pulse is during the retrace of the horizontal sawtooth, when the picture beam is cut off.

[To Be Continued]

TV Antennas

(*Continued from page 27*)

to an acceptable level. This type of antenna has a very narrow bandwidth and can be used for only a few adjacent tv channels. It is possible, where complete frequency coverage is desired, to stack these antenna assemblies. A coaxial switch can be used at the receiver to select the antennas. These arrays best match 50-73 ohm coaxial line.

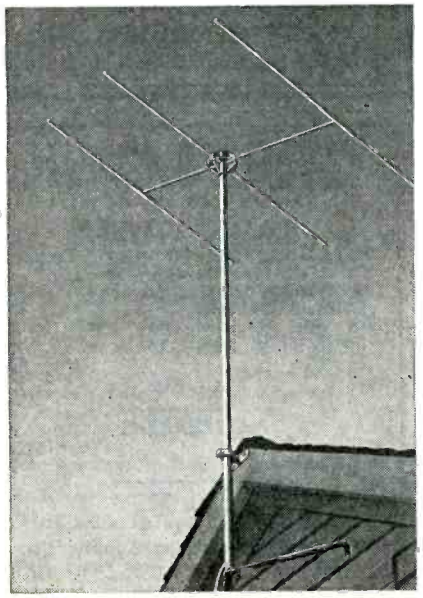
In multiple dwelling installations, use can be made of existing steel structures to shield the dipole from reflected signals. This type of shielding is often more effective than installing a reflector on a dipole antenna.

Multipath Reflections

In urban locations where multipath reflections are common, a survey is usually justified. To conduct a successful survey four pieces of equipment are required: (*1*) Adjustable mast, from 10′ to 30′; (*2*) a set of easily assembled tv antennas which fit the adjustable mast; (*3*) portable tv receiver with 100′ of power cable, and (*4*) reel of transmission line.

To make the best antenna adjustment, the antenna should be connected to the receiver with sufficient transmission line so that the antenna can be moved over the entire roof. The test receiver should be located where there'll be a minimum of glare from sunlight and interpretation of the screen pattern will not be affected. Sound powered phone communication should be established between a Service Man at the antenna and another at the television receiver.

Fig. 8. Dipole reflector and director type antenna. (*Courtesy Workshop Associates*).



In a private home or an apartment house, all antenna tests should begin in the most convenient place to make the installation, with the dipole element facing in the general direction of the tv transmitters. Best results will be obtained when the adjustments are made while looking at a steady test pattern, with the Service Man at the test receiver directing the roof man rotating the antenna. If a perfect pattern is not found after a full 360° rotation at the preferred location, the antenna must be moved to another location and the adjustments repeated. In complex locations, on multiple dwelling roofs, the entire area may be covered without finding a perfect picture. The best way to meet this problem is to prepare a complete drawing of the roof, and mark the positions where the reflections least mar the pictures. Comparing these *good* positions will enable the selection of the best location for reception. When mounting antennas on multiple dwelling roofs

(*Continued on page 40*)

TV Antennas

(*Continued from page 39*)

consideration must be given to building regulations and electrical codes which always call for the installation of lighting arrestors and the bonding of all steel masts to ground.

In many urban locations, where several antennas will be required to provide satisfactory reception, a coaxial switch may be used to connect any of four tv antennas to a single receiver. Suitable patch panels or plug boards can also be fabricated for selecting antennas using 300-ohm transmission line.

Signal-to-Noise Ratio Problem

(*C*) The signal-to-noise ratio is dependent upon the strength of the transmitted signal with respect to the noise in the local area. To reduce the effect of interference when the noise in a local area is high, a directive, high-gain antenna (preferably a stacked array of dipoles with reflectors or a wide band antenna with reflectors) is recommended. Physically, the signal-to-noise ratio can be increased by raising the antenna on a higher mast and using lower loss coaxial cable (RG11/U instead of RG59/U) or shortening the length of the transmission line leadin. In many cases, as a compromise, an antenna is installed several hundred feet from the tv receiver to make the installation in a lower noise area.

Coaxial cable is preferred in all high noise areas. A trifilar transformer will increase the signal level 2:1 in voltage or 6 db, in addition to matching the coaxial line to a 300-ohm receiver input.

The next step in increasing the signal-to-noise ratio is to suppress the noise at the source by shielding, grounding and filtering the devices which produce the noise.

A low-priced tv receiver without horizontal afc noise-limiting circuits can be used to locate the noise producing equipment.

A simple dipole is connected to the receiver and a search is made for a picture which best indicates the noise.

The picture is then studied as such devices as motors, neon signs, elevators and other appliances are turned off.

When the device is located, shielding, grounding or filtering is applied in a manner similar to that used to reduce radio interference. The pigtails on r-f filter capacitors should be kept short, so that the lead inductance does not reduce the efficiency of the filter.

Ser-Cuits

(*Continued from page* 31)

miral models, the 8C11 to 8C17.

In this model a 6BA6 is used for r-f, 6SB7Y for converter action, two more 6BA6s in first i-f and second i-f stages, 6AL5 as a ratio detector, 6SQ7 as the a-m second detector and first a-f, and a 6V6GT for output.

Commenting on the care required in replacements in f-m receivers, Admiral says that the physical structure of the chassis should be studied carefully before making replacements. For instance, since the leads tend to act as small inductances or capacities at high frequencies and thus may appreciably alter the electrical characteristics of the circuit, the lengths of all replaced components should be watched carefully. Ground connection should always be maintained as originally made in the receiver. In these models, the bypass capacitors are quite critical at the high i-m frequencies. Therefore, when replacing them, it is important that capacitors of identical capacity values, tolerances, temperature coefficients and construction be used.

Admiral 8B1 Circuit Change

Due to an acute shortage of 6AU6s, it was necessary in later production to alter the 8B1 chassis to permit use of the 6BA6 in place of the 6AU6 in the f-m second i-f and a-m detector stage. Chassis which have been rewired for this change have been stamped on the back with the letter *B*.

If it is necessary to replace either the 6AU6 with the other, it is important that the proper components and necessary circuit changes be made. These tubes are not interchangeable.

Servicing Helps

(*Continued from page 33*)

braiding and switch bracket do not come in contact with the chassis.

If the common-negative wiring in the a-c/d-c set is isolated from the set chassis, the cable shield should be connected through a .25 mfd capacitor, to the common-negative wiring, and not to the chassis.

Speech Equalization[4]

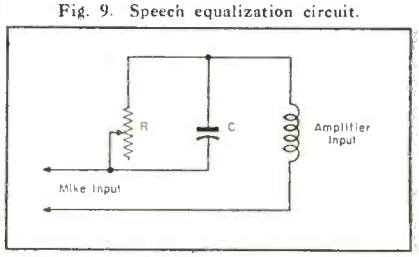
EQUALIZATION should *roll off* the lower end of the tonal spectrum gradually from 500 cycles downward whenever speech alone is handled with high-quality microphones. The very low frequencies are not conducive to good intelligibility; in fact they contribute boominess.

Speakers tend to crowd the microphone at times and then a variable simply constructed equalizer is invaluable; Fig. 9. It not only cleans up the reproduction but also reduces the tendency toward feedback.

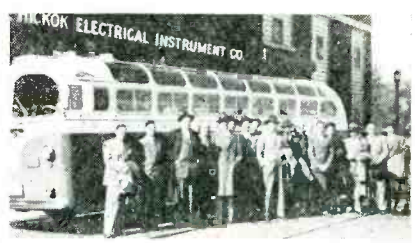
In this equalizing circuit, a 120-ohm variable resistor is shunted across a 4-mfd capacitor and the combination inserted in the high leg of a 30-ohm input between the amplifier and the microphone. For a 250-ohm input, the resistor should be 1,000 ohms and the capacitor .5 mfd. The impedances may be adjusted by varying the resistor to best suit different voices and they should be faded out of the circuit whenever music is handled.

[4]From a talk delivered by C. A. Tuthill at a ARSNY meeting, sponsored by John F. Rider.

Fig. 9. Speech equalization circuit.



HICKOK SALES MEETING



Sales representatives of Hickok, who met at the conclusion of the recent Radio Parts Show and toured the Hickok plants. R. D. Hickok, Jr. (third from left) and Herb Johnson, sales manager (second from right), addressed the group at a dinner which followed the tour.

New Products

ELECTRO-VOICE CARDYNE CARDIOID DYNAMICS

Cardyne cardioid dynamics with an impedance selector switch (recessed at rear of case) providing selection of high (25,000 ohms) or low impedance (150 ohms) have been announced by Electro-Voice, Inc., Buchanan, Michigan. Has external shock mount which eliminates undesirable vibrations transmitted from stand.

One type, model 731, broadcast Cardyne II, is said to have a frequency response which is substantially flat 30-12,000; output of —50 db.

Another type, model 726 Cardyne I, is said to have frequency response substantially flat from 40—10,000; output is —53 db.

For complete data, write for bulletin No. 139.

* * *

MINIATURE BATTERIES

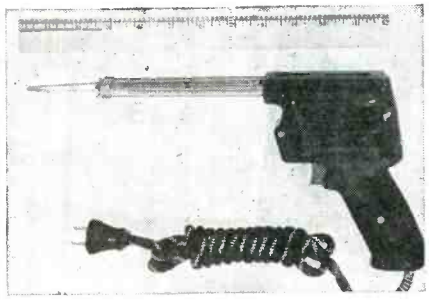
A rechargeable wet-cell A battery, weighing 5 ounces, measuring 1¼ x ⅞" x 3¾" and capable of developing 180 milliampere hours, has been announced by Miniature Batteries, Sycamore, Illinois.

The battery charges to full strength in six to eight hours.

* * *

WELLER SOLDERING GUNS

Two *longer reach* type soldering guns, 8" and 12" units, have been announced by Weller Mfg. Co., Easton, Pa. Dual heat at 100 and 135 watts is provided on both models. Soldering guns' features include five second heating, built-in transformer, prefocused spotlight and trigger switch.



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ATLAS ALNICO-V SPEAKERS

An Alnico-V-Plus line, featuring magnetic shielding, hermetic sealing, and phenolic diaphragm driver units has been announced by Atlas Sound Corp., 1450 39th Street, Brooklyn, N. Y.

Multiple speaker support stands which accommodate from one to five speakers, and are available in either indoor or collapsible tripod outdoor models, have also been announced.

* * *

SPRAGUE ATOM CAPACITORS

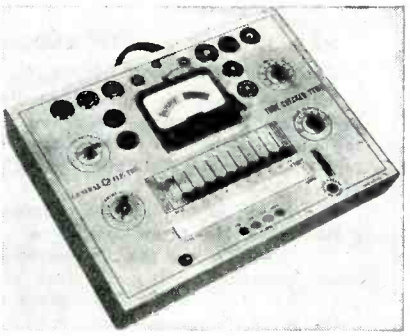
Smaller size Atoms (Sprague's dry electrolytic capacitors) were recently announced by Sprague Products Company, North Adams, Mass. Many of the Atoms have been reduced a full half inch in length, from 1 13/16" long to 1 5/16".

G. E. TUBE CHECKER

A tube checker, type YTW-1, has been announced by the specialty division of G.E.

Checker tests for filament continuity, heater cathode, open elements, shorted elements, and quality of emission. Each tube element has its own individual circuit switch. Tests 4, 5, 6, 7, and 8 pin standard, 5 pin small, 7 and 9 pin miniature, and lockin tubes, as well as pilot bulbs and batteries.

Circuit of the YTW-1 is designed to immediately expose a tube with an open filament without the usual warm-up period.



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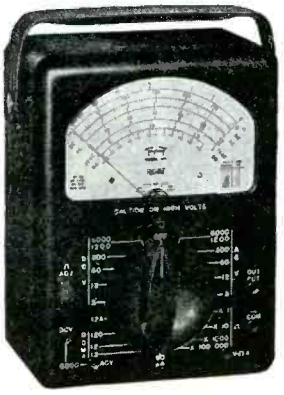
TRIPLETT VOLT-OHM-MIL-AMMETER

A Volt-Ohm-Mil-Ammeter, type 630, has been produced by the Triplett Electrical Instrument Co., Bluffton, Ohio.

Has six d-c volt ranges from 0 to 6,000, at 20,000 ohms/volt, and six a-c ranges to 6,000 at 5,000 ohms/volt. Five d-c ranges are also provided from 0-60 microamperes to 0-12 amps. Resistance ranges to 100 megohms; db ranges from —30 to +70.



* * *

ATR INVERTERS

A line of d-c/a-c inverters, operating on d-c input voltages ranging from 6 volts to 220 volts and delivering an output of 110 volts, 60 cycles, a-c at output capacities ranging from 75 to 500 watts, has been announced by American Television & Radio Co., 300 East Fourth St., St. Paul 1, Minnesota. Featured is an automatic switching unit for use as an auxiliary unit with 32-volt and 110-volt d-c input inverters, permitting automatic start and stop of these units as the load is turned on and off.

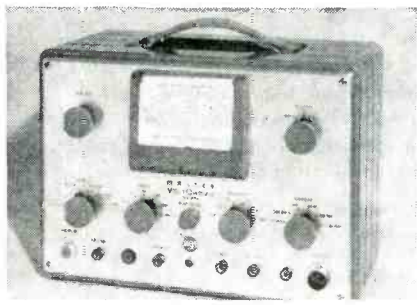
RCA MASTER VOLTOHMYST

A *Master VoltOhmyst*, type WV95A, providing capacitance and current measurements, has been announced by the RCA tube department.

Capacitance measurements from 5 mmfd to 1000 mfd may be made with the instrument, which also reads currents from 1 microampere to 10 amperes.

Instrument combines the functions of eight meters: Capacitance meter, ammeter, audio voltmeter, a-c voltmeter, d-c voltmeter, ohmmeter, f-m discriminator balance indicator, and v-h-f voltmeter. All the scales necessary for all service readings are on a single meter.

In the servicing of v-h-f equipment, the unit contains provision for use of the accessory RCA diode probe, permitting measurement of r-f voltage at frequencies up to 250 mc.



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TELEVISION ASSEMBLY CO. KITS

Tv kits, featuring the Du Mont continuous tuning system, and providing 52, 75 or 120 square inch pictures, have been announced by Television Assembly Company, 387 Bushwick Avenue, Brooklyn 6, N. Y.

Company has prepared a consumer advertising program, detailing the advantages of having Service Men wire up kits, test and install them.

* * *

CLAROSTAT SMALL VOLUME CONTROLS

A ⅜" diameter carbon volume control has been announced by Clarostat Mfg. Co., Inc., 130 Clinton St., Brooklyn, N. Y.

Control is available with or without switch; switch is factory-equipped or built integral with the control proper. Dimensions are ⅜" diameter by 29/64" deep without switch, or 49/64" deep with switch. Standard units have a ¼" long ⅜-32 threaded bushing, together with a 1" long knurled shaft, and are available in 250,000, 500,000, 1,000,000 and 2,000,000 ohm values, with the Z audio taper.

* * *

AEROVOX METAL-CASED OIL TUBULARS

Oil capacitors, type 89, with capacitance values of .1 mfd for voltages up to 5,000 d-c-w and .05 mfd at 6,000 volts d-c-w, have been announced by Aerovox Corporation of New Bedford, Mass.

For these higher working potentials, special insulating sleeve bushings are used to provide the necessary creepage distance without increasing the diameter of the casing or materially increasing the length. Oil-impregnated paper section is enclosed in a corrosion-proof metal case filled with oil and hermetically sealed against oil leakage or moisture penetration.

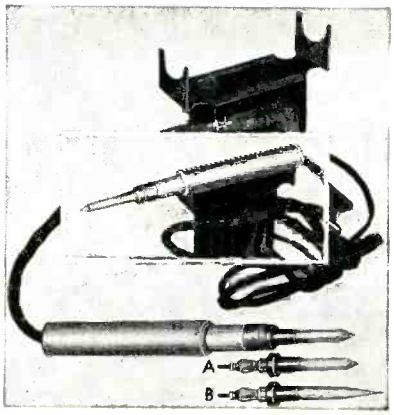
TRANSVISION SOLDERING IRON

A soldering iron called "Soldetron," which weighs three ounces, has been announced by Transvision, Inc., New Rochelle, N. Y.

Iron features interchangeable thin tip-heads; fingertip control; bakelite handle with cork covering; heater element incorporated in each tip head.

The iron is said to heat up within 20 seconds from a cold start.

Iron supplied for operation on 110v a-c 50-60 cycles; through transformer supplied with iron or 6-8 volt a-c or d-c without transformer (from an automobile battery). Choice of three tip-heads—long, stubby, or medium shape heads. Overall size of iron is 9¼"x15/16".



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WEBSTER-CHICAGO PORTABLE PHONO

A portable automatic phonograph, model 161, housed in an all wood case covered with burgundy leatherette, has been produced by Webster-Chicago Corp., 5610 West Bloomingdale Ave., Chicago 39, Illinois. Will play a full stack of records with cover closed. Volume and tone controls are on the outside.

Incorporates the Webster-Chicago model 148 record changer.

* * *

PRECISION APPARATUS CIRCUIT TESTER

A pocket-size circuit tester, series 40, has been announced by Precision Apparatus Co., Inc., 92-27 Horace Harding Blvd., Elmhurst, L. I., N. Y.

Instrument, 3¾" x 6¼" x 2½", affords 31 a-c/d-c ranges to 6,000 volts, 600 ma, + 70 db and 5 megohms. No external batteries or multipliers are required. Meter is a 3" rectangular cased instrument of 400 microamperes sensitivity. Rotary range selection permits two pin jacks to serve all standard functions.

JFD BALTIMORE ANTENNA FORUM

The second JFD forum on the installation and servicing of television antennas was held recently in Baltimore, Maryland.

Speakers included Martin Bettan of the Colonial Television Co., who analyzed major problems arising from the selection of arrays to suit location, reception efficiency and other related conditions.

Albert J. Friedman, JFD chief antenna development engineer, also addressed the forum and described in detail, the finer points of tuning, resonance, response, transmission lines, matching stubs and phasing.

* * *

RIDER EXPANDS LAB

The John F. Rider Laboratories have been moved to enlarged quarters at 480 Canal Street, N. Y. City.

Much of the activity in the Rider Labs during the past years has found its way into the service industry, either in the form of John F. Rider books or equipment. New equipment of special interest in the training of personnel for home radio, television, and other applications has been under development and will be announced shortly.

JOTS AND FLASHES

TELEVISION has been of immeasurable help in returning installation and servicing to its important niche in industry. Conclusive evidence of this trend appeared in a report prepared by the sub-committee of the National Electrical Wholesalers Association covering the problems of installation and servicing of tv receivers. The report entitled *Television Service and Installation. . . . A Manual of Experience* was written for the benefit of electrical distributors by four specialists: E. Anthony of G. E. Supply, Chester Graven, D. W. May Corp., Philip Ingraham, Times Appliance Co., and William Mackie, Westinghouse Electric Supply. The report describes the relationship of installation to servicing, installation for dealers, distributor's minimum setup, area of operation, service hours, consummation of sale, acceptability by sales departments and dealers, and the owner's warranty and its extent and limits. Analyzed also are the various types of television receivers now available, responsibility of the distributors and questions of liability. The report will only be made available to members of the association. . . . Hytron Radio reports that nearly a thousand entries have already been received for its national Service Men's tool contest. The rewards will be announced soon. . . . John D. Hawkins has become manager of Philco Distributors of Philadelphia. . . . Ellis L. Redden is now director of advertising and sales promotion of the Crosley Division, Avco Manufacturing Corp., Cincinnati, Ohio. . . . The annual breakfast and sales meeting of Alpha Wire was held during the recent Parts Show. Present was the national sales organization of 28 men including Peter Bercoe, president in charge of sales; A. E. Bernardik, vice president, and Sam Schaeffer, eastern district sales director. . . . Joseph K. Rose now heads the Chicago office of John F. Rider Publisher, Inc., at 6240 N. Francisco Avenue. Rose was formerly service manager for Wells Gardner. . . . Dr. Henry H. Hausner has joined the staff of the metallurgical research and development laboratories of Sylvania. . . . Electronic Instrument Co., Inc., are now located at 377 Blake Avenue, Brooklyn, N. Y. . . . Columbia Records have announced a long-playing microgroove vinylite type of record which will be made in 10" and 12" sizes. The 10" size will provide 27 minutes of playing and the 12" double-faced record 45 minutes, according to Columbia. Philco has developed a 33⅓ rpm record player for use with these microgroove records. . . . The first tv models of Bendix were shown at the Furniture Market Show in Chicago. . . . A technical bulletin describing the design and application of the recently developed tube tapper and miniature 7-pin straightener has been prepared by Hytron Radio and Electronics Corp. . . . Zenith Radio will build tv receivers under Farnsworth patents. . . . E. H. Vogel is now manager of marketing of the electronics department of G.E. . . . L. E. Pettit has been named manager of the advertising division in the G.E. electronics department. . . . John M. Otter has been appointed vice president and general sales manager of Philco.

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An especially developed Solar processing technique makes possible small yet sturdy capacitors designed for high temperature operation with no sacrifice in long life or electrical characteristics.

Because of the remarkable film stability of Solar's DY-TV series of electrolytics, there is but an extremely small change in power factor and leakage current from room temperature to 85° C.

Type DY-TV capacitors, with their special film formation, do not "run away" when voltage is applied after idling under no-voltage conditions at 85° C. These characteristics are retained even after extended shelf life.

Investigate this remarkable achievement in capacitor design today! Write today for catalog.

SOLAR CAPACITOR SALES CORP.
NORTH BERGEN, NEW JERSEY

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"Quality Above All"

SOLAR

You can sell more RCA Batteries

Get the complete catalog of RCA Battery Sales Promotion Material from your RCA Distributor

Powerful Sellers . . . all geared to the radio trade!

Greatest Radio Battery Promotion Program in the Field!...

✓ Banners ✓ Streamers ✓ Cartoons ✓ Counter Displays ✓ Counter Merchandisers ✓ Direct Mail Post Cards ✓ Advertising Mats ✓ Battery Guides ✓ Dealer Price Lists ✓ Battery Cartons

Again RCA leads the battery field in progressive merchandising with a *complete* line of powerful selling aids specifically designed for the *radio trade!*

Now you can get everything you need to sell *more* RCA Batteries than ever before . . . compelling full-color displays to lead more customers your way . . . self-serving counter merchandisers that sell batteries on sight...banners and seasonal window streamers to let all radio owners know you're headquarters for RCA Radio Batteries.

Don't miss the *extra* business these new sales aids will bring you. Ask your RCA Battery Distributor for Bulletin No. 2F406 that contains the complete story on the most comprehensive *sales promotion plan* in the radio battery industry today!

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RADIO CORPORATION of AMERICA

HARRISON, N. J.