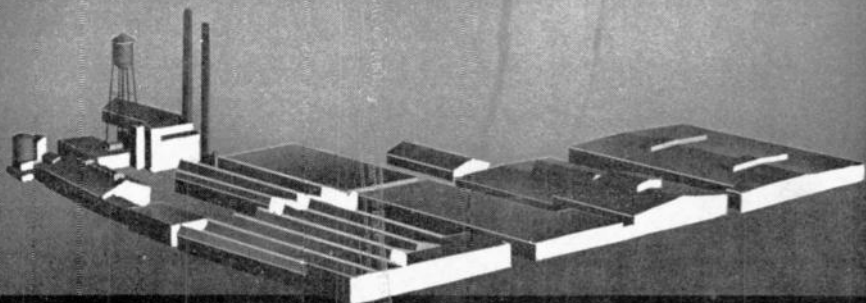


THE ED



CAPACITOR

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No. 2

CORNELL-DUBILIER ELECTRIC CORP.
HAMILTON BOULEVARD
SOUTH PLAINFIELD, N. J.

Mr. George M. Beale
130 25th Ave.
San Francisco, Calif.

RADIO SERVICE HINTS

**Practical Suggestions on Solution of Radio Servicing Problems
Encountered in Actual Experience by Servicemen Everywhere**

This section, conducted by our servicemen readers, will be a regular feature of the C-D Capacitor, and is intended to provide other servicemen with helpful notes on testing, locating troubles in specific models of sets, repairing them, or any other suggestions to simplify service work.

Cornell-Dubilier will pay \$2.00 for each hint published in this section. Notes must be limited to 75 words, or less. Any number of hints may be submitted at one time. Unpublished items will not be returned. Be sure to give your name and mailing address. Send hints to: Editor, C-D Capacitor, Cornell-Dubilier Electric Corp., So Plainfield, N. J.

Sets Using 50Z7G Rectifier

On sets using this type rectifier tube the voltage may be found to rise to normal and then drop very low intermittently, or at very low voltage the set checks O.K. This may be particularly apparent in Zenith model sets using this type tube.

In many cases this trouble may be traced to an open capacitor connected in the voltage double circuit from the plate through a resistor to the heater tap on the 50Z7. The remedy in any case of a defective or shorted capacitor in this circuit is to replace it with a new unit of the same capacity and voltage rating.—*Alvin Morgan, Louisville, Ky.*

Wells Gardner A3 Series

Complaints of distortion at low volume while being tuned in on powerful local stations with sets of this type are usually caused by the IF stages being out of alignment. At high volume or on weaker stations tone seems satisfactory.

To correct this condition, realign the entire set particularly the IF stages with fidelity control set at sharp tuning. — *E. F. Badger, Indianapolis, Ind.*

Speaker Cone Repair

When confronted with a problem of repairing a warped speaker cone which is cemented in position without a spider centering construction, the following procedure will make quick and satisfactory repair job.

Center the voice with suitable shims. Then, thoroughly saturate the entire cone with a fast evaporating solution such as carbon tetrachloride and place the speaker in a warm place to dry. After completely dried, remove the shims and the cone will set centered as before becoming warped.—*Bernard Scamon, Wiscasset, Maine.*

A Good Ground

An old hot water tank buried in the ground makes an excellent ground connection for radio service work or amateur transmitter. The writer removed the fittings from one end of an old tank, and bored $\frac{1}{4}$ " holes 2" apart down one side. Then the tank was fitted with a short length of pipe 3 feet long extending upward, and a heavy copper ground wire was soldered directly to the side. The tank is kept filled with water from an overflow drain pipe which gives an exceptionally good ground due to the moisture making contact with the tank at all times.—*E. C. Pitts, Albany, Ga.*



A Simple Ground Tester

In many cases antenna and ground wire are brought up through a hole in the floor, and it may be necessary to determine which of the two is the ground. Consequently, the writer uses a $7\frac{1}{2}$ watt 110 v. bulb with one prong of a receptacle plug soldered to the end contact and a flexible lead three feet long with small clip soldered to the side contact or screw contact of the bulb. When testing the bulb is plugged into the hot side of an outlet from the 110-volt line and the clip connected on one wire and then the other. The bulb will light on the ground. If the bulb does not light there is no ground, and if it glows a poor ground is indicated.—*John A De Bats, Williamson, N. Y.*

Farnsworth ATL50-52

A loud hum in these sets may be caused by a capacitor (No. 30), a single section 15 mfd. electrolytic. The writer has experienced several cases of this trouble and corrected it by moving this condenser about one inch away from the spring shield on the radio-phonograph leads. Better still replace the unit with a shielded type capacitor.—*I. T. Willis, Burlington, N. C.*

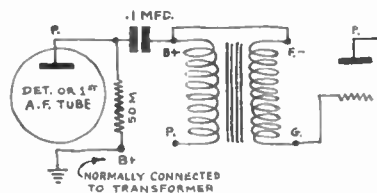
Triplet 1612 Tube Tester

An element switch on this instrument may indicate a short in a tube when there is no short in the tube under test. This trouble has been found to be caused by the metal lock directly above the contact points. The lock becomes dry of lubricant and metal fillings collect on the fibre plate on which the contacts are mounted.

To correct this clean metal fillings from between contacts and relubricate the metal lock above contacts.—*O. J. Washburn, Jr., Mena, Ark.*

Transformer Coupling Change

Here is a hint which has been especially useful to the writer in building portables or modernizing older model sets that employ transformer coupling.



No alterations are made in the transformer itself, but the leads are reconnected as shown in the accompanying diagram. A .1 mfd condenser and a 50,000 ohm resistor are used as indicated. The connection changes increase gain by keeping the a. c. voltage and d. c. from the point of saturation in the transformer. It is of course necessary to have a grid return on the 2nd tube, otherwise leads are connected exactly as shown.—*Perry Ferrell, Jr., Pleasantville, N. J.*

A Master Safety Switch

A sure way to insure against damage to all equipment connected on the electric service line in the shop is to install a master switch which will disconnect all instruments, soldering iron, lights, etc., when going home for the night, or when leaving the shop for any length of time. A simple flip of the switch and you are sure everything is off, or when starting to do any work on the bench simply throw on the switch and everything is in readiness.

As obvious and simple as this suggestion may seem it is surprising how many service men use individual switches and plugs for connecting each piece of equipment.—*Milton V. Ratynski, Richmond, Va.*



A Free Market-Place for Buyers, Sellers, and Swappers.

These advertisements are listed FREE of charge to C-D readers so if there is anything you would like to buy or sell, if you wish to obtain a position or if you have a position to offer to C-D readers, just send in your ad.

These columns are open only to those who have a legitimate, WANTED, SELL or SWAP proposition to offer. The Cornell-Dubilier Electric Corp. reserves the right to edit advertisements submitted, and to refuse to run any which may be considered unsuitable. We shall endeavor to restrict the ads to legitimate offers but cannot assume any responsibility for the transactions involved.

Please limit your ad to a maximum of 40 words, including name and address. Advertisements will be run as promptly as space limitations permit.

FOR SALE—Readrite 430 tube tester with Trinet meter, in good condition. Will sell for \$10.00 or will accept small electric drill as part payment. Also have parts for sale or trade. Roy Frank, 248 West Main Road, Conneaut, Ohio.

FOR SALE—450 watt transmitter, 6v6-807-pr. 812s as described in "Radio and Television" Oct. \$60.00 or swap for good photo enlarger. Herman Yellin, 351 New Lots Ave., Brooklyn, N. Y.

WANTED—Rider's manuals, vols. 1, 2, 3, 4, 5, 6, 7 and 8, used but in good condition. What am I offered? Alfred Lindner, 71 South 19th St., San Jose, Calif.

WANTED—Used signal tracer or electronic volt-meter of reputable manufacture, Rider's manuals Nos. 9 and 10, and Ghirardi radio service books. W. C. Waller, 432 W. Bway, Newton, Kansas.

SALE OR TRADE—Brand new Astatic pick-up, lists for \$6.50, brand new battery charger 4-2 amps. 0-8 Weston 2" M. A. meter and other meters. What have you to offer in trade? Floyd Paul, 773 N. Alexandria, Los Angeles, Calif.

WILL SWAP—100 high grade, high speed drills, sizes up to 1/2". Also over 75 taps, standard, pipe and others, up to 5/8". Want oscillograph in good condition, photo lens not less than 3". Wm. Maillie, Stop 45 Broadway, Lorain, Ohio.

FOR SALE—1939 N. R. I. radio servicing course. Will sell for \$25.00, or swap for a good condenser checker. Dennis Radio Service, East Main St., Oblong, Ill.

FOR SALE OR TRADE—36" wood-cutting lathe with face-plate and chisels, motor, jig-saw, small hand saw. Complete set of Audel's Carpenter and Builders Manuals. Want Rider's manuals or test equipment. What have you? George Galeota, 200 Cherry St., Morgantown, W. Va.

FOR SALE—Precision Ser. No. 500 tube checker and condenser tester \$12.50 cash. Radio and Television Shop, 1472 Jerome Ave., New York City.

FOR SALE OR SWAP—R C A radio course, \$35. Perless Signagraph, four tapes, \$15. Jewell 199 Analyzer, \$10. Large file of radio magazines. Want late model Supreme Analyzer, tube tester or good communication receiver. Ray H. McKendrick, 46 Center St., West Haven, Conn.

FOR TRADE—Instructograph, spring-wind, speaker and A.C. oscillator. Want Rider manuals or good signal generator or what have you? Samuel Hornick, 8707—12th St., Detroit, Mich.

FOR SALE—Burton-Rodgers tube tester like new. First reasonable offer takes it. Frank Evans, 794 So. 14th St., Newark, N. J.

FOR SALE—N. R. I. complete course in practical radio. Will include 14 lessons in television with answers and over 25 special text books. Good condition. Best cash offer takes all. Peter J. Jarvis, 4817 So. Elizabeth St., Chicago, Ill.

WANTED—Instructograph or Teleplex code practice machine. State price, and number of tapes. Fred C. Stuckert, 6021 N. Kent Ave., Milwaukee, Wis.

(Continued on page 10)

SERVICING FOR FIDELITY*

HIGH fidelity, quality, frequency response, and tone range are terms that are coming before the listening public in ever increasing doses. FM has been talked about, demonstrated and proved its reproducing qualities to an increasingly critical public. All of which points toward the serviceman's opportunity of selling high quality parts that will improve the tone range and quality of sets brought in for service.

The quality of reproduction that is possible from any receiver depends upon the quality of the parts used, especially in the audio section. Speaker, tubes, transformers, have to be good in themselves and must be properly matched to each other.

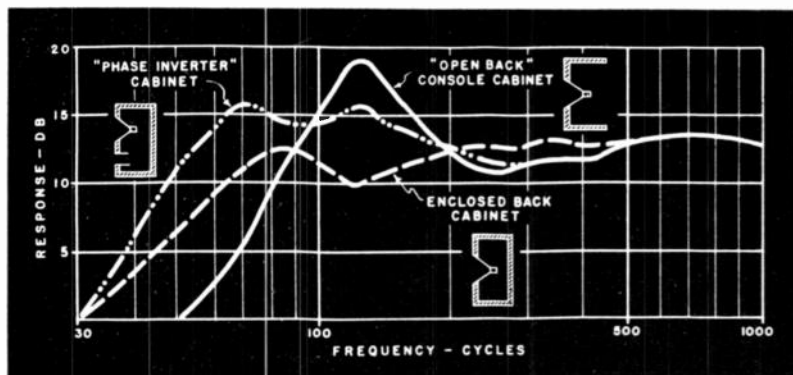
Chassis must be rigid, cabinets well braced, rf and other parts solid and not subject to vibration with normal operating conditions. Alignment must be perfect, tuning condenser, coils and speaker free from dirt. When these things are in tip-top shape, the correct electrical conditions can be established that will insure the best quality.

** By Courtesy of "Radio Today."*

Speaker Delivers

The speaker has the job of vibrating the air at the intensity and frequency of the electrical power supplied to it. To do this job, its fundamental design must be such as to reproduce frequencies in the audible range equally well.

The modern high quality electrodynamic and PM dynamic speakers have been carefully designed so that the weight of the voice coil and cone, the compliance or springyness of the cone suspension, and the magnetic structure work together. This compliance of the cone edge support is an important factor in the reproduction of "lows," while it is less important at the higher audio frequencies. A large diameter cone is required to reproduce the low notes. The mass or weight of the moving parts of the speaker (voice coil and cone) limit the high frequency response, but in order to prevent the generation of harmonics due to vibration of the cone itself, a fairly heavy cone is used. The facts indicate that it is not possible to produce a speaker having perfect response at both the low and high ends of the audio range.



Comparison of frequency response characteristics for three different types of speaker housings. Note the resonant hump for the typical open back cabinet at approximately 120 cps. All improvement by other two types is below 500 cps.

Selling Performance

This is very much the case, and speakers are a compromise of the desirable qualities. The usual console set uses a 10 or 12 inch speaker which gives moderately good reproduction on the lows and middle register. Smaller speakers give a better high frequency response because of their light cones, thus the absence of "lows" in the small table sets and compacts. Because the average listener reacts more favorably to the low frequency response of a set, the single large speaker is usually satisfactory. Extension of the high range of reproduction would mean an additional speaker of small diameter. Adding a "hf" speaker is a very good "special job."

When one of the older sets comes into the shop for service, and observations show that a new modern speaker would really perk-up the response, install one and let the customer hear the difference. This procedure should only be attempted with regular customers when it is obvious that a new speaker will improve the set and you have suggested a trial with the new speaker.

Baffle Improvements

Another cause of poor performance in some sets is the baffle effect of the cabinet. The purpose of a baffle is to increase the length of the sound path from the front of the cone to the rear and prevent cancellation of the two sounds which are 180 degrees out of phase. If the baffle is large enough to delay the sound from the back by $\frac{1}{2}$ wave length, the front and rear sounds will then be in phase and aid rather than oppose one another. The wave length at 100 cps is about 11 feet. This would require a baffle 11 feet square (11/2 from speaker center to any edge). Such a baffle size is not practical for home receivers even when "folded" into a cabinet, and other means are used to secure good low frequency response.

If the open back of the cabinet is closed, the objectionable "cabinet resonance" is eliminated and more lows

will come through, if the resonant frequency of the speaker is less than the open cabinet resonant frequency.

Phase Inverter

The graph, on page 5, shows the relative responses for an open back, closed back, and "phase inverter" type of cabinet. The open cabinet resonance "hump" is apparent as well as the extended low frequency response of the other two types.

The phase inverter cabinets are modifications of the closed back type. The design is such that sound from the back of the cone comes through the opening in the front of the cabinet in phase with the normal sound.

The tubes in any set vitally affect the quality of reproduction. Push-pull tubes in particular can create distortion if they are not balanced, that is, they are not similar enough electrically. If one tube has a higher transconductance than its partner, distortion will result because the voltages from the two tubes will not be equal in magnitude.

Three types of distortion which may be in an amplifier are amplitude, frequency and phase distortion.

Distortion in Amplifiers

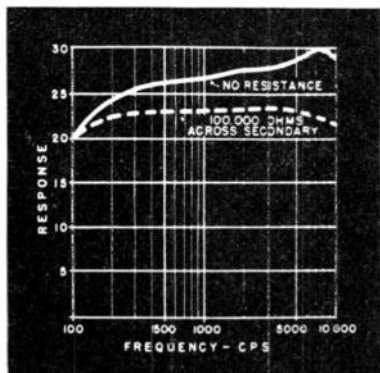
Amplitude distortion is the most common type and is due to operation on the non-linear portion of the tube characteristic. This type of distortion can be corrected by adjustment of the bias for the tubes so that correct operation is obtained, and limiting the driving voltage if necessary.

Where a special job is to be done, measure the line voltage in the customer's home and if it is quite different from that in your shop, adjust the bias for correct operation under its usual operating conditions.

An average difference of 5 volts in the AC line would easily change the plate voltage by 25 volts and thus throw the bias off by several volts. As stated before, this procedure is not for the run-of-mill jobs, but only where the maximum quality is to be obtained.

The correct bias condition can be determined by several methods. The

easiest is probably direct comparison with data on the particular tube type. Where the plate voltage is not the exact figure given in tube manuals, a satisfactory bias voltage is found by interpolation of the recommended operating condition.



Response of older audio transformers can be smoothed out by adding shunt resistor to secondary.

Thus, if the actual plate voltage is half way between two recommended values, the bias can also be assumed to be half way between the two given voltages. If you want to be more fussy, use an oscilloscope across the voice coil while driving the amplifier at full volume from an audio oscillator and adjust the bias until the output wave has exactly the same shape as the input wave, usually sine shaped. Too low or too high a bias will flatten off the tops or bottoms of waves.

Flat Transformers

Older types of audio transformers do not have the flat frequency response of new models. Better core materials and winding methods have improved response to a remarkable degree. Changing to these high fidelity units will make a better satisfied customer, and at the same time increase your "per job profit."

Where the additional cost of new transformers is not warranted, response of the old units can be

improved by shunting the secondary with 100M or 125M resistor, if this is not already incorporated. A graph on this page shows the relative effect of adding the shunt resistor. If the secondary is push-pull, put the same value resistor across each half of the secondary.

Feedback is another one of the means you can use to improve quality in some of the older sets. Positive feedback (introducing part of the plate voltage into the grid circuit so that it is in-phase with the grid voltage; regeneration) is seldom used because the amplifier becomes unstable. Negative feedback (degeneration; the reverse of positive feedback) is being employed in modern audio amplifiers to smooth out peaks in the response characteristic and reduce distortion.

Frequency Distortion

Frequency distortion, the second of the three types, is largely reduced by negative feedback. If the amplifier tends to amplify the highs more than the lows, feedback will level this out because more of the highs will be canceled in the grid circuit. Feedback can best be used only with high gain stages, because of the loss of output which occurs.

The feedback voltage may be applied to the grid of the output tube or to the cathode of the preceding driver tube.

Phase distortion is not a problem in audio amplifiers.

Other Sources

Other sections of a receiver can also cause distortion trouble. The alignment of radio or intermediate transformers may be such that the bandwidth is insufficient.

If the IF transformers are too "sharp" for good quality, stagger the alignment of primary and secondary so that the wider band audio signals can get through without being cut off. This type of alignment work should preferably be done with a scope and wobulator. The peak should be as "flat" as possible. Avoid too large a

(Continued on page 10)

KILLING THE HUM-BUG*

PART 2

(Continued from January Issue)

Hum Bucking

Hum bucking consists of introducing at some point in the audio amplifier a voltage in magnitude and of opposite phase to every hum fre-

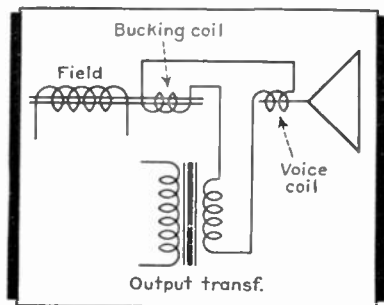


Fig. 5. (Above). A hum-bucking coil wound around the speaker field coil is a popular method used to neutralize hum voltages.

quency present. These frequencies are usually 60 cycles and many harmonics. In most cases some trick giving partial hum bucking is used for reasons of economy. The most universal stunt is to use a hum-bucking coil wound around the field coil of the speaker and connected in series with the voice coil. (Note Fig. 5.) Another scheme uses a copper slug, or shading ring around the field coil, this being particularly effective against a-f ripple generated in the battery circuit of auto sets. (See Fig. 6.) A-c, d-c sets, using a half-wave rectifier which generates a 60-cycle ripple, have a greater hum problem. In small receivers the speaker doesn't reproduce bass notes so not much fundamental hum gets through. P-m speakers have the one disadvantage that a number of these hum reducing ideas cannot be used.

Hum Neutralization

Fig. 7 shows a method of hum neutralizing using a tapped choke or step-up autotransformer with a small trimmer condenser coupling the anti-hum voltage into the first a-f grid circuit. Fig 8 shows a newer stunt that is particularly effective, delivering anti-hum voltage to the power tube cathode. As it is extremely simple, Service Men should be able to apply it where costs must be kept down.

Degeneration offers a means of reducing hum from all sources as well as improving quality but substantial gain must be sacrificed to do a good job. This usually calls for an additional a-f stage.

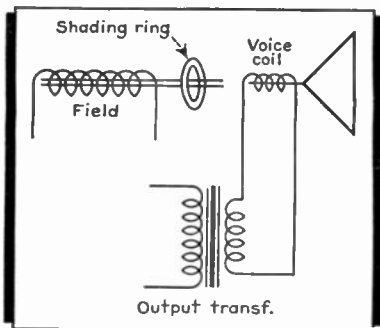


Fig. 6. A copper shading ring around the field coil of auto-set speakers is sometimes used to reduce a-f ripple.

The hum output from a given filter is proportional to the load current or, conversely, larger filter components are required for a given amount of hum voltage as the load increases because more stored energy is demanded. This energy comes from the charge in the condensers and the magnetic field of the chokes, if any. A push-pull output stage can take a great deal more ripple than a single-ended

* By Mark Glaser and Edw. M. Glaser in "Service."

stage because the hum is neutralized by the bucking action in the primary of the output transformer

fields of the heater influence the plate current. In the manufacture of heater type tubes the heater is kept well

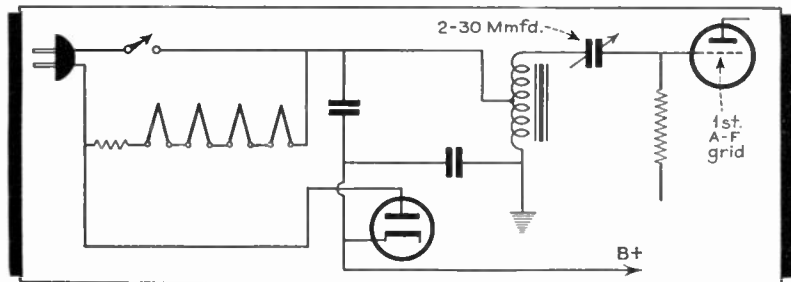


Fig. 7. Hum neutralization may be accomplished through the introduction of anti-hum voltages, by means of an autotransformer and trimmer condenser, at the first a.f. grid.

Filaments and Heaters

In filament type tubes the grid and plate returns must be brought to the electrical center of the filament by means of a center-tap on the filament transformer or a potentiometer. Early a-c sets all had adjustable potentiometers and these were often quite critical. Since substantial hum results from a-c on a filament type tube, only power tubes where the ratio of signal voltage to hum voltage is very large are of this type. In heater types, both the magnetic and electrostatic

below the cathode to give sufficient shielding to lick the static effect. The use of very narrow loops or a double spiral, wound non-inductive for the heater element, minimizes the external magnetic field.

Certain oscillator tubes when operating on short-wave bands tend to introduce hum on the carrier, modulating the signal with 60 cycles. This effect is proportional to frequency and is particularly noticeable when the cathode operates above ground, as in electron-coupled oscillators in communication receivers or cathode feedback circuits common in many new receivers. One cure is to by-pass both heater leads to ground. Another is to replace the tube!

One method of reducing heater hum in microphone preamplifiers is to run the heater from the d-c output of the plate supply. Some late sets are using a 12SQ7 or 12SF5 running at below-normal currents which reduces tube noises as well as hum. The tubes may be a bit critical in this application.

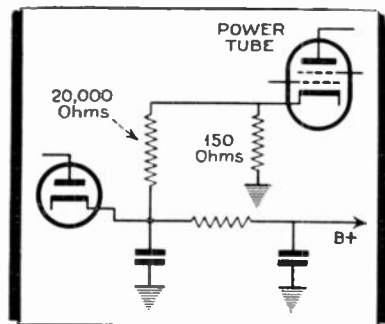


Fig. 8. An anti-hum voltage introduced at the cathode of the output stage is an effective means of reducing hum in the speaker.

Induction

In the days of audio transformers, magnetic induction was a very important consideration. Copper bands

around the laminations of the power transformer as well as high permeability iron shields were used to minimize this induction. Most sets now using audio transformers (or audio chokes) are of the expensive variety where wide spacing may be used and all precautions taken. The elimination of audio transformers and chokes and the use of inverter stages for push-pull have almost allowed us to forget about magnetic fields in relation to hum. One exception to this is the high-gain audio amplifier where the heater leads must be watched for magnetic as well as static effects.

The parts of detectors and audio amplifiers that are at a high impedance to ground are always subject to hum pickup, the susceptibility being proportional to the impedance above ground. Tubes must therefore be shielded and grid leads must be either very short or shielded.

Tunable Hum

R-f stages cannot amplify hum but can modulate the program at hum frequency which may be even worse. Hum on the carrier is minimized by using an electrostatic shield in the power transformer and by-passing one or both sides of the a-c line to ground. In replacing an output transformer, the phasing must be watched as considerable hum may be introduced by reversing a winding. Where high gain audio amplifiers are used don't forget the ground connection. A real ground is usually a major asset in reducing hum.

SERVICING FOR FIDELITY

(Continued from page 7)

"dip" in the center as the lows will suffer.

Audio howls, hum and microphonics all detract from good quality. Trace out feedback causing howling, shield the high gain audio tubes to prevent hum and rubber-mount parts causing microphonics.

Servicing for fidelity can be profitable business. The first few may be hard to sell, but results will speak for themselves in advertising what you can do.

THE RADIO TRADING POST

(Continued from page 4)

FOR SALE—Triumph 120A signal generator, 100 KC to 75 MC in 7 bands. Like new, \$18.95. Also Solar capacitor bridge CB-1-60. Like new, \$13.95. Have discontinued radio service. W. A. Haeussinger, 1102 Marion St., Winona, Minn.

WANTED—Crystal pick-up, good electric turntable, symphony records, crystal mike, enclosed record player and range finder for camera. Have bug, tubes, radio parts, etc. Wayne Storch, Beecher, Ill. W9FOC

FOR SALE OR SWAP—New C.R.E.I. radio and television course over 50 lessons, cost \$150.00. Have Radio-Craft, Radio News, Short-Wave Craft Magazines. Sprayberry Practical Radio course. Want Perflex 55—12.8 lens or what have you in photography. Matthew Perraino, 19150 Wexford St., Detroit, Mich.

WANTED—Am interested in obtaining test equipment, especially test oscillators, also complete volumes of Rider's manuals. Please state prices. Clifford F. Smith, 1600 Jones St., Ft. Worth, Texas.

FOR SALE—1 model 1230 Superior signal generator, Superior channel analyzer, model 1240 Superior tube tester, volumes 1, 2, 3, 6, 7, 8, 9, Rider's manuals, 7, 8, and 9 are new. Will sell the bunch for \$65.00, F.O.B. Galena, 25% with order, balance C.O.D., will sell only in one bunch. Reason for selling, bad health. Galena Radio Service, 406 Main St., Galena, Kan.

WANTED—Rider's manuals. State condition and price of books when writing. W. E. Adkins, Box 45, Kimball, Minn.

FOR SALE—Supreme 590 de luxe tester, \$24.00. Triplett 1177 oscillator and analyzer, \$14.50. Vacuum tube v.m., \$21.00. Tube tester, 9 inch meter, \$20.00. Oscilloscope, \$21.00, and other meters, books, etc. Super Radio Service, 138 Vine St., Plymouth, Pa.

WANTED—Small a.c.-d.c. battery portable, also broadcast super (r.f. stage). Have stamps, covers, radio parts, or will pay cash. Give description and particulars. Harry Gursh, 161 Sutter Ave., Brooklyn, N. Y.

FOR SALE—One Webster-Chicago model 4L35, 35 watt P.A. amplifier; one R.C.A. velocity mike; two large speaker trumpets complete with adjustable brackets and Jensen 8" P.M. speakers; m.k.e. plugs, etc. Outfit used less than one month, cost \$225.00. Also complete N.R.I. Radio course. Best cash offer takes either outfit. C. Earle Short, P.O. Box 565, Annapolis, Md.

FOR SALE OR SWAP—Kolster and Kolster Brandes chassis, 43, 15, 3K20, Kolster speaker K5-3, RCA 2-18, i-33, Majestic 90-3 chassis and speaker, "B" eliminator, Brunswick 17 chassis, and other equipment. Want Supreme 585 tester or what have you? Gladstone Radio, 1279 Sheridan Ave., Bronx, N. Y. C.

PRINTING—Will print servicemen's cards, letterheads, envelopes, billheads, etc. at lowest prices or in exchange for low or medium power transmitting tubes and parts. Write stating condition and value of equipment. John A. Makuta, W8TTF Press, Curtisville, Pa.

SELL OR SWAP—R.C.A. beat oscillator universal, output transformers and wave traps, radios, meters, tubes, transformers, short wave parts, speakers, books and magazines etc. Want archery equipment, phonograph pickup, 1938 R.C.A. service manual, bulb type battery charger. O. F. Klein, % O K Radio Service, 2235 N. 39 St., Milwaukee, Wis.

WANTED—R.C.A. Rider Chanalyst. Please mention condition and your lowest price. Capital Radio Service, 637 West 21 St., Erie, Pa.

FOR SALE—No. 85 Supreme tube tester with A & B adapters, \$20.00; Ralston Radio Code Course (6 lessons) on records \$3.50. Magy's Radio Service, 1325 Loyd St., Nanty-Glo, Pa.

FOR SALE OR TRADE—Clough Brengle O.C. 5-103 meter oscillator, \$18.50; 2-R.K. 20's, \$7.00 each; sure crystal cartridge, \$2.00; 954, \$2.50; 3" C.R. scope, case and tube included, transformer \$24.00. Al. R. Dayes, 1418 81 St., Brooklyn, N. Y.

FOR SALE OR TRADE—I.C.S. Industrial Management course, 64 vol., brand new, cost \$185.00. Will sell for \$45.00 or trade for Rider's manuals 3, 4, 5, 6, 8, 9, & 10 or 15-watt amplifier. What have you. Melvin Kihlfeiner, 270 Duke St., Ephrata, Pa.

WANTED—Motor generator, 110 v a.c. to 60 v d.c. about 8-10 amps. Public address amplifier racks with or without high fidelity power amplifier. Please give full details and lowest cash price. Alfred B. Werhan, Manlius, N. Y.

FOR SALE—Hallcrafters SX24, less speaker, 3 months old. Also C-D capacitor bridge, model BN with tubes. Complete phone rig, duplicate of Stancor 10P. Make offer. Fred E. Lee, 2239a Montgomery St., St. Louis, Mo.

WANTED—Will pay cash for best bargain in modern testing equipment and also late radio repairing correspondence course complete. Give full details. Wesley Kay, 129 N.W. 32 St., Miami, Florida.

WANT—Rider's manual, vol. No. 4. Please state price and condition of book. Carl Becker, Scotland, South Dakota.

FOR SALE—Rider's manuals 1 to 6, Gernsback's manuals 1 to 5 at half regular price. Supreme 89D, \$15.00; Precision analyzer, \$12.50; Weston 42S galvanometer, \$5.00; Weston 301-1 1/2 m.a., \$3.50; Shallock tester a.c.-d.c., \$7.50; Burton mod. 10 batt. oscillator, \$8.50. Geo. T. Morgan, 60 1/2 Ely St., Coxsackie, N. Y.

WANTED—Modern radio testing and calibrating equipment, in exchange for Gruen gold case wrist watch; Late model golf clubs, with leather bag and new balls. Also tennis racquet and balls. J. C. Green, 1266 S. Lake St., Los Angeles, Calif.

WANTED—Good all-wave oscillator. Give all details, model and price. L. M. Mick, 424 Second Ave., Dixon, Ill.

FOR SALE—We have several 6 foot trumpets. First class condition and at low prices. Write for full description of them. National Sound Equipment Co., 625 Main St., Worcester, Mass.

WANTED—Rider's manuals 3, 6, & 7. State price and condition of books. Joseph P. Adrosko, 914 Lafayette St., Elizabeth, N. J.

FOR SALE—R.C.A. model 167 test oscillator, Jensen Hi-Fidelity P.M. speaker 12". Other radio and electrical parts and equipment, Rider's manuals. Send card for list and prices. John Camarda, 2857 Blanche St., Pasadena, Calif.

FOR SALE—Rider's manuals one to five inclusive. All 5 manuals like new with index for only \$20.00. Will send on C.O.D. James Radio Service, 2909 Buena Vista, Alton, Ill.

FOR SALE OR TRADE—Hallcrafters 5-tube Skyriders I.R.F. Will trade for volt-ohm-m.a. tester or photo enlarger, or 35 m.m. Kodachrome projector, or what have you? J. Flowers, 33 No. 18 St., Harrisburg, Pa.

FOR SALE—One N.R.I. radio course. Lessons only. In good condition but lost one lesson. Will sell for \$30.00 or trade for service manuals. Fred Kitchens, Box 335, Commerce, Ga.

FOR SALE—Radio Physics Course and Modern Radio Servicing by Alfred Ghirardi. Both books in new condition, \$5.00 for the two. Want, a 12 volt or 32 volt converter to 110 volt a.c. Irvin Moody, Smith's Grove, Route 2, Ky.

WANTED—Air-cooled engine of 3/4 to 2 H.P. 4 cycles. State condition and best cash price. John W. Reigel, Annville, Pa., Route No. 2.

FOR SALE—Hickock 510X tube tester; ATR 6-v. eliminator; Solar condenser tester CB1-60; X Ray O Meter 9"; Superior oscillator; UCT 1/2 volt eliminator; dual speaker; IRC resistor analyzer; Tripplett 1175 tester; 11 Rider manuals; 200 new tubes; NRI course; Watt meter and electric drill. All for \$300.00. Ellison Radio Service, 211 West Main St., Sedalia, Mo.

WILL TRADE—500 watt 110 volt a.c. generator used for sound truck and transmitter, 5/8 H.P. "Pioneer" gasoline engine with built-in 6-v. 20 amp. d.c. generator for battery charging, new; 6 volt Windcharged with 6-ft. steel stand. Want, Rider's manuals, test equipment, meters, PA trumpets, speakers, etc. G. A. Marken, Box 158 Church Point, La.

FOR SALE OR TRADE—3 photoelectric cells 3 amp. Western Electric type and 2 \$16.50 input transformers, Western Electric type all for \$25.00 or trade for a good used P.A. system of about the same value. W. C. Mc Clung, Dawson Rd., Albany, Ga.

POSITION WANTED—Serviceman, completed NRI Course, experienced in radio repair 4 years. Can repair all makes of radios and amplifiers efficiently. Honest, progressive interested and willing. Can furnish references. James Wilson, Jr., Box 409, Sheffield, Ala.

FOR SALE OR TRADE—4 Cardwell x-mitter condensers, XCXS 171" airgap, two phototubes R.C.A., 2-100 watt 1 ohm and 50 ohm power rheostats, 2 Kenyon grid mod. transformers. All new. Want Carron CCH signal tracing amplifier, also speed flash. Geo. Jennings, 75 Hume Ave., Medford, Mass.

FOR SALE—Burton-Rogers model 22 portable tube tester with circuit diagram. Tests over 600 tubes from 1.4 volts to 110 volts including miniatures. Price \$15.00 cash. H. C. Sohnlein, 807 25th N.W., Canton, Ohio.

FOR SALE OR TRADE—QST magazines 1921 to date. Antique music box. Want, coils for National HRO receiver 50 to 2050 kcs., or RME low freq. inverter. W. C. Gross, 717 Maple Ave., Conneaut, Ohio.

FOR SALE—National NC 100 receiver. Perfect condition, \$75.00 F.O.B., or will trade in on HRO Senior. W. H. Cooney, Wrights Ave., Conneaut, Ohio.

WILL SWAP—Six tube Atwater-Kent auto-radio, Keystone movie projector, and ten watt amplifier for good Howard or similar communications receiver. Will trade any one of these for good a.c.-d.c. battery portable. Frank Thaxton, 3404 Lovell, Fort Worth, Texas.

FOR TRADE—New Superior channel analyzer and instructions for late model oscillator or multimeter. H. E. Nichols, Box 3872, Lowell, Ariz.

FOR SALE—Supreme 592-593 comb. analyzer, \$45.00; Readrite Ranger 432-A tube tester, \$15.00; Superior 1130-S signal generator, \$9.00; Rider's manuals Nos. 4 & 7, \$5.00 & \$7.00 respectively. All one year old and in perfect condition. Harry G. Hochanadel, 427 S. Martinson, Wichita, Kans.

FOR SALE OR TRADE—Latest R.C.A. recorder complete. Original price \$180.00. What have you to trade for it? John Magnus, 404 North Wells St., Chicago, Ill.

SALE OR SWAP—De Forest radio course, 62 lessons, A1 condition, also 30 lesson course by De Forest on sound talking pictures and television. What am I offered? Would like '38 or '39 NRI or Sprayberry radio course. John R. Napes, 803 Ford Ave., Youngstown, Ohio.

WILL TRADE—Radio-Electric shop with established business and good equipment for small stock farm, or will sell at bargain, and if so desired will personally train man to do repair work. Good town reasonable rent. J. W. Capps, Hillsboro, Texas.

WANTED TO BUY—Jewell 199 & 444 set analyzer with adapters, etc., Jewell 57 d.c. volt meter 0-50 ohms. 0-50 v. in one instrument, Test-O-Phone test unit, Zenith table model 71232 combination (110 v. or 6 v.), battery tester, Triumph model 633 or Tripplett 696, Radio City tube tester 308 portable, and back issues of Radio News, Radio Today, Radio Craft. Howell's Radio Service, Anna, Texas.

FOR SALE OR TRADE—Have meters, analyzers, tube checkers, cabinets, cases, rectifiers, tubes, parts, kits, speakers, phones, magazines, books, fence charger, motors, micrometers, tools, firearms, trombone, Gene-motor etc.—Sell or trade for anything of value. Roby, 6303 Kenwood, Chicago, Ill.

WANTED—Gasoline driven generator for about 500 watt 110 volt a.c. or other usable output. M. Budd, 7511 New Utrecht Ave., Brooklyn, N. Y.

FOR SALE—3 Majestic G2 speakers, \$1.00; 3 Photophone 14" speakers, \$3.50; 2 Magnavox model 80 a.c., \$2.00; and 4 Magnavox d.c. model 80 \$2.00. Ed. C. King, Jr., 129 East Marie St., Hicksville, N. Y.

WANTED—Used clarinet in good condition. Will swap anything you suggest or pay fully in cash. A. Brennan, 432-142 Rockaway Beach, New York.

POSITION WANTED—Radio Technician graduate N. R. S. Five years experience service and sales own shop, American, speaks Spanish fluently, wants position in southwest with opportunity to use Spanish. Would consider buying good service business cash or trade business. Jess Hymas, Burley, Idaho.

FOR SALE OR TRADE—Like new Westinghouse Illumination Analyzer type PM-24 consists of Foot candle meter and a.c. volt ammeter list price \$75.00. Want, oscilloscope, AF oscillator, tube tester or other laborator" equipment. Jack Potter, 33 Kensington Ter., Maplewood, N. J.

SELL OR TRADE—500 manufacturers schematics, Tobe condenser tester, 5 x 7 camera with tripod, transmitting tubes and other equipment. Send 3 cent stamp for list of stuff. David Meyerson, 3425 Knox Pl., Bronx, N. Y.

FOR TRADE—465 kc filter crystal, also two condensers 1 mid. 2M00 v. and 2 mid. 1000 v filter unit. Want Rider or Gernsback manual after vol. 3 & 4 respectively. W. Crooks, Radio Shack, R 3, Kent, Ohio

FOR TRADE—Power supplies, power trans., earphones, magnetic speaker, milliammeter, ammeter, tubes: 27, 01A, 00A, 26, 10, 71A and others; also have cash. Want Ghirardi's Radio Physics Course in good condition. Michael Crawley, 7 Walnut St., Pompton Lakes, N. J.

FOR TRADE—Auto radios, speakers, "B" eliminators, trickle charger's, key, radio parts, electric shaver, violet ray oscillator, motors, etc. Want pickup, service manuals, test equipment or what have you? Chas. H. Wallace, 532 Forster Rd., Princess Bay, S. I., N. Y.

FOR SALE OR SWAP— $\frac{3}{4}$ H.P. Maytag gasoline engine. Single cylinder. Swap for two Rider's manuals, Nos. 2 to 11 or will sell for cash \$10.00. Oalvin Showalter, Box 372, RFD C, Vienna, Va.

WANTED—Volt-ohm-milliammeter or tube checker, used but in good condition; also radio course. Must be bargain. Please send prices to Wm. Byron Meyers, 556 Bradley St., Columbus, Ohio.

SALE OR SWAP—7 tube 15 watt amplifier, triode output, 12" speaker, two inputs for mike and phono. Only 6 months old. Stanley Garner, 29 W. Chestnut St., Norristown, Pa.

WANTED—Rider's manuals, 3, 9, 10, & 11. Advise condition and best price. Vollmer Radio Sales Service 600 E. Erie St., Painesville, Ohio.

FOR SALE—R.C.A. electric clock 20", \$4.00; "Radio Service" electric sign, \$2.00; Westinghouse 0-5-50 voltmeter, Hoyt galvanometer, Steinite 0-4 voltmeter 0-500 d.c. milliammeter 0-10, 0-300, 0-1, 20-0-20 amps. All new condition. Want Radio Craft 32 manual. W. F. Onder, Rt. 1, Box 269, Kimmswick, Mo.

WANTED—Late model signal generator, tube checker, signal chaser, meters. Must be of late model. Give description, serial number, model and lowest price. Chas. Carroll, 211 Crapo St., Flint, Mich.

FOR SALE—Combination push-button analyzer, tube checker and multimeter in one compact unit. Tripplett 4" sq. foundation meter (used). Components accurate to 1% \$19.00. Chester Martowicz, 116 E. 7th St., N. Y. C.

SALE OR TRADE—Old type Jewell tube tester for 4 & 5 prong tubes. Electric with milliammeter, in good condition. Also "Popular Science" from Nov '39 to Sept. '40. Will trade for phono oscillator. W. H. Frese, Readlyn, Iowa.

SALE OR SWAP—4 Utah G-12 speakers, 2 Rola G-12 speakers, 1 50-watt 2 channel amp., 1-30-watt 3 channel amp., Triplett 1503 tube tester and volt-ohm-meter, N.R.I. course complete, phono motors, pick-ups, etc. Best Radio & Tel. Labs., Box 122, Rockville, Conn.

WANTED—Western Electric condenser microphones. Heads alone as No. 394, or complete with pre-amplifier. Must be in working order. State cash prices. J. C. Thomas, 361 Fourth St., David City, Neb.

FOR SALE—Complete De Forest radio television and sound course. Make offer. Also De Vry hand driven 16 mm. motion picture projector. Cash or what have you. Rider's manuals wanted. Carl Mowery, 230 S. Oak St., Mt. Carmel, Pa.

FOR SALE—Superior Laboratrometer Model 1180-S (super-allmeter and tube tester). Like new. Cheap for cash. What am I offered? Ernest E. Tiberghien, 1420 Wisconsin Ave., Gladstone, Mich.

WANTED—Rider's manuals, 8, 9, 10. Please state condition and price. Irving Katz, 31-05 31 St., Astoria, L. I., N. Y.

SALE OR SWAP—Paragon oscilloscope, second and third edition the Radio Manual by Sterling. Second and third edition Principles Radio Communication by Morecroft, and many other high grade radio engineering books. Quitting radio business. Electric Service Co., Box 315, Leesburg, Fla.

FOR TRADE—90 National Geographic Magazines, from 1913 to May 1937. Contains some scarce issues 1917 Flag—1925 Cattle number—1934 Flag number, Fish, Fowl, Birds etc. Wanted: Need all Rider's manuals or what have you? Chet. O. Bedell, 8825 208 St., Queens Village, N. Y.

WANTED—Short wave receiver either 1 or 2 tube model, please give make and price of receiver. Also signal generator give full particulars and condition and price. Howard Dodge, 484 Sayre Ave., Perth Amboy N. J.

FOR SALE—Hand drawn schematic diagrams, everything from one tube beginners set to 7-8 tube superhets. Also transmitters and test equipment diagrams send stamp for list. Edgar Boles, R. 4, Marion, Ill.

WANTED—Any commercial ham super-het in fair working condition under \$10.00 complete. Also instructograph with tapes or complete Teleplex. Send full particulars and final price in first letter. Wm French, 2656 East 27 St. Sheepshead Bay, N. Y.

SALE OR EXCHANGE—Public address system complete with Wright De Costa speakers, mixer fader panel etc. Also 1 16 mm. De Vry de luxe projector (motor-drive) in sturdy leather case. Write for list. H. Ford, 29 Beach Ave., Madison, N. J.

WANTED—Oscillograph. State make model, condition and how much you want for it. Stanley Radio Service 232 54 St., Brooklyn, N. Y.

WILL SWAP—Triplett signal generator model 1231 will trade for a turntable and pick-up. Motor on turntable must be for 60 cycle, 110 volts. Anderson's Radio Service, 431 Garden City Dr., Syracuse, N. Y.

FOR SALE—Duplicating outfit, uses large size mimeograph stencils \$5.00. Home Recording outfit \$2.00. Want, Piano accordion, give number of bases, age, condition, and best cash price. Code machines and tapes. State makes, condition and price. Sam Shor, 3451 Park Heights, Baltimore, Md.

FOR TRADE—RK36 transmitting tube for tube tester or other test instrument. Thordarson grid-modulation transformer for 100TH tube and Thordarson transformer 1200 V.C.T. at 200Ma. Either item for 0-1 milliammeter, speed key, or what have you? Bauman, Box B, St. Cloud, Minn.

FOR SALE—Superior signal-generator the new model 1230. Like new, used only twice. Price \$10.00. Make offer. Marion Francis, 1232 E. 75 St., Chicago, Ill.

FOR SALE—Westinghouse motor generator. A.c. motor $\frac{1}{4}$ H.P., 110 volts, 3.5 amps., 3450 R.P.M. D.c. generator, 350-500 volts, .1 k.w., .2 amps. Like new, used very little, perfect condition. Price \$45.00. Geo. W. Bowers, 604 Scarborough Ave., Rehoboth Beach, Del.

WANTED—Candlers system scientific jr. course on code. State price and age of course. Wm. Pepe, 405 So. 10 St., Newark, N. J.

SWAP—Milliammeter, 100 range, 5 in. wide; was in Sylvania tube tester; also 220 to 110 v. transformer, both in good condition; want good 3 in. 0-1 or 0-5 milliammeter; no trash please. My meter too large. Arthur Bulmer, Sutton, N. H.

WANTED—The third issue of the, "Stan- cor Hamanual" (1937). Also would like to hear from any one having any amateur equipment for trade. James E. Smith, Box 612, Spindale, N. C.

FOR SALE OR TRADE—2 6' trumpets, 2 Racon units, 2 genemotors, 1 generator battery charger, will charge 25 batteries. Want Rider's Manuals and microphones. Budin's Radio & Sound, 11203 Superior Ave., Cleveland, Ohio.

FOR SALE OR TRADE—NC80X communications receiver, 6 months old, used two weeks. Will sell or trade for Rider Chanalyst. Coe's Radio Service, R. 5, Mt. Vernon, Ohio.

FOR SALE—Tube tester, manufactured by Radio Technic Labs. Tests all popular types of tubes—\$12.50 FOB Luxembourg. H. A. Zeitler, Luxembourg, Wis.

FOR SALE—Philco 817 6-tube auto radio, 5-tube a.c. amplifier, Precision 500 tube tester. Want signal tracer. I. Horowitz, 1472 Jerome Ave., Bronx, N. Y.

SELL OR TRADE—Ghirardi Radio Physics Course and other radio books, photo-electric control unit, short wave receiver, tube tester, large assortment of radio parts, Univex camera, Perflex camera. Want communications receiver, stamps or what have you? N. Rehbein, Larsen, Wis.

FOR SALE OR TRADE—R.F. a.c.-d.c. meters, transmitting tubes and transformers, vibrator supply parts, A & B eliminators, neon transformer, battery charger, headphones and speakers, homemade VTVM, quartz crystals, SW TRF receiver. Miscellaneous amateur receiving, transmitting, and electrical equipment. If interested write—A. Zambakian, 1259 Gaylord, Denver, Colo.

WILL SWAP—Meissner B.C.S.W. police-3 band kit for any good popular make a.c. radio. S. Green, 908 De Kalb Ave., Brooklyn, N. Y.

WANTED—Phono-recording motor, with or without turntable (any condition) will buy reasonable, or make swap. Send for list. Stanley Zuchora, 2748 Meade, Detroit, Mich.

FOR SALE OR TRADE—Supreme 535 2" scope, like new. Want outboard motor or automatic shotgun. Also have "Servicing by Signal Tracing", by Rider and other radio books to trade for telescope gun sight or other radio books. Frank Popma, Orange City, Iowa.

FOR SALE—Factory built 6L6 amplifier complete with record player, two speakers and two crystal mikes. Will sacrifice for \$20.00. Merrill L. Winner, 1546 Sherman St., Williamsport, Pa.

WILL SWAP—Craftsman lathe with extra gears, 2 self centering chucks, mica undercutter electric attachment. Cost \$125.00, 4 months old. Want its equal in good engineering text, radio engineering course, test equipment or Rider's volumes 9 & 10. Joe Ennarano, 110 Gesler St., Providence, R. I.

FOR SALE OR SWAP—Vibroplex in excellent condition. What am I offered for it, or will swap for radio parts. What have you? Dyer Matlock, Jr., Box 423, Mt. Pleasant, Tenn.

FOR SALE—Pocket a.c.-d.c. multimeter volts a.c.-d.c., ohms, m.a. and decibels. Brand new with original instructions, uses a 1000 ohm-volt meter, price, \$7.00. Chester T. Martowicz, 115 E. 7 St. New York, N. Y.

FOR SALE OR SWAP—Stanco 20-P Transmitter complete with tubes xtal and coils. HY-51-B, TZ-40, T-4J Tubes, 40 Meter Xtals-SX-25 Hallicrafters brand new. Want Bell-Howell 8-MM Projector and Camera. Otis K. Wolfe, Box 724, Harlan, Ky.

WANTED — A C.R. oscilloscope and its allied equipment. Have other radio equipment to swap or ready cash. Rider's Manuals and signal tracers are also wanted by me. Edw. Connor, 1000 Brown St., Wilmington, Del.

FOR SALE—Supreme 339 model analyzer —A.I. condition, less cabinet. Volts-ohms-capacity, complete with cable and adapters. \$22.50—\$10.00 down, balance C.O.D. Ideal Radio, 1713 Larrabee St., Chicago, Ill.

FOR EXCHANGE—4-8" Utah speakers with output transformers for 6F6 tubes. Speakers are new. What have you? Irving Malinoff, 1137 63 St., Brooklyn, N. Y.

WANTED—Rider's manuals, 5 to 11. Write state which volumes you have, condition and price. John Dipinto, 1748 E. 177 St., New York, N. Y.

POSITION WANTED—Young man 25, nine years practical experience servicing radios and sound equipment with outstanding service shops. Ambitious, honest and will go anywhere for reasonable offer. Alvin Morgan, 2015 West Jefferson, Louisville, Ky.

FOR SALE—Thordarson T-25W28, 6 volt d.c.—110 volt a.c. mobile P.A. New, complete with tubes \$100.00, slightly used Astatic T-30 microphone and 20 watt Utah P.M.D. speakers. Berry's Radio Service, Box 243, Olive Hill, Ky.

FOR SALE—High quality P.A. systems from N. Y. World's Fair, Cineaudograph speakers, record changers, two speed turntables, etc. Bargain prices. Suitable for speech amplifiers etc. Also large stock of used auto radios. Write or call—Grant Gallo, 181 Hillside Ave., Jamaica, L. I., N. Y.

WANTED—Weston or Clough-Brengle V.T. V.M. State price, model and condition. B. J. Woodward, 513 Main St., Honesdale, Pa.

POSITION WANTED—Radio serviceman, 34, married, 10 years experience. University Physics and E. E. graduate, 3 radio schools, modern equipment, good character and technical references, desires position in radio shop or store with promising future and advancement. Adapted to radio laboratory work. Joe Wunderlich, 802 E. Webster St., Clinton, Ill.

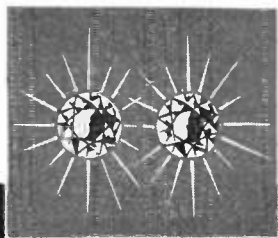
SELL OR SWAP—1939 push button mantel Crosley. List \$17.95, sell for \$10.00, or swap for model 1240 nearly new Superior tube tester. A. Penquite, Marshalltown, Iowa.

FOR TRADE—National SW3, power supply and 5 sets of coils for two volumes of Rider's from 7 on, or a condenser checker. Paul Rumbol, 14 N. Wood St., Greenville, Pa.

FOR SALE—Confidence Master tube tester also checks octal base tubes as well as 4-5-6 and 7 prong tubes, will sell for \$8.00 cash. W. G. Kaeshamer, 1025 Lynch St., St. Louis, Mo.

WANTED—Rider's service manuals, any or all volumes. Also capacitor analyzer and back copies of radio magazines. Please state condition and lowest cash price. Raymond Fletcher, Cisco, Ark.

POSITION WANTED—R.C.A. graduate—radio, sound and television course. One year college. First class radio-phone license. Four years experience as radio service technician, 25. Now employed, but desire position with greater future. Excellent references. Go anywhere. Mr. Peterson, 725 N. Raymond, Pasadena, Calif.



TO YOU these diamonds may look alike. But to the diamond expert, able to see beyond surface similarities, there is a difference in quality. And so it is with capacitors. The things that lie hidden are the things that count most in determining value.

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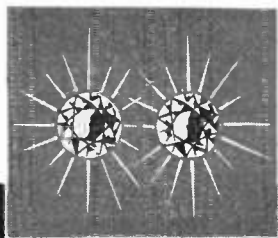
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- Special high voltage paper separator
- C-D etched plate
- Special C-D electrolyte
- Special high formation process

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