

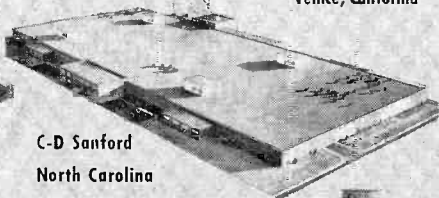
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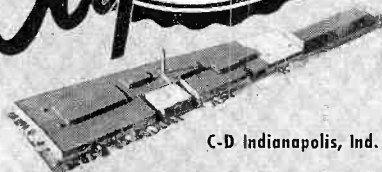
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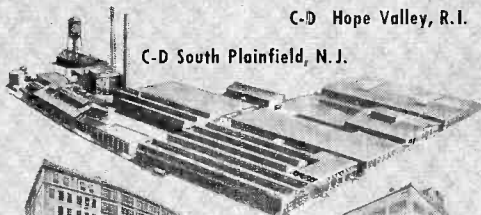


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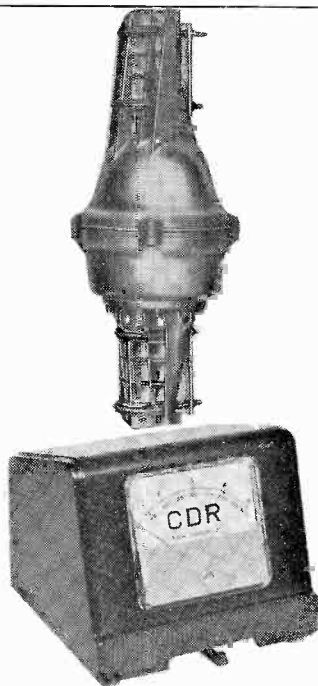
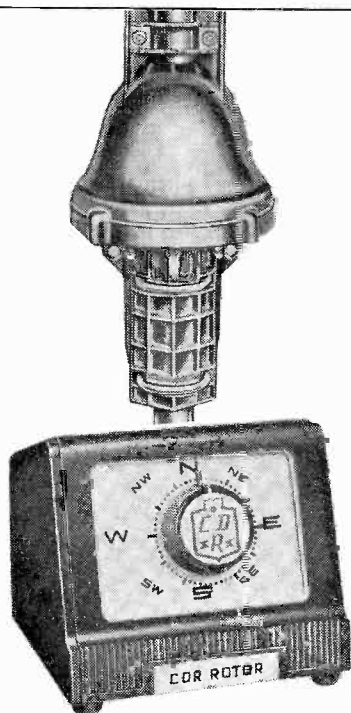
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# SERVICING TRANSISTOR AUDIO AMPLIFIERS

Standard techniques for testing audio amplifiers are well known to most technicians. Many shortcuts and spot-checks also are widely known and practiced. In general, amplifier operation is tested (1) during development to check the suitability of a design or to note the effect of changing parts of the circuit, (2) in field operation to ascertain the quality of performance, or (3) in troubleshooting to detect the presence and location of malfunctioning.

Transistorized audio amplifiers require the same performance tests as their vacuum-tube counterparts. However, the tests sometimes are not made in exactly the same manner and occasionally require modifications of the test equipment. The differences are due sometimes to the low input impedance of the transistor, compared with that of the tube; and at other times to the interaction between output and input parameters of the transistor.

## Amplifier Measurements

Most dynamic tests involve the use of an audio signal generator and output meter. The output circuit of the generator usually is of no consequence when driving an RC-input vacuum-tube amplifier, since the high input impedance of the tube grid circuit minimizes generator loading. The transistor amplifier, on the other hand, presents a lower value of input impedance (typically 10 to 300 ohms for common-base, 325 to 1000 ohms for common-emitter, and 100,000 ohms to 1 megohm for common-collector circuits) and can load some generators significantly. Moreover, the generator output resistance,  $R_g$ , determines the value of the output resistance of the transistor to which the generator delivers a signal.

When the generator output impedance is low (say, between 1 and 50 ohms), little or no difficulty is experienced when coupling to the input of a transistor amplifier, except when

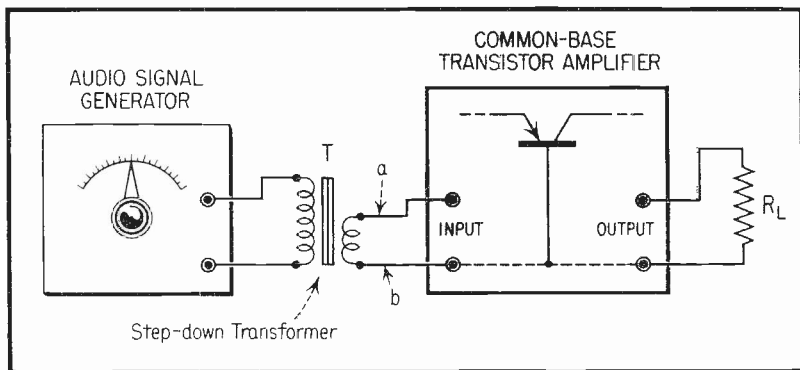


Fig. 1. Use of Impedance-Matching Generator Transformer.

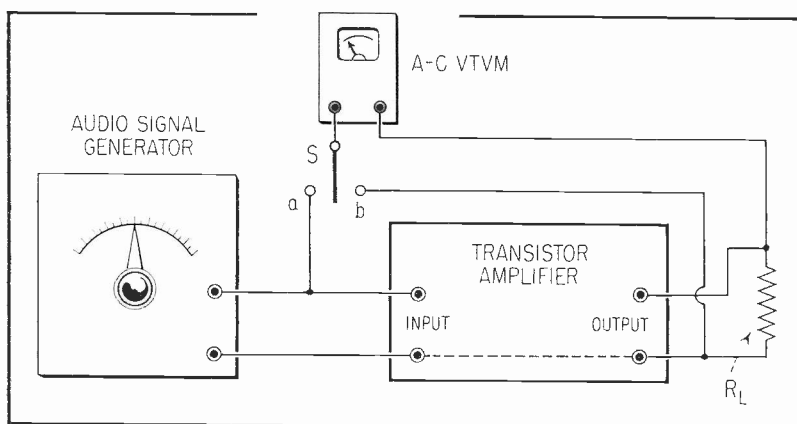


Fig. 2. Test Setup for Frequency Response and Voltage Gain.

testing a common-base circuit, a type not often used. The common-collector circuit, as shown in the preceding paragraph, has comparatively high in-

put impedance and will not load the average generator appreciably. However, the common-emitter circuit, like the common-base, may load an average

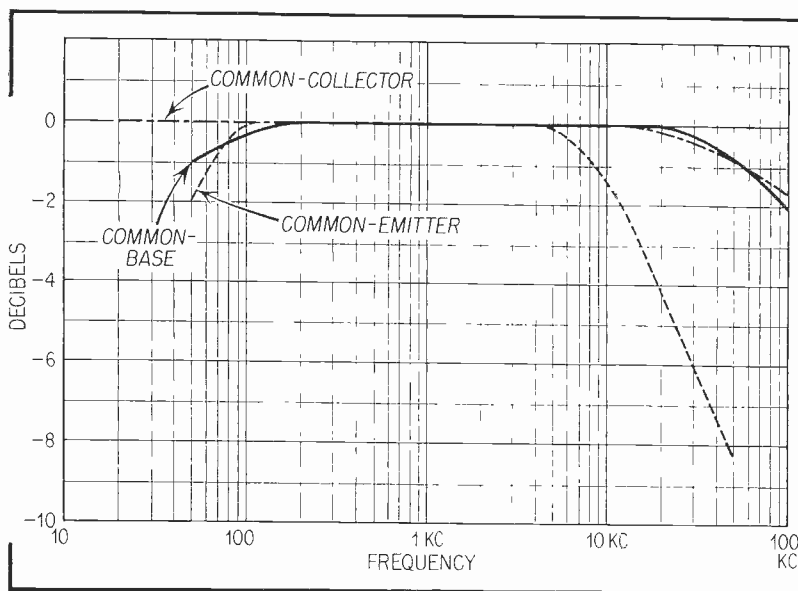


Fig. 3. Comparative Frequency Response of Uncompensated Transistor Amplifiers.

generator enough to upset the readings of an attenuator if the latter is in the actual output circuit of the generator. The best remedy if the generator output impedance is between 1000 and 10,000 ohms, is to employ a step-down coupling transformer to match the transistor amplifier input impedance. (See Figure 1.) This transformer must be shielded and have excellent frequency response. The amplifier input-signal voltage must be measured across the secondary winding (Points a and b). Because the transformer will have a step-down turns ratio ( $1/x$ ), the generator must supply a signal voltage amplitude  $E = xe$  to the transformer primary, where  $e$

is the desired amplifier input-signal amplitude.

**Frequency Response.** The setup shown in Figure 2 may be employed for frequency response measurements. The amplifier is terminated with a load resistance,  $R_L$ , equal to the amplifier output impedance. When Switch  $S$  is at Position  $a$ , the a-c vtvm indicates the input-signal voltage. When  $S$  is at  $b$ , the vtvm indicates the corresponding output voltage. The input voltage is held at a constant amplitude while the tests are repeated at a number of frequencies throughout the a-f spectrum.

Some transistor amplifiers contain frequency-compensating circuits for desired response characteristics. These

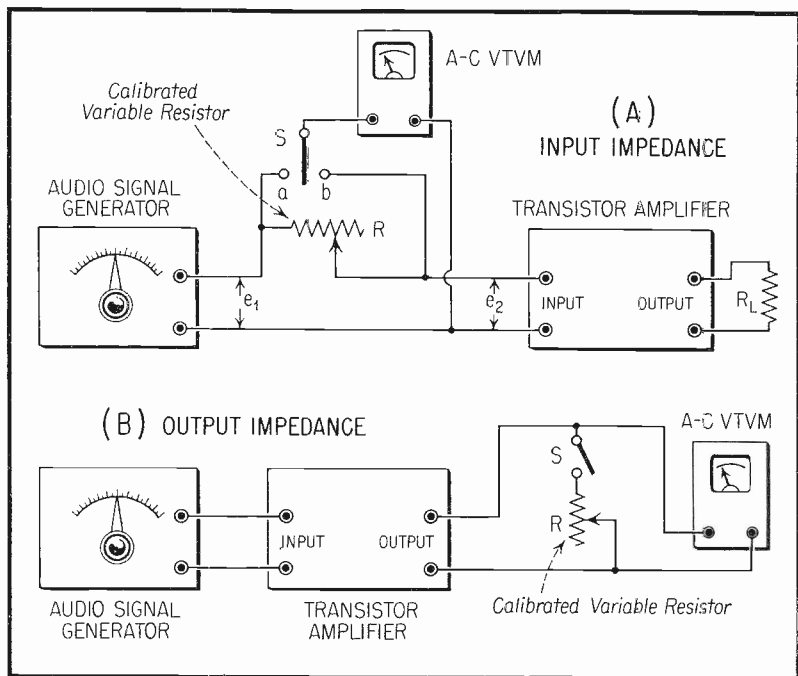


Fig. 4. Test Setups for Impedance Measurements.

response features accommodate certain pickups, recorders, and instruments. The response curve should be consulted in the amplifier manufacturer's service literature for comparison of test data obtained in a frequency run. Uncompensated transistor amplifiers have typical frequency responses for the common-base, common-emitter, and common-collector configurations. Figure 3 shows typical response curves for single-stage resistance-capacitance-coupled circuits. These curves will be modified somewhat when transformer coupling is employed in the amplifier, by the response characteristic of the transformer.

**Voltage Gain.** The test setup shown in Figure 2 may be employed also for voltage gain measurements. The a-c vtvm-millivoltmeter indicates the input-signal voltage ( $E_1$ ) when Switch S is at Position a, and the corresponding output-signal voltage ( $E_2$ ) when S is at b. The voltage gain (A) is calculated:  $A = E_2/E_1$ . The amplifier is terminated with a resistance  $R_L$  equal to the amplifier output impedance. When power transistors are employed in the output stage, Resistor  $R_L$  must be rated to withstand safely at least twice the expected power output of the amplifier.

**Power Gain.** The test setup shown in Figure 2 may be employed also for measurement of amplifier power gain. The test procedure is the same as that described in the preceding Section for voltage gain; i.e., the input-signal voltage ( $E_1$ ) is measured with Switch S at Position a, and the corresponding output-signal voltage ( $E_2$ ) with S at b. The input power level ( $P_1$ ) is equal to  $E_1^2/R_1$ , where  $R_1$  is the input resistance (impedance) of the amplifier; and

the output power level ( $P_2$ ) is equal to  $E_2^2/R_L$ , where  $R_L$  is the matched load resistance. The power gain is calculated:  $PG = P_2/P_1$ .

**Input Impedance.** Figure 4(A) shows the test setup for measuring amplifier input impedance. In this arrangement, R is a calibrated, non-inductive, variable resistor, preferably an accurate decade box. The amplifier is terminated with a load resistance,  $R_L$ , equal to the amplifier output impedance. When Switch S is at Position a, the a-c vtvm-millivoltmeter indicates the output voltage ( $e_1$ ) of the generator. When S is at b, the vtvm indicates the amplifier input-signal voltage ( $e_2$ ).

To make the test, set Resistor R to zero resistance and adjust the generator output for undistorted amplifier output. Throw Switch S to Position a and note the value of voltage  $e_1$ . Next, throw S to b and adjust Resistor R to reduce the signal voltage to one-half the previous reading. (This new value is  $e_2$ ). When  $e_2$  thus is  $1/2e_1$ , the resistance setting of the variable resistor, R, automatically shows the input impedance of the amplifier.

**Output Impedance.** Figure 4(B) shows the test setup for measuring amplifier output impedance. In this arrangement, R is a calibrated, non-inductive, variable resistor. When power transistors are employed in the output stage of the amplifier, this resistor must be able to withstand safely at least twice the expected power output. The generator is adjusted for maximum undistorted output of the amplifier. With Switch S open, the output-signal voltage (E) is measured with the a-c vtvm. Switch S then is closed, and R adjusted to reduce the meter reading to  $1/2E$ . At this point,

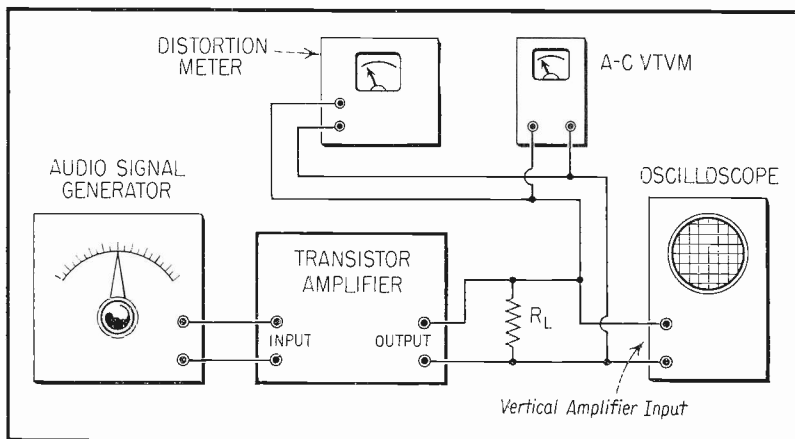


Fig. 5. Test Setup for Distortion Measurement.

the resistance setting of the variable resistor indicates the output impedance of the amplifier.

**Distortion.** Figure 5 shows a test setup for the measurement of harmonic distortion. The generator must supply an exceptionally pure sine-wave signal. The distortion meter will be necessary for rapid, accurate measurements of distortion percentage; and when this instrument is available, the oscilloscope and vtm are useful but not mandatory. The oscilloscope alone may be employed for qualitative detection of distortion and for slower (and often less accurate) analysis of distortion. The vtm will not be required if the oscilloscope is voltage-calibrated.

When only an oscilloscope is available, the presence of distortion may be ascertained by noting how much the output signal of the amplifier departs from sine waveform. Peak flattening, high-frequency loops, bending or breaking of the trace, and ringing phenomena are readily visible. However, determining the actual percent-

age of distortion from these patterns is not always easy.

Crossover distortion is present in some pushpull transistor output stages, especially in Class-B amplifiers, when the d-c base bias has fallen off. Figure 6 shows the output wave shape which depicts this trouble. Not all cases are as severe as that shown in this illustration.

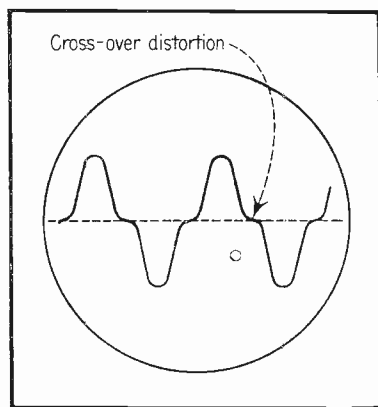


Fig. 6. Pushpull Amplifier Wave Pattern.

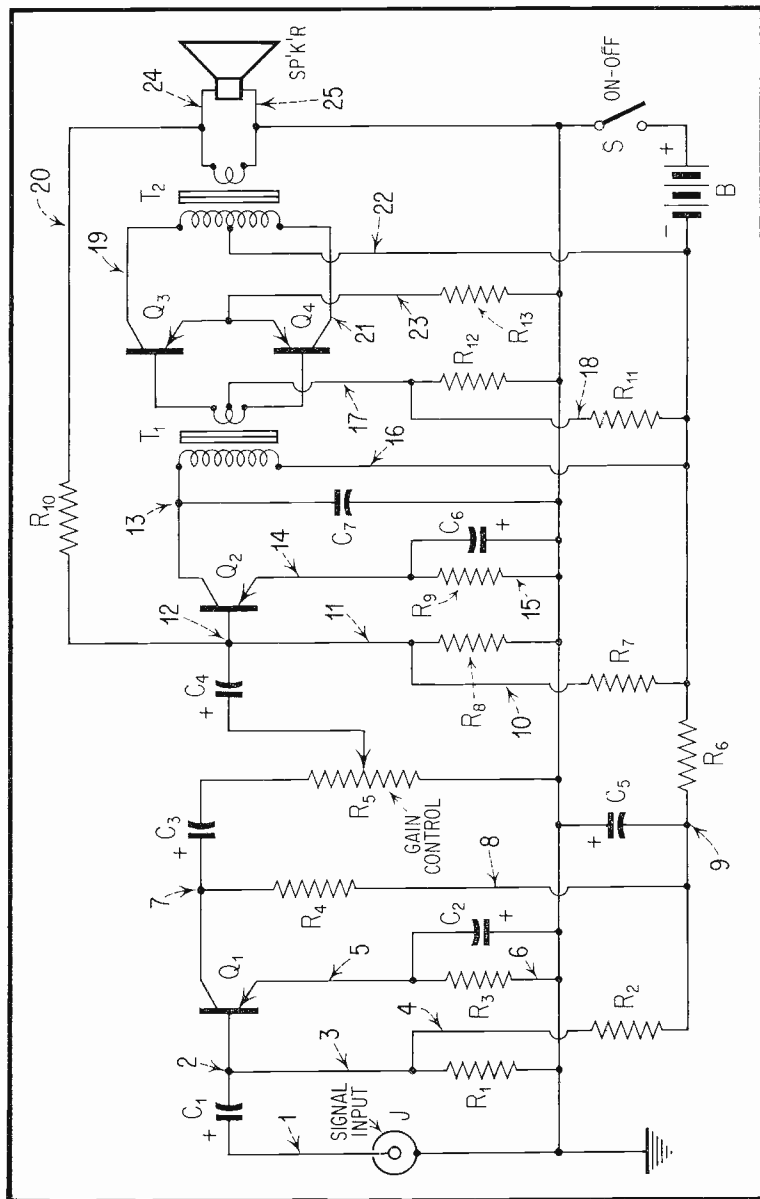


Fig. 7. Typical Transistor Amplifier.



**Collector Current Balance.** A low-resistance d-c milliammeter must be used for checking collector current in a pushpull stage. The meter is inserted successively at Points 19 and 21 in Figure 7. The current should be checked separately under zero-signal and maximum-signal conditions.

**Noise.** To check the amplifier noise level, connect an a-c vtvm-millivoltmeter across the loudspeaker voice coil (Points 24 and 25 in Figure 7) or across an equivalent dummy load resistance, and read the voltage with the amplifier gain control set for maximum gain. Tests should be made separately with the amplifier input (Jack J in Figure 7) open and short-circuited. In the absence of a vtvm, a voltage-calibrated oscilloscope may be employed for measurement of the noise voltage.

Noise voltage often is combined with hum voltage in the output of any amplifier. A listening test is invaluable in establishing the character of the voltage measured in this test. In some transistor amplifiers, particularly those which do not employ low-noise transistors, the noise level is somewhat higher than in a tube amplifier of the same gain and power output.

**Temperature Characteristics.** In transistor amplifier development work, the variation of gain, power output, distortion, d-c parameters, and frequency response with temperature is of interest.

For significant temperature tests, the entire amplifier, including batteries, should be enclosed in the test oven or refrigerator. Only input, output, and instrument leads should extend outside. In this way, the complete amplifier is subjected to the test environ-

ment in much the same way that it will be exposed to an operating environment.

The test temperature should not be varied outside of maximum values specified by the transistor manufacturer.

### **Amplifier Troubleshooting and Repairing**

The measurement procedures outlined in the preceding Sections are good troubleshooting procedures as well and can serve to localize trouble in a transistor amplifier. Thus, a power output measurement would serve to pin-point a defective output or driver stage. Subsequent specific tests, such as d-c current and voltage measurements, then could spot the defective component in the stage.

**Transistor Test.** In a tube-type amplifier, a large amount of trouble is due to defective tubes. In a malfunctioning amplifier, a tube probably is bad. In a transistor amplifier, the opposite situation is apt to prevail — the transistor probably is not bad. Thus, testing tubes is a logical first step in shooting trouble in a tube-type amplifier, but testing the transistors is perhaps the last test to be performed in a semiconductor amplifier. Transistors essentially are long-lived. When a transistor is tested, the characteristics to be measured are alpha or beta,  $i_c$ , and  $i_{co}$ .

**D-C Parameters.** Direct currents and voltages should be checked first in a completely dead transistor amplifier. Use only a d-c vtvm or 20,000 ohms-per-volt non-electronic meter for this purpose. Check all collector voltages (between ground and 7, 13, 19, and 21 in Figure 7), next all base voltages (between ground and 2, 12, and 17), and finally all emitter voltages (between ground and 5, 14, and 23).

The fixed d-c base bias is extremely important in stabilizing the operating point of the transistor amplifier. In the circuit given in Figure 7, base bias voltages are set by the resistor divider networks  $R_1$ - $R_2$ ,  $R_7$ - $R_8$ , and  $R_{11}$ - $R_{12}$ . Current is limited by emitter resistors  $R_3$ ,  $R_9$ , and  $R_{13}$ . The amplifier must not be operated for a long time without these networks, especially in a hot environment. When the base voltage is discovered to be incorrect, the faulty resistor must be replaced with the correct value at once.

Direct currents may be checked with a suitable low-resistance milliammeter inserted at Point 3, 5, 8, 11, 14, 16, 17, 22 or 23. Care must be taken in the use of a d-c microammeter. Most of these instruments have high internal resistance which can change the operating point of the transistor significantly.

Small-sized, low-voltage electrolytic capacitors are employed in miniature transistor amplifiers and hearing aids. These capacitors ( $C_1$ ,  $C_2$ ,  $C_3$ ,  $C_4$ ,  $C_5$ , and  $C_6$ ) should be checked occasionally for leakage. For this purpose, unsolder one lead from the circuit. Do not use an ohmmeter; instead, apply a d-c voltage not in excess of the specified d-c working voltage of the capacitor and measure the corresponding leakage current with a milliammeter or microammeter, observing the correct capacitor polarity. Excessive leakage will change the d-c voltage at Points 2, 5, 11, 12, and 14.

**Signal Tracing.** Conventional methods of signal tracing may be employed in troubleshooting transistor amplifiers. Thus, an audio signal generator may be connected to Input Jack J in Figure 7, and an a-c vtvm, oscilloscope, or conventional signal tracer employed to follow the signal through the amplifier

at Points 1, 2, 7, 12, 13, 19, 21, and 24 in that order.

**Repair Precautions.** While transistors are being removed from a circuit, they must be protected from the heat of soldering. Each pigtail should be gripped between the jaws of pliers and held in this way until completely cool.

Numerous commercial amplifiers employ printed circuits. The common precautions should be observed when working with these etched or printed boards; e.g., a soldering pencil is preferred to a gun. The wiring on the board must be protected from mechanical damage as well as from heat.

Never perform a signal test of any kind on a transistor amplifier unless the latter is suitably terminated with its loudspeaker or an equivalent dummy load resistor. If this rule is not followed, the transistors in the output stage may be damaged by excessive power dissipation.

Always provide a satisfactory heat sink for power transistors operated at high output levels. Do not test or operate a transistor away from the heat sink provided for it in the amplifier. When replacing a power transistor, be sure to replace any insulating washer or wafer used to isolate it from the chassis or heat sink.

Do not remove d-c stabilizing networks, such as resistor voltage dividers, thermistors, or special diodes from the amplifier circuit. The voltage established by a stabilizing network often prevents destruction of the transistor by collector current runaway.

Keep the d-c power dissipation of a transistor safely within the limits specified by the manufacturer. Varying a base, emitter, or collector resistor from its correct value may produce a current increase of sufficient magnitude to exceed rated dissipation of the transistor.



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**FOR SALE** — RCA Victor 6M1 45 rpm Slide-o-matic record player in very good condition, single play automatic start and stop, in original carton, best offer. Lawrence Albert, 292 Foster St., Brighton 35, Mass.

**FOR SALE** — Pair of unused 4-250A's, sockets, blowers \$50, 4-65A socket \$15; 300W Kenyon modulation \$25; 500W RCA modulation \$20; 1750V, 500 MA transformer \$25; B&W TR switch \$15. K. J. Chase, 1164 Edgemere Dr., Rochester 12, N. Y.

**FOR SALE** — Weston multimeters, tube testers, portable standard meters and capacity meters; Electro-Voice 612 mike with switch, cable, desk stand and GE 1N158 rectifiers. Send for list. O. Hergenhan, 335 Hoe Ave., Scotch Plains, N. J.

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**TRADE** — Weston 665 selective analyzer with model 666 tube sockets for late model tube tester. Nickles Lettieri, 588 Humboldt St., Brooklyn 22, N. Y.

**FOR SALE** — Antiques: Murdock 43-pl. var. condenser in table-top case; Radiotron UV200 (brass-ceramic base); also UV199, 201A tubes, var. grid leak, Baldwin phones, auto license plates. Make offer. J. D. Hannel, 304 South Ivy St., Arlington 4, Va.

**FOR SALE** — Motorola 7" TV receiver with cabinet, good working order except needs picture tube. Make offer. H. Rosenberg, 57-19 254th St., Little Neck, L. I., N. Y.

**WANTED** — Circuit diagram for Citizens, Stewart-Warner elec. "Portafone" Model 73 walkie talkie. Manufacturer unable to comply. Will pay reasonable price. M. E. Zwoster, 5708 Palatine Ave., Seattle 3, Wash.

**FOR SALE** — Sams Photofacts 151-372 and 21 binders; also sets 45, 58, 71, 108, 118, 119, 123, and 148. Make offer. Guy Hollis, Box 155, Scottsboro, Ala.

**FOR SALE** — Heath G-10 scope, expertly wired, like new cond., \$59, probes included. Randall's Radio & TV, PO Bin 52, Hobe Sound, Fla.

**FOR SALE** — "Super Constellation" SC-500S, high-gain fringe-area TV antenna, double stack, with mast, less than half price, \$37; Zenith FM-AM clock radio, gray, \$52. Write for free list of other electronic equip. Stanley Bombka, R-3, Eagle River, Wis.

**FOR SALE** — Mallory No. 952W vibrators \$.50 each, and No. 4000 2-volt vibrators \$.25 each; Electronic Lab, Inc., 2-volt vibrators \$.25 each. Include postage for return. V. Krull, 301 W. 19th, Houston, Texas.

**FOR SALE** — Gonset 6 meter converter, 50 w. 6 meter trans. with mod. and 6/12 v. DC dual power supply @ 265 v. DC 50 ma. and 540 v. DC 450 ma. with complete set of heavy duty cables and 60" whip ant. with base, \$175 with spare set of tubes, FOB. Bart B. Bonney, 86 Pennsylvania Ave., Coatesville, Pa.

**SELL OR TRADE** — Unused Heath TS-4A TV sweep generator, in perfect condition with manual and test leads, \$55 FOB, or swap for Heath AG-10 sine and square generator or similar audio osc. H. D. Maresh, 4732 Baylor Dr., Bartlesville, Okla.

**SELL OR TRADE** — Edison Amberola cylinder phonograph, enclosed horn type, in very good condition, with 15 cylinders. Want BC-221 freq. meter. Vernon F. Slavik, 511 4th St. N.E., Montgomery, Minn.

**GIVE AWAY** — Number of surplus electronic parts, postage paid by you upon arrival. W. C. Knepper, Rt. 5, Box 216, Cumberland, Md.

**FOR SALE** — Heath pre-amp., in very good condition and working, \$17.50. Gil Howarth, 216 1st Ave. East, Oskaloosa, Iowa.

**WANTED** — Gonset comm. for six meters. Will pay reasonable price, have low freq. gear. Charlie's Radio Service, 81 Warren St., Roxbury 19, Mass.

**FOR SALE** — Thirty Sams Photofact binders only for best offer over \$1.50 each, just like new. John Bossone, 24 Benjamin Dr., North Providence, R. I.

**FOR SALE** — RCA WR-36A white dot bar generator, rf and video outputs, complete, in orig. carton, \$95. Local preferred. Walter Raucher, 5101 Morley Dr., Greendale, Wis.

**WANTED** — Riders Radio and TV manuals, must be bargains. Vlad Hamato, Schuyler, Neb.

**FOR SALE** — 2 meter trans. 100 watts 832-829B final, \$90. Have several 2 meter frequency meters, \$10; 6 meter Tectcraft, \$25; Eico 425 scope less CRT, \$28. Stan Doben, 82-03 Hammels Blvd., Rockaway Beach 93, N. Y.

**SWAP** — Complete sound system for in or outdoors, with choice of speakers with 40 watt Bogen amplifier. Want comm. radio such as SX-71, SX-62 or what have you?? John Arnold, Wilson St., Bluffs 3, Ill.

**TRADE** — Hallicrafters SX-100 communications receiver and matching speaker and photo equip., for high quality dual track tape recorder or Hi-Fi components. Local only. Bernard Arkenau, 23 Berwyn St., East Orange, N. J.

**WANTED** — Crystal calibrated marker generator, prefer Hickok 680, 690, or RCA WR-99A. Must be in good cond., and reasonably priced. Bernard Fritz, 3608 St. Lawrence Ave., Reading, Pa.

**SELL OR SWAP** — Dumont 208 scope, \$45; RME-84 comm. receiver, 550 kc-42 mc., \$40; surplus schematics and technical manuals. Send for list. S. Cansalvo, 4905 Roanne Dr., Washington 21, D. C.

**WANTED** — For cash: WD-11 (old) tubes, and Hickok 209A VTVM. Give price, age and condition. Dean Stoner, 903 Page St., Iowa City, Iowa.

**FOR SALE** — NRI model 69 tube tester, sturdy metal case, in good working condition, with the latest roll chart, \$40 cash. Merrill Kline, 625 Spruce St., Pottstown, Pa.

**FOR SALE** — Eimac 304TH, unused, \$10. Want schematic for Freed-Eisemann TV receiver type CHT-1620. Must have voltages, etc., on it. Prefer Riders. M. Shleifer, 3514 Rochambeau Ave., Bronx 67, N. Y.

**WANTED** — Tubes: all types, receiving, TV, radio, special purpose. Will pay cash or swap. William Schechter, 141 Beach 125th St., Rockaway Beach 94, L. I., N. Y.

**SELL OR TRADE** — HQ129X with speaker, very good cond., metropolitan area only. Want Sams, Riders, TV sets, radios, tubes, or ? John Resol, 28 Winans Ave., Newark 3, N. J.

**WANTED** — Supreme TV manuals, 1949 to 1958, also Radic manuals or Sams. State years, price, and condition. Walter Romashko, 14 Ranier St., Rochester 13, N. Y.

**FOR SALE** — Have six very good electric recording A-2P-15 Dictaphones, operates on 115 v. AC, portable belt recording-reproducing units: two separate identical record-reproducing machines and audio amplifier, \$30 each. Tom Conrad, Box 93, Princess Anne, Va.

**FOR SALE** — Asst. of radio and electrical books, \$1-\$2 or 10 for \$10; Heathkit signal tracer T-3, like new, without probe, \$10; Philco Circuit Master VTVM-capacity-ammeter, needs calibrating \$15. J. C. Strickland, 1547 North Ave., N.W., Atlanta 18, Ga.

**FOR SALE** — Electrical Manufacturing, 60 issues Jan. 1953 to Dec. 1958. Make offer. W. Skalski, 280 Carlton Ave., East Rutherford, N. J.

**SELL OR TRADE** — 30 power terrestrial telescope, 60 mm (2.4") objective, Porro-Abbe prisms, screw-apart body, 11" dismountable tripod, adapter, leather case for \$19, or accurate AC volt, amp., watt, or clip-on meter. R. Dusina, Dutch Valley Rd., Knoxville 18, Tenn.

**FOR SALE** — Western Electric 755A spkr, \$25; Heath, C-3 condenser checker, \$15. Both very good condition. Paul Richter, 4235 Wickham Ave., Bronx 66, N. Y.

**FOR SALE** — Riders radio 1 thru 16, \$85; TV 1 thru 8, \$85; both \$150 FOB; SC-1-222-A sig. gen., 8-15 and 150-200 mc, good cond., \$75; RCA WV-65-A batt. volt ohmyst, \$45. Exp. Res. Lab., 62 Broad St., Albany 2, N. Y.

**FOR SALE** — Alliance Tenna scope AB-3 TV booster, \$3 plus P.P. A. C. Scofield, 119 South 23rd St., La Crosse, Wis.

**WANTED** — Heathkit OL-1 in good cond. State price R. M. Burleton, Box 235, Oakfield, Wis.

**FOR SALE** — Meissner 150B band switching final coils, 20-40-75-160 meters, 275 watts CW and tone, Meissner exciter, Johnson match box. All very good cond., \$200. Cecile Malo, 43 Whitman St., Leominster 2, Mass.

**FOR SALE** — Hallicrafter S-53A receiver, 2 years old, in very good condition with manual and original carton. Henry Di Genova, 55 Manor Dr., Newark 6, N. J.

**SWAP OR SELL** — Old copies of Radio and TV News, mostly engineering edition, approximately six years of consecutive issues plus others. Want electronic or photo items. Milton Storch, 3605 Sedgwick Ave., New York 63, N. Y.

**SALE** — Heathkit FM3A tuner, newly wired and in very good cond. Best offer. E. Smith, 6028 North 12th St., Philadelphia 41, Pa.

**WANTED** — Type 304TL tubes or other high plate dissipation types. Ted Dames, 308 Hickory St., Arlington, N. J.

**FOR SALE** — Tube tester, \$15; CTI VTVM, \$15; DC and resistance meter, \$5; De Vrey scope, \$25; also millampere meters. Stanley Tobey, 5103 Pensacola Avenue, Chicago 41, Ill.

**FOR SALE** — Globe Scout model 65, band-switching transmitter, 160 through 10, in very good cond., \$55; Heathkit VFO, \$12. Larryle Kraustuber, 6713 Brookside Rd., Cleveland 31, Ohio.

**FOR SALE** — Heathkit BE-2 battery eliminator, 6 volts, with manual, like new, \$15 or make offer. C. H. Manger, 69-43 181st St., Flushing 65, N. Y.

**FOR SALE** — Used stereo tapes half price; 78 rpm changer-phonosc., \$5; Hallicrafter S-27, 28 to 149 mc, FM-AM, BFO, S-meter; misc. items. Send for list, stamp appreciated. Bradman, 3152 Merchandise Mart, Chicago, Ill.

**FOR SALE** — Motorola P-8501-A test set specifically for testing mobile equip., complete, like new, for reasonable cash offer over \$50. York Marine Radio, Stonington, Conn.

**TRADE OR SELL** — Ballantine 300 VTVM, TS 175 A/u 85-100 mc freq. meter, General Radio 783-A audio power output meter, Hewlett-Packard 208-C, 608-A. Want GR 544-B, 1612A, Techtronix scope. W. C. Pendergast, 9777 East Hasket Lane, Dayton 24, Ohio.

**WANTED** — Teletype model 15, TG-7 or 26, or consider 12. Must be in good working condition for cash and/or trade. Joel Jones, 809 Cherry Dr., Jeffersonville, Ind.

**FOR SALE** — Weston: model 433 AC, 0-150-300-500 volts, with leather carrying case, \$60; model 280 volt-ammeter DC, volts .1-3-30-150, amps 3-30-300, \$25; and model 280 volt-ammeter, 0-15 volts, 0-30 amps, \$10. M. R. Butler, 486 Second St., Northumberland, Pa.

**SELL** — Best offer: complete professional record cutting system: Rec-O-Kut M-12 lathe, additional 240 lines per inch lead screw, TR-12H turntable, Elmat 20 watt Williamson-type 20 to 20,000 within .5 db amplifier. Y. Brevda, 2732 Florida Avenue, Tampa, Fla.

**WANTED** — Operating instructions and schematic circuit diagram of Precision EV-10-S vacuum tube multi-range tester. John Lellelid, Colman, S. D.

**WANTED** — Jackson 648 or comparable late model tube tester. State condition and price. Also need rf sig. gen. State ranges covered. R. Mehrl, 719 Ries St., Dubuque, Iowa.

**SELL OR TRADE** — VTVM, mobile converter 1.5 to 18 mc, VOM, 6 v. vibrapack, 5-tube personal radio. Want — lo-pass filter, match-box, TV rotator, xtal calibrator, or what have you. B. Nastoff, 320 W. 56th Place, Gary, Ind.

**SELL OR SWAP** — Airplane side by side, Taylor Craft complete with brakes — needs recovering — ship good cond., with logs, etc. Want test equipment for Radio and TV business. Russell Naylor, Jr., No. Shore Rd., Cape May Court House, N. J.

**FOR SALE** — National NC-98 communications receiver, with preselector and tilt base, very good condition, \$90. Ed Pims, 814 Albany Ave., Brooklyn 3, N. Y.

**SWAP** — Navy type RBU-2 pan-adaptor, for Hallcrafters SX-25 short wave receiver. C. L. Piester, 304 Alpert St., Fort Collins, Colo.

**WANTED** — Dictograph type wire or tape recorders, also tape recorder, both in any condition. Murray Cohen, 8th Signal Detachment, Ft. George G. Meade, Md.

**FOR SALE** — 12 watt Harmon-Kardon Prelude Hi-Fi amp, like new condition. Best offer. H. Gehring, 1200 Stockwell Lane, El Paso, Texas.

**TRADE** — Popular Electronics issues Oct. '54 to Dec. '58, for books on Handloading of bullets. Also \$40 or best offer on trade for reloading tools and Hallcrafters rec. SX-19. Prefer local. Frank Tarantino, 16 6th Ave., Newark 4, N. J.

**FOR SALE** — BC-221 frequency meter, regulated power supply, good cond. Best offer over \$50. Frank Fels, 1000 Lee's Dr., Las Cruces, N. M.

**WANTED** — Good 8BP4 picture tube. Will sell very good Lafayette F249 and F208 radio control transmitter and rcvr. Victor Scheideler, Rt. 2, Box 197, Burlington, Wis.

**TRADE** — Eico 320 signal generator, like new, with instructions for Heath T-4 or Eico 145 signal tracer. Larry Andrews, 2 Doyle St., Lawrence, Mass.

**SELL OR TRADE** — Old band FM tuner; juke box amp; SCR-522; jig saw; small Hi-Fi amp; TV boosters. Need good rec. changer or turntable, Hi-Fi equipment. Walter Smith, 307 Pleasant St., Charlotte, Mich.

**FOR SALE** — 6 volt battery eliminator by Motorola in good cond., \$10 FOB. Want Polaroid Land camera in good condition. L. E. Smith, Route 1, Trion, Ga.

**WANTED** — Sams Photofacts from 356 to 400 and up. Send set No. and price. Garvis McKeen, 109 Mallory Dr., La Grange, Ga.

**FOR SALE** — Collectors Items: RCA Radiola '20, model AR-918 complete with cabinet and spkr, good condition; Freshman Masterpiece rcvr. ser. No. B-137246 without cabinet and spkr, mint cond. Make offer. A. B. Cross, Jr., 18 Holmes Ave., New Providence, N. J.

**WANTED** — High quality audio test equip: BFO, distortion meters, analyzer, DC scope. C. Jarrold, 115 Mt. Washington St., Everett 49, Mass.

**FOR SALE** — 152-162 mc Gonset 3012, \$36; Hallcrafters 30-50 mc \$30; RME UHF converter 200, \$20; Anchor VHF booster, \$9; two-speed tape recorder; all like new, priced FOB, no trades. R. Lackner, 2029 Bradley Pl., Chicago 18, Ill.

**FOR SALE** — 50 5" test tubes, wired for TV substitution and set check out. No ion trap needed. Guaranteed to work, \$5.50 plus postage. H. Eldridge, 3728 Seneca Ave., Los Angeles 39, Calif.

**WANT** — Hallcrafters S51 marine receiver. Have Regency TV converter and TV booster. W. E. Fuller, R. 1, Dimondale, Mich.

**SELL OR TRADE** — Superior 670A super metered, for Hallcrafters SW or police alarm. Dick Miller, 1920 East Broadway, Muskegon, Mich.

**WANTED** — Hickok tube checker meter for model 534B 20,000 O.P.V. in good condition. C. H. Dietz, 1421 Harris St., Gainesville, Texas.

**FOR SALE** — Permanent Quam magnet speaker, 8" 7.0 max. watts, pincushion shape, and Argos wall baffle, 8" spkr size, \$7.50 for both, plus postage. Merle L. Henske, Route 1, Box 6, Omak, Wash.

**BEST OFFER** — Sams Photofact folders, 1 thru 100, in very good condition, any or all. R. Kreiel, 1026 East-West Hwy., Takoma Park 12, Md.



**SELL OR TRADE** — Complete ham station: Transmitter 300 w., all bands, topnotch audio, quality construction in rack, antenna coupler, Superpro receiver, all in matching gray cabinets. Steal for \$200 or swap for quality audio gear. C. A. Turner, Lowville, N. Y.

**FOR SALE** — Globe Chief 90, \$45 prepaid; Lysco 600 TVI'd transmitter in good condition, \$55 prepaid. L. M. McGee, 501 East Wyatt, Herington, Kan.

**WANTED** — Old one-tube receiver, RCA, Westinghouse, etc., using WD11, UV199, etc., sentimental value; what can I offer? A. J. Canning, 1721 Burnham, Orlando, Fla.

**WANTED** — Heathkit OM1 or OM3 scope and CD rotator. Have KW antenna tuner with B&W KW antenna coils and Johnson 100 mfd per section 7,000 volts per section. Currin Skutt, 119 North Foster St., Lansing 12, Mich.

**WANTED** — Schematic, instruction manual, or any pertinent information concerning set-up and operation of McMurdo-Silver UHF 700 transmitter. Will buy, borrow, or rent such information. F. Brenn, 290 Lenox Ave., Uniondale, L. I., N. Y.

**FOR SALE** — Picture tube rejuvenators, \$15, bias voltage supply incorporated \$3 extra, built-in meter \$3 extra. David Wilson, 13131 N.W. 21st Ave., Miami 68, Fla.

**SELL OR TRADE** — National NC-57 comm. rcvr, fine condition, \$57, or trade towards nearly new portable shortwave set: RCA, Zenith, etc. Vicinity only. Charles Matzinger 3630 22nd St., San Francisco 14, Calif.

**WANTED** — Course on Electric Motors Re-winding and Elements 2 and 6 of CREI. Fred Vicente, 114 East 102nd St., Apt. 1, New York 29, N. Y.

**FOR SALE** — Rider TV manuals 3 thru 8, \$42; 1208 FM signal generator, \$40; Hickok 620 linearity generator, \$40 FOB. Ace TV, 5341 Cordelia Ave., Baltimore 15, Md.

**FOR SALE** — Viking Valiant, new cond., \$329; DX-40 with VFO, \$70; International Crystal FCV-2 six meter converter with case, \$12; 1400vct 400ma plate transformer and 10hy choke \$12 FOB. Cliff Falls, Box 113, Bay Village, Ohio.

**FOR SALE** — Eico 425 scope, \$25. John Sullivan, 19 Horodan Way, Apt. 720, Roxbury 20, Mass.

**FOR SALE** — Deluxe cabinet racks in like new cond., 14" space, \$7, 17 1/2" space \$8; RDZ radio receiver with xtals and oven. Joseph Attoli, 1070 Parker St., Springfield, Mass.

**SWAP** — Recent NRI Radio and TV Servicing course for recent Sprayberry Radio-TV Servicing course. Fred Grimes, 600 Alabama, Savannah, Tenn.

**FOR SALE** — Simpson 260 VOM in very good condition, and portable receivers in working order, same battery only, others AC-DC tube. Best cash offer only considered. S. J. Lonigro, 14 Madeline Ave., Clifton, N. J.

**FOR SALE** — Antique collectors items: RCA Radiola 60, console and Radiola 18, table model, good working cond. Best offer. F. Plonka, 101 Hadwin St., Central Falls, R. I.

**SELL OR TRADE** — Hickok 305 3" oscillograph, \$35; RCA 158 5" oscillograph, \$40; Hallcrafters Super Sky-rider S-11 rcvr, \$35. Want Heath DX-40, etc., CD AR-2 or AR-22, and Heath AG10. Earl Meyer, 121 W. Hollister, Romeo, Mich.

**FOR SALE** — Hollywood CRT check/rejuv., \$15; Pilot F601 FM tuner, \$12; GTC batt. elim., needs filter, \$3.50; RCA remote TV controls, pair 6146 tubes, \$5. R. Dick, Box 3152, Chicago 54, Ill.

**FOR SALE** — Standard coil strips, 17 F/G, 17Q, 59Q, two 59H, also 2 sets of Zenith S19241 chan. 17, \$2 per set. Royal Radio & TV Service, 1494 Genesee St., Buffalo 11, N. Y.

**FOR SALE** — Battery charger, 6 volt, 10 amp., like new condition, with cable, built-in charge and short indicator, Mallory type 6SAC10, for \$10.50. Robert McKinley Jr., 89 Stratford Rd., Eatontown, N. J.

**SELL OR SWAP** — 1957-53 NRI professional TV Servicing Course, no kits. Want Eico model 460 5" scope or model 368 generator. No kits. William J. Reagan, 4705 Avenue S, Galveston, Texas.

**SELL** — Mega-Marker. Sr. crystal controlled TV channel marker generator, good cond.; 30-tube RCA TV chassis, most tubes, and Crosley 19-tube TV chassis, less power transformers. Roy D. Rosner, 843 East 48th St., Brooklyn 3, N. Y.

**FOR SALE** — Tube tester steel cabinet, 3 drawers, A-1; do it yourself automatic tester, 20 sockets, \$75. Electric Repair Shop, 1925 E. Jackson St., Springfield, Ill.

**FOR SALE** — Simpson 1000 tube tester in very good cond., latest tube chart, \$60; Seco GCT-5 grid circuit tube tester, like new, \$12. Want good VTVM. State make, price, and cond. H. Kroll, 221 South Main St., Seymour, Wis.

**FOR SALE** — DX-20 in good cond., neat wiring with plug in back for modulator or VFO, pilot light, complete with manual, \$35 FOB. Local preferred. Louis Gross, 139 Berkshire Place, Irvington 11, N. J.

**WANTED** — TR-4 complete in good shape, also 117MT. Have 6 volt dual vibra-pack, fiber and stainless steel whips, meters, tube tester, moniscope. Sell or trade locally. James H. Young, 4821 26th Avenue N, St. Petersburg, Fla.

**SELL OR TRADE** — 10 TV sets including 21" Dumont and 21" console, as is, \$100 for lot, or trade for Polaroid camera. No deliveries. Hillcrest TV Servicenter, East Chatham, N. Y.

**FOR SALE** — BT: 2 ultraversers, HA3 booster, HA2M antensifier, DA2 1M 2 set coupler, CA1M antensifier, 4 Jerrold AD03 couplers, Regency RCR3 UHF converter, in working order, \$5 each or \$50 for lot. Marv Davidson, 5953 San Vicente, Los Angeles 19, Calif.

**FOR SALE** — Pentron HFP-1 tape preamp in excellent cond., and 9T3M tape deck, needs new belt, for \$25 plus shipping. R. M. See, 1708 East Woodland, Ponca City, Okla.

**WANTED** — Late TV servicing course without kits, B.W. or color. J. Boehm, 3534 No. Narragansett, Chicago 34, Ill.

**FOR SALE** — El-Tronics geiger counter PR-5A, complete with new batteries, headphone, radioactive source and instructions, large 2" meter, never used, \$65. James Maskasky, 225 Ludlow St., Long Branch, N. J.

**FOR SALE** — Janette rotary converter, 110 v. DC to 110 v. AC, 450 watts, completely filtered, weight 50 lbs., will deliver NYC area, \$40. Henry Kudian, 607 West 191st St., New York 40, N. Y.

**FOR SALE** — Tubes: four 829B; two 810; five 2E30; five 2E24; five 803; one 832; one VT127; ten 1626; two 872A; one 808 and one 813. Vincent C. Howerdell, Sr., 223 Terrace Ave., Jersey City, N. J.

**FOR SALE** — Three SL-1 radar-transmitter converters, complete with spare parts; and one TS-311B echo box. Elliot Bell, 5102 Caywood, San Diego 17, Calif.

**SERVICE** — Will assemble electronic equip (specializing in Heathkits) for anyone. Send kit and 20% of cost or send cost plus 25% and I will order. All assembled equipment rushed to you prepaid. Larry Sledge, 4107 Hampshire Dr., Greensboro, N. C.

**WANTED** — Multiphase "Rejuva-Tube" CRT rejuvenator, model RE-1 or RE-2. State details, and if above or below Serial No. 55700 and if 110° and color adapters are included. M. G. Dozier, 315 W. 12th St., Tifton, Ga.

**FOR SALE** — Complete station including Collins 32VI, Hammarlund 110-C, Mosley tri-band ground plane, Turner mike, Bud low-pass filter, and advance coax relay, in operation now, \$450 takes all. Samuel Lieberman, 130-29 228th St., Jamaica 13, N. Y.

**FOR SALE** — Western Electric ship-to-shore 227 radiotelephone, 6 v. DC, complete with 8 new Bassett crystals, instr. book, approx. 25 w. plate input to ant., 4 chan., very good cond., best offer. R. H. Ives, Rt. 2, Box 32, Lynnhaven, Va.

**WANTED** — Good quality Hi-Fi AM-FM tuner, must be a bargain or swap unused intercomm. system or Western Electric amplifier. L. Buddine, 1700 West High St., Haddon Heights, N. J.

**WANTED** — Kwik-check in-circuit capacitor checker; good VTVM; Meissner analyst. Will trade RCA 160-B 5" scope, Superior channel analyzer, Hickok 510 tube and set tester, all types of radios. KcKinley's Radio & TV Serv., So. Main St., Zebulon, Ga.

**WANTED** — Instruction manuals for McMurdo-Silver VTVM 900 and Bridge model 904. William Barnes, 1713 15th St., N.W., Washington 9, D. C.

**WANTED** — Sams schematic for Philco 49-602 radio, in Photofact folder 41. Will pay cash, if reasonable. Clyde W. Wimer, R. 800 Wampum Ave., Ellwood City, Pa.

**SELL OR TRADE** — Tube testers: Fast check, 82, like new, \$29. TC-55, \$18; "Superior" Knight sweep gen., with crystal and leads, \$29; RCA Radiola 66 Hi-boy, AC lighting circuit operated, made in early 20's, best offer. Space TV Service, 131 Stratford Dr., Houghton Lake 12, Mich.

**FOR SALE** — CQ magazines 1949-'52, '55-'57, sell by the year; misc. issues '53 and '54. Write for details. E. Erickson, 148 Miller Ave., Sayreville, N. Y.

**WANTED** — Tube checking charts for Simpson 440 tube checker; operating manual from Nov. 1940 on. Thomas McNichols, 108 Fourth St., San Francisco, Calif.

**FOR SALE** — BC610B transmitter and BC614C speech amplifier, orig. design and untouched, coils for 10 through 160 meters, guaranteed perfect, \$400, you pick up. Julius Shkowitz, 6901 20th Ave., Brooklyn 4, N. Y.

**TRADE OR SELL** — Radio and TV tubes; boosters and UHF converters; 920 Precision tube and set tester, \$35; 3" Pilot TV perfect, make offer. Andrews, 740 Maple St., Bethlehem, Pa.

**WANTED** — Measurements Corp. Standard 65B or 80 sig. gen.; Gonset G36 rcvr.; Gonset Universal power supply with built-in speaker, 12 v. DC - 115 v. AC; Gonset G77B xmr and 12 v. power supply and modulator. L. J. Schnedorf, 610 Monroe Ave., River Forest, Ill.

**FOR SALE** — Solar CF Capacitor Examiner with manual, \$49; Jackson 106 RF signal generator, \$30; Eico 360, TV-FM sweep signal generator and manual. Make offer. Radio-TV Hospital, 116 W. 11th St., Tulsa, Okla.

**FOR SALE** — National SW-54 short wave rcvr, in good cond., all new tubes; pair earphones and instruction manual included. G. Coon, 531 Farley Avenue, Scotch Plains, N. J.

**FOR SALE** — 3 Myers Audions Circa 1923, one for \$7, all three for \$18 P.P. R. Conover, Stone Ridge, N. Y.

**FOR SALE** — Table model RCA TV 17S-350G, 110 v. AC, famous 630 chassis, in working condition. Make offer. Allatt, 151 East 83rd St., New York 28, N. Y.

**FOR SALE** — Heathkit LP-2 linearity pattern generator, completely wired, used once, \$20. Edward C. King, Jr., 129 East Marie St., Hicksville, L. I., N. Y.

**FOR SALE** — Seeburg 100 33 $\frac{1}{3}$  rpm records mechanism in beautiful cabinet, very good cond., plays over 100 hours of music unattended, \$350 or make offer. Major Steve Miller, 4506 South Trask, Tampa, Fla.

**FOR SALE** — Stromberg-Carlson 401 AM-FM tuner; 10 w. Munston Hi-Fi amp.; 4-station intercom and Bogen 2-station wireless intercom, like new. All half-price. C. Collier, Box 2512, South Bend 14, Ind.

**FOR SALE** — Heathkit 0-6, 5" scope, 15 cps - 100 kc, completely wired and gives good service, instr. book and diagrams, \$28 express collect. L. R. Bagwell, 427 Stockton St., Apt. 704, San Francisco 8, Calif.

**FOR SALE** — Single sideband CE 20-A exciter, \$175; Gonset 500W linear amp., \$165; Tri-band beam, \$65; Cook stereo system 50 records, \$55; Livingston stereo arm, \$15; 2 Pickering L.P. diamond cartridges, \$10 each. A. R. Dwyer, 29 Charles St., Merrick, L. I., N. Y.

**FOR SALE** — SS75 - SSB xmr - exciter with built-in Eco for 75 mtrs.; BC221AE freq. meter, no calibration charts, \$30; Van freq. meter 100-25 mc, \$18. Ray Glemser, 6115 North Lawrence Street, Philadelphia 20, Pa.

**SELL OR TRADE** — Modern portable lab. microscope, 3 objectives, 2 oculars, Abbe condenser, brass and magnesium alloy construction, captured in North Africa, good cond., \$100 or trade for good tape recorder or Hi-Fi equip. J. J. Custer, 44-55 Kissena Blvd., Flushing 55, N. Y.

**SELL OR TRADE** — Two Command transmitters, BC-457-A and BC-458-A, with power supply, already converted for amateur operation. Power supply is home brew. Gary W. Grover, 11401 Bellflower Rd., Cleveland 6, Ohio.

**FOR SALE** — Two Federal type 298A 40-50 mc transmitters with tubes, \$20, without, \$10, and 299A 150-160 mc transmitter without tubes, \$10; ABC5 transmitter 100-156 mc, 815 modulator, all tubes, \$15. All units like new. A. R. Eggensperger, 101 Christie St., Tenafly, N. J.

**WANTED** — Electronics Illustrated, Vol. 1, No. 1; Popular Electronics, Vol. 1, No. 1 to Vol. 2, No. 2; Life magazine for June 2, 1958. Will trade for parts or pay cash. Jack Schwingel, 9 West Liberty St., Dansville, N. Y.

**FOR SALE** — Photofact folders, 81-324, good condition, used very little, all for \$150 FOB. Roy O. DeVoe, 500 South Beltline, Madison, Wis.

**FOR SALE** — Two 25 w. Heath amps, Knight 700 stereo preamp, Heath FM built-in AFC, Heath AM — all units expertly soldered, built into one cabinet, \$240. Hans Nordmann, 1070 Washington Ave., New York 56, N. Y.

**FOR SALE** — Riders Radio manuals, Vols. 1 thru 6 and 14, \$15. Darrall Co., 6601 Carnegie Ave., Cleveland 3, Ohio.

**FOR SALE** — 16 L.H. University trumpets with PA 30 drivers, used, good working condition, complete units, \$40 FOB; microphones: Shure 315, \$41, and 55S, \$35 FOB; also amplifiers. Ralph Becholt, 48 East Auglaize, Wapakoneta, Ohio.

**SELL OR SWAP** — Older type tubes back to 1930, national advertised brands, in original cartons. Turner Radio-TV, 2019 Sherman St., Anderson, Ind.

**FOR SALE** — 2 TV boosters: Alliance AB and RMS, model SP5, \$10 for both. M. G. Weiman, 4514 Avenue K, Brooklyn 34, N. Y.

**WANTED** — For parts, damaged or discarded scopes. Need other test equip. Give cond. and price. George Russell, RFD 2, Pulaski, Tenn.

**FOR SALE** — One each 3EP1, 3CP1, 5BP1, 5BP4, 7EP4, 12DP7; 4-8 mfd 1700 v. oil filled capacitors; AM-FM tuner for Magnavox with schematic. All like new, make offer, plus postage, for any or all. Ed Ciuba, 409 Harvard Ave., Hillside 5, N. J.

**WANTED** — Surveying equipment. Have misc. electronic gear including neon sign transformers to sell, sealed carton, \$76; Dietzen tripod, \$40. D. Cuomo, 3023 Radcliff Ave., New York 67, N. Y.

**SELL OR TRADE** — For communication rcvr, or Simpson VTVM - VOM: Heath RF signal generator, completely wired for 110 v. AC and probe; Heath visual aural signal tracer, with probes, wired for 110 v. AC; other radio parts. J. S. Casazza, 14228 Westman Dr., Fenton, Mich.

**WANTED** — Vol. 23 Riders Radio Trouble-Shooters manuals. Will pay list price if in excellent condition. Fred Davis, 43 Rivermont Dr., Warwick, Va.

**FOR SALE** — Good used 1/2 hp GE and Westinghouse with thermocoupling, \$5 and \$6. Dan Umholtz, 392 Armstrong Ave., Jersey City 5, N. J.

**TRADE** — British Honduras mint stamps for radio parts. William Williamson, Belize, Br. Honduras, Central America.

**FOR SALE** — Ballantine 300 electronic voltmeter, \$45; Sola Televolt, T-702 voltage regulator, \$25. R. Van, 412 Humboldt St., Rochester 10, N. Y.

**WANTED** — Late model tube tester, mutual conductance type preferred; also Sprague condenser tester. S. Sirianni, 408 West 54th St., New York 19, N. Y.

**TRADE** — Philco 61-C window air conditioner, very good condition, little used, for good comm. receiver or lab gear. D. R. Canady, 931 South Court St., Medina, Ohio.

**WANTED** — Gonset 2-meter transceiver. Will swap comm. receiver, other gear. State price expected, cond. and model. T. R. West, 78 Greenmanville Avenue, Mystic, Conn.

**WANTED** — BC-683 receiver, any condition. Brown Taylor, 717 Currey Rd., Nashville, Tenn.

**FOR SALE** — Riders Radio Troubleshooters manuals, 1 to 5 abridged and 6 thru 21, for highest reasonable offer. Sweeney's Radio-TV Service, 922 West 5th St., Winona, Minn.

**FOR SALE** — Smith's Advanced Radio Engineering course, \$30; Nelson's TV Engineering course, \$15; speech clipper, \$10; Simpson 260 high-voltage probe, \$3; 100 kc crystal oscillator, \$5; Hallcrafters S-53A, \$35. Frank Walker, 10015 Yale Ave., Chicago 28, Ill.

**WANTED** — Leeds & Northrup, Hewlett-Packard, General Radio and similar quality instruments and equipment for general lab. Charles C. Littell, Jr., 434 Patterson Rd., Dayton 19, Ohio.

**WANTED** — Old radio books, by such as Eico or Conrad Co., Titles: All About Radio Parts, 101 Radio Hookups, etc. Wilbur E. Peatfield, 55 Putnam St., East Boston 28, Mass.

**SERVICE** — Repair all electronic equip for community TV systems. Also design and build special equip for CCTV to your specifications. Hollis Electronics, 87-10 204th St., Queens 23, N. Y.

**FOR SALE** — Motorola: H11-1A Handi-Talkie, 39.85 mc, good cond.; dry battery power pack for transistorized P-31 Handi-Talkie; L2160B-1 120 v. base station, 42.98 mc in good cond. \$425 prepaid in U.S. Clifton Park Electronics, 6009 Falkirk Rd., Baltimore 12, Md.

**FOR SALE** — Gas-driven generator, good cond., 115 v. AC, 60 cy., 2500 watt, continuous duty, with automatic voltage regulator, meter, etc. Best offer over \$200. Local only. C. T. Francis, 153 Nashua Rd., Billerica, Mass.

**WANTED** — Automatic switchboard for several private telephone lines. C. H. Crawford, 216 Russell Ave., Liverpool, N. Y.

**SELL** — Full volumes of QST 1940 thru 1953 except: Nov. and Dec. 1942; May 1944; Dec. 1947; Jan. and March thru July 1948; and Aug. 1951 and 1953. Have Oct. and Nov. 1933; June, Oct., Nov. 1934; Aug. 1935. Make offer. O'Brien, 48 Prospect Ave., Westwood, N. J.

**WANTED** — Schematic for Superior signal tracer, model CA-11. N. B. Bowerman, 1520 Plank Rd., Jeffersonville, Ind.

**FOR SALE** — BC-224H 12 v. receiver; BC-348 converted to 115 v. AC, very good cond., \$65; Hallicrafter T54 7" rack-mounted TV with cabinet, \$25; C-D vibrator converter, best offer; RCA 70 yoke and flyback, both \$5. S. E. Lipsky, 64-85 Wetherole St., Flushing 74, N. Y.

**WANTED** — Good ham receiver. Will trade Webcor Hi-Fi stereophonic tape recorder, like new. E. A. De Cobert, Jr., 609 Henrietta St., Gillespie, Ill.

**WANTED** — Radio and TV correspondence course with or without equip., 1953 or later, for cash. Give condition, price. Cross Radio Electronics, c/o L. Tutela, 629 So. 13th St., Newark, N. J.

**FOR SALE** — Wired and working: Allied's Knight wireless broadcaster 83Y705 with Lafayette crystal mike PA-27; Lafayette KT-116 3-transistor superhet pocket radio with MS-260 dynamic earphone and earmold. S. Sinuk, 61 White Oak Street, New Rochelle, N. Y.

**FOR SALE** — Webcor Magic-Mind 4-speed changer, 1631-27B, plug-in head type, GE reluctance cartridge included, with sapphire 78, diamond 45, LP, dual cartridge, mounted in portable case, ready to plug in. R. C., 20 Deborah Way, Fanwood, N. J.

**FOR SALE** — BC-433G compass receiver, \$12 plus postage; 40 technical and scientific books; all ten Scientific American books, 1958; Nuclear Science Abstracts. Need complete antenna rotator. Julian Sher, 160 Central Ave., Chelsea 50, Mass.

**WANTED** — Tube tester, AC generator, program time clock, FM 152-162 receiver, citizens Walkie-Talkie, VTOM, binoculars, projector. Cash waiting. S. Krzak, 65 Main, Pawtucket, R. I.

**WANTED** — Two meter FM tuner or rcvr for 6 volt mobile. Will trade or sell Gonset 3-30, tape recorder, outdated magazines, photo equip. Send for list. Martin Goffe, 1011-44th St., Brooklyn 19, N. Y.

**WANTED** — Schematic and instruction manual for ECA FM TV sweep signal generator. State cost in letter. Leon Brown, 1446 No. Olden Ave., Trenton 8, N. J.

**SELL OR TRADE** — Riders manuals 1 to 10 inclusive, very good condition, and Clough-Brengle 110 signal generator, for field strength meter, Radion or Simpson, transistor radio, Zenith, GE, RCA, or Westinghouse. Chas. S. Bratzman, 33 Main St., Mexico, Maine.

**TRADE** — Misc. tubes for Raytheon transformer, Part No. C-12A-18395. G. H. Swiska, 109 East School St., Woonsocket. R. I.

**FOR SALE** — GE and Delco 1/3 hp, 110 volts, 60 cy., electric AC motors, \$10 plus shipping. John Georgion, 1460 Grand Concourse, New York 57, N. Y.

**FOR SALE** — Hickok 610A TV FM alignment signal generator, Precision scope, series ES-500A with SP5 probe set, less direct probe, also instructions and schematics. Both very good cond. Local only. K. C. Moss, Millbrook Avenue, Dover, N. J.

**FOR SALE** — Heathkit A-9C 20 watt amplifier, preamplifier, completely assembled in very good working condition, instruction manuals, price reasonable. Gerald Stone, 2501 Nostrand Ave., Brooklyn, N. Y.

**FOR SALE** — DuMont 304A scope, \$225, and type 322 dual beam scope, \$250. Domco, 3023 Radcliffe Ave., Bronx 69, N. Y.

**WANT** — Old time Tru Vue films. Will pay cash or trade meters and tubes. W. J. Erb, 3064 "A" St., Philadelphia 34, Pa.

**FOR SALE** — 1/4 hp, 3/4 hp, and two 1/2 hp, 220-440 volt, 60 cy., 3-phase motors. C. K. Jewell, 206 Oak St., Mt. Vernon, Ohio.

**FOR SALE** — Pickering 190D arm, \$20, 260 diamond cartridge, 1 mill, \$10, 194D Unipoise arm, \$29; Cook stereo: 50 records, \$50 and pre-amp, \$35. Livingston 2 cartridge arm, \$15. Al Dayes, 29 Charles St., Merrick, L. I., N. Y.

**WANTED** — "AM and FM Servicing Short Cuts," by Kiver; Riders Specialized Home and Portable Radio Manuals; manual for 1900A multi-frequency generator. W. E. Schwenzer, 3619 Peach St., Erie, Pa.

**WANTED** — Gonset deluxe mobile converter, all-band or older model. Cash or trade. H. W. Bartsch, R.D. 1, Milton, N. Y.

**FOR SALE** — Antique radios, 1 Breadboard with horn; also tubes for antique radios 46, 47, 58, 201a; price 15 cents. Southgate Radio & TV, 503 East 36th St., Tucson, Ariz.

**WANTED** — Recent Radio & TV correspondence course with or without kit. Carl Gregory V, 109 Newman Avenue, Bayonne, N. J.

**SELL OR TRADE** — Color-Tel color converter with all orig. parts and instructions, \$40; elec. console reed organ with 24 lesson course, \$85 FOB. W. R. Lake, 617 N. Main St., Piqua, Ohio.

**WANTED** — Pix tube checker and rejuvenator with short burn out feature, video sweep 60 to 5 mc; RCA absorption type marker. R. E. Cauble, 345 No. Washington Ave., Whittier, Calif.

**SELL OR SWAP** — Hallicrafter HT6 transmitter, \$50, and S76, \$75; VHF 152 converter 2.6-10, \$50; tape recorder, 3 speed, \$75; Echophone receiver, \$20; 6-meter Walkie-Talkie, \$20; Meissner AM-FM tuner, \$25. Joseph Schwartz, 433 Georgia Ave., Brooklyn, N. Y.

**WANTED** — Color TV equip: color bar generator, and crosshatch or dot gen. Will pay Top Dollar for good used equip., except scopes. O. B. Hasson, 17824 So. Clark Ave., Bellflower, Calif.

**FOR SALE** — National NC-300 receiver with 2 and 6 meter converter, and crystal calibrator. Cost over \$500; sell for \$299. Alan York, East Hampton, N. Y.

**FOR SALE** — RME DB-23 preselector in very good cond., \$30. Louis Tonik, 1204 Passmore St., Philadelphia 11, Pa.

**WANTED** — Isolation transformer any type, Regency DB250 signal booster, Western Electric ERPI 12" transcriptions, RCA KRK 9 tuner. Dom Bruzzese, 150 Norman Rd., New Rochelle, N. Y.

**FOR SALE** — Assembled Heathkit CC-1 CRT checker; 50 common radio and TV tubes in orig. cartons. No reasonable offer refused. R. L. Everhart, RD 3, Fleetwood, Pa.

**FOR SALE** — Globe Scout model 12 xmitter in good cond. with new 6146 tube, \$60. Paul Zarembka, 7716 Country Club Ct., St. Louis 5, Mo.

**WANTED** — AC generator 110 volt, 2-3 kv in working condition for cash or swap test equip and NRI radio-communications course with kits. B. Price, 470 7th Ave., Brooklyn 15, N. Y.

**BEST OFFER** — For Sams Photofact folders: 1 to 12, 28 to 31, 35 to 47, 78, and 88 to 95. John Waskowitz, 541 Marcy Ave., Brooklyn 6, N. Y.

**FOR SALE** — Cooke radio slide rule (K. & E., Co.) with leather case and two manuals. Best offer. Michael Spies, 6529 Merwin Ave., Cincinnati 27, Ohio.

**WANTED** — Diagram and operational data for McMurdo-Silver 905 "Sparx" signal tracer. Will pay well just for loan of it. Gerard A. Baldauf, 3137 Philmont Ave., Huntingdon Valley, Pa.

**WANTED** — Service manual with diagram or repair instructions and parts for Supreme 600 tube and set tester. L. T. Davin, 2457 University Ave., Bronx 68, N. Y.

**TRADE** — QSTs 1920-1953, 406 issues, no duplicates, for QSTs Dec. 1915 to Nov. 1916 and Jan. to Mar. 1917. R. D. Zehr, 4126 Midvale Ave., Oakland 2, Calif.

**FOR SALE** — Heath QF-1 Q multiplier, like new, \$5; Eico 221 VTVM in working con., but ohmmeter range needs repair, \$5. Local only. Max Reiter, 2531 East 19th St., Brooklyn 35, N. Y.

**FOR SALE** — Simpson 383 in-circuit capacitor leakage tester in orig. box, \$40, very good cond. Ralph Buffington, 1113 30th St., Rockford, Ill.

**WANTED** — Condenser decade; Hickok 770 scope; Wheatstone bridge; Hickok 900 or Triplett 2470 wattmeter. Bert C. Emery, 5729-23 Ave. So., Minneapolis 17, Minn.

**FOR SALE** — Heath QF1 and AR3, \$15 and \$40 respectively, or \$50 for both. Butch Houts, 7311 Plank Ct., El Cerrito, Calif.

**FOR SALE** — BC-342 receiver; RA 20 pack; Millen R-9'er preamplifier; Gonset meter converter; Sylvania tube tester; tubes; CRT 7BP7. Charles Horn, 325 East 163rd St., New York 51, N. Y.

**FOR SALE** — Instructograph with built-in oscillator and 10 tapes. Local only. Harold Arblloff, 12 Pinehurst Ave., New York 33, N. Y.



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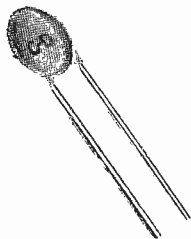
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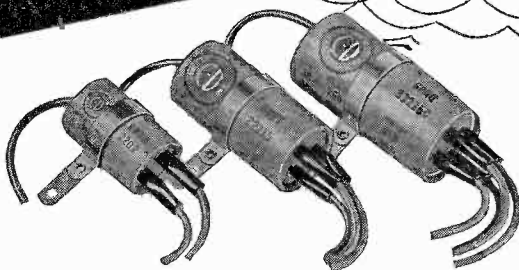
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