G-E Electronic TUBES

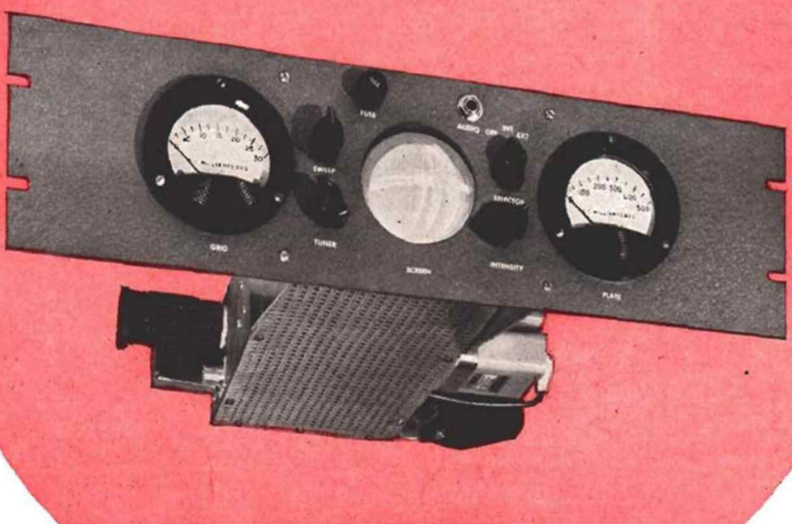
G-E HAM NEWS

GENERAL ELECTRIC

SEPTEMBER–OCTOBER, 1956 VOL. 11—NO. 5

THE HAMSCOPE

monitors your AM or SSB transmitter



The problem of visually monitoring your audio is solved by building a HAMSCOPE, as shown, between your amplifier grid and plate meters—or, if you prefer, in a separate unit constructed to suit your needs.

—*Lighthouse Larry*

CONTENTS

The HAMSCOPE .... page 2
Announcing the 1956 Edison Award .... page 6
Sweeping the Spectrum .... page 7
Using the HAMSCOPE .... page 8

THE HAMSCOPE

DESIGN CONSIDERATIONS

The "HAMSCOPE" is a simplified cathode-ray oscilloscope—designed specifically for checking the operation of amplitude-modulated and single-sideband transmitters operating in the 1.8–30-megacycle frequency range. The screen patterns will tell a more complete story about linearity, distortion, percentage of modulation, than meters or similar indicators. Since a linear sweep, vertical and horizontal deflection amplifiers and other complications are not needed for examining transmitter output, this 'scope is reduced to essentials—the cathode-ray tube; a tuned circuit for applying RF voltage to the vertical deflection plates; a 60-cycle or audio frequency sweep on the horizontal plates; and a high-voltage power supply.

Choice of the cathode-ray tube determines other factors, such as over-all size and voltages, and will be considered first. Even though a late type, the 3KP1, was used in this circuit, older cathode-ray tubes—the 3AP1, 3BP1, 3CP1, 3GP1, 3MP1, or the 2AP1, 2BP1, etc.—should be suitable. Many amateurs already have these tubes stored away, with the intention of putting them to work in a unit of this type.

A cathode-ray tube is similar to other thermionic vacuum tubes in that electrons emitted from the hot cathode are attracted toward a more positively charged anode. The main difference in C-R tubes is that the cathode and several disk or cylindrical-shaped elements, called the electron gun, concentrate the electron stream into a thread-like beam. These elements each have a small axially aligned hole through which the beam passes. The control grid, adjacent to and negatively charged with respect to the cathode, controls the intensity of this beam. The next element is the focusing anode, operating at 30 to 50 percent of the total supply voltage. The accelerating anode, next in line and having a high positive charge, pulls the electron beam through the gun and hurls it toward a phosphor-coated screen on the faceplate. A small spot appears on this screen when voltages applied to the elements have the proper relationship. Last element in the gun, four deflection plates arranged in pairs about the electron beam axis, bend this beam in accordance with a difference in potential between the pairs. Because each point on the fluorescent screen continues to glow briefly after being energized by the beam, the spot traces a composite pattern of any varying deflection voltages applied to the plates.

The electron beam also will be deflected by stray magnetic fields. Presence of a permanent magnet or inductance energized by direct current near the tube neck will cause the spot to move from its normal position. An alternating-current field, such as that which surrounds power transformers, will cause the spot to sweep back and forth at right angles to the plane of the field. For this reason, selecting a location for the power transformer which causes no stray beam deflection is usually the most critical mechanical problem encountered in constructing cathode-ray oscilloscopes. Since the transformer may induce a field into a steel chassis if it is fastened directly to that chassis, an adjustable transformer mounting bracket helps overcome this difficulty.

CIRCUIT DETAILS

Since current flow through a cathode-ray tube is quite small, voltages for the elements may be tapped from a high resistance voltage divider connected across a power supply which need deliver only a few milliamperes of current. Resistance values in this voltage divider, shown in the schematic diagram, Fig. 1, have been selected to offer a wide adjustment range on the "INTENSITY" and "FOCUS" controls, and to place some load on the power supply. Different values should not be necessary even with other cathode-ray tube types and higher supply voltages. Centering controls for positioning the pattern were considered an unnecessary refinement, since most cathode-ray tubes are constructed to place the undeflected spot within ¼ inch of the center of the screen.

If the cathode or control grid is operated near chassis potential (the "normal" method of connecting B-minus), the accelerating anode and deflection plates must have a high positive potential applied to them. This creates a dangerous shock hazard in circuits where the deflecting signal to be observed is connected directly to these plates. The danger is easily reduced by operating the latter elements near chassis potential and applying a negative high voltage to the control grid-cathode end of the voltage divider network. This system also avoids the necessity of using high-voltage coupling capacitors to isolate the deflection plates, the alternate method of reducing the shock hazard. Most 2- and 3-inch cathode-ray tubes will have sufficient pattern brightness for this application if at least 800 volts appear across the voltage divider, although operation at 1000 to 2000 volts insures some reserve brightness. One side of the cathode-ray tube heater is connected to the negative high voltage to insure that the heater-cathode potential difference will not rise above the rated value.

A built-in negative high-voltage supply is pictured in the schematic diagram, rather than depending upon the transmitter being monitored to furnish positive high voltage. Thus, the 'scope will check even *flea-powered* transmitters. Even though special oscilloscope power transformers are available (Merit P-3170 and Triad A-43-C), a conventional replacement-type power transformer delivering at least 600 volts across the *entire* secondary winding was used for T_1. Because of the low current drain, a simple half-wave rectifier and capacitor input filter, which charges up to the peak AC transformer voltage, is suitable. Capacitors C_1 and C_2 should have a working voltage rating at least 1½ times the transformer secondary voltage.

As only a 5-volt rectifier heater winding with no center tap was available on this transformer, the 2.5 volts required by a 2X2A rectifier tube is supplied by inserting dropping resistor R_1 in series with the heater. One section of a 5R4-GY full-wave rectifier tube may be used in place of the 2X2A, R_1 not being required for this tube. The maximum AC voltage-per-plate ratings of most other full-wave rectifier tubes will be exceeded in this circuit, and should not be used.

Both power and horizontal sweep selection are controlled by S_1, wired so that the 'scope is "OFF" in one position. The second position applies line voltage to the power transformer and 25,000-ohm sweep control potentiometer, and the third position also connects the power and applies an external audio voltage, fed through J_1 into this control. The primary of a single plate to push-pull grid interstage audio transformer is connected between the arm and one side of the potentiometer and both ends of the secondary winding connect to the horizontal deflection plates. A transformer with a large step-up ratio, 1:4 or higher, will sweep the full width of most cathode-ray tubes with 20–30 volts RMS applied to the primary. A linear horizontal sweep generator would needlessly complicate the circuit, since the center portion of a sine wave sweep is sufficiently linear.

The vertical deflection plates are connected across tuned circuit C_3—L_1, resonant at the frequency of the RF signal being checked. A small RF voltage fed through a coaxial cable plugged into J_3 is link-coupled to the tuned circuit through L_2. Any combination of variable capacity and inductance which will tune to the desired frequency may be used in place of the parts specified for C_3, L_1 and L_2. The large maximum capacity specified for C_3 enables the tuned circuit to cover all popular bands with only 2 coils, but a bandswitching coil system may be incorporated for added convenience.

MECHANICAL DETAILS

Most relay rack panels with holes cut for three 3-inch meters have about 6½ inches of space between the two outer meter holes, limiting one "HAMSCOPE" dimension to less than this figure. Over-all depth of the unit is regulated by the depth of the relay rack cabinet into which the 'scope will be mounted. Most cabinets are more than 14 inches deep, but the 6- by 14- by 3-inch chassis used on this model is the largest that may be safely accommodated. A chassis drilling diagram is not shown, since available transformers, capacitors, tubes, etc, may vary in size somewhat from the components pictured in Fig. 2. Instead, approximate dimensions for locating major parts have been marked on the side view illustration, Fig. 3. Actual parts to be used should be placed in and about the chassis to find locations which will not conflict with the cathode-ray tube, control shafts, brackets, etc.

Holes for the "SWEEP" potentiometer and S_1 are drilled as close as possible to the upper chassis corners, and corresponding holes for panel-bearing assemblies are drilled at the lower corners. On this model, the hole centers were three quarters of an inch each way from the outside chassis wall. The four control knobs will then form a rectangle about the tube face.

The faceplate end of the tube is not held in a clamp, but rests between two strips of rubber cemented to the underside of the chassis deck and bottom lip. A square hole in the panel end of the chassis for the tube is preferable to a round hole, since the bottom lip must

COIL TABLE

1.8—7.5 MEGACYCLES

L_1—32-uh, 34 turns No. 24 enameled wire, center tapped, wound in two 17-turn coils spaced ¼ inch, 1½ inches long on a 1½-inch-diameter 5-prong molded phenolic plug-in coil form.

L_2—3 turns No. 20 insulated hook-up wire at center of L_1.

9—30 MEGACYCLES

L_1—1.3-uh, 6 turns No. 24 enameled wire, center tapped, wound in two 3-turn coils spaced ¼ inch, ¾ inches long on same type form.

L_2—2 turns No. 20 insulated hook-up wire at center of L_1.

Commercially available coils which may be substituted for the above coils include the Bud CCL or OLS; or the B & W MCL, JCL and JVL series.

PARTS LIST

C_1, C_2—0.1 to 0.5-mfd paper, working voltage 1.5 times secondary voltage of T_1.

C_3—Two-section variable, 10–400-mmf per section.

F_1—Chassis-type fuse holder with 1-ampere fuse.

J_1—Open circuit midget 'phone jack.

J_2—Chassis-type male 2-prong power connector.

J_3—5-prong ceramic tube socket.

J_3—Chassis-type coaxial cable connector.

J_4—5-prong ceramic tube socket.

R_1—5-ohm, 10-watt adjustable resistor.

S_1—4-pole, 3-position, single section non-shorting tap switch (Mallory 3243J).

T_1—Replacement type power transformer with a 600–750-volt, 40-ma high voltage winding; 5-volt, 2-ampere and 6.3-volt, 0.6-ampere heater windings; 115-volt, 60-cycle primary.

T_2—Single plate to push-pull grid interstage transformer having a step-up ratio of 1:3 or higher (Stancor A-53-C, A-64-C).

V_1—2X2A or 5R4-GY rectifier tube (see "CIRCUIT DETAILS").

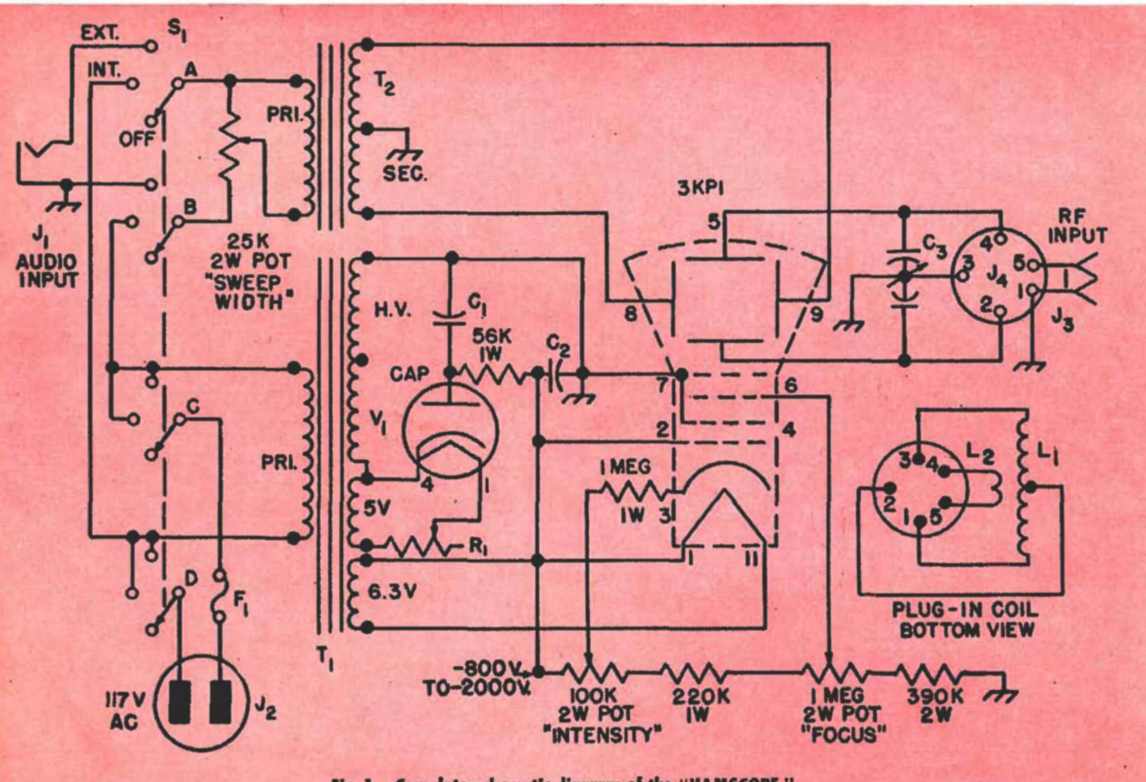


Fig. 1. Complete schematic diagram of the "HAMSCOPE."

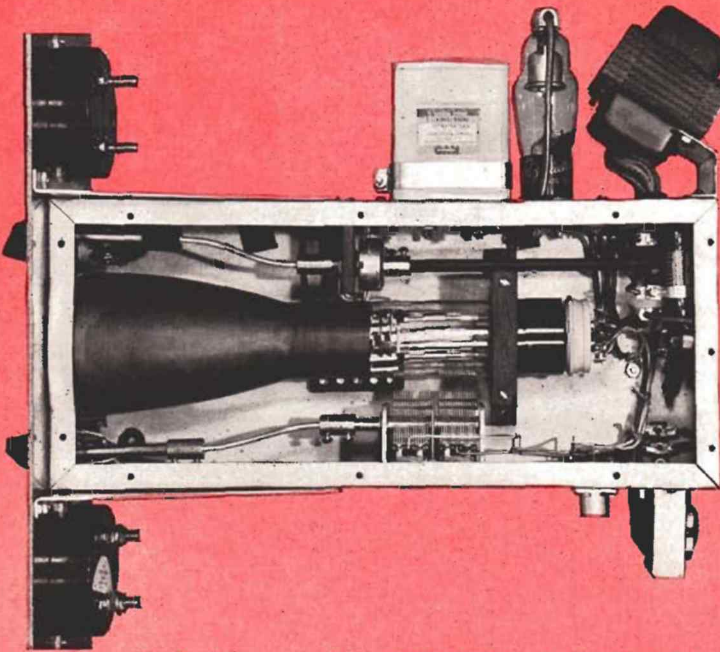


Fig. 2. Bottom view of the "HAMSCOPE" showing the shape of the power transformer mounting bracket and position of components inside the chassis. The plug-in coil has been removed.

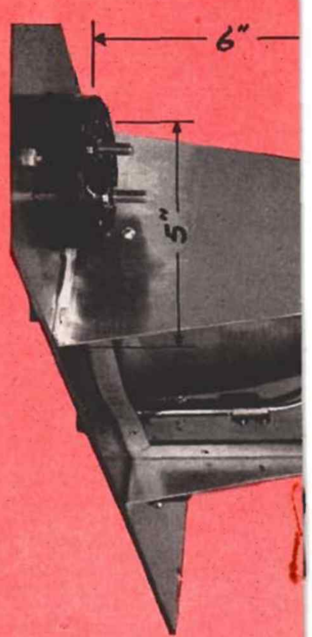


Fig. 3. Side view showing approximat
capacitors. Dimensions of the side brack

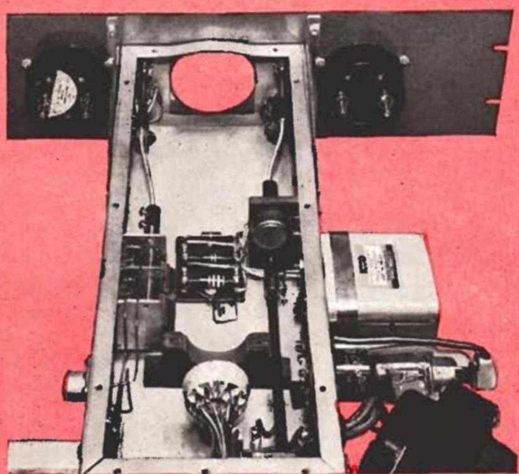


Fig. 4. View from rear of chassis with C-R tube removed to show 3-inch-square cutout in chassis front wall and bulge in bottom lip.

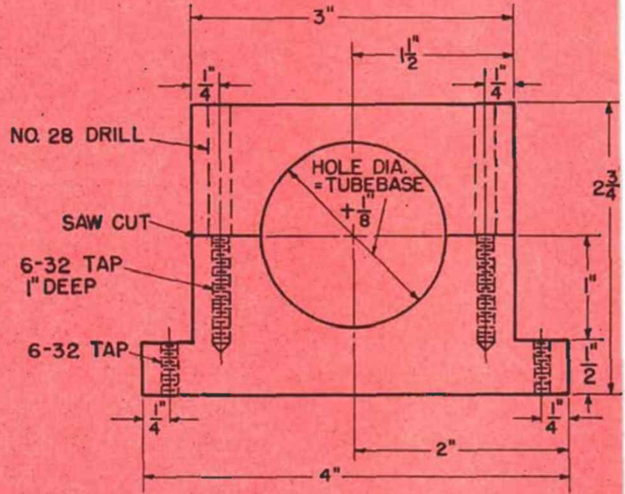
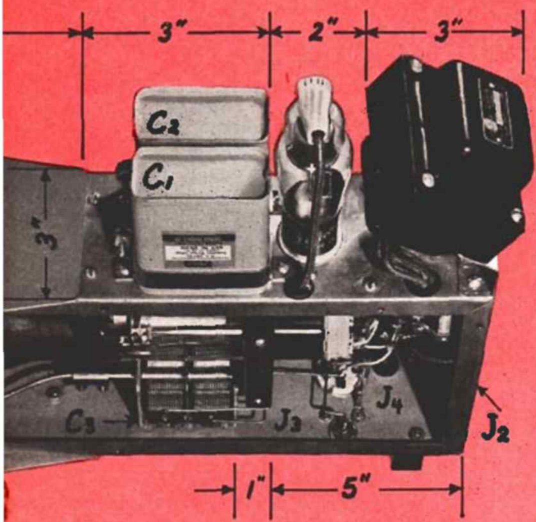


Fig. 5. Mounting bracket for C-R tube base made from ½-inch-thick phenolic insulating board or similar material.

be bent down to clear the large end of the tube as shown in Fig. 4. With the tube in place, the chassis is positioned behind the panel so that the tube is centered in the meter hole. The chassis top deck measured about 1 inch down from the top edge of the rack panel in the correct position. The 3/8-inch diameter chassis holes for the control shafts are now marked on the back side of the panel with a scriber or pencil and matching holes are drilled through the panel in these locations. Large holes for the fuse holder and J_1, and small holes for the chassis support brackets are also drilled. These brackets, shown in the side view, were made of 1/16-inch-thick sheet aluminum and rigidly brace the chassis.

A clamp for the cathode-ray tube base end, pictured in Fig. 5, was fashioned from ½-inch thick phenolic insulating board. A hole 1/8-inch larger in diameter than the tube neck is bored, all small holes drilled, then the board is cut in half at the line indicated on the drawing. Finally, all holes are tapped, except the holes for the clamping screws on the top portion which are redrilled to clear the 6–32 by 1½-inch-long machine screws which hold the clamp together. Then, cement two strips of 1/16-inch-thick sheet rubber into the large hole to act as a cushion for the tube. A sheet aluminum bracket for fastening the power transformer may be fashioned after the proper transformer location has been



spacing of the power transformer, rectifier tube and filter
ts are exact, but may be varied to suit the available space.

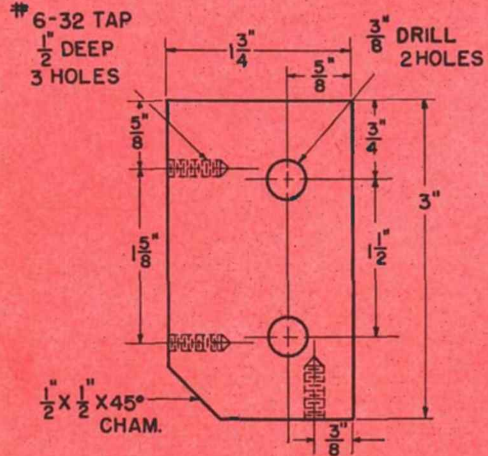


Fig. 6. Bracket made from ¼-inch-thick insulating board to hold the "FOCUS" and "INTENSITY" potentiometers next to the C-R tube neck. Mounting holes may be first drilled in the chassis, then marked on both brackets.

determined by following the suggestions outlined under "OPERATION." Universal mounting transformers will require a bracket similar to that illustrated in Fig. 2. Upright mounting transformers normally have the bolting flange at the bottom, dictating a shorter type of bracket. Tubular-type filter capacitors with leads may be substituted for C_1 and C_2 by supporting them on a terminal board which is placed in an unoccupied portion of the chassis. A steatite 4-prong socket for the 2X2A, or octal socket for a 5R4-GY, is preferable to phenolic types because of the fairly high voltage.

The deflection circuit components mount on the opposite side of the chassis. Sweep transformer T_2 was located at the rear corner, also to minimize the effect of its stray fields on the 'scope tube. The plug-in coil socket, J_4, and the coaxial cable connector, J_3, may be mounted side by side if L_1 and L_2 are to be wound on molded plug-in coil forms. However, if the larger manufactured air-wound coils specified in the "COIL TABLE" are preferred, additional coil space may be obtained by moving J_4 toward C_3 and centering it vertically on the side wall. The variable capacitor should be a fairly compact unit; otherwise the rotor plates may strike the cathode-ray tube neck when the capacitor plates are about half meshed. If necessary, the tube may be positioned slightly off center in the chassis to obtain this clearance. The capacitor shaft is driven through a panel-bearing and shaft assembly coupled to a 3-inch flexible shaft.

A strip of ¼-inch-thick insulating board, shaped and drilled to dimensions shown in Fig. 6, is a convenient mounting for the "INTENSITY" and "FOCUS" potentiometers, both of which are insulated from the chassis. Insulated couplings, a 3-inch flexible shaft, and a shortened 3-inch shaft and panel-bearing assembly permit operation of the "INTENSITY" control from the front panel. A length of fiber shafting extends the "FOCUS" control to the rear of the chassis, since it seldom requires adjustment. The voltage divider fixed resistances are fastened to a small terminal board suspended on machine screws, with extra nuts as spacers, just above the cathode-ray tube neck where they may be conveniently wired to the potentiometers.

WIRING DETAILS

Leads from the power connector, J_2, on the rear of the chassis to S_1 are shielded wire, but all connections except the high-voltage leads are made with conventional hook-up wire. High-voltage wire was used on the rectifier anode, filter capacitor and voltage divider connections. Plastic insulating tubing was slipped over the transformer high-voltage and heater leads for added protection. Connections between the coil socket, variable capacitor and coaxial connector are made with tinned No. 14 copper wire. Leads to S_1 and the "SWEEP" control should be assembled before they are mounted in the rather restricted chassis corners. The cathode-ray tube socket leads should be connected so that pin 1 is *down* for a 3KP1 and have some excess length. For other tube types the pin number denoting the deflection plate axis is placed down.

The power transformer should be temporarily wired into the circuit with all leads left full length and running through rubber-grommeted holes in the power supply side wall. The transformer is permanently mounted following preliminary tests, leads are cut to proper lengths and any unused leads are clipped short and taped. Wiring to the fuse holder and J_1, above the chassis, runs up through rubber grommets placed in ⅜-inch diameter holes. Meters inserted in the outside panel holes are wired into the transmitter circuits by direct connection to the meter terminals. The power leads to J_2 may be connected to existing transmitter filament wiring.

OPERATION

After a final wiring check, set the slider on resistor R_1 to 1.5 ohms with an ohmmeter. Lay the power transformer, which is hanging by its leads, about 1 inch from the chassis in the position shown in Fig. 4. Insert the 2X2A rectifier tube, but do not connect its anode cap or plug in the cathode-ray tube at this time. Connect an AC voltmeter to pins 1 and 4 on the rectifier socket, turn S_1 to the "EXT." position and read the heater voltage. If 2.5 volts is not read, *turn off* the power and adjust the slider on R_1 until this voltage appears across the 2X2A socket with power on.

With the power off, connect the anode cap on the 2X2A, insert the cathode-ray tube and clamp it in place. Again turn S_1 to the "EXT." position and turn

nominations invited for
FIFTH ANNUAL EDISON AWARD

The 1956 Edison Radio Amateur Award again will honor an amateur who has rendered important public service. As before, the Award also will serve to acknowledge the generous help which all radio amateurs offer their communities and the nation when need arises.

For 1956, a new Award winner will be added to the call letter honor roll of the four previous winners (1952—W5PHP; 1953—W9NZZ; 1954—W6VFT; 1955—W2JIO). He will receive the handsome Edison Award trophy, a $500 check, and nationwide recognition.

A committee of distinguished and impartial judges will select the winner from candidates who are nominated by letters from you and others. Since only names submitted in this way will be considered by the judges, your participation is vital. Start now to choose your candidate for the 1956 Edison Award!

RULES OF THE AWARD

WHO IS ELIGIBLE. Any man or woman holding a radio amateur's license issued by the F.C.C., Washington, D. C., who in 1956 performed a meritorious public service in behalf of an individual or group. The service must have been performed while the candidate was pursuing his hobby as an amateur within the continental limits of the United States.

WINNER OF THE AWARD will receive the Edison trophy in a public ceremony in Washington, D. C. Expenses of his trip to that city will be paid.

$500 GIFT. Winner will be presented with a check for this amount in recognition of the public service he has rendered.

WHO CAN NOMINATE. Any individual, club, or association familiar with the service performed.

HOW TO NOMINATE. *Include in a letter these five facts:* (1) Name of nominee. (2) Mailing address of nominee. (3) Actual place of residence of nominee (if different from mailing address). (4) Amateur radio call letters assigned to the nominee by the Federal Communications Commission. (5) A *full description* of the public service performed by the nominee.

In addition, it is desirable—but not absolutely necessary—to supply additional general information such as the following: (6) Age of nominee. (7) Occupation or profession. (8) Name and address of employer (if employed). (9) Telephone number (or telephone at which nominee can be reached). (10) Any other information about the nominee which may be available and which may assist the judges in evaluating the public service performed. (11) Newspaper clippings, letters of commendation, photographs, and other supporting documents are welcomed. Papers having personal value will be returned after the judging, upon request.

BASIS FOR JUDGING. All entries will be reviewed by a group of distinguished and impartial judges. Their decisions will be based on (1) the greatest benefit to an individual or group, (2) the amount of ingenuity and sacrifice displayed in performing the service.

Winner of the award will be announced on or before Thomas A. Edison's birthday, February 11, 1957. Employees of the General Electric Company may nominate candidates for the Edison Radio Amateur Award, but are not permitted to receive the Award.

Generally, amateur radio public services fall under the following four headings: 1. Emergency Communications. 2. Organizational Efforts. 3. Unique Individual Service. 4. Message Handling. They all share equally important consideration by the judges.

JUDGES WILL BE

E. ROLAND HARRIMAN,
Chairman, The National American Red Cross.

HERBERT HOOVER, JR., W6ZH/K6EV,
The Under Secretary, U.S. Department of State

ROSEL H. HYDE,
Commissioner, Federal Communications Commission.

GOODWIN L. DOSLAND, WϕTSN
President, American Radio Relay League.

the "INTENSITY" control clockwise until a pattern appears on the tube screen. Next, adjust the "FOCUS" control until the pattern resolves into a sharp spot or line. If a line is observed, turn S_1 to the "OFF" position and note whether the line changes to a small spot before it fades from view. If it does, the stray field from the power transformer is deflecting the spot. With S_1 again in the "EXT." position, turn the transformer in various positions until the line reaches minimum length. Leave the transformer in this position and take measurements for the mounting bracket, described under "MECHANICAL DETAILS." Tests with three types of transformers indicate that it should be spaced at least 1 inch from the chassis.

The internal 60-cycle horizontal sweep now can be tested by setting S_1 on the "INT." position and turning the "SWEEP" control clockwise until a full-width line appears on the screen. With the sweep transformer specified in the "PARTS LIST," it should be possible to extend the sweep far beyond the tube face.

An external RF voltage is applied to the "HAMSCOPE" by running a small coaxial cable from J_3 to the device being checked. This cable should terminate in a small coil placed near the output tuned circuit in that device. The loop also may be coupled to the antenna tuning network or *balun* coils used with some transmitters. For convenience in making connections, an extra coaxial cable connector may be added to the unit in which the coupling loop is placed.

After tuning C_3—L_1 to the output frequency, the RF voltage on the vertical deflection plates appears as a band across the C-R tube face. Maximum height of this pattern can be set by adjusting the coupling loop; then the C_3—L_1 tank can be detuned to reduce the vertical deflection if desired. A wide pattern is developed on a 3KP1 even from the low output of a grid-dip oscillator coupled to the tuned circuit, indicating good deflection sensitivity. The width of this pattern will vary in accordance with the modulation applied to the transmitter. A detailed description of the patterns obtained from amplitude- or frequency-modulated, and single-sideband-suppressed-carrier transmitters will be found in amateur radio handbooks and magazine articles covering these forms of modulation.

Final dressing up includes: adding control knobs which match those in your station; marking these controls with *decal* labels; cementing a bezel made from ¼-inch-diameter plastic tubing around the C-R tube opening; and fitting a perforated sheet aluminum chassis bottom plate to the underside of the "HAMSCOPE."

SWEEPING *the* SPECTRUM

COUNTERFEIT TUBE RACKET

Fellows—the story you are about to read is true—only the ***brands*** have been changed to confuse the customers. Brands? Not cattle brands! Electronic tube brands! Modern-day rustlers who change the ***brands*** and ***warranty dates*** on electronic tubes are a serious problem and important subject in the radio-television service industry these days.

Before going into the corrective measures now being taken by most tube manufacturers, let's trace the path of a typical rebranded counterfeit tube from one former source—the discarded tube box of a television repair shop or tube distributor. Obviously, such a tube will be very weak at best, or more likely, completely inoperative. The brand counterfeiters usually obtain these tubes for little or no cost, sometimes with the explanation that they are to be used as targets in a shooting gallery. Old markings are removed and the tubes given a cleaning before being rebranded, usually with the trade-mark of a prominent tube manufacturer. The most important step, stamping on a current warranty code number, makes a skilled rebrander's finished ***product*** almost identical in appearance to a new tube.

The rebrander markets reworked tubes through several channels, including turning them back to a tube distributor handling that brand, claiming that the tubes are ***inoperative***—certainly a true statement. New, operative tubes are received in exchange, and these are sold to anyone who will buy them at below-market prices. Some tube rebranders mix these new tubes with rebranded duds when selling them to a repair shop. Of course, the duds are discovered when the serviceman attempts to operate them in a set he is repairing. These inoperative rebranded tubes are also returned to a distributor by the repair shop, again in exchange for new tubes, since the counterfeit warranty code numbers indicate a recently-manufactured tube.

So far, our path has completed a cycle back to the tube distributor for many rebranded tubes—but that's not the end of the trail—since most tube manufacturers have taken definite steps to run the rebranders out of business. Until recently, a common method of handling in-warranty defective tube replacements was for the manufacturer to extend to wholesale tube buyers a percentage discount at the time of purchase which covered the replacement tube costs. Now—to keep worn or defective tubes out of the hands of rebranders, most tube manufacturers offer a tube-for-tube replacement plan, under which the distributor must return to the manufacturer any defective tube covered by a warranty. The manufacturer then gives the distributor a new tube for it.

Returning tubes to the factory which fail while still in warranty serves a three-fold purpose. Each tube is closely examined to insure that it is legitimate and also to determine the cause of failure. Thus, product quality is constantly improved as a result of tube failure studies. In addition, the manufacturer has an opportunity to destroy the tube to prevent it from falling into the hands of counterfeiters. Finally, the ***dud*** tube gives the authorities a clue to locations where counterfeiters are at work.

Additional precautions against counterfeiting are being taken by General Electric, which co-operates with local law enforcement authorities wherever the Company uncovers evidences of rebranding. Men from our security staff are assigned to obtain legal evidence of such illegal operations, recently resulting in the conviction of one rebrander in an eastern city. This tube counterfeiter claimed that his counterfeiting income could have reached $25,000 annually if he had not been ***lazy!*** Equipment required for these operations is simple and easy to transport, greatly increasing difficulties in obtaining the concrete evidence required for successful prosecution.

These rebranded tubes should not be confused with so-called seconds, tubes which do not conform to specifications, nor with legitimate surplus tubes. General Electric destroys "seconds" at the plant, although shady tube brokers at times have attempted to obtain them from us. Surplus tubes, sometimes available at low prices, usually are new tubes obtained from equipment manufacturers who may have gone bankrupt, out of business, or have changed the design of their equipment, etc. Since these manufacturers buy new tubes from tube makers in bulk and may select only those tubes which have certain desirable characteristics, the remainder may be resold to surplus tube dealers considerably below list price.

What about the supply of out-of-warranty discarded tubes still available to rebranders? This is the area where the co-operation of you, the radio amateurs, experimenters, electronic equipment repairmen and general public, counts heavily! Dispose of all such tubes in a manner by which they will no longer be available to the illegal operators! Otherwise, they may again appear on the market as rebranded tubes.

Nearly 500 million receiving and allied type tubes were manufactured during 1955, with a considerable percentage destined for the replacement tube market. For each new replacement tube sold, a dud of that type usually was discarded. The above figures highlight the importance of halting ***every*** flow of duds into illicit channels from this potentially huge source.

Obviously, the best solution to your personal tube supply problem is to deal with an authorized tube distributor. His nationally-branded stocks contain only new, factory-fresh tubes. Low-priced tubes from other sources may be bargains, but if a bulk purchase contains some inoperative tubes, cost of the tubes which do work might be higher than their first-line equivalents. The old saying, "You pay your money and take your choice," definitely applies to tube purchases too!

—*Lighthouse Larry*

USING THE HAMSCOPE

Two types of patterns, wave envelope and trapezoidal, normally are used for checking AM or SSB transmitter modulation with an oscilloscope. The "HAMSCOPE" will present a wave envelope pattern simply by feeding the transmitter RF output into the vertical deflection circuit through J_3 and turning S_1 to the "INT." position. Modulation of the transmitter either by voice or an audio tone will cause the RF carrier band on the screen to vary in height. The pattern may move across the screen or remain stationary if the modulating frequency is an exact multiple of the 60-cycle horizontal sweep frequency.

When a trapezoidal-type test pattern is desired, an amplitude-modulated transmitter output is applied to J_3, but S_1 is turned to the "EXT." position. An audio voltage which is in phase with the audio being applied to the modulated amplifier stage is fed into J_1. With the transmitter unmodulated, no horizontal sweep appears, but the RF output is indicated by a vertical line. Applying 100-percent modulation should result in the usual trapezoidal pattern. Any phase difference between the sweep and modulator audio will cause oval-shaped traces to appear along the upper and lower edges of the trapezoid. This condition may be corrected by installing a 500-mmf capacitor and a 0.5-megohm potentiometer in series with the ungrounded audio lead to the "HAMSCOPE."

The modulation transformer secondary in plate, screen or control-grid type modulators, and the plate of a clamp-tube modulator, are suitable points to connect one end of a voltage divider from which the audio sweep voltage for the "HAMSCOPE" is obtained. This divider should include a: (1) coupling capacitor, (2) fixed resistance and (3) potentiometer, series-connected in that order between the tap-on point and the chassis. Suitable values for these components are: (1) capacitor, 0.005-mfd per megohm of total divider resistance; (2) fixed resistance, 1 megohm per 1000 volts DC potential at the tap-on point; (3) potentiometer, 0.1 megohm. The capacitor should have a working voltage rating equal to 2.5 times the DC voltage, and the fixed resistance should have one resistor for each 500 volts at this point. Audio is fed from the potentiometer arm to J_1 through a shielded cable.

Audio sweep voltage for checking single-sideband transmitters with a trapezoidal pattern on the "HAMSCOPE" may be taken from the output of the separate audio amplifier stage for the voice-controlled break-in circuit with which most SSB exciters are equipped.

RANDOM IDEAS

A smaller chassis, 5 by 10 by 3 inches, may be chosen for a "HAMSCOPE" built around a 2-inch or one of the short 3-inch cathode-ray tubes (3MP1, 3UP1). In this narrower chassis, the tube still should be placed 3 inches from the power supply wall of the chassis. The variable capacitor should be mounted outside the chassis, preferably in a small box, which also could house the plug-in coil socket. The shorter chassis also permits locating the power transformer directly behind the cathode-ray tube base where it is less likely to cause stray deflection effects. Another variation is to select a chassis large enough to also enclose the meters on the panel, which gives the constructor space to add future accessories to the basic 'scope circuit.

If your meter panel has three holes for 2-inch meters, a "HAMSCOPE" using a 2-inch cathode-ray tube may be constructed in a chassis up to 7 inches wide. The "HAMSCOPE" also may be adapted for table mounting by selecting a utility cabinet proportioned to house all components. Again, the principal design problem is locating the power transformer where its stray field does not affect the cathode-ray tube operation.

Electronic TUBES

G-E HAM NEWS

Available FREE from

G-E Electronic Tube Distributors

published bi-monthly by
ELECTRONIC COMPONENTS DIVISION
GENERAL ELECTRIC
Schenectady 5, N. Y.
In Canada
CANADIAN GENERAL ELECTRIC CO., LTD.
189 Dufferin St., Toronto 3, Ontario

E. A. NEAL, W2JZK—EDITOR

Printed in U.S.A.

VOL. 11—NO. 5

SEPTEMBER–OCTOBER, 1956

DES ROBERTS
24-60 MT. VERNON STREET
LYNN, MASSACHUSETTS

Form 3547 Requested