NEW G-E RECTIFIER TUBES

NEW TUBE TECHNOLOGIES and materials have been combined by General Electric Receiv-
ing Tube engineers in three new rectifier tube types which are more efficient than previ-
ous rectifiers.

A new kind of fabricated 3-ply tubular cathode, which acts as its own heater and
thus permits a 45 percent power saving, features the SDG4 high vacuum rectifier
now in production at General Electric.

The total cathode and plate dissipation of the SDG4 is 26 watts, compared to 42 watts
for the 5U4G or 6U6, a substantial saving in pow-
er loss and wasted heat.

This design offers several advantages. It permits use of a relatively large cathode
emission surface, as opposed to the wire cathode of Elementary type rectifiers. Tube
voltage drop is less than half that of other high vacuum rectifiers in similar service.

Elimination of a separate heater eliminates the possibility of heater-cathode failures
through arcing, breakdown or burn-out. Finally, the new large-surface cathodes in the
SDG4 provide exceptional mechanical strength.

Scanning the Spectrum

IMPROVED CARBON MICROPHONE

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---Lighthouse Larry---
IRE SHOW STARS . . .

Many amateurs have been asking us, "What's new in ceramic tubes?" And our best answer has been to show them the ten types which were displayed at the 1960 IRE International Show and Convention in New York City last March.

Capable of operating at high temperatures, ceramic receiving tubes deliver the ultimate in high frequency performance in the small tube range without the use of blowers or other bulky, inefficient cooling systems.

As you can see from this picture, ceramic tubes vary in diameter from about half that of a pencil to a half dollar, depending on power output capabilities. Low noise figures are typically good in these tubes. The tubes are easy to mount, rugged, and provide flexibility in circuit design. General Electric's line of registered types includes:

7027 — low-noise high gain triode for RF amplification.
7366 — high impedance, high frequency diode detector.
7394 — VHF power amplifier triode.
7461 — low noise, high frequency amplifier.
7463 — high frequency multiplier and oscillator.
7635 — low-noise, high impedance, high voltage gain amplifier.

Development models are:
— broad-band, low-noise triode amplifier.
— high push-in voltage medium power diode rectifier.
— low & linear triode power amplifier.
— small high frequency oscillator and multiplier triode.

Of particular importance is the fact that ceramic receiving tubes are relatively immune to spurious radiation.

Increasing acceptance of ceramic receiving tubes is reflected in General Electric's Receiving Tube Department at Owensboro, Ky., expanding its line of these devices.

COMING NEXT ISSUE . . .

... information on high power, high-voltage supplies for mobile operation, plus a construction article on crystal controlled mobile converters. Also, we'll tell you about new, high-gain pentode receiving tubes. Ask for this issue from your nearby G-E Tube distributor. He'll have it about July 15.

NEW PUBLICATIONS . . .

We're planning three new projects at G-E HAM NEWS and want our readers to know about them, since we have had many inquiries about the first two. Details on each project follow.

1. THIRD BOUND VOLUME.

Yes, we're planning another bound volume of G-E HAM NEWS, to be made available in December, 1960 (in answer to a multitude of requests).

This book will contain all thirty issues of G-E HAM NEWS published from January-February, 1956 (Vol. 11, No. 1) to November-December, 1960 (Vol. 15, No. 6).

For those who are not acquainted with our bound volumes, this will be the third such book. The first and second bound volumes (no longer available, and now collector's items, incidentally) contained all issues published in 1946 through 1950, and 1951 through 1955, respectively.

The third bound volume will be rugged hard bound with the cover in gray, orange and black. The book will contain about 250 pages and include a complete cross index of all material contained therein. The cost will be $2.50, postpaid.

2. NEW SIDEBAND BOOK: 

Since our supply of the SSB PACKAGE of G-E HAM NEWS has run out, we're considering compiling all the information we have ever published on sidetube techniques — both single and double — plus related subjects, into a bound book.

This proposed book would contain about 150 pages and be the same over-all size as the G-E HAM NEWS. We're aiming at a selling price of $1.00 per copy, postpaid.

The book will be announced early next fall.

3. KING-SIZE G-E HAM NEWS

In our continuous program to improve G-E HAM NEWS, we've been studying a larger page size — 8½ x 11 inches — as compared to the present 6¼ x 9¼ inch page size. The larger page size would provide 60 percent more usable editorial space in each regular 8-page issue.

If we change the size, it will start with the January-February, 1961 issue. It will also be published on a standard 8½ x 11 inch paper, allowing for insertion in a standard 3-ring binder, thus providing a convenient means for keeping your back issues in good condition.

NOTE: The disclosure of any information or arrangements herein does not constitute an offer or solicitation under any authority of General Electric Company or affiliates, to the disclosure of an interest therein, whether directly or indirectly. General Electric Company assumes no responsibility or liability arising from the use of such information by others.
TABLE I — PARTS LIST, PI-NETWORK TUNER

<table>
<thead>
<tr>
<th>Part</th>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>C2</td>
<td>30-350-muf variable, air gap 0.03 inches per 1,000 plate volts at final (for up to 1,000 volts, see Cornell Pi-8004 or Johnson 350E20, Cat. No. 154-2, for 1,200 to 3,000 volts, use Cornell Pi-8044 or Johnson 350E20, Cat. No. 154-1)</td>
<td>1</td>
</tr>
<tr>
<td>C3</td>
<td>20-200-muf variable, air gap 0.07 inches per 1,000 plate volts at final (for up to 1,000 volts, use Cornell Pi-8050 or Johnson 250E43, Cat. No. 154-1; for 1,500 to 3,000 volts, use Cornell TC-2000-60 or Johnson 250E43, Cat. No. 153-12)</td>
<td>1</td>
</tr>
<tr>
<td>L2</td>
<td>16 inchches, 20 turns, No. 10 tinned wire, 2 inches in diameter, 3/4 inch long, 10 turns wound 4 turns per inch (2 1/2 inchers long) and 10 turns wound 8 turns per inch (1 1/2 inchers long) (order No. 240804 dual pilot indicator)</td>
<td>1</td>
</tr>
<tr>
<td>L1</td>
<td>Same coil as L2, tapped every second turn</td>
<td>1</td>
</tr>
<tr>
<td>M5</td>
<td>0-4-inch thermocouple type R, S, and B (60 feet SM-51, or equivalent)</td>
<td>1</td>
</tr>
<tr>
<td>F1</td>
<td>Fig. 1, positions 2, 3, position heavy duty ceramic insulated tap switch (from Telecine, Inc. transmitter)</td>
<td>1</td>
</tr>
<tr>
<td>F2</td>
<td>Fig. 2, position 11, section 10-feeler power tap switch ceramic insulation (Ohmite Model 111, 11 taps)</td>
<td>1</td>
</tr>
</tbody>
</table>

FIG. 1. SCHEMATIC DIAGRAM OF THE PI-NETWORK ANTENNA TUNER MODEL SHOWN IN THE PHOTO.

FIG. 2. DIAGRAM OF A TUNER WITH ADDITIONAL diapositives ON THE COIL TO OBTAIN A PRECISE IMPEDANCE MATCH. A 15-microhertz rotary inductor (Johnson 229-202, or equivalent) can replace L4 and L5.

"W3985, a mechanical engineer by profession, is Manager — Pump and Valve Engineering, in the Machinery Apparatus Operating General of Electrogenic Turbine Division in Schenectady, N. Y."

His previous contributions to G-E HAM NEWS have been the "SQUID HIGH C VFO" in the July-August, 1939 issue, and "Soltech, Para-Chump" for the Special DX LOG issues of G-E HAM NEWS (the latest DX LOG was published in July-August, 1938). The latter is a by-product of Sam's veldt DX chasing. His present SRECK country hams is just over 200."
of coaxial feedlines and the impedance matching properties of the tank circuit itself. By tuning a pi network around, it can match a low-impedance coaxial cable to a high-impedance end-fed antenna.

As W2FPH, a pi-network tuner was constructed to resonate a long wire antenna on three bands, 20, 15 and 21 megacycles. The schematic diagram is shown in Fig. 1. Total inductance of the coil, L1, for the 20-megacycle band, and the tap positions for 15 and 21-megacycle operation, were determined by experiment. A 64-ampere r.f. ammeter was installed to indicate maximum antenna current.

More tape can be added to L1, as shown in the diagram of Fig. 2, to provide greater flexibility in matching. An 11-position power type tap switch will withstand the r.f. voltages present when insulatated from the tuner panel. Tape on every other coil turn.

A BACK PANEL was used to support all components in the pi-network tuner at W2FPH, shown in the photo. Any make of variable capacitor having the proper capacitances and plate spacing should be suitable for C3 and C4. The coaxial cable connector was mounted on an aluminum bracket fastened to C. The coil was supported between the capacitors on its leads (No. 10 wire). Leads for the coil taps and ammeter connections were made from No. 12 tinned solid wire. The parts layout for this tuner is shown in Fig. 3.

A 15-megacycle rotary indicator can be substituted for L3 and S. Its current rating should be at least 5 amperes for a kilowatt transmitter. For 100-watt class transmitters, use smaller tuning capacitors and inductance, as suggested in TABLE I.

When installing the pi-network antenna tuner, be sure to connect the panel to an earth ground with a short, direct lead. Preferably, the tuner should be located close to the point at which the end-fed antenna lead-in enters the shack. A standing wave ratio indicator in the coaxial cable between the transmitter and tuner is handy for initially determining the correct settings for C3, C4 and S for each of the bands to be covered.

The end-fed antenna installation at W2FPH is depicted in Fig. 3. Note that the total length of wire in the antenna is measured from the connection to the antenna tuner. If the ground lead is more than a few feet long, it should be included in the over-all length.

By selecting an antenna length that is an odd number of quarter wavelengths long on the lower frequency amateur bands, the feed

---

**TABLE II — END-FED ANTENNA LENGTHS**

<table>
<thead>
<tr>
<th>Overall Length &quot;L&quot; Including Lead-in (Feet)</th>
<th>Number of Quarter Wavelengths at</th>
</tr>
</thead>
<tbody>
<tr>
<td>105</td>
<td>3.5 MC.</td>
</tr>
<tr>
<td>173</td>
<td>4.0 MC.</td>
</tr>
<tr>
<td>243</td>
<td>7.0 MC.</td>
</tr>
<tr>
<td>313</td>
<td>14.0 MC.</td>
</tr>
<tr>
<td>383</td>
<td>21.0 MC.</td>
</tr>
<tr>
<td>458</td>
<td>28.0 MC.</td>
</tr>
</tbody>
</table>

(continued from page 3)
**IMPROVED CARBON MICROPHONE CIRCUITRY**

By D. T. Geliric, WA2ANU

"SNEAK" CIRCUITS in carbon microphones can disrupt control circuits, or even run down batteries. Here's WA2ANU's answer.

THE INTERNAL CIRCUITRY of the TS-13 handset can cause difficulty when the microphone plug is inserted into circuitry designed for the T-17T microphone. The difference in internal wiring are shown in Fig. 1. It is not known whether all have these circuits, but they have been found in the T-17TD and TS-13E. Several other types of carbon microphones also have similar internal circuitry.

The switching circuit has separate leads in the T-17T microphone cable, but the TS-13 has a common lead, connected to the tip of the plug, for the "cold" side of the microphone and the connection for the control circuit switch. Thus without the switch pressed, power can travel from the microphone circuit into the control circuit, or vice versa.

THIS "SNEAK" CIRCUIT on "hold-in" control circuit relays or discharge microphone batteries, to name only two undesirable effects. If both microphone and control circuit supplies are direct current (a good idea), a rectifier can be used to open this sneak circuit. A diode with low leakage, such as the G.E. IN9, can be connected in the forward direction for the lower voltage supply, both supplies having the same polarity with respect to ground. Fig. 2 shows the IN9 in the microphone lead; if the control voltage is lower than that on the microphone, the diode should be in series with the relay coil. Of course, if the two voltages are equal, no diode is needed.

If you have noticed relay, mysteriously holding your equipment, try adding the IN9 diode to eliminate "sneak" circuits.

point will be at a current node and impedance matching problems are minimized. (Suggested wiring connections are shown in TABLE II. At W2FRL, a wire 243 feet long was strung up. This length is slightly less than one wave-length long on the 3.5-megacycle band, so that the feed-point is between voltage and a current maximum. At 14, 21 and 28 megacycles, the microphone has enough square-wave lengths so that other effects are more important in determining the feedpoint impedance at the tuner.

A 1000-ft. long wire antenna will have a current maximum at the feed point on both 4 megacycles and 7 megacycles. To calculate the over-all length of an even longer odd multiple of a wave-length long-end-fed antenna, add 70 feet for each additional quarter wave-length at 7 megacycles. Of course, the pi-network antenna will match a transmitter into any odd length of wire, in addition to the standard resonant lengths. How-

**FIG. 1. COMPARISON of circuitry found in some T-17T, TS-13 and other carbon microphones with push-button switch buttons. Note that the T-17T has a fourth lead for the control circuit which becomes common with the microphone circuit at the 3-way plug.**

**FIG. 2. A.G.E. IN9** (uniden diode blocks the circuit by which reverse current could otherwise flow when the push-button switch is open (current path is traced by arrows). Power supply polarities should be the same. The diode should be connected in the forward direction of the lower voltage supply.

WA2ANU is a components engineer with General Electric's Light Military Electronics Department, Utica, N. Y.

**INITIAL TUNEUP** for each amateur band is simply a matter of determining the capacitance and inductance required for a combination of the desired DC plate current on the transmitter's final amplifier, lowest standing wave ratio in the coaxial cable from the transmitter, and the highest antenna current reading on the f.m. ammeter.

First set C at maximum capacitance, then try L1 at different taps, returning C as needed, for maximum output with a minimum standing wave ratio. If the transmitter cannot be loaded heavily enough, set G at a lower capacitance and again adjust L1 and C.

When the correct settings have been established for each band, mark the settings on the diode or a calibration chart for instant tuneups thereafter.

every, at or near a current node, the matching will be much easier, and there will be less r.f. energy radiated at the antenna tuner.
THIS BUILT-IN ADAPTER provides both r.f. and audio signals for a test oscilloscope, permitting visual monitoring of the modulation on amateur transmitters.

TEST OSCILLOSCOPES are coming into wide use among radio amateurs, thanks to the low cost, scope kits on the market. In addition, many amateur radio clubs now have scopes available for loan to members for checking their equipment.

The utility of these scopes is greatly increased by building in a handswitching tuned circuit, connected to the cathode ray tube's vertical deflection plates. But this change alone does not provide a sample of the audio output signal from the transmitter, necessary for forming the triangular test pattern on the oscilloscope screen.

The addition of a simple diode demodulator circuit and r.f. filter to the tuned circuit provides this audio signal, avoiding the complication of having to tap it from the transmitter's audio section. The audio signal from the diode is then applied to the horizontal amplifier in the oscilloscope.

The complete circuit is shown in the schematic diagram, Fig. 1. Connection to the terminal board is made as shown on page 7.

CLOSING VIEW of the handswitching tuned circuit and demodulator as installed terminal board.

---

TABLE 1—PARTS LIST

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>G...</td>
<td>8-100-uf variable (Hammond or MC-1000)</td>
<td></td>
</tr>
<tr>
<td>J...</td>
<td>chasis type coaxial cable connector, phone type jack is optional.</td>
<td></td>
</tr>
<tr>
<td>1...</td>
<td>....... 24 turns, No. 20 tin wire, 1 inch in diameter, 11/2 inches long, 32 turns per inch, tapped at 18 turns (9 M), 24 turns (14 M), and 33 turns (21 and 28 M), from ground end No. 3016 Male Nut, air-duct No. 532 cell case.</td>
<td></td>
</tr>
<tr>
<td>6...</td>
<td>....... 6-turn (1/4 in) coil of same coil stock of grounded end of J.</td>
<td></td>
</tr>
<tr>
<td>9...</td>
<td>....... male type coaxial cable plug, phone type plug is optional.</td>
<td></td>
</tr>
<tr>
<td>B/C</td>
<td>....... 2½-mm pin wound r.f. choke (Morchil 8-100, or equivalent).</td>
<td></td>
</tr>
<tr>
<td>S...</td>
<td>....... 1 pair, 4 position, single section rotary tap switch</td>
<td></td>
</tr>
<tr>
<td>G...</td>
<td>....... 1 pair, 2 position toggle or selector switch</td>
<td></td>
</tr>
<tr>
<td>T...</td>
<td>....... Audemars type 83-17 coaxial Ten connector</td>
<td></td>
</tr>
</tbody>
</table>

FIG. 1. SCHEMATIC DIAGRAM of the scope adapter. All components to the right of J should be installed inside the scope cabinet. The optional r.f. coupling circuit, L, is recommended where more than 10 feet of coaxial cable is required between the transceiver and oscilloscope. The "ground" connector should then be replaced with a 10-uf wire capacitor. All capacitances are in uf, microm, unless otherwise specified.
NEW G-E RECTIFIER TUBES

(Continued from page 1)

cathode heating time of all three types, the 3DG4, SAB4, and 6CA4, approximated that of other cathode type tubes. Thus, the power supply voltage surge which usually occurs when operating rectifiers, heating tubes draw plate and screen current in this manner. Further, the capacitor breakdowns from this cause are unlikely.

In addition to the 3-ply cathode material, new 3-ply plates have been incorporated into the 3DG4, SAB4, and 6CA4. The bonded plate material, shown in Fig. 1, spreads heat evenly, uses it where it is needed, and dissipates heat efficiently where it is not needed.

Typical operating conditions for these new rectifiers are given in Table 1. For perfor- mance comparison, ratings of the 6U4-GB have also been listed. Complete technical data is available in the 1945 edition upon request to the G.E. HAM NEWS office.

Utilize these efficient new rectifier tubes in your ham radio or amateur radio equipment. Try the SAB4 as a plug-in re- placement for older rectifier types having similar base connections for improved perfor- mance.

Table 1 — CHARACTERISTICS AND OPERATING FULL WAVE RECTIFIERS WITH CAPACITOR INPUT FILTER

<table>
<thead>
<tr>
<th>TUBE TYPE</th>
<th>2DG4</th>
<th>SAB4</th>
<th>6CA4</th>
<th>6U4-GB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plate Supply Voltage per Plate, RMS...</td>
<td>375</td>
<td>375</td>
<td>375</td>
<td>375</td>
</tr>
<tr>
<td>Filter Input Capacitance...</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>DC Output Current...</td>
<td>350</td>
<td>350</td>
<td>350</td>
<td>350</td>
</tr>
<tr>
<td>DC Output Voltage at Filter Input...</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>Tube or Cathode...</td>
<td>15</td>
<td>15</td>
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<tr>
<td>at Current per Plate...</td>
<td>@350</td>
<td>@350</td>
<td>@350</td>
<td>@350</td>
</tr>
<tr>
<td>Coated Directly Heated...</td>
<td>3.3</td>
<td>3.3</td>
<td>3.3</td>
<td>3.3</td>
</tr>
<tr>
<td>Coated (p-potential)...</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Coated Unpotentiated...</td>
<td>2.8</td>
<td>2.8</td>
<td>2.8</td>
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<tr>
<td>Coated Filament...</td>
<td>3.0</td>
<td>3.0</td>
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<td>Amperes...</td>
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<td>275</td>
<td>275</td>
<td>275</td>
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</tbody>
</table>

7
6AR8 SHEET BEAM TUBE

The General Electric 6AR8 is a miniature double-plate sheet-beam tube which incorporates a pair of balanced deflectors to direct an electron beam to either of the two plates, and a control grid to vary the intensity of the picture beam, or "sheet." The 6AR8 is especially suited for amateur radio applications in balanced modulator, frequency converter and product detector circuits. It also has a variety of switching and gating applications.

A cross-section diagram of the 6AR8's unique construction is shown at the right. As the electron beam leaves the cathode, it is acted on by the control grid and focus electrodes. Between the accelerators and the plates, the electron beam passed between the deflector electrodes. Depending on the voltages applied to the deflectors, the beam is directed entirely to one or the other plate, or proportioned between them. The internal shields, located between the two plates, acts to suppress the interchange of secondary-emission electrons between the plates.

In balanced modulator operation, for instance, one input signal is applied to the control grid, and the other to the accelerators with a push-pull circuit. The output signals are then present at the plate, and the proper signal frequency is selected with a push-pull tuned circuit.

Try the G-E 6AR8 in your new home-built equipment. Complete technical information is available on request to the G-E HAM NEWS office.

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VOL. 13 — NO. 2

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E. A. Neal, W407C — Editor

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