MHE transmitter
Thirty Watt Phone Rig for Mobile, Home or Emergency Work on 6 & 10 Meters

Fig. 1. Three-quarter Rear View of the MHE Transmitter. The Oscillator and Final Tubes are on the Left, Modulator Tubes on the Right.

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Fig. 2. Circuit diagram of the MHE Transmitter

CIRCUIT COMPONENTS—TRANSMITTER

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CL1, CL2</td>
<td>50 uF 50v electrolytic</td>
</tr>
<tr>
<td>CL3, CL4</td>
<td>0.001 uF ceramic</td>
</tr>
<tr>
<td>CL5</td>
<td>50 uF 50v electrolytic</td>
</tr>
<tr>
<td>T1</td>
<td>27 kΩ, 10 W, tap at 0.5, 1.0, 1.5 W</td>
</tr>
<tr>
<td>L1</td>
<td>680 µH, tapped 220 µH, 300 µH, 470 µH</td>
</tr>
</tbody>
</table>
| L2 | ceramic ferrite toroid, spaced wound, 3.5 in.
| R1, R2 | 1MΩ, 1 W, fixed |
| R3, R4 | 200kΩ, 1 W, fixed |
| X1 | 20 turn, 0.5% RF choke |

Fig. 1 shows the complete four-tube MHE Transmitter. The 6AG7 oscillator tube and the GL-2E26 final are at the left, and the two 6V6 modulator tubes are on the right. The over-all size is 5 by 8 by 12 inches, making the rig suitable for use in a car, on a boat or of the operating table, or as a small transmitter which can be employed practically anywhere in an emergency. Power requirements are 6 volts a.c. or d.c. at 2.55 amperes and 500 volts at 10 ma. For use as a home station, the final may be run with 500 volts in order to take advantage of the full power capabilities of the GL-2E26.

No coil changing is required. It is only necessary to change the crystal and operate two switches in order to move from six to ten meters, or vice versa. Separate antenna terminals are provided so that two antennas may be connected to the transmitter at all times.

ELECTRICAL DETAILS—TRANSMITTER

With reference to the circuit diagram of the transmitter, Fig. 2, the r-f section consists of a 6AG7 tube...
permits a limited range of adjustment of the drive to the GL-260. Resistance \( R_1 \) and \( R_2 \) provide the operating bias and jack \( J_1 \) allows grid current to be read for tune-up adjustments. Total cathode current may be read by use of jack \( J_2 \) and this jack may also be used as a bridging jack for c-w operation. If c-w operation is contemplated as a regular thing, it might be wise to arrange a switch so that the plate current to the final does not have to flow through the secondary of transformer \( T_1 \).

A one-hundred ohm resistor in the screen-grid circuit of the 6AF7 makes it possible to have the plate grid receive a negative bias in the final. For \( c-w \) operation, the grid is dropped to 150 volts. If the transformer \( T_2 \) is used, the plate current will be split equally between the two transformers.

The plate supply is furnished by a filament transformer \( T_3 \) which is housed in a 1500-volt, 0.3-ampere air-cooled transformer and with a 315-volt filament to the anode.

Modulation for the final is obtained from a push-pull 6FS5 stage. A single-button microphone provides sufficient drive for the 6FS5 tubes. No gain control is used because a small reduction in the output of the microphone drops the modulation down beyond a usable point. Jack \( J_3 \) allows determination of the cathode current of the 6FS5 tubes. The mike should not be plugged in when reading cathode current as the mike will tend to short the current.

Mile voltage for the carbon microphone is obtained from the cathode circuit of the 6FS5 tubes. Only a carbon microphone may be used with the circuit shown.

MECHANICAL DETAILS—TRANSMITTER

Instead of the original idea behind the MME Transmitter was to provide a unit capable of being used in a car for mobile work, the front panel space is as small as practical. Fig. 1 shows a side view of the transmitter. The main chassis is a 3-inch by 3-inch by 10-inch metal chassis. On the front section of the chassis is mounted a 30-inch by 30-inch front panel with the five-inch side horizontal. The total front panel space is therefore 2 by 1 by 10 inches.

The Bilby CCO-2A unit mount on the rear of the set, \( R_1 \) completely kills a parasitic which occurred on the large chassis directly beneath the CCO-2A unit. The box did not start high-frequency to ten meters. This grounded metal case can be clearly seen in Fig. 4. The coil is shown by the coil on the left, a through hole in the chassis, and goes directly to \( C_1 \) which is mounted on the CCO-2A unit.

The socket for the GL-260 is mounted beneath the chassis, and the rear of the socket is 13 % inch from the rear of the metal chassis so that the top of the GL-260 tube base is about even with the chassis. Note the cathode damper, the screen by-pass capacitors, which connect from the terminals to ground with no leads except their own. It is also noted that they have a short lead from the grid of the GL-260 to the plate of the GL-260 to the cathode. The grid of the GL-260 is grounded for wiring is not critical and may be done as desired. The small box contains the two plate circuits and their associated output circuits. Fig. 3 shows the inside details of this small box. Condenser \( C_2 \) is mounted on two \( \frac{1}{2} \) inch metal spacers, which brings the shift to \( \frac{1}{2} \) inch up from the bottom of the small box. Condenser \( C_3 \) grounds underneath the bottom of the metal spacers and the other end to a ceramic insulating which is mounted \( \frac{1}{2} \) inches back from the front panel and \( \frac{1}{2} \) inch in from the right-hand side of the box. Con-
Fig. 5. Circuit Diagram of Power Supply

CIRCUIT CONSTANTS—POWER SUPPLY

C1, C2, C3—.04 mf 300 volt filter condenser (O.S.T. 741) (D-8)
C4, C5—.1 mf 600 volt electrolytic (Sprague BL-1)
C6, C7—.2 mf 600 volt electrolytic (Sprague BL-1)
P1—4 amp fuse
P—115 volt pilot lamp (O.S.T. 8-8)

The six meter coil is similarly made from a No. 3010 Miniductor. A total of 8 turns is used, and one turn is removed inside, leaving 4 turns for L6, and 3 turns for L5. The No. 3010 coil has a 5/8 inch I.D. and is wound 8 turns per inch with No. 14 wire.

Referring to Fig. 3, the ten meter coil and link are mounted vertically, being supported by their four leads. The leads of L6 go to the switch (top machine screw) and the ceramic insulator. One lead feed goes to the front chassis connector and the other to the socket of C6.

The six meter coil and link mount directly below the ten meter coil and at right angles to it. The connections are made in a similar manner to those for the ten meter coil and link.

The modulator circuit is placed on the rear of the

R—20,000 ohm 50 watt divider, tapped 20,000 ohms up from ground end
D5—D25-2 type 25 watt unit
500—Contactors
W5—-250 x 235 volts at 100 ma. 25 volt filament lamp
RY—D27OT relay, 115 volt coil (Pelco Standard MMA-6) chassis, referring to Fig. 1. The modulator transformer, T4, and the two D46 lugs are placed side by side. These two tubes should be placed as far back as possible so that the 6AG7 may be easily removed from the oscillator unit.

Fig. 6. Top View of MHE Transmitter and Power Supply
ELECTRICAL DETAILS—POWER SUPPLY

The MHE Transmitter requires a dynamotor or vibration-type power supply when used in a mobile installation, and a regular a-c power supply for home use. Only the latter type of supply will be considered here.

For maximum power input to the GL-363 tube, 500 volts is needed. The remainder of the circuit requires 300 volts. This could be obtained by using a dropping resistor with a 500-volt supply but a substantial amount of power is lost in this manner. However, a 500-volt supply capable of approximately 0.150 amperes would be adequate. Consequently, a 500-volt 0.075 ohm supply used with a 300-volt 0.100 amperes supply would do the same job.

 Entirely aside from the power supply required for this specific transmitter, a medium voltage power supply of moderate current capabilities is an asset around any shack. For this reason a duplex power supply was designed for the MHE Transmitter. Fig. 5 shows the circuit diagram for this power supply.

Two heavy-duty receiver-type power transformers are used with their high-voltage secondaries in series. The total high-voltage output is fed to a G.E. 3R6-GY rectifier. An a-c voltage of one-half the phase is also obtained from the center tap of the two transformers, and this voltage is fed to a G.E. 6L4-G rectifier tube. With such an arrangement, one d-c voltage will normally be twice the value of the other. In this case the desired voltages were 500 volts and 300 volts and this was made possible by using choke input on the high-voltage supply and condenser input on the low-voltage supply. If the circuit constants indicated are used, and the two power supplies are loaded down with the currents drawn by the MHE Transmitter, the proper voltages will be obtained.

The two 4-kw windings were used to supply power to the filaments of the two rectifier tubes, the two 6.3-volt windings are paralleled and brought to the output connector. The d-c voltage is turned on and off without affecting the filament voltage by breaking the center-tap of the rectifier system with a relay. The contacts of this relay are wired in series to achieve the greatest possible make and break distance.

Rectifier R of Fig. 5 serves as the bleeders for both power supplies. The tap at 35,000 ohms may be adjusted to match any other details of your transmitter. It is very important that this tap be placed accurately to prevent overloading the rectifier.

The power supply shown is larger than is actually required. The chassis are specified as 300 ma chokes. A 150 ma choke would suffice in the 300-volt supply and a 75 ma choke would be large enough for the 500-volt supply. However, made as shown, the power supply is capable of 200 ma output from either voltage, or a total of 300 ma if both voltages are used.

MECHANICAL DETAILS—POWER SUPPLY

Fig. 6 shows the MHE Transmitter in place on the power supply and Fig. 7 is the same view with the transmitter removed. The underside view of the power supply is given in Fig. 8.

The power supply chassis is 16 by 17 by 3 inch steel chassis. Front panel controls—S1, S2 and the pilot lights—are on the left-hand side as seen in Fig. 7. The fuse and a-c power cord may be seen on the right-hand side. Layout of circuit components is not critical and almost any arrangement can be employed.

The female power plug is a four-prong socket mounted on a piece of 1/4 inch aluminum at a height to mate with the male output plug on the transmitter. Two right-angle pieces of aluminum are used to support the socket as illustrated. Spaghetti sleeves cover the socket prongs to keep stray hands away from the high voltage.

USING THE TRANSmitter

For mobile work a shack-mounted power source should be designed for the MHE Transmitter. The transmitter itself can be mounted under the dashboard and operated directly or it may be placed in a remote spot in the car. Some adjustment of the line voltage may be required in order to feed a car antenna properly.

The MHE Transmitter makes an ideal emergency or standby transmitter. If the main rig goes off the air, the MHE rig has enough power to do a decent job by itself.

Beginning amateurs will find this transmitter easy to build. There are no critical parts required and there should be no difficulty getting the rig to operate properly.

OPERATING NOTES

With 300 ma supplied to the CCO-1A oscillator the plate and screen current will run about 20 to 35 ma. With 500 volts on the GL-363 plate the measured output power was 22 watts on ten meters and 15 watts on six meters. Under these conditions the GL-363 cathode current was 66 ma and the GL-363 grid current 2.3 ma. Modulator cathode current normally runs 60 ma.

Fig. 7. Top View of Power Supply

Fig. 8. Underside View of Power Supply
TRICKS AND TOPICS

TRICKING A BUD
You’ll be supplied with a copy of your bag key which will operate if you keep the knob-handled surfaces dry in contact with a little metallic paint. The absence of even the slightest drag caused by stickiness perpiration will improve your变得.

IMPROVING A STRAIGHT KEY
Many C-V men who spend long hours pouring beams will find the following trick helpful. Drill, a small hole in the center of a plastic-jet chip (color is immaterial) and insert an eyelet in the arm and the knob of a standard eyelet. The result is a “strapless” which is more nearly self-regulating.

LISERED ECONOMY
Here is a trick for economy-minded bams. All power supplies should use a transistor resistor in their output. If two power supplies are constructed on one transistor, cut one lead to one transistor supply and one to the other. Adjust the other to mid-position and connect it to ground. —W.R.I.D. (The other may be adjusted off center if the two voltage are not alike in value, but it is safer to use the washer most economically.) —Eds. note
Amateur evidently abandon reconstruction work or new rig design work during the Christmas-New Year holiday season—but come back with a vengeance in February. This comment is based on the interest of mail coming to my desk. If it weren't for the ostrich egg laid by the poll-takers in the presidential election, I might be tempted to interpret the mail and act as an amateur radio opinion expert. Fortunately it doesn't take an expert to see that single-sideband is increasing in popularity. The adapter described in the November-December, 1948 Ham News has hit the fancy of many amateurs—or to quote a letter, "I'm certainly glad I built the SSB Adapter. I don't know how I ever got along without it before."

Like an example? Your editor dabbles in DX occasionally and recently came across ZBIA in Gibraltar (20 meter phone), accompanied by three other stations, with ZBIA fourth man down on thetotem pole. There probably was no more than 200 cycles covered by all four stations. Using the SSB Adapter described in Ham News, I rejected the upper sideband and removed two of the offenders. The remaining heterodyne, now effectively weakened because of the coaxial carrier action of the adapter, fell in the crystal notch with the turn of a knob on the receiver, leaving ZBIA in the clear.

A page of examples alone won't improve your reception, however, so I apologize if I have made you discontented.

A goodly portion of my correspondents always ask, among other things, for the location of the nearest G-E Tube Distributor where the Ham News will be available. If this copy of the Ham News you are reading came from a distributor, his name and address probably appears on the last page. (If not he isn't taking advantage of that nice blank space we have for him.)

To help you further, a list of the G-E Tube Distributors who handle the Ham News is appearing in QST and CQ magazines on page one. By coincidence, that's the same page that advertises G-E Electronic Tubes.

Would you like to have a secondary frequency standard which can be read directly in 40 cycle steps at 4 megacycles? One with only two tubes, no crystal, and only a handful of parts? Then don't miss the May-June, 1949 Ham News. Which brings to mind a note control station that asked the others to change frequency to a new spot—only to be told that the specified frequency was the one they were now operating on.

Accurate frequency measuring equipment need not be expensive if you roll your own. The need for such equipment increases daily. The Ham News policy is to keep abreast of amateur needs, so, with the able assistance of W3FDW the May-June issue will give complete constructional details of an inexpensive frequency standard using two tubes and capable of being read to 35 cycles at 3.5 megacycles.

Every once in a while your editor gets a slick idea, and then can't publish it in Tricks and Topics. (That's a buzz word to prevent me giving myself ten dollars worth of those G-E tubes.) It concerns putting washers and nuts on a bolt which is always found in those "hard-to-get-at" places. This is a problem which comes up often, due to my general aptitude for designing more and more in less and less space. To solve, place the machine screw in place, then use an impulse or similar weapon and place the nut and washers on it. Hold them on the ice pick with your forefinger until you have gotten the point of the impulse firmly against the end of the machine screw. Release the nut and washers, and they will slide down and on the screw. From here on you are on your own.
The GL-2E26 is a five-electrode beam power amplifier tube designed for use in FM transmitters, either in low-power driver stages, or in the output stage when only low-power output is required. It is also useful in audio-frequency power and modulator service. The anode is capable of dissipating 12.5 watts, and cooling is accomplished by radiation. The cathode is the indirectly heated type. Maximum ratings apply up to 125 megacycles.

**General Characteristics**

**Number of electrodes:**

- **Electrical**
  - Heater voltage, a-c or d-c: 8.5 volts
  - Voltage range: 6.5 volts
  - Grid, plate, and filament current: 0.6 ma, 200 ma
  - Grid-screen amplification factor: 6.5
  - Interelectrode capacitance: 8 microfarads
  - Input: 50 microfarads
  - Output: 7 microfarads

- **Mechanical**
  - Mounting method: any
  - Nut weight, approximate: 1.5 ounces
  - With no external shielding and base secured to ground.

**Maximum Ratings and Typical Operating Conditions**

**Plates-Modulated Radio-Frequency Power Amplifier—Class C Telephony**

Carrier modulates the grid for use with a maximum modulation factor of 5.0.

<table>
<thead>
<tr>
<th>Maximum ratings, absolute volts</th>
<th>CC</th>
<th>ICAB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dc plate voltage</td>
<td>600 max</td>
<td>500 max</td>
</tr>
<tr>
<td>Dc grid No. 1 voltage</td>
<td>500 max</td>
<td>200 max</td>
</tr>
<tr>
<td>Dc grid No. 1 voltage</td>
<td>150 max</td>
<td>100 max</td>
</tr>
<tr>
<td>Dc grid No. 2 voltage</td>
<td>75 max</td>
<td>50 max</td>
</tr>
<tr>
<td>Dc grid No. 2 current</td>
<td>15 ma</td>
<td>15 ma</td>
</tr>
<tr>
<td>Plate dissipation</td>
<td>0.7 W</td>
<td>0.7 W</td>
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**Typical operation**

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<thead>
<tr>
<th>Maximum values</th>
<th>CC</th>
<th>ICAB</th>
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<tbody>
<tr>
<td>Dc plate voltage</td>
<td>600</td>
<td>500 volts</td>
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<tr>
<td>Dc grid No. 1 voltage</td>
<td>150</td>
<td>100 volts</td>
</tr>
<tr>
<td>Dc grid No. 2 voltage</td>
<td>75</td>
<td>50 volts</td>
</tr>
<tr>
<td>Peak of grid No. 1 voltage</td>
<td>90</td>
<td>60 volts</td>
</tr>
<tr>
<td>Dc grid No. 2 current</td>
<td>15</td>
<td>15 ma</td>
</tr>
<tr>
<td>Dc grid No. 2 current, approximate</td>
<td>15 ma</td>
<td></td>
</tr>
<tr>
<td>Maximum power output</td>
<td>15.5</td>
<td>15.5</td>
</tr>
</tbody>
</table>

[Motor added bias required must be supplied by a cathode resistor or a fixed supply.]

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