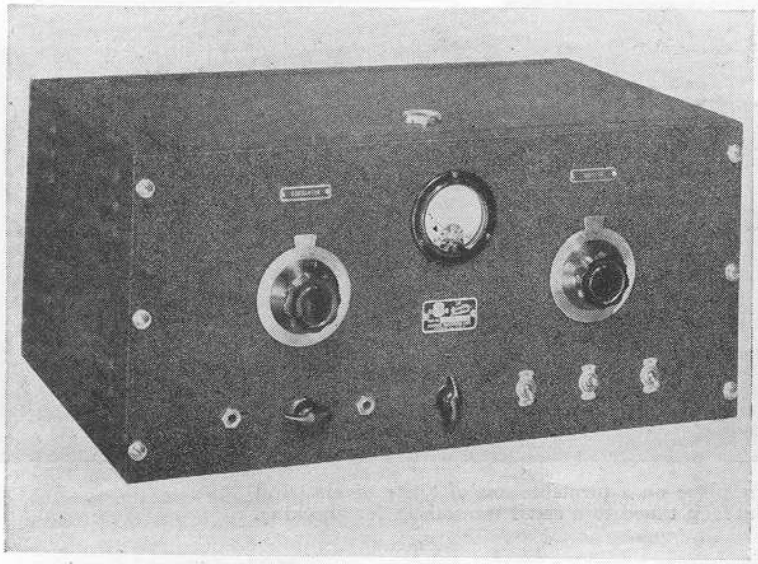
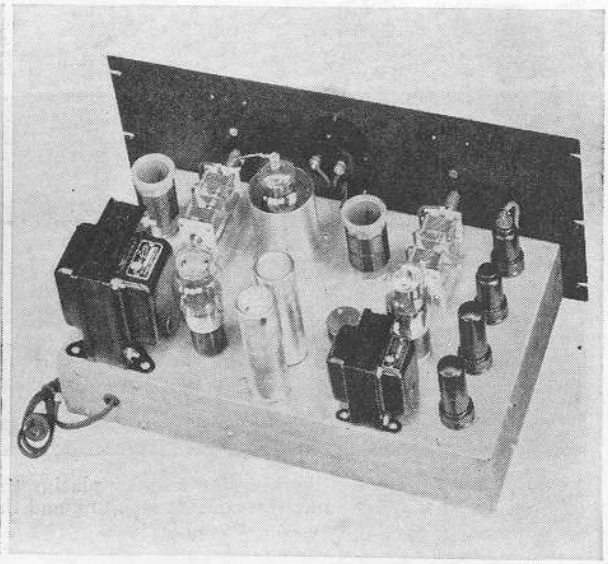


Excellent for QRR work, this transmitter looks like a receiver.



A.F. to right, and r.f. to left makes servicing easy.

A 20-watt All Band Xmitter

By EDWARD P. KELLY, W9HPW
Engineer, Standard Transformer Corp., Chicago, Ill.

Built essentially for small space, this set will make an excellent QRR rig because its power requirements are sufficiently low to make it readily transportable.

IN building this transmitter, the factors of flexibility, performance, and economy were carefully considered before the final design was adopted. Complete coverage of all bands with quick band change was desired, and crystal control with a minimum number of stages. The all-band feature dictated the use of both phone and C.W. and, therefore, a complete speech amplifier and modulator had to be included. Other features such as metering of all important circuits, oscillator keying for break-in operation, and front panel control were worked into the set as the design crystallized, while economy was the deciding factor in determining the tube lineup and the use of a single power supply and meter for the entire unit, as well as the overall size.

The result is a complete phone and C.W. transmitter, including its A.C. power supply, in a cabinet measuring 19" x 13" x 8¾" overall, and capable of operation on any frequency from 1.6 to 60 mc with crystal control. Frequency change can be accomplished in 30 seconds or less by means of two plug-in coils and a plug-in crystal; and the rated input at all frequencies is 20 watts. The modulator delivers 10 watts of audio power which is capable of modulating the amplifier one hundred percent. The input can be increased to 30 watts if desired with one hundred percent modulation possible at voice frequencies on peaks.

The radio frequency section utilizes a type 6F6G tube as a crystal controlled oscillator, driving a type 807 or RK39 final amplifier. Split stator condensers are used both in the oscillator and amplifier tank circuits so that the proper L-C ratio is obtained for all frequencies; and the sections of both condensers are automatically switched when the plug-in coils are inserted. A 2 v. 60 ma. pilot light bulb is connected in series with the crystal to act as an indicator of the crystal current and also as a fuse. Proper shielding in the amplifier stage is incorporated for increased stability and eliminates neutralization even at the higher frequencies. The antenna is coupled to the set by means of a link or by capacity coupling to the amplifier tank circuit.

The speech amplifier and modulator tube lineup is as follows: 6J7 input, 6C5 voltage amplifier, 6N7 Class "A" driver, and 6N7 Class "B" modulator. Sufficient gain for any crystal microphone or similar high impedance input is provided; and different load impedances are available at the modulation transformer by tapping the secondary at a number of suitable points.

The power supply uses a type 5Z3 full-wave rectifier and delivers approximately 400 volts D.C. out of the filter, which uses condenser input. An additional filter section is inserted to the supply power circuit to the three speech amplifier stages to insure hum-free operation; and a tapped voltage divider R 17 is used to obtain the proper voltage for the speech amplifier (300 v. D.C.) and the oscillator screen grid (175 v. D.C.), while the screen voltage of the 807 (or RK39) is supplied through dropping resistor R4.

All controls are mounted on the front panel, including the microphone and keying jacks and a built-in meter switch permits the reading of oscillator, amplifier, and modulator plate currents with a single meter and no plugs or jacks.

The front panel view of the transmitter, shows all of the controls which are as follows, from left to right across the top: oscillator plate tank tuning dial, plate circuit meter, and amplifier plate tank tuning dial; bottom: microphone jack J, gain control R_{10}, keying jack J_1, meter switch, modulator "on-off" switch, filament switch, and plate switch.

The chassis parts layout is as follows, along the panel from left to

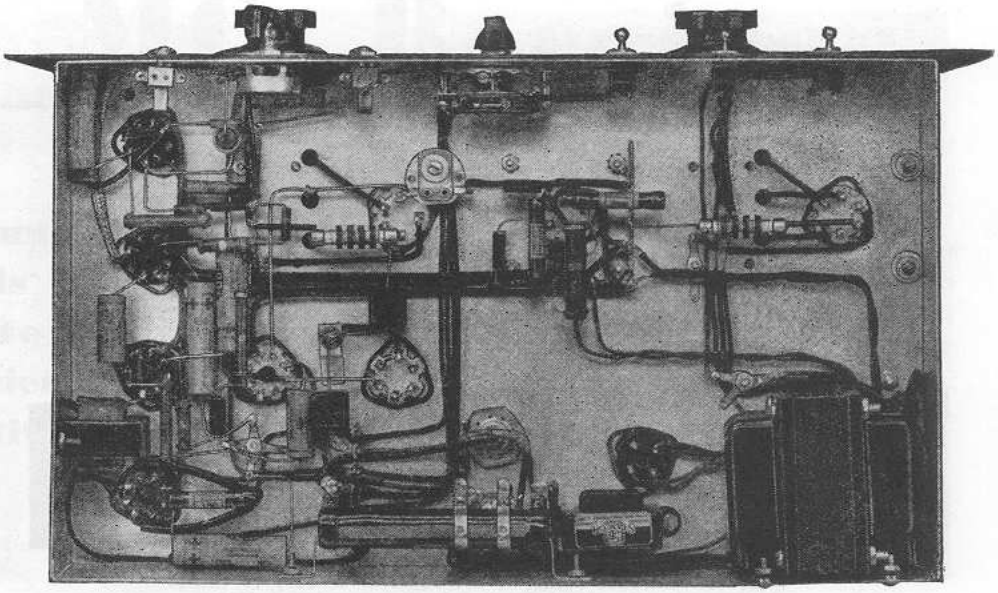
right; amplifier tank coil, amplifier tank condenser 807 (or RK39) amplifier tube, oscillator tank coil, and oscillator tank condenser.

The ordinary four metal tubes at the right end of the chassis are those of the speech amplifier and modulator. Along the rear of the chassis (foreground in the picture) from left to right: the power transformer 5Z3 rectifier tube, filter power condensers; and the tapped modulation transformer. The crystal is to the left of the oscillator tube, and the pilot light crystal fuse is between it and the tube.

It is at once apparent that the layout of each section, R.F., A.F., and power, follows as closely as possible that shown in the schematic circuit diagram.

The R.F. and A.F. sections are spread out enough to prevent feedback and interaction between circuits and still keep the plate and grid leads reasonably short. Care was exercised in the placement of the power transformer and filter chokes with respect to the audio transformers, so that a minimum of inductive coupling would exist and no apparently noticeable hum would be induced in the audio system.

In constructing the transmitter, layout the chassis and panel along the same lines as shown. After the chassis has been punched and drilled, the parts which mount on top of it can be put on, starting first with the sockets. Then the panel can be added along with the parts which hold it to the chassis. It is a good idea not to mount the other parts which go under the chassis until they are necessary to complete each circuit. This leaves more room to work and reduces the possibility of errors in wiring.



A beautiful example of wiring and careful placement of components.

The filaments should be wired first, along with the primary circuit of the power transformer and tested right away. Then the plate supply connections can be made and the complete power supply tested. Next comes the R.F. Crystal oscillator circuit followed by the 807 amplifier stage. It now becomes necessary to wind a pair of coils so that the R.F. section can be tested. All of the coils consist of a single winding and it should not take long to make up the first pair. All data for number of turns, wire size, base connections, etc., can be found in the coil table. If the data is followed carefully, little or no trouble should be experienced in getting the tank circuits to resonate properly.

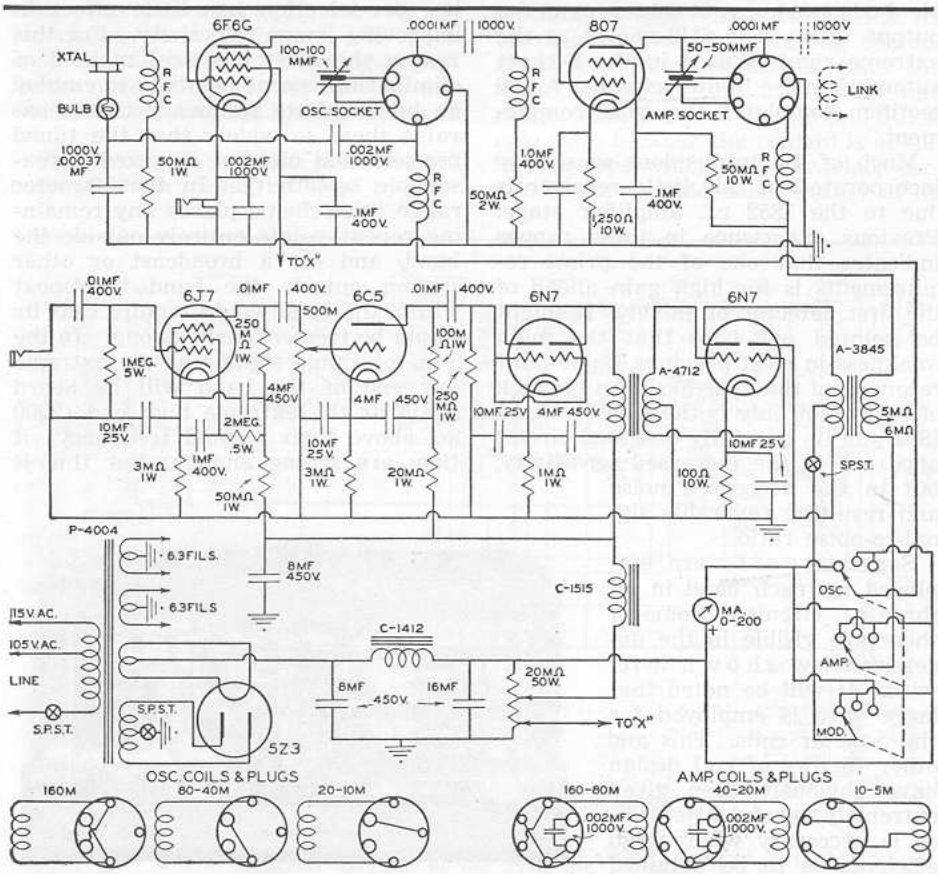
A reliable 80 or 40 meter crystal is usually a great help in getting started on the "right foot"; so, with the proper coil plugged in the oscillator plate circuit, the oscillator can be tuned up. The meter switch should be in the "Oscillator" position and the meter should read anywhere from 20 to 40 ma., minimum dip, depending on the frequency, crystal, tube, voltage, etc. When tuning the oscillator for the first time, it is advisable to leave the amplifier coil and tube out of their sockets. If the 807 is left in the socket and the amplifier coil removed, the full voltage is left on the tube's screen. This will short life the amplifier tube considerably and might even cause its complete destruction. After the oscillator is resonated, the amplifier coil and tube can be inserted and also tuned to resonance. With the meter switch in the "amplifier" position the current should dip to a value ranging from 5 to 15 ma. at resonance. When loaded the amplifier plate current should be from 50 to 75 ma., depending upon the input desired.

Frequency doubling or quadrupling can be employed in both stages of this transmitter, which makes it possible to cover all bands with 160, 80 and 40 meter crystals.

The value of condenser in the oscillator circuit is fairly critical and can be varied either way to obtain the greatest harmonic output.

The 2 v., 60 ma. pilot light bulb in series with the crystal indicates the crystal current, which should be kept to the lowest value consistent with good output. The resonant points are rather sharp in both tuned circuits, so care should be used in tuning them; especially when doubling or quadrup-

(*Please QSY to page 65*)



Schematic diagram of the 20-watt all band transmitter.

A 20 watt Transmitter

(Continued from page 37)

ling.

With the R.F. section operating satisfactorily, attention can now be focused on the speech amplifier and modulator. This circuit is perfectly straightforward and most of the connections can be made to the resistors and condensers themselves, which simplifies the wiring and saves time, as well as helping to maintain short leads. Both the grid and plate leads of the three speech amplifier stages should be shielded to prevent pickup and feedback. This also applies to the leads going to the gain control.

The amplifier can be tested before connecting it to the modulator by placing a pair of phones in the plate circuit of the 6N7 driver stage in place of the driver transformer primary winding. The total plate current drain of these three stages can be checked if desired and should be approximately 15 ma. The 6N7 Class "B" modulator may now be connected and should draw about 30 ma. when idling, and up to 100 ma. on peaks. The audio output can be checked by means of a 10-watt lamp used as a load across the secondary of the modulation transformer.

The proper tap to use on the secondary winding of T_2 is the one which will most nearly match the load impedance presented to it by the 807 amplifier stage.

The load impedance is equal to the plate voltage on the 807 (or RK39) divided by the current that it draws when loaded to the point at which it will be operated.

There are several constructional details, which have not been mentioned before, but which are important to the person contemplating construction of this unit.

Condenser does not appear on the circuit diagram as it is used only on the four lower frequency bands. It is mounted inside the coil form for each of these bands, and is automatically plugged in or out of the circuit with each coil. The connections for C_{25} are shown on the coil chart.

Two antenna insulators are provided for use with link coupling to the amplifier stage. The link cannot be connected to any of the prongs of the coil form, as they are used for other connections; so it should therefore be attached to the insulators.

All leads of the R.F. tank circuits should be made with No. 14 ga. solid tinned wire and be insulated by rubber grommets where they pass thru the chassis.

The socket used for the plug-in crystal has 6 prongs. These prongs should be connected, three in a row on each side, so that the crystal will always make the proper connections; no matter which way it is inserted in the socket.

Any other details can be clarified by a perusal of the circuit diagram.