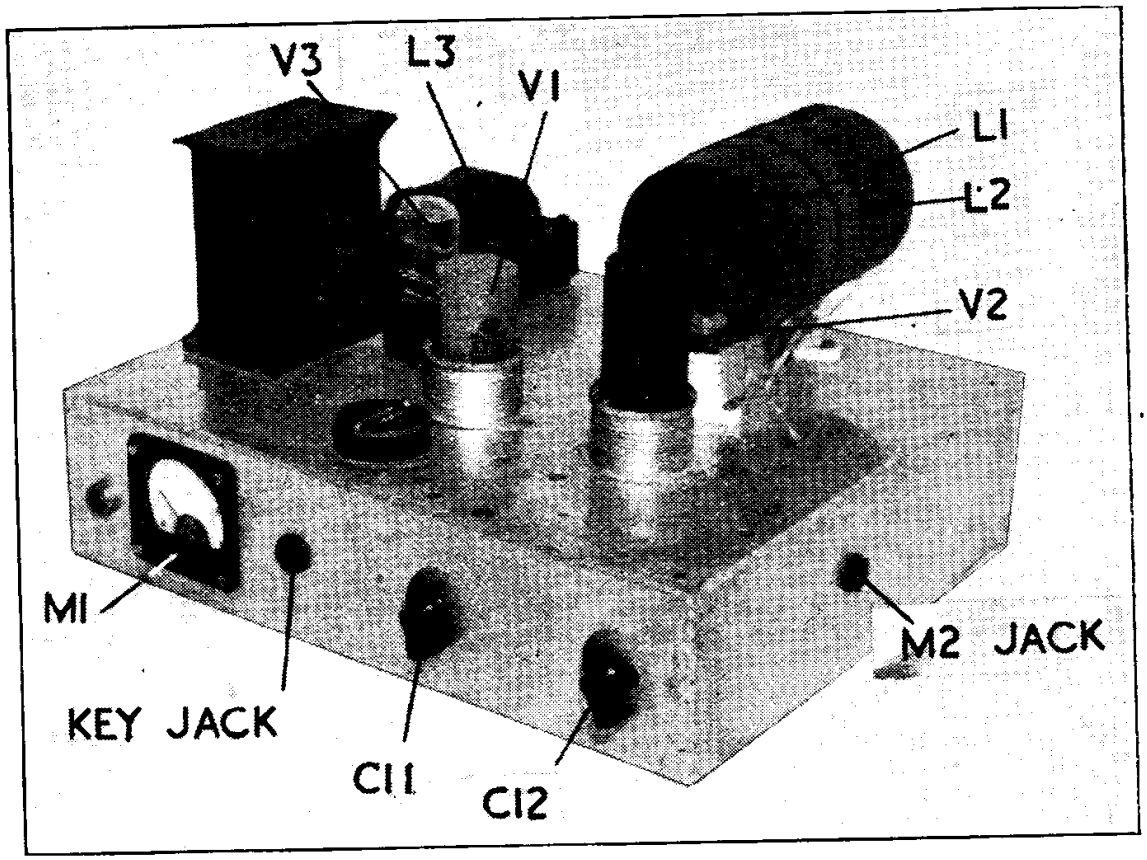


Top-Band Station

Part 1. The Transmitter

By C. L. Wright, B.Sc., G3CCA

Introduction

This series of constructional notes will give the reader all the information that is necessary to build a very cheap but efficient Top-band station. The transmitter, receiver and all the associate gear have been designed and constructed in a very short time, and was made specially for "Radio Constructor" readers. I know that most of you will be saying "Why the Top-band?" but I think that question can be fully answered by stating that the same circuit and valves, with slightly different L-C. values can be used on the higher frequency ranges as a QRP rig if another band is preferred. Future articles in this series will give details for building a receiver, a modulator, and a very special frequency meter and cw/phone monitor combined.

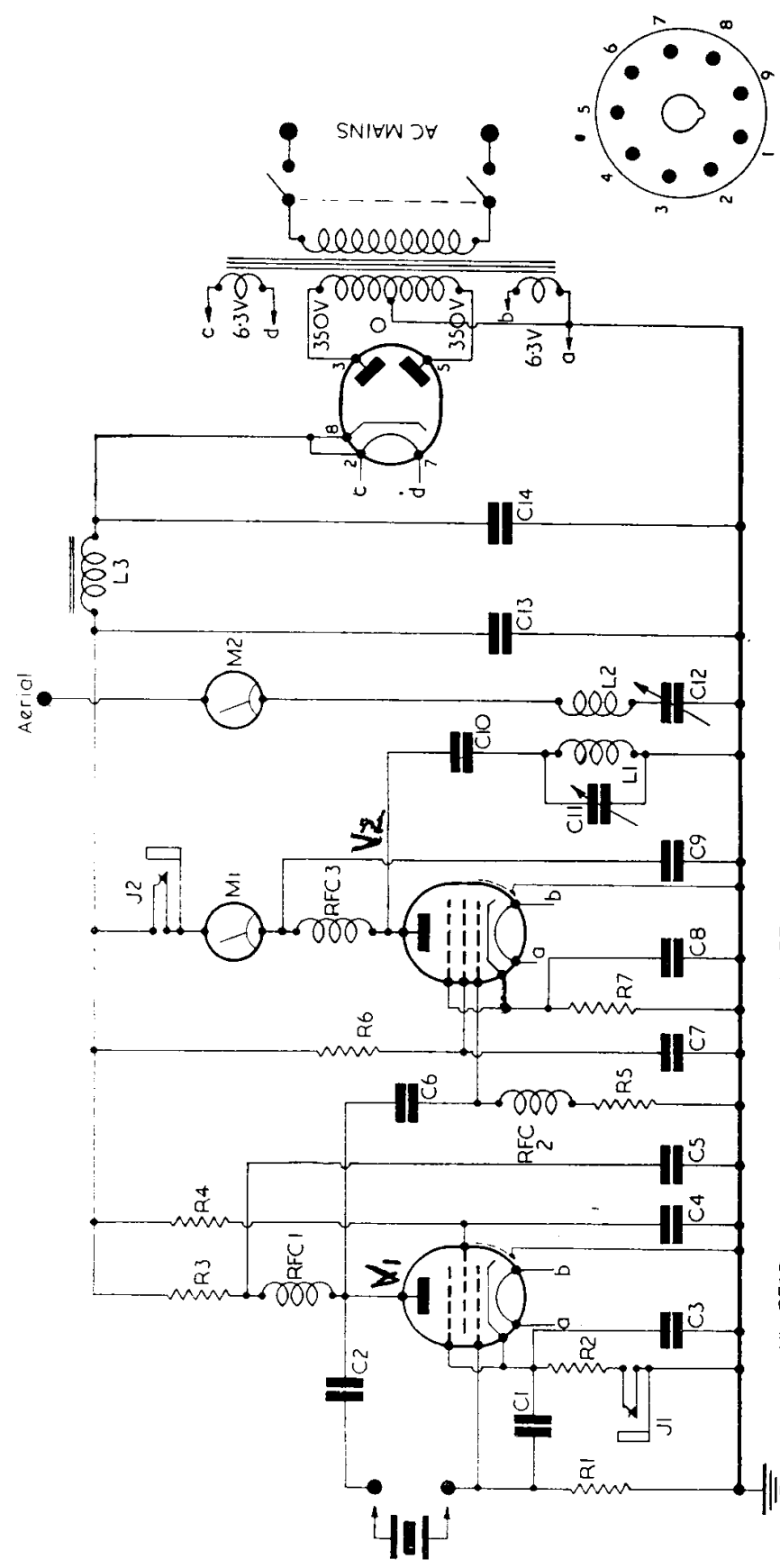
Before giving details of this new "Radio Constructor" Station I would like to say to all those stations who have worked G3CCA on the top-band during the past months, that this is the rig which was used for these QSO's.—AUTHOR.

The Circuit

IN designing the TX it was decided to make it as simple as possible, and of course as cheap as possible, so by using "demobbed" service valves this latter object was achieved. I think that the Pierce Crystal Oscillator assists greatly in making this TX very simple to build and to operate, and it also means that no variable tuned circuit is necessary. I know that some of you do not favour this type of oscillator and have "visions" of a shattered crystal but if the circuit constants are correct and the HT voltage low these "visions" can fade away.

To conform to the standards required by a good Pierce Oscillator circuit I chose the EF50 (VR91) as this valve with its low anode current makes it most suitable in this stage.

Now for the P.A. stage. Remembering that only 10 watts are allowed on the "Top band" I turned my mind to either a 6V6 or 6L6 slightly under-run, but I also thought about a valve which has not been



Capacitors

C1: 200 $\mu\mu$F (350 volt mica)
2: .002 μF (2 kv. working mica)
3: .002 μF (350 volt working)
4: .001 μF (500 volt working)
5: .001 μF (500 volt working)
6: 100 $\mu\mu$F (350 volt mica)
7: .001 μF (500 volt working)
8: .002 μF (350 volt working)
9: .002 μF (500 volt working)
10: .002 μF (500 volt working)
11: 350 $\mu\mu$F Variable—Receiving type
12: 500 $\mu\mu$F Variable—Receiving type
13: 8 μF Electrolytic 500 volt working
14: 8 μF Electrolytic 500 volt working

Chokes

RFC1, RFC2, RFC3: S.W. HF Chokes Standard type.
L3: 20 H, 70 mA. (Any standard make)

Meters (Optional)

M1 0-50 mA. Moving-coil
2 0-500 mA. R.F. meter

Jacks

J1 & J2 Closed circuit type

Resistors

R1: 47000-~ $\frac{1}{2}$ watt
2: 400-~ 1 watt
3: 5000-~ 1 watt
4: 39000-~ 1 watt
5: 47000-~ $\frac{1}{2}$ watt
6: 15000-~ 1 watt
7: 150 ~ 3 watt

Pin connections for EF50 and EF55
1 Heater
2 Grid 2
3 Anode
4 Grid 3
5 Shell (to earth)
6 Cathode
7 Grid 1
8 Shell (to earth)
9 Heater

(Note—Cathode connection of V2 should be taken to earth)

given much publicity but which most ex-service Radar Engineers must have used from time-to-time. This valve, an EF55, was used as a Video Amplifier in many Radar circuits under its "Services" name of CV173. The use of this valve as a P.A. would make the TX very efficient, and its maximum anode dissipation is 10 watts. A small transformer was re-wound from stampings taken from an old ex-service one to give a maximum of 350-0-350 volts at 75 mA.

As a rectifier, a 6X5 is very suitable and will supply all the voltage and current required.

Two spare meters were available, one a 0-50 mA., and the other a 0-500 mA. Thermocouple R.F. meter and I added these to the finished model, but whilst it would be advisable to have at least the meter in the P.A. it is left entirely to the constructor to arrange for these "refinements" to suit his pocket.

Construction

Several ideas were tried before the finished TX resulted, and I would like to point out here that all the construction was done with the aid of the following tools:—

One Soldering Iron, Cutters, Pliers. One Hand Drill and several drills and two "Q Max" chassis cutters.

The tuning capacitors are both at "Earth" potential, and so were mounted under the chassis, and being of the general receiving type with four feet this was found to be the best position. The keying jack (J1) was placed between the meter and the PA tuning capacitor, and a pilot light was added. This light is not shown on circuit diagram because it was for the writer's personal use only as his transmitters are situated 10 yards away from the receiving point and his "junior ops" have been trained not to touch anything showing a light.

The mains switch is at the side of the chassis next to the mains input plug and on the other side is the modulation jack (J2), this being again the most convenient position in the case of the writer's layout. The rest of the components on the top of the chassis can be seen from the photograph, but a word about the crystal. This is mounted in an American 5 pin (807) valveholder and can be plugged in and out easily, also as the crystal uses only pins No. 2 and 4 it was decided to earth pin No. 3 so that a V.F.O. could be inserted in place of the crystal as required, thus cutting out the use of a switch for this purpose.

The only chassis which could be obtained here was 14in. x 12in. and I would advise anyone building this TX in the same way as in the photos to give thought to purchasing a chassis with a "Black Crackle" finish as I realised only too late that these can be obtained for an extra shilling and they certainly do improve the looks of the equipment. (See Part 3—Modulator—to follow).

I have always found that in building equipment most of the work is done in drilling out the chassis, but by using the standard chassis cutters this was accomplished without any trouble. These were used to cut out the transformer slot by cutting several rings together and filing out the surplus material.

The coil is mounted on Eddystone stand-off insulators and the HT below the chassis is run to convenient anchoring points. A third "stand-off" is used to anchor the lead from the PA tuning capacitor to the aerial coil.

Wiring

All wires are as short as possible, and the PA grid capacitor (C6) with RFC2 are mounted direct on to the grid of the valve base (Pin No. 7). The Pierce Oscillator "feed-back" capacitor (C1) is mounted between pins No. 6 and 7 on the EF50 valveholder. These are small points but they go to make the TX more efficient, and the most important items regarding these valves is to see that the internal screens on the valves are placed at the same potential as the cathode and NOT

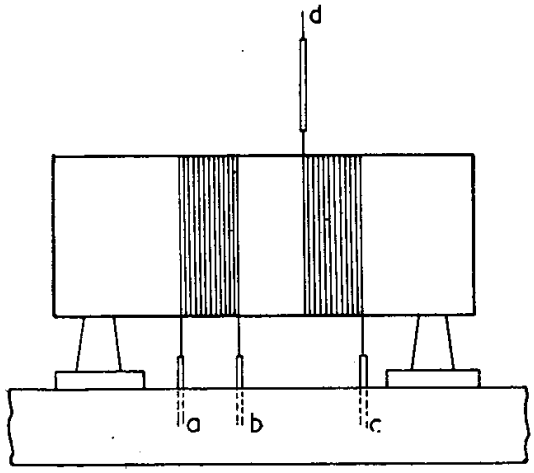
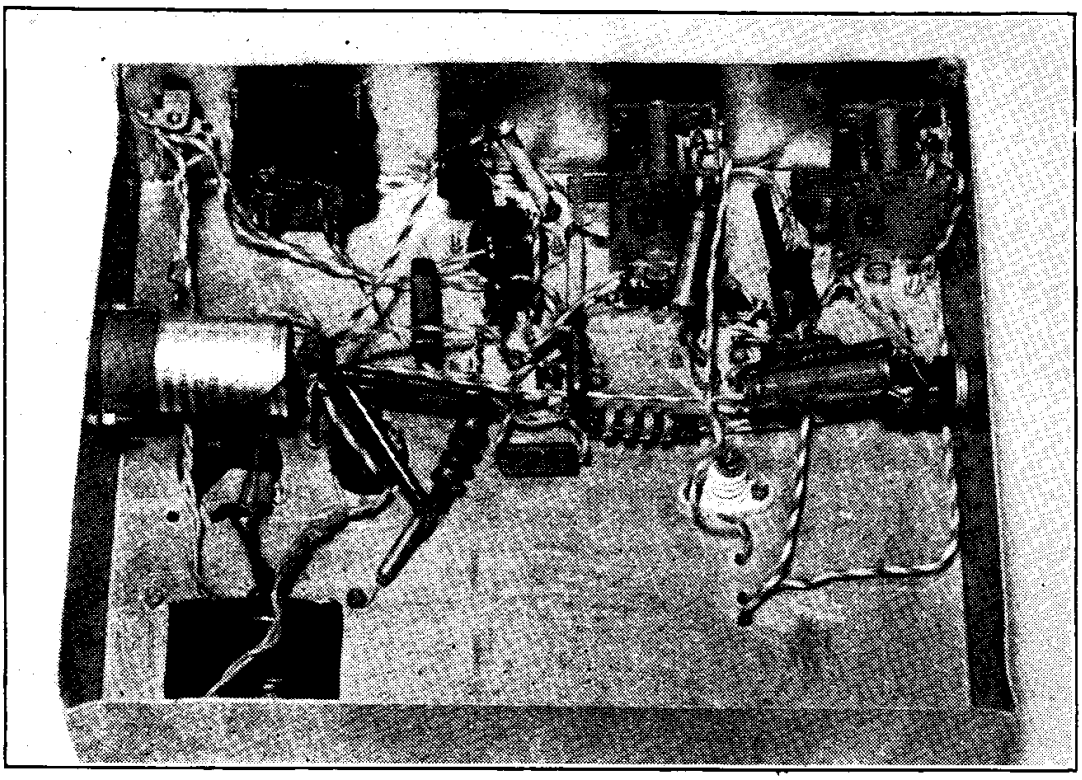


Fig. 2. TX coil mounting and assembly details: "a" to C11 fixed vanes; "b" to C11 moving vanes; "c" to C12; "d" to meter M2—or aerial

earth, this is achieved by joining pins Nos. 5, 6 and 8 together, and to earth the centre spigot. If these items are not carefully attended to, you may find that the performance of the transmitter is very erratic. In order to obtain full screening of the valve the valveholder clamping rings should be used thus clamping both valves very tightly in their holders and forming a very good earth on the metal screening cans.



The Coil

I have drawn out the mounting of coil on the chassis and also the position of the windings. The former is 3in. in diameter and the PA tuning coil is 20 turns of swg 22 double cotton covered. I did not have any d.c.c. wire so I wound this coil in single cotton covered and painted the winding with shellac, using the XYL's cooker to bake same!

The aerial tuning coil consists of 18 turns of the same wire and is wound ¼in. away from the PA coil, both these coils are close wound. The capacitors which I had available for the tuning of these coils were 350 $\mu\mu$F for the PA stage and 500 $\mu\mu$F for the aerial, and it was found that these tuned the top band with the capacitor vanes half out.

Operational Tests

Before giving the full details of the tests carried out with the author's transmitter it should be noted that the figures given may vary with different valves.

When the crystal had been placed in the holder and the TX switched on it was found that the current in the anode of the EF55 (PA valve) was 30 mA. On tuning the PA tuning capacitor (C.11) there was a spot where the current decreased to 20 mA, this of course meant the PA was in tune with the Pierce Oscillator and being driven correctly. The only aerial which would give any reasonable radiation at my QRA was a long wire (100 feet) and this was coupled to the aerial coil through a RF (0.5 Amps) meter. On tuning the aerial coupling capacitor (C12) the PA meter current rose to 30 mA. and a slight adjustment to the PA capacitor (C.11) increased the current to 35 mA.

By further adjustment of these capacitors to bring both circuits into the correct alignment 40 mA. was shown on the PA meter and on full load the PA anode volts were 250 volts, thus giving an input of 10 watts to the EF55 PA valve.

The current in the aerial RF meter was 0.4 amps (400 mA.) the time of the day was 12.52 GMT and the first CQ was sent out on CW. On tuning the receiver we heard G3AWJ calling us. A very fb contact was had with this station who gave us a very fine report on our transmission, the first on the "Radio Constructor" transmitter. We were very pleased to learn that the QRA of this station was Huntingdon and rapid calculations showed that the distance covered was 45 miles in **daylight** with a report of RST559. Another contact was made with G8RB of Derby who gave us RST579 thus proving that the TX was working really well. Since then we have worked "cross-band," G3CCA on 1.7 Mcs. with London on 7 Mcs. during daylight. It was after these tests that it was agreed that the TX was very efficient and credit is due to the EF55 valve. G3CCA will be very pleased to work anyone on Top-band with this TX any evening on sked (via "Radio Constructor") on a frequency of 1790 kcs., and it is hoped to use this transmitter to transmit "Frequency Predictions." SWL's reports would be welcomed.