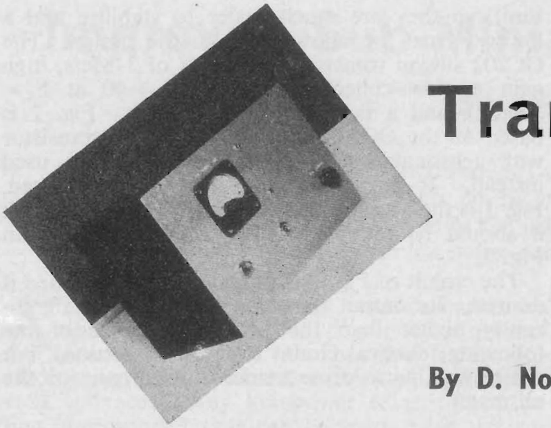

Transmitter Design for 4 Metres

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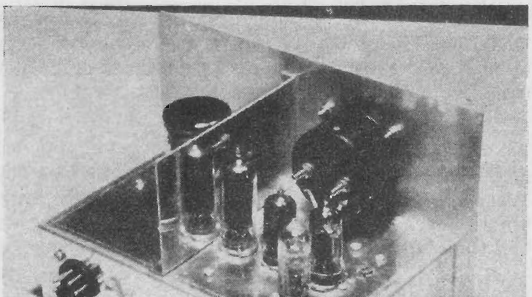
The transmitter described in this article was designed specifically to investigate the prospects of using the four metre band for local working.

In hilly country the four metre band is found to be preferable to the higher v.h.f. bands. Furthermore, four metres has advantages over, say, 10 metres as a band for local working due to smaller aerials being required. Also, the interference with Dx stations is much less likely to cause trouble. For these reasons a simple transmitter was designed and constructed to enable experiments to be carried out.

Circuit

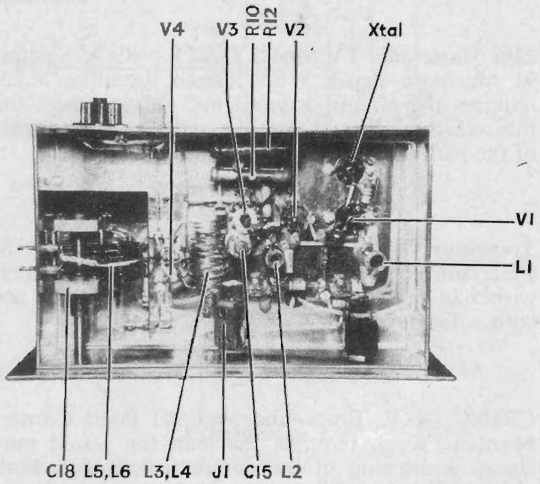
A conventional design is employed using a modified Colpitts crystal oscillator on 11.717 Mc/s, the anode circuit of which is tuned to the crystal frequency. This is followed by an EF91 operating as a doubler, and a 5763 tripler. The anode circuit of the 5763 is link-coupled to the Power Amplifier grids. The P.A. uses a TT15 as a push-pull amplifier.



Three-quarter rear view of the transmitter showing the B7G based crystal mounted in the foreground.

In the anode circuit a split-stator capacitor is used to tune the centre-tapped coil. As the centre-tap is grounded as regards r.f. by the capacitor C19, the rotor of the P.A. tuning capacitor must be isolated from chassis.

An anode current meter (150mA full-scale deflection) is provided for tuning-up purposes.



A view of the underside of the transmitter, showing the major components and below-chassis screen

It is not anticipated that the transmitter will be used much for c.w. operation, but a key jack is provided in the P.A. cathode "just in case". This avoids the necessity of providing protective devices which would be required if an earlier stage were keyed. The key jack may also be used for metering purposes.

T.V.I. Precautions

As 35 Mc/s falls in the vision i.f. passband of most modern television receivers, it is undesirable to have one stage tuned to 35 Mc/s. For this

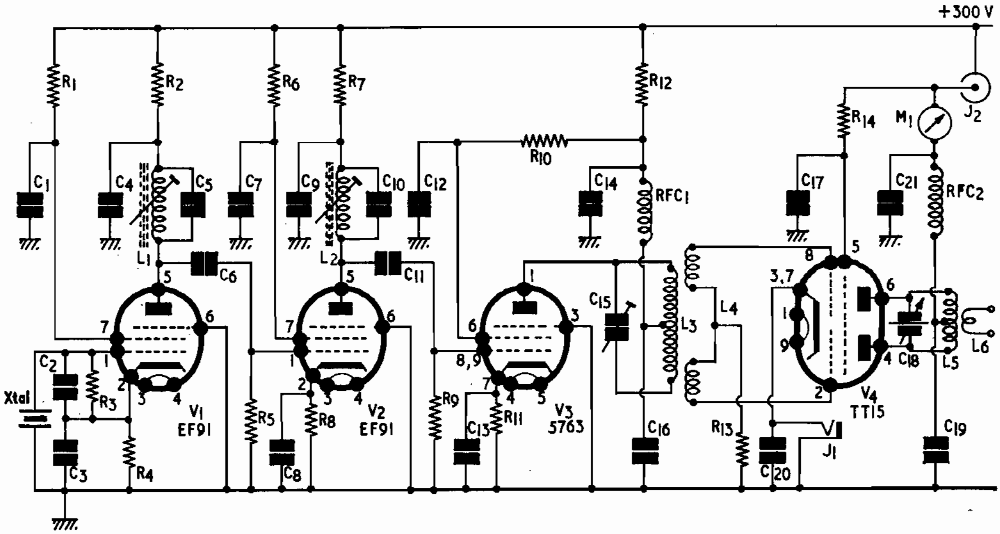


Fig. 1. The circuit of the 70 Mc/s transmitter

Components List

Resistors. (All $\frac{1}{4}$ watt unless otherwise specified)

R_1 47kΩ
R_2 22kΩ
R_3 100kΩ
R_4 2.2kΩ
R_5 68kΩ
R_6 47kΩ
R_7 22kΩ
R_8 1kΩ
R_9 100kΩ
R_{10} 12kΩ 1 watt
R_{11} 390Ω 1 watt
R_{12} 1kΩ 2 watts
R_{13} 22kΩ
R_{14} 15kΩ 2 watts

Capacitors

C_1 1,000pF disc ceramic
C_2 50pF silvered mica
C_3 180pF silvered mica
C_4 1,000pF disc ceramic
C_5 4.7pF tubular ceramic
C_6 50pF silvered mica
C_7 1,000pF disc ceramic
C_8 1,000pF disc ceramic
C_9 1,000pF disc ceramic
C_{10} 4.7pF tubular ceramic
C_{11} 50pF silvered mica
C_{12} 1,000pF disc ceramic
C_{13} 1,000pF disc ceramic
C_{14} 1,000pF disc ceramic
C_{15} 2–8pF concentric trimmer
C_{16} 1,000pF disc ceramic
C_{17} 1,000pF disc ceramic
C_{18} 25+25pF split-stator
C_{19} 1,000pF disc ceramic
C_{20} 1,000pF disc ceramic
C_{21} 1,000pF disc ceramic

Inductors

$RFC_{1,\,2}$ 50 turns, 28 s.w.g. enam. close-wound on $\frac{1}{4}$in wooden dowel
L_1 30 turns, 28 s.w.g. enam. close-wound on $\frac{3}{8}$in Aladdin former with iron dust core
L_2 18 turns, 22 s.w.g. enam. close-wound on $\frac{3}{8}$in Aladdin former with iron dust core
L_3 6 turns, 18 s.w.g. tinned copper, spaced $\frac{3}{4}$in, self-supporting, $\frac{5}{8}$in inside dia. Centre tapped. (See Fig. 2)
L_4 6 turns, 18 s.w.g. tinned copper, split winding, $\frac{1}{2}$in inside dia. (See Fig. 2.)
L_5 6 turns, 16 s.w.g. enam. spaced $\frac{3}{4}$in, self-supporting, $\frac{3}{4}$in inside dia. Centre tapped
L_6 1 turn link, p.v.c. insulated 22 s.w.g. tinned copper, $\frac{3}{4}$in inside dia.

Valves

V_1, V_2 EF91
V_3 5763
V_4 TT15

Jacks

Close-circuit jack socket
J_2 Insulated coaxial socket (Belling-Lee type L.603A)

Crystal

11.700 to 11.733 Mc/s

Meter

M_1 0–150mA d.c. milliammeter

Miscellaneous

3 B7G valveholders
1 B9A valveholder
1 B9G valveholder
3 Nylon lead-through connectors

Cabinet

Type W
(H. L. Smith & Co., Ltd.)

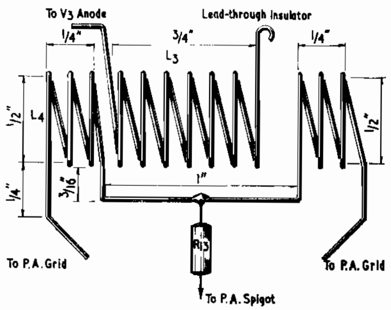


Fig. 2. Dimensions of the tripler anode and P.A. grid coils. The wire used is 18 s.w.g. tinned copper

reason the sequence of double-tripler rather than vice versa is chosen. V_2 is tuned to 23 Mc/s, which is then tripled to 70 Mc/s.

Construction

The unit is built on a 16 s.w.g. aluminium chassis 8 x 5 x 2in with a front panel 6 x 9in. The layout employed may be seen from the illustrations. Fig. 3 gives chassis drilling details, and it is recommended that all holes are drilled before the assembly is commenced. Details of the above and below-chassis screens are given in Figs. 4 (*a*) and (*b*). The below-chassis screen is made of brass in order that the valveholder spigot of the P.A. can be soldered to it. This screen is designed to be positioned between pins 3 and 4 and pins 6 and 7 of the valveholder, which should be inserted from the top of the chassis. The holes for the screen fixing screws are not given on the chassis and front panel drawings.

TABLE

Key to Holes in Figs. 3 and 4

Hole	Dimension	Hole	Dimension
A	⅛in diam.	G	¾in diam.
B	5/32in diam.	H	1⅛in diam.
C	⅜in diam.	J	1½in diam.
D	15/32in diam.	K	¼in diam.
E	½in diam.	L	No. 22 drill
F	⅝in diam.		

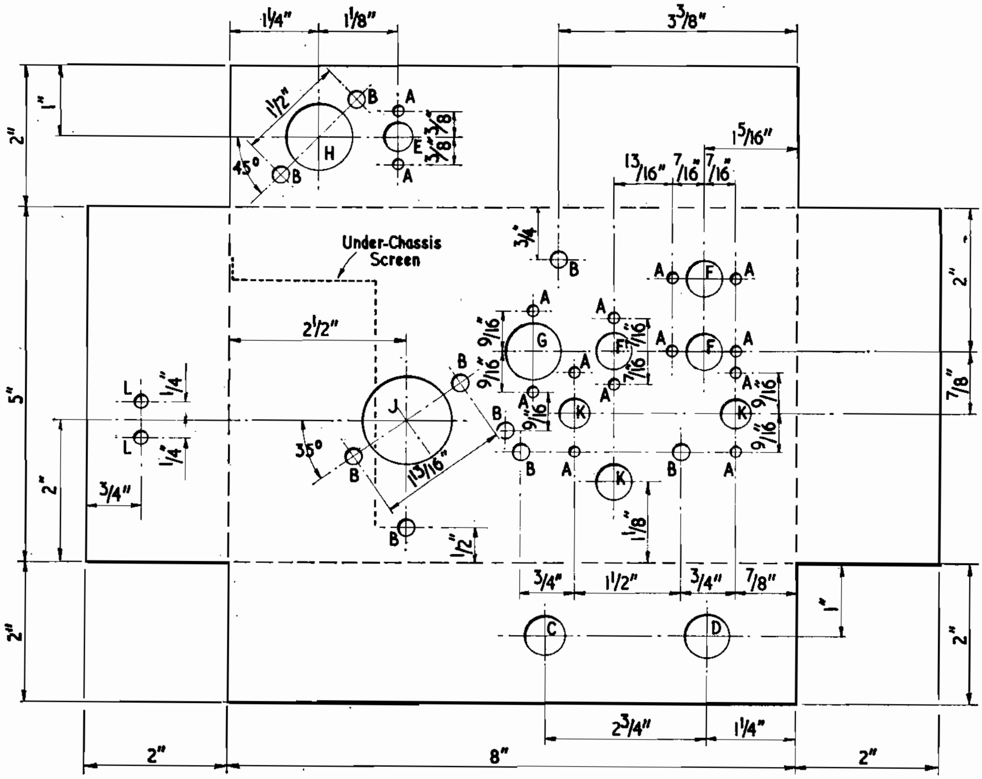


Fig. 3. Chassis drilling details

These holes are best marked out with the screens correctly positioned on the chassis. Due to the many different types of split-stator capacitors which may be used for the P.A. tuning, the positions of the fixing and spindle holes for this have also been omitted from the drawings. Hole diameters for the chassis drawings are given in the Table.

The arrangement of the coils, L_3 and L_4 is given in Fig. 2. It should be noted that these details should be followed closely in order to obtain optimum drive conditions. One end of L_3 is connected to the anode tag of V_3 valveholder while the other is supported by a nylon lead-through insulator. As L_3 and L_4 are wound with non-insulated wire it is essential to ensure that they do not touch each other, since the positive voltage which would result at the P.A. grids would cause damage to the valve.

The P.A. anode coil is soldered across the anode pins of the TT15 valveholder. The leads to the stators of the tuning capacitor should be of thick wire and kept as short as practicable. A link coupling coil of p.v.c. insulated wire is positioned near the centre of the winding, and its twisted leads connected to a pair of nylon lead-through insulators which are used as aerial terminals.

The P.A. stage is designed for anode and screen modulation. To this end a Belling-Lee insulated coaxial socket is provided on the rear of the chassis. This type of connector is recommended as it will withstand the high peak voltages associated with anode and screen modulation.

Power Requirements

The transmitter requires a heater supply of 6.3 volts at 3A. For the high tension a supply capable of delivering 300 volts at approximately 150mA is needed. Of this, the power amplifier draws about 70mA anode current when tuned up. The d.c. power input is, thus, just over 20 watts. In order to fully modulate the transmitter a modulator with

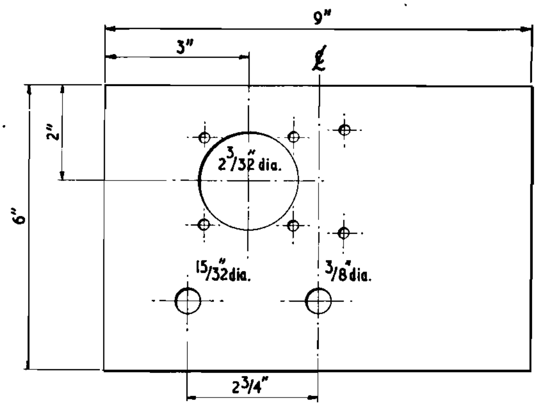


Fig. 5. Drilling details for the front panel of the 70 Mc/s transmitter. The exact positions of the meter fixing holes and above-chassis screen fixing holes are not given here, these best being marked out after assembly

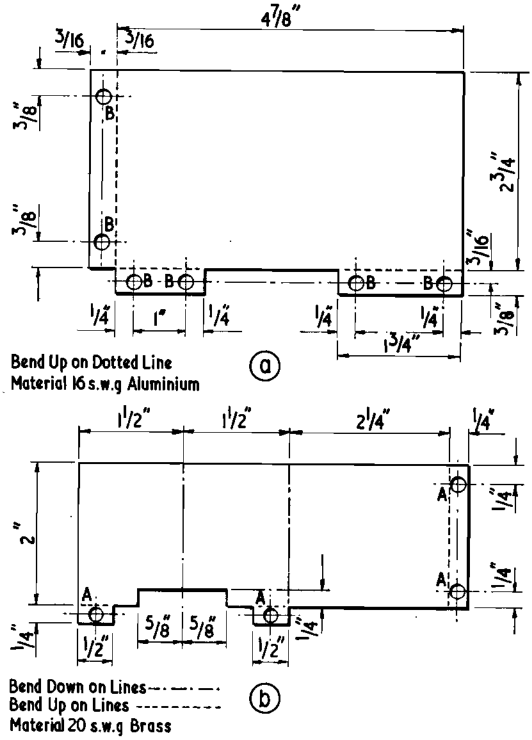


Fig. 4 (a). Above-chassis screen for the 70 Mc/s transmitter and (b) the below-chassis screen

an output impedance of 3,000Ω and a power output of at least 10 watts would be required.

Alignment

The transmitter was built stage by stage, in order, commencing with the crystal oscillator. Thus, it is possible to align each stage as it is completed. Final adjustment must be made, however, when the unit is completed.

Before alignment is commenced the P.A. valve should be removed from its holder. H.T. power may then be applied and each stage tuned to its correct frsquency. When optimum output from the 5763 is achieved, the P.A. valve may be inserted and tuned to resonance, a lamp being used as a load. The anode circuit of the 5763 will require slight readjustment in order to obtain optimum drive conditions. This slight readjustment is necessary due to the additional capacitance of the TT15.

The r.f. circuits will be slightly detuned when the unit is inserted into a cabinet. Suitably aligned holes should, therefore, be provided in the underside of the cabinet in order to facilitate final adjustment of the circuits.

Results

Encouraging reports were received from many stations when a simple indoor dipole aerial was used. With a good aerial system for the four metre band, stations can be worked all over the country.