TRI-BAND RANGER

PART 2

by

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In this concluding article, constructional details are provided for drilling the chassis and panel, and for wiring and assembly. Finally, information is given on the process of alignment and setting up

DETAILS OF THE COMPONENTS SPECIFIED, TOGETHER with coil winding information, were given in the Components List published last month. Substitute components may be used provided they meet the necessary electrical and physical requirements.

The only components which require comment are the two wide-band coupling transformers. T1 and T2. They were originally designed by B. J. P. Howlett (G3JAM)* and the information is included in the present article by courtesy of *Short Wave Magazine*, to which journal grateful acknowledgement is made. The transformers are home-wound on Aladdin PP5937 or Neosid 5000B TV type of i.f. formers. The formers, top plates and dust cores required are available from Denco (Clacton) Ltd. Full winding details for both transformers are given in Fig. 3, and the correct bandwidth will be obtained if the specifications are followed closely. One layer of self-adhesive paper tape should be wound on the former initially at the position of each winding so as to prevent the wire slipping on the former. Tape is also used between each layer of the windings, but this should be used sparingly otherwise the Q-factor and self-capacitance will be affected.

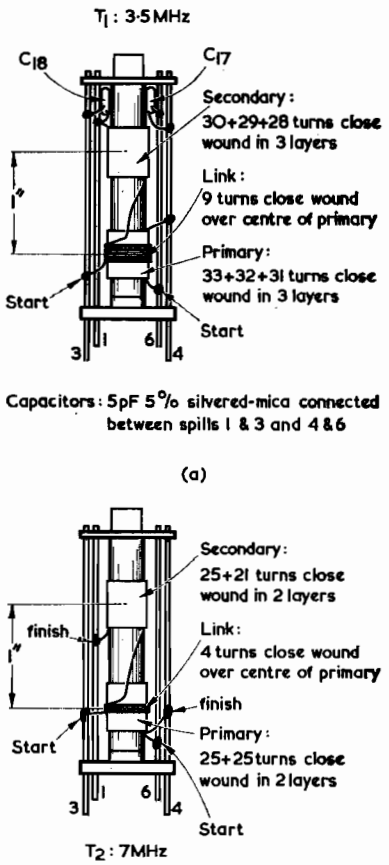


Fig. 3. Assembly and winding details for the wide-band coupling transformers

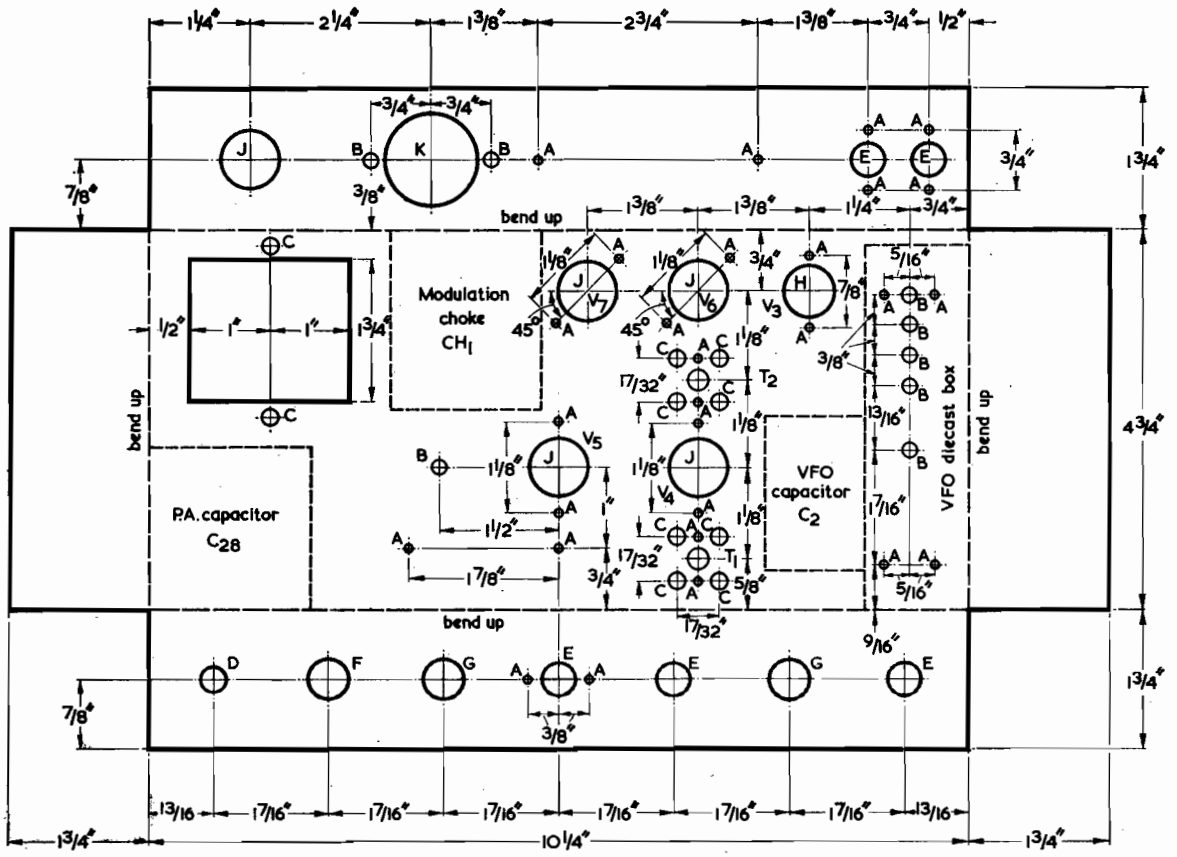


Fig. 4. Chassis drilling details. The material is 16 s.w.g. aluminium, and the sides are bent up along the broken lines. The drilling details for CH1 and C28 have been omitted as they will vary for different versions of these components

After winding each transformer a top supporting plate is fitted. Lengths of 18 swg tinned copper wire 2½in. long are used for the connecting spills. They should be soldered to the eyelets at the base of each former, and their tops should be cut off flush with the top plate to prevent them short-circuiting to the screening can.

On the 3.5 MHz transformer, T1, small 5pF 5% silvered-mica capacitors are connected across each winding to supplement the stray capacitance and provide the correct bandwidth characteristics. The capacitors should be positioned at the top of the former and soldered across the appropriate spills.

METALWORK

The transmitter is built on a 16 s.w.g. aluminium chassis, 10¼ by 4¼ by 1¾in., with a front panel 11½ by 7in. Drilling details are given in Fig. 4 and Fig. 5. The v.f.o. (V1) and buffer amplifier (V2), together with their associated components, are built into an Eddystone die-cast box measuring 4⅜ by 2⅜ by 1⅞in. which is mounted onto the main chassis. A screen is positioned between the v.f.o. and buffer amplifier sections.

The chassis drawings give details for the components specified, but if alternative types are used, appropriate variations in the drilling details will be necessary. It should be noted that drilling details for the modulation choke CH1 and capacitor C28 are not given in Fig. 4 as these will depend upon the type of choke and capacitor employed. The transmitter is fitted into an aluminium cabinet and cut-outs will be required to coincide with the rear mounted sockets on the main chassis.

The appearance of the transmitter is enhanced by finishing the chassis and panel in silver-hammer after drilling. A cabinet finished in black crackle provides a pleasing contrast. 'Panel Signs' are used in order to identify the various front panel controls.

Fig. 6 shows the holes required in the Eddystone die-cast box. Note that this diagram is drawn in third angle projection (that which is normally employed for drawings appearing in *The Radio Constructor*). To obviate doubt the 'open' edges of the top and bottom sections are indicated, these being the edges against which the lid fits.

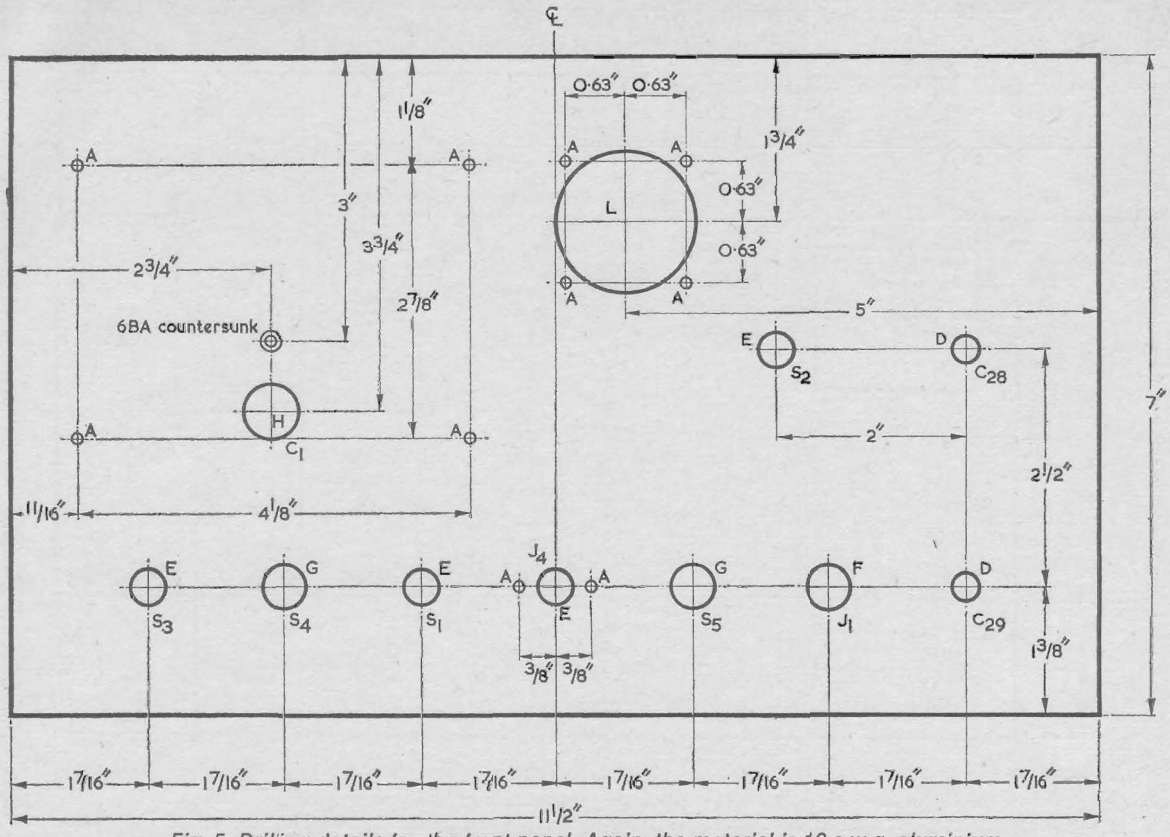
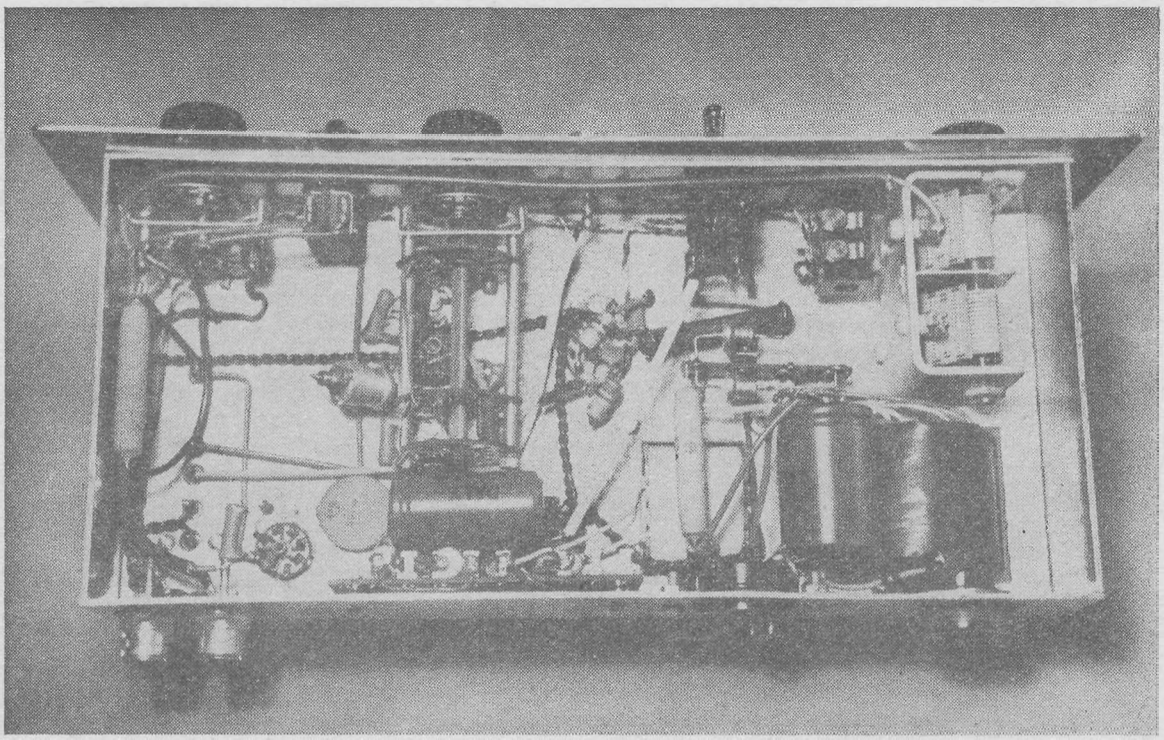


Fig. 5. Drilling details for the front panel. Again, the material is 16 s.w.g. aluminium



Layout of the components under the chassis. Note the position taken up by the 3-water band-switch, S1. The 2-gang capacitor at the right is C29

Fig. 7 shows the inter-section screen for the v.f.o. box. The material is 16 s.w.g. aluminium and the flanges should be bent up along the dotted lines. The locations of the holes for fixing are best marked out with the screen in position.

Details of the transparent dial cover are given in Fig. 8. The material here is $\frac{1}{16}$in. Perspex sheet.

Fig. 9 gives details of the mounting pillar for the p.a. r.f. choke. The material is $\frac{1}{4}$in. diameter Perspex rod drilled and tapped 6BA at each end. Two pillars are required.

The accompanying Table gives a key to the hole diameters in the applicable drawings.

TABLE

Key to chassis diagram hole diameters.

A $\frac{1}{8}$in. dia. (6BA clearance)
B $\frac{5}{32}$in. dia. (4BA clearance)
C $\frac{7}{16}$in. dia. (2BA clearance)
D $\frac{5}{16}$in. dia.
E $\frac{3}{8}$in. dia.
F $\frac{7}{16}$in. dia.
G $\frac{15}{32}$in. dia.
H $\frac{5}{8}$in. dia.
J $\frac{3}{4}$in. dia.
K $1\frac{1}{8}$in. dia.
L $1\frac{1}{2}$in. dia.

CONSTRUCTION

Anyone with a transmitting licence will be conversant with the constructional techniques required in equipment of this kind but, for guidance, detailed wiring diagrams of the v.f.o. unit and transmitter chassis underside are given in Fig. 10 and Fig. 11.

All the components in the v.f.o. and buffer stage are mounted inside the Eddystone die-cast box with the exception of the variable capacitor C1 which is fitted to the large side. The variable capacitor is a good quality single gang type with ceramic insulation and ball race bearings at each end of the spindle. It is the type used in the ex-surplus RF27 unit but is also available as a new item from Jackson Bros. The output from the v.f.o. is fed via a nylon lead-through insulator in the screen to the buffer amplifier grid. Nylon lead-through insulators are also used for the supply leads and output connections of the v.f.o. unit.

The v.f.o. drive comprises a Jackson Bros. epicyclic slow motion drive fitted to the spindle of C1 and retained by a screw mounted on the front panel. The pointer is made from a short length of polished brass wire fitted to the drive, and the scale is made from paper trapped to the front panel by the Perspex sheet detailed in Fig. 8. A suitable scale is shown in Fig. 12. This is reproduced actual size and may be traced or cut out.

The stabiliser valve V3 and its associated dropping resistor R2 are mounted external to the v.f.o. unit in order to keep heating effects to a minimum.

Having constructed the v.f.o. unit as a separate entity the remainder of the components may now be affixed to the main chassis. The valveholder for V4 has a skirt to take a screening can.

The rest of the transmitter may now be wired up as illustrated in the wiring diagram, taking care to use screened wire where shown. The earthy end of R10 should be accessible as this will need to be disconnected for the alignment procedure. The dual smoothing capacitor C37 should be the last item fitted under the chassis as this will tend to hide other components previously fitted.

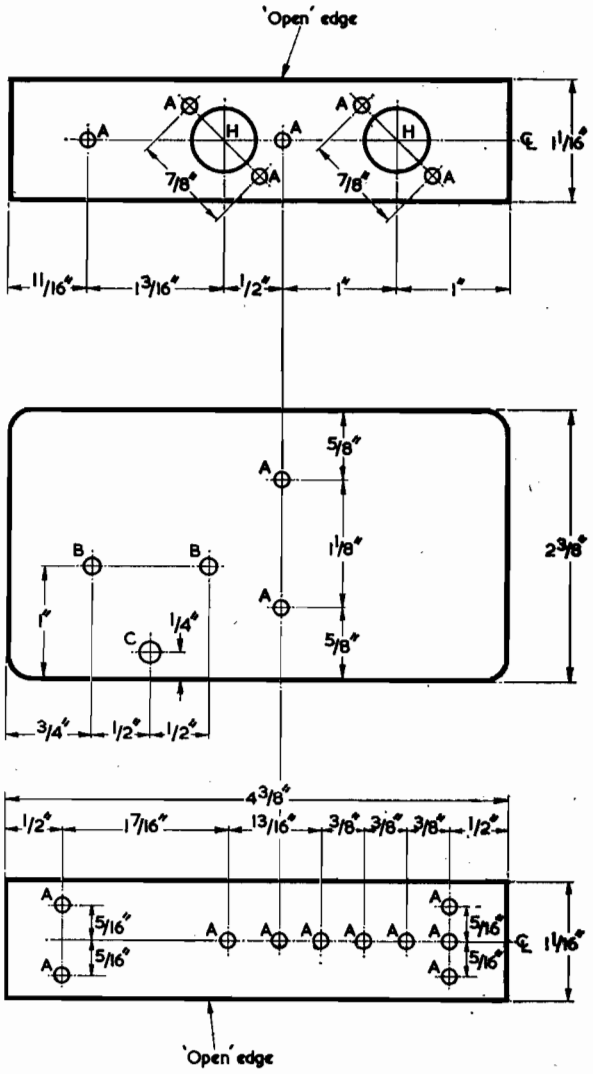


Fig. 6. The holes required in the Eddystone die-cast box in which the v.f.o. components are fitted

Most of the p.a. anode circuit is contained above the chassis, the parasitic stopper resistor R13 being fed from the anode pin to a nylon lead-through insulator on the main chassis. The p.a. r.f. choke RFC3 is mounted on small 'Perspex' stand-off insulators as detailed in Fig. 9. P.A. coil L2 is mounted vertically and is held in position by the same 4BA bolt that secures the 4-way tagstrip below the chassis.

The photograph giving a rear view of the upper side of the chassis will be helpful in indicating the above-chassis layout. Along the rear of the chassis, from left to right, are the mains transformer, the

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mate values required are 4.5Ω for R5, 3.5Ω for R6 and 2.5Ω for R7. The resistors are reduced in value experimentally until TR4 passes the desired collector current. It is possible to measure this by connecting a meter capable of reading the appropriate current directly across the output terminals of the supply, but some constructors may not have access to meters capable of reading currents of the order of 100 to 300mA, and there is also a slight risk that damage will occur to the meter if the resistor being adjusted is accidentally set up to too low a value.

An alternative course consists of taking advantage of the voltmeter which is already installed in the unit. If VR1 is set to its maximum position (where its slider is at the D5 end of its track) and a 50Ω 2 watt resistor connected across the output terminals, the meter will indicate 5 volts for a current of 100mA and 10 volts for a current of 200mA. If the 50Ω resistor is replaced by a 30Ω 3 watt component, the meter will indicate 9 volts for a current of 300mA. Other values of resistor may be used for this procedure, if those mentioned are not readily available, the only criterion being that, working from Ohm's Law, they allow the voltmeter to give a reading between 4 and 11 volts when they pass the appropriate current.

Constructors will have their own ideas on the best method of experimentally adjusting the values in R5, R6 and R7. One good scheme consists of initially fitting a resistor which is just slightly higher in value than the expected final resistance, and of then temporarily shunting across it in turn a second resistor of continually decreasing value until the desired parallel combination is found. *Great care must be taken not to accidentally insert too low a resistance in the R5, R6 or R7 positions, or to accidentally short-circuit the emitter of TR4 to the positive supply rail, as the resultant current surge may cause damage to the transistors and to other parts of the circuit.* R5, R6 and R7 each dissipate less than ¼ watt.

When the required values for R5, R6 and R7 have been found and these resistors have been finally wired into circuit, the supply unit is ready for use. Set S2 to the maximum limiting current desired and switch on by means of S1. The voltmeter needle will rise, and it will then be possible to select any output voltage between about 0.5 and 15 volts by adjustment of VR1.

REFERENCES

1. Hugh L. Moore, 'Current-Limiting Power Supply', *Electronics World*, October 1965.
2. G. A. French, 'Variable Voltage Regulated Supply With Excess Current Protection', *The Radio Constructor*, April 1966.
3. G. A. French, 'Improvement Power Supply With Excess Current Protection', *The Radio Constructor*, May 1966.
4. 'In Your Workshop', *The Radio Constructor*, December 1967. ■

'TRIO'

9R–59DE Receiver Modifications. The October 1970 issue of *Radio Constructor* which contained details of modifications to the 'Trio' Communications Receiver Model 9R–59DE is now completely sold out. Copies of the March and April 1971 issues are still available at 22p each post paid.

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modulation choke, V7, V6, V3 and the rear of the v.f.o. box. Valve V5 and valve V4 (the latter in a screening can) are forward of V7 and V6 respectively. On the panel, C28 is at the extreme left, with S2 and the meter to its immediate right. C1, at the right hand end of the panel, is bolted to the v.f.o. box. P.A. coil L2 appears between S2 and the modulation choke. RFC3 is horizontal and is positioned

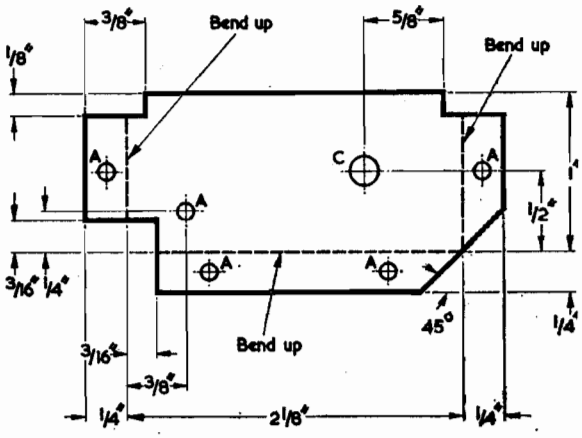
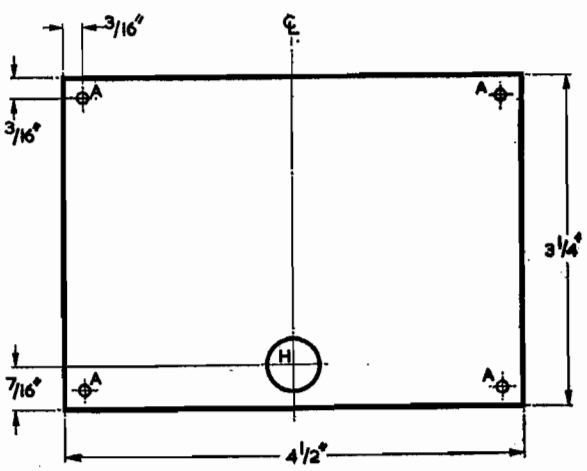


Fig. 7. Inter-section screen for the v.f.o. box. The material is 16 s.w.g. aluminium and the flanges should be bent up along the broken lines. The locations of the holes for fixing are best marked out with the screen in position



Material – 1/16" Perspex sheet

Fig. 8. The transparent scale cover

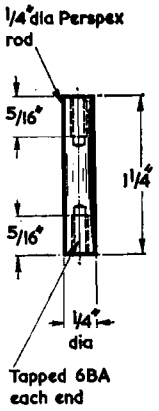


Fig. 9. Mounting pillar for r.f. choke RFC3. Two pillars are required

below the meter. It is secured to tags at the top of the pillars of Fig. 9.

ALIGNMENT

The first step in the alignment of the transmitter is to ensure that the v.f.o. is covering the required frequency range. With the component values specified the prototype covers 1.75 to 2 MHz when the trimmer capacitor C2 has its vanes approximately at half mesh. Because of the limited space available in the v.f.o. compartment the value of this trimmer is lower than that which would normally be used in a v.f.o. circuit on this frequency. Due to differences in stray capacitance and small variations in the inductance of the coil L1 may be necessary to adjust slightly the value of the fixed capacitor C3.

A 0-5 mA moving-coil meter may now be temporarily connected in series with the earthy end of the P.A. grid resistor R10, the positive terminal being connected to chassis. The earthy end of R10 should be bypassed to chassis with 0.01μF disc ceramic capacitor. With the transmitter switched to the 1.8 MHz band and its output matched to a dummy load resistor an indication of approximately 1.5 mA of grid current will be obtained at 1.9 MHz.

The transmitter should then be switched to 3.5 MHz and the top core of the wide-band coupler T1 adjusted for maximum grid current at 3.5 MHz. The bottom core should be adjusted for maximum at 3.8 MHz.

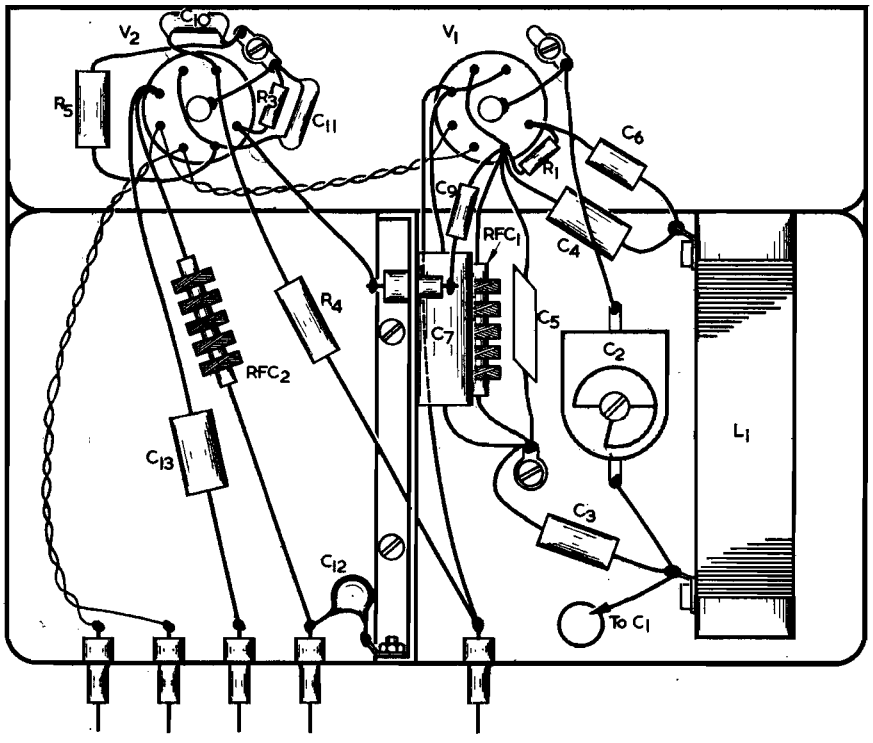


Fig. 10. Wiring inside the v.f.o. unit die-cast box. Lektrokit lead-through insulators are used for output and supply connections, and for the connection between C9 and pin 1 of V2

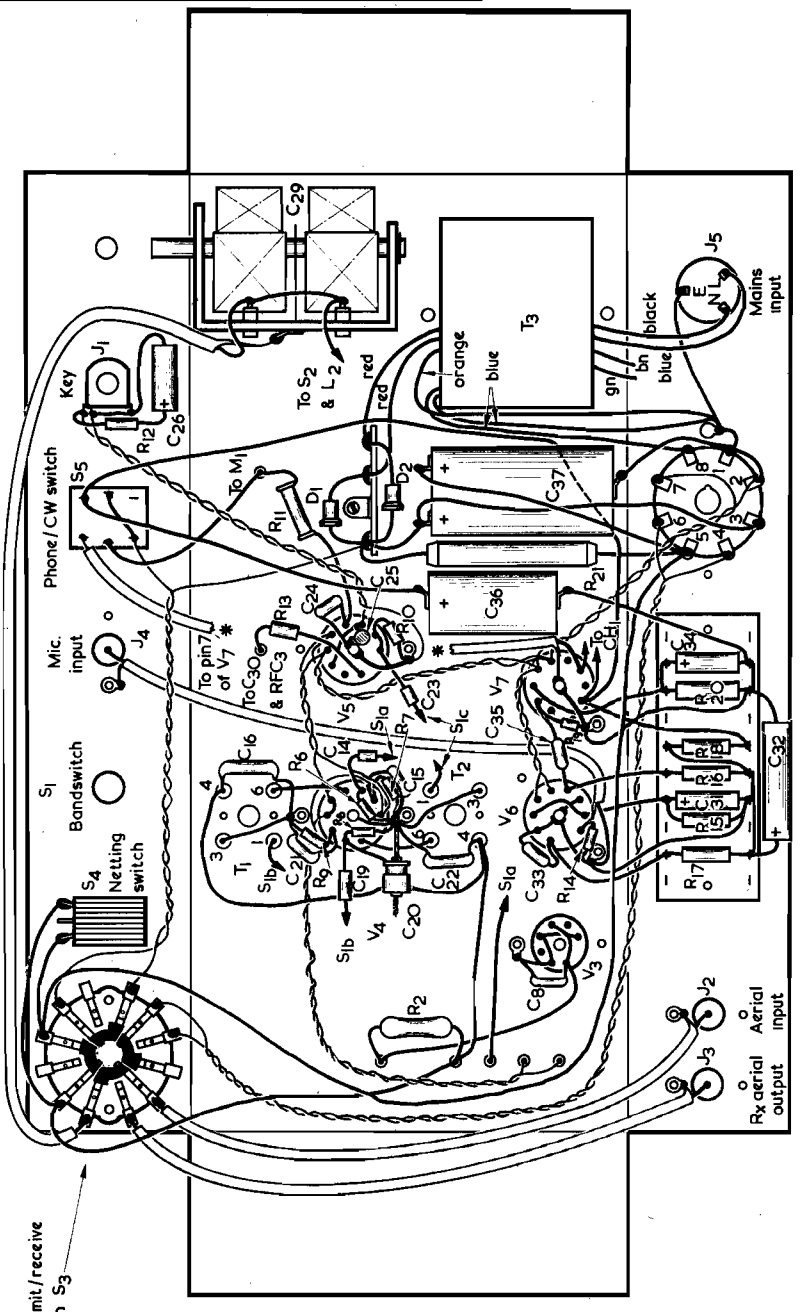


Fig. 11. Wiring diagram of the transmitter. For clarity, S1 is omitted (see Fig. 2, published last month). The 4-way tagstrip is the 5-way tagstrip specified in the Components List, with one tag cut off. Mains transformer lead-out colour coding is that employed in the prototype; constructors should check the colour coding on the actual component to be used before wiring it into circuit

Next, switch to 7 MHz and adjust the top core of T2 for maximum at 7.0 MHz, and the bottom core for maximum at 7.1 MHz. Finally, adjust C20 for maximum at 7.05 MHz. The grid current on the 3.5 and 7 MHz bands will be of the order of 1 mA. The meter may now be removed and the earthy end of R10 permanently connected to chassis.

RESULTS

The transmitter described has had much use since its initial construction. It has been employed at a local National Field Day event, and has had extensive use as a fixed station by many newly licensed radio amateurs. A good note is produced on c.w. and the modulation quality on a.m. is better than the average transmission on the amateur bands. The transmitter is ideal for the person with limited space available and for those who are interested in exploring the low frequency bands on low power 'phone and c.w.

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