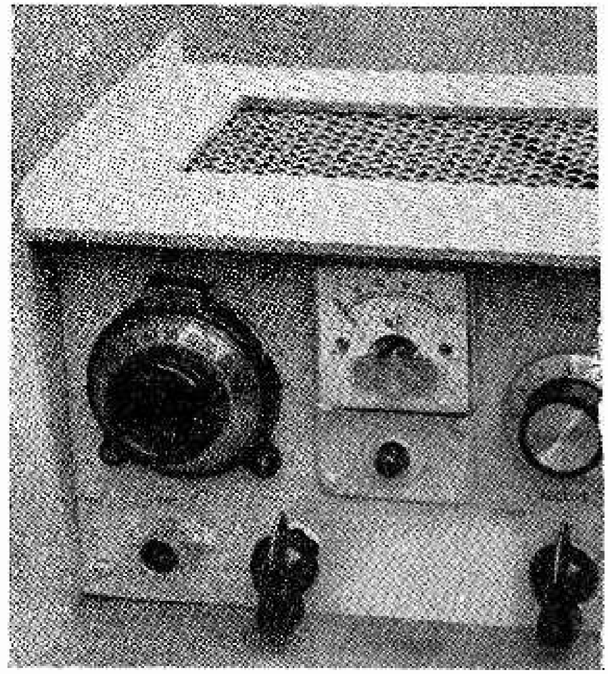
Cover Feature

TOP BAND "QUARTET" TRANSMITTER

by

A. S. CARPENTER, G3TYJ



An easily built little transmitter using reliable circuitry which can be operated fixed or mobile on either Phone or CW. This transmitter must not, of course, be used without the appropriate Post Office licence. A companion receiver, similarly designed for Top Band, will be described in next month's issue

SEMI-MINIATURE TRANSMITTERS SUITABLE FOR TOP Band/M working are usually of interest to the licensed Amateur fraternity, this being particularly true when 'sure-fire' circuitry is employed. Fixed station operators may also find the neat pocket-handkerchief-sized rig of interest— at least it is hoped so. Optional phone/c.w. facilities are a worthwhile inclusion and are incorporated in the little rig to be described. Using valves in the transmitter simplifies a design which cannot yet be made less expensively 'sure-fire' with transistors as the r.f. active components.

CIRCUITRY

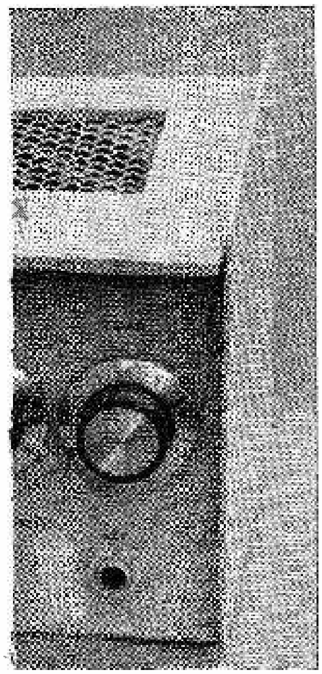
The complete transmitter circuit, which can be powered either by an external mains power supply unit or by a transistorised d.c.—d.c. inverter delivering 100mA at 300V, is given in Fig. 1.

Only four valves (plus a stabiliser tube) are used, with V1, operating as v.f.o. and multiplier, feeding V2, the final r.f. amplifier. The remainder of the circuit consists of a 2-stage speech amplifier feeding V4 which effectively anode/screen modulates the r.f. stage when Function switch S2 is in the 'Phone' position. When S2 is at the 'CW' position any charge left on the modulator h.t. line is leaked away via resistor R20.

RF STAGES

The v.f.o. circuitry around V1(a) is reliable, and in the interests of obtaining a good c.w. note operates at a division frequency. This may be either over the range 600-666 kc/s, or 900-1,000 kc/s to give final output in the Amateur frequency band of 1,800-2,000 kc/s. Frequency multiplication is taken care of by V1(b) and coil L2 is pre-tuned to afford maximum output at approximately 1,900 kc/s; v.f.o. tuning is panel-controlled via a small vernier reduction drive scaled 0 to 100. In the prototype, the v.f.o. ran at 600-666 kc/s, but the range 900-1,000 kc/s is equally satisfactory in practice.

The stabiliser tube, V5, provides stabilised h.t. for V1, The ECF80 triode chosen as oscillator is able to work satisfactorily from an applied d.c. potential of 150V, as supplied by the stabiliser. Stabilising the triode section of the valve alone seems less effective than when both sections are similarly treated. Additionally, both sections of V1 are allowed to run continuously when the transmitter is 'On' and drift is thus virtually eliminated once the rig has reached its normal operating temperature. On 'Receive' the v.f.o. does not interfere with reception in any way provided the value assigned to the detuning capacitor, C21, is so chosen that harmonics do not fall in the frequency range of 1,800-2,000 kc/s. It will be appreciated that the associated power supply unit will 'see' differing load currents as the transmitter is operated. The lightest load is presented to the supply during 'Receive' when only V1 and V5 are operating but to prevent the applied h.t. potential from rising excessively a swamping resistor, R19, is included as a dummy bleeder.



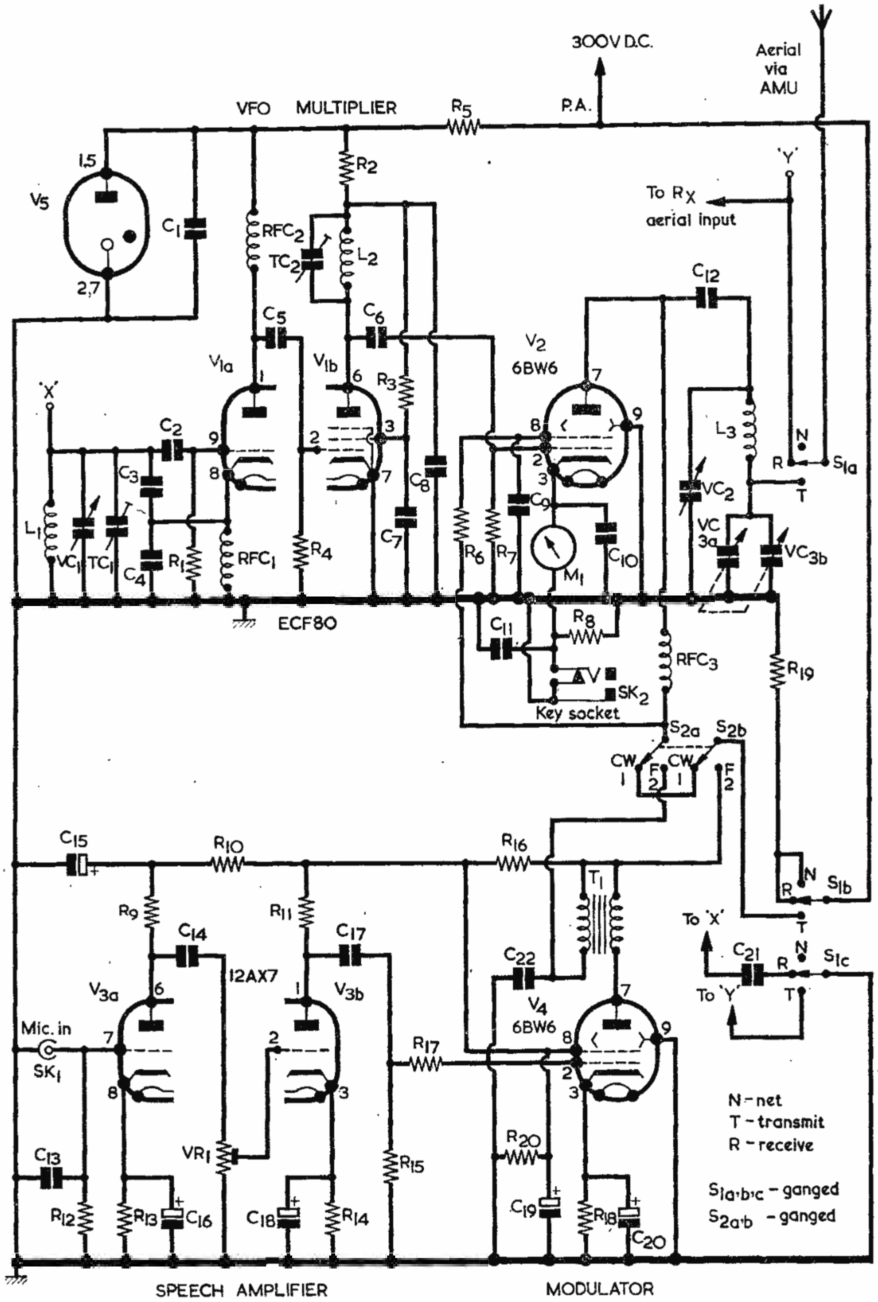
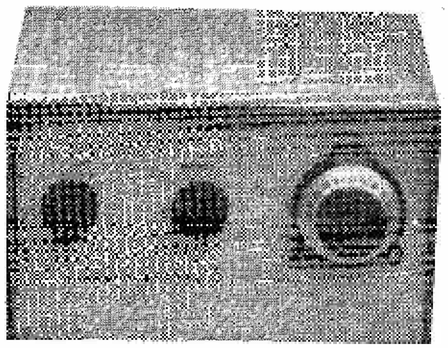


Fig. 1. Complete circuit of the Top Band "Quartet" transmitter

The p.a. stage is conventional pi-tank output with cathode keying. The meter is also included in the cathode circuit of V2 and thus enables the user to check that drive is present prior to going over to 'Transmit'. To check for drive, S1 is placed at 'Net' and in this position some 1.5 to 2mA should be just detectable in the meter.

AUDIO STAGES

Use of a crystal microphone is assumed, this being connected to socket SK1. The modulator looks simple enough but care is needed during construction if the full potential gain is to be realised. To adequately modulate the transmitter at least 5 watts of audio



Front view of the completed receiver – see next issue

must be developed and this is not over-easy using a single 6BW6 valve for the output stage. This means that the whole modulator must operate at maximum efficiency and to this end high value anode and grid return resistors are fitted. The speech amplifier valve, V3, is an excellent choice for the work, but it does tend in common with all high gain devices to become unstable when pressed hard. All grid leads *must* therefore be short, carefully oriented and run in screened cabling whilst unwanted capacitive positive feedback must be eliminated by keeping anode and grid circuits well apart.

A variable modulator gain control is unnecessary and the preset control VR1 may be fitted to the rear chassis apron. An anti-parasitic 'stopper' resistor, R17, was also found essential in the prototype, one end of this component being soldered direct to V4 valveholder at pin 2.

Audio modulation of the p.a. stage is achieved via T1 which, in the prototype, is a half-wave mains transformer. This is of the type having a mains voltage primary and an h.t. secondary offering 230 to 250 volts at a current of 25mA or more, a typical example being the Elstone MT11. The primary is in the V4 anode circuit. The heater windings are ignored and their connecting lead-outs are merely taped up and placed safely out of the way. It is appreciated that a proper modulation transformer might perform slightly better but, in the present instance, operation is only at 10 watts maximum d.c. input and the mains transformer works, in practice, very well. (Since a mains transformer has interleaved laminations instead of the butt-jointed laminations normally associated with modulation transformers, it might be worth-while checking whether modulation is improved if the leads to either the primary or secondary are experimentally transposed. If the magnetising force due to V2 opposes that due to V4, there is less risk of approaching core saturation.—Editor.)

SWITCHING

The Phone/c.w. switch S2 simply removes or connects h.t. to the modulator as required, the T1 secondary being bypassed when c.w. is the desired operating mode.

The main operating switch is S1 and is a 3-pole 3-way rotary Yaxley type, the central position being assigned to 'Receive'. In this position, the modulator and p.a. are inoperative whilst the v.f.o. and multiplier are running but thrown off-tune due to capacitor C21. The aerial is also connected through to the associated receiver. At the 'Net' position, to right of centre, capacitor C21 is disconnected and the v.f.o. signal may be sought on the receiver or may be tuned to the receiver as required, anywhere in Top Band. Moving the operating switch to its remaining position, 'Transmit', brings the p.a. to life and also the modulator provided S2 is at the Phone position; normal tuning and loading of the p.a. using the meter as a guide is then possible.

(A 3-pole 3-way switch is specified for S1. If, however, the transmitter is to be used with the receiver which will be described next month and if no external aerial switching or receiver disabling facilities are provided, it would be preferable to use a 4-pole 3-way switch. The spare pole may then be used to switch off the receiver when transmitting.—Editor.)

COILS

L1 may be a small medium wave coil provided that it is a robust and well-made component. If the coil has an r.f. coupling winding (i.e. a coupling winding which is intended for connection to the anode of a preceding r.f. amplifier) this coupling winding may be ignored. It is best to avoid using a medium wave coil with a coupling winding intended for connection to an aerial, as such coupling windings sometimes resonate with their own self-capacitance at a point in the medium wave band and cause unwanted absorption effects. Although an air cored coil may be preferred, an iron-dust cored coil has the advantage that it can simplify initial setting up, since its core may be adjusted to permit Top Band to be spread over the whole length of the v.f.o. tuning scale. For L2 another

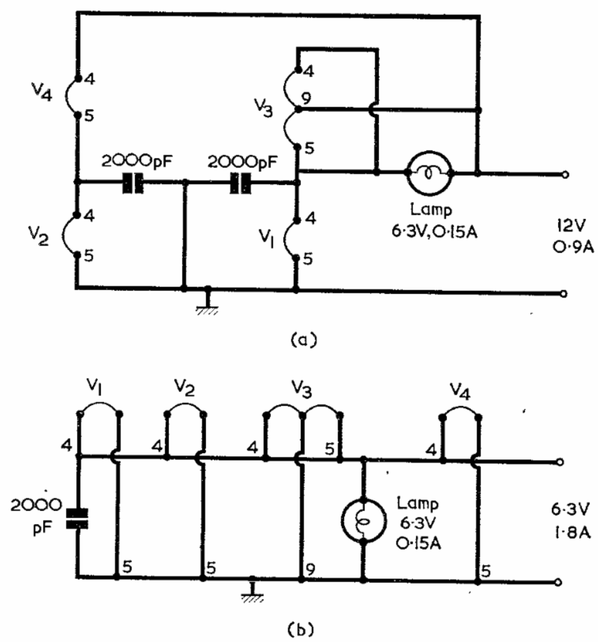


Fig. 2(a). How the heaters and panel lamp are connected for 12 volt operation
(b). The heaters and lamp are wired in parallel for 6.3 volt operation

COMPONENTS

Resistors
(All fixed values ½ watt 10% unless otherwise stated)

R1	47kΩ
R2	470Ω
R3	6.8kΩ
R4	47kΩ
R5	6.8kΩ 10 watts
R6	6.8kΩ 1 watt
R7	22kΩ
R8	100kΩ
R9	470kΩ
R10	18kΩ
R11	330kΩ
R12	3.3MΩ
R13	3.3kΩ
R14	2.2kΩ
R15	1MΩ
R16	1.5kΩ
R17	10kΩ
R18	330Ω
R19	27kΩ 5 watts
R20	470kΩ
VR1	2MΩ potentiometer, log, pre-set

Capacitors
(All fixed capacitors 350V wkg. unless otherwise stated)

C1	0.01μF ceramic
C2	100pF silver mica
C3	1,000pF silver mica
C4	1,000pF silver mica
C5	100pF silver mica
C6	330pF silver mica
C7	0.01μF ceramic
C8	0.01μF ceramic
C9	2,000pF ceramic
C10	2,000pF ceramic, 100V wkg.
C11	2,000pF ceramic, 100V wkg.
C12	1,000pF paper, 1,000V wkg.
C13	100pF ceramic, 100V wkg.
C14	1,000pF ceramic
C15	8μF electrolytic
C16	50μF electrolytic, 6V wkg.
C17	2,000pF ceramic
C18	50μF electrolytic, 6V wkg.
C19	32μF electrolytic
C20	50μF electrolytic, 25V wkg.
C21	200pF silver mica
C22	1,000pF paper, 1,000V wkg.
VC1	100pF variable, type C804 (Jackson Bros.)
VC2	250pF variable (see text)
VC3	410+410pF twin-gang variable (see text)
TC1	56pF trimmer, Mullard concentric
TC2	56pF trimmer, Mullard concentric

(N.B. Also required are ceramic capacitors, 2,000pF 100V wkg., as shown in Fig. 2.)

Inductors

L1, L2, L3	see text
RFC1	R.F. choke, 2.5mH
RFC2	R.F. choke, 1.5mH
RFC3	R.F. choke, 2.5mH
T1	Modulation transformer, see text

Valves

V1	ECF80
V2	6BW6
V3	12AX7
V4	6BW6
V5	OA2

Switches

S1	3-pole, 3-way, Yaxley (see text)
S2	2-pole, 2-way, Yaxley or toggle

Meter

M1	0-50mA type MR38P (SEW)

Sockets and Screening Cans

SK1	Coaxial socket
SK2	Closed-circuit jack socket

1 B7G valveholder
2 B9A valveholders without skirts
2B9A valveholders with skirts
2 B9A screening cans (for V1 and V3)
2 coaxial sockets (for transmitter and receiver aerial connections)

Lamp
6.3V 0.15A panel lamp and holder

Miscellaneous
1 Vernier dial drive type T502 (Eagle)
Knobs, as required
1 ¼in. insulated spindle coupler, extension shaft and panel bush (for VC1)
Material for chassis, panel and case

medium wave coil (meeting the same requirements so far as any coupling winding it may have is concerned) can be used but preferably with some 20 turns removed. The use of a grid-dip oscillator enables one to find the required resonances quickly but if such an instrument is not available a receiver may be used together with the transmitter itself. The receiver is tuned to around 1,900 kc/s and with the transmitter operation switch at the 'Net' position the VC1/L1/TC1 combination is manipulated until a beat note is heard. Coil L2 is then peaked for maximum output as shown either by the panel meter or, more clearly, by an externally connected meter set to read 0-5mA and inserted between the 'cold' end of R7 and chassis.

If no beat note can be found, a meter set to read 0-50mA should be inserted in series with the h.t. end of RFC2. At switch-on a reading should be obtained—say 5mA — whereupon L1 should be momentarily short-circuited whilst watching the meter closely. If no current change is detected the v.f.o. circuit is inoperative and must be checked; when functioning correctly the oscillator current should increase briskly when L1 is short-circuited.

Coil L3 consists of 60 turns of 28 s.w.g. enamelled

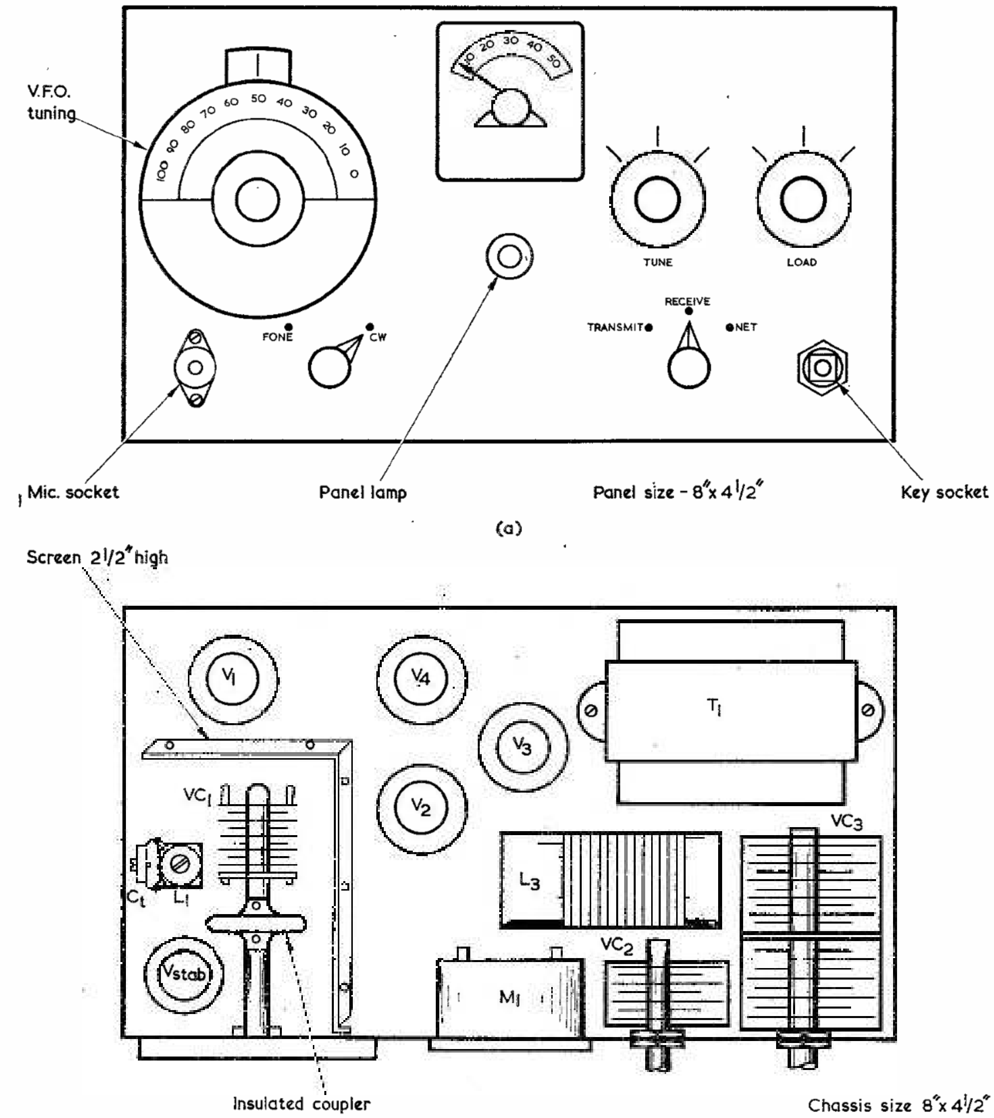


Fig. 3(a). The front panel layout employed for the prototype. Note the small overall dimensions (b). View above the chassis. VC1 is mounted on a small bracket

copper wire close-wound on a 1in. diameter former and mounted horizontally.

HEATER WIRING

This depends on the type of service required of the transmitter and for /M working a 12V heater supply will doubtless be used. Connections for both 6V and 12V heater supplies are shown in Fig. 2; a panel lamp is also included and is essential with 12V connections to act as a bypass due to dissimilar heater current ratings in V1 and V3.

LAYOUT

The layout used in the prototype is shown in Figs. 3(a) and (b). This layout need not be followed, although it is doubtful whether any significant improvement can be made. Due to possible variations in size between different components employed for T1, VC2 and VC3, all the parts should be obtained first before deciding on dimensions for the front panel and chassis. In the writer's transmitter both the panel and the chassis surface measured 8 by 4½in., these small dimensions being achieved whilst using standard components. When the transmitter is fitted in a case, adequate ventilation should be provided.

VC2 and VC3 may be of small size but should not be "miniature" types. In the prototype VC3 was 410 plus 410pF, Jackson type O2, and VC2 was of similar type.

The aerial sockets may be located, with VR1, on the rear chassis apron. The power supply cable may be fed in at the rear of the chassis also.

It should be noted that V1 and V3 are fitted with screening cans.

TESTS

Initial tests consist of the usual current and voltage measurements, checking v.f.o. coverage and so on. The stabiliser tube should glow whenever power is applied to the transmitter; should it not do so at any position of S1 or S2, R5 may require to be reduced slightly in value to obtain the required 185V striking voltage. It is important to check the current flowing through the stabilizer tube; this should not be allowed to exceed 30mA at any position of switches S1 and S2.

No aerial should be connected initially, just a 15 watt lamp as an artificial load. On 'Transmit' the lamp should glow quite brightly when tuning and loading have been carried out correctly, and speaking into the microphone on Phone should cause the lamp to brighten on peaks.

Prior to air-testing the transmitter a wavemeter must be brought into use with which to prove that radiation is taking place in the correct frequency band. viz. 1,800-2,000 kc/s. Subsequently the dummy load may be exchanged for the station or car aerial, perhaps through an aerial matching unit, and contacts sought. In next month's issue, the author will describe a companion receiver similarly intended for operation on Top Band. ■

"RADIO 2" MODIFICATION FOR M.W. TRANSISTOR RADIOS

by

B. R. HEWITT

Many of the less expensive transistor radios now in use cover medium waves only. This article describes a simple modification for the reception of Radio 2 on long waves, and continues with a practical example as carried out with a typical imported receiver

There must be many owners of small medium-wave-only transistor superhet radios who, with the introduction of separate programme schedules for Radios 1 and 2, are now restricted in their choice of listening—being unable to receive Radio 2 on 1,500 metres. However, with the author's set, which has a standard i.f. of 470kc/s, it was found possible to make the modification described in this article, this remedying the situation very satisfactorily. It should be possible to carry out a similar modification on most other medium-wave-only transistor receivers, provided that the associated mechanical problems can be overcome.

Some radios on the market have an integral switch on the tuning capacitor which, at one end of its travel, connects additional parallel capacitors into the aerial and oscillator tuned circuits. By suitable choice of values, 1,500 metres may then be accurately obtained.

RADIO 2 SWITCHING

It was decided to take advantage of this approach with the writer's radio. The basic switching scheme appears in Fig. 1, which shows typical ferrite aerial and oscillator tuned circuits for a medium-wave-only receiver.

Additional components introduced by the modification are switches S1(a) and S1(b), and capacitors C1

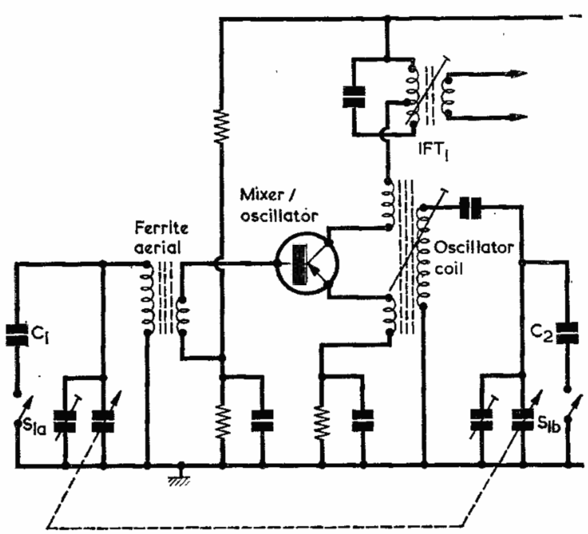


Fig. 1. Basic mixer/oscillator circuit for a medium-wave-only transistor radio, with C1, C2, S1(a) and S1(b) added. These components enable Radio 2 on 1,500 metres to be received