A MOBILE TRANSCEIVER
for
1·8 Mc/s. Telephony

A compact 1.8 Mc/s. transceiver which can be easily installed in a car, or indeed almost anywhere, is an attractive idea—particularly when capable of giving effective two-way telephony operation over a radius of about 10 miles with a simple whip aerial. Here is a description of the ingenious circuit adopted by G8TL to meet such requirements: the design, whether or not copied exactly, presents many useful ideas for mobile and portable operation.

THE development and operation of amateur low-frequency mobile equipment has for many years proved a source of considerable interest and enjoyment at G8TL. Some of the early experiments, using a transmitter, built in 1937, were described in the August, 1940, issue of the *T. & R. Bulletin.* More recently, however, it was felt that less bulky equipment of higher efficiency was desirable, provided that standard components, as available from a typical "junk-box," could be utilised. This urge eventually resulted in a five-valve transceiver in which each valve plays some part in both transmission and reception, an arrangement calculated to reduce not only the space required, but also the heater consumption.

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Photograph of the mobile "Top Band" transceiver.

The Circuit

The complete circuit is shown in Fig. 1 with the five-bank two-way change-over switch in the "receive" position, when the apparatus takes the form of a five-valve superheterodyne receiver: VT501 (R.F. stage); ECH35 (mixer); EF39 (I.F.); 6J5 (second detector); and VT501 (A.F. output) with A.V.C. applied to the mixer stage. On changing to "transmit," the triode section of the ECH35 becomes the master oscillator, driving the first VT501 as a power amplifier to an input of about 3 watts, while the EF39, 6J5 and remaining VT501 function as pre-amplifier, A.F. amplifier and modulator respectively. Components which play a dual role include the loudspeaker transformer which is also the modulation choke, the P.A. tank circuit which serves as the anode load of the R.F. amplifier during reception (with the condenser used to increase gain if necessary), and, of course, the entire audio-cum-modulator section.

As the .5 megohm gain control in the VT501 audio amplifier affects both receiver gain and depth of modulation, an additional .25 megohm potentiometer is used to control the input to the grid of the EF39 in the "transmit" position, partly to prevent overloading when a carbon microphone is used and partly to permit separate adjustment on "transmit" and "receive." A 4½-volt torch battery is incorporated in the unit for energising the carbon microphone. A 6-volt car battery supplies all the heater and relay circuits and 230-volt high tension, obtained from a rotary converter, is sufficient for an input of about 3 watts. Automatic bias is provided for all valves. The unit can also be used with a standard 230 V. power pack under "alternative address" conditions.

Fig. 1 should be found largely self-explanatory with the possible exception of the aerial switching. In order to cure a tendency for the R.F. stage to oscillate, two six-volt relays are arranged to "break" (in the "receive" position) the lead to the transmitter aerial loading coil and also one side of the link coupling between this coil and the P.A. tank circuit. A separate receiver aerial loading coil with slider adjustment is incorporated. It should be noted that the two ECH35's shown in the circuit diagram (one drawn dotted) are in fact the same valve, and the switches in the anode and grid circuits of the triode sections are the same switches, being shown duplicated to simplify the diagram.

Construction

Although the construction of such a unit can be adopted to utilise the particular components on hand, a few notes on the original model may be of interest as a supplement to the information available from the photographs. The valves and most of the components are mounted on an aluminium chassis 7in. x 7in. x 2½in. which, in turn, is bolted to a 7in. x 6½in. front panel. The *Yaxley* 5-bank two-way change-over switch is mounted roughly in the centre of this front panel which also carries the milliammeter, gain controls and tuning controls for the oscillator and receiver. Screwed to the top of the panel and supported

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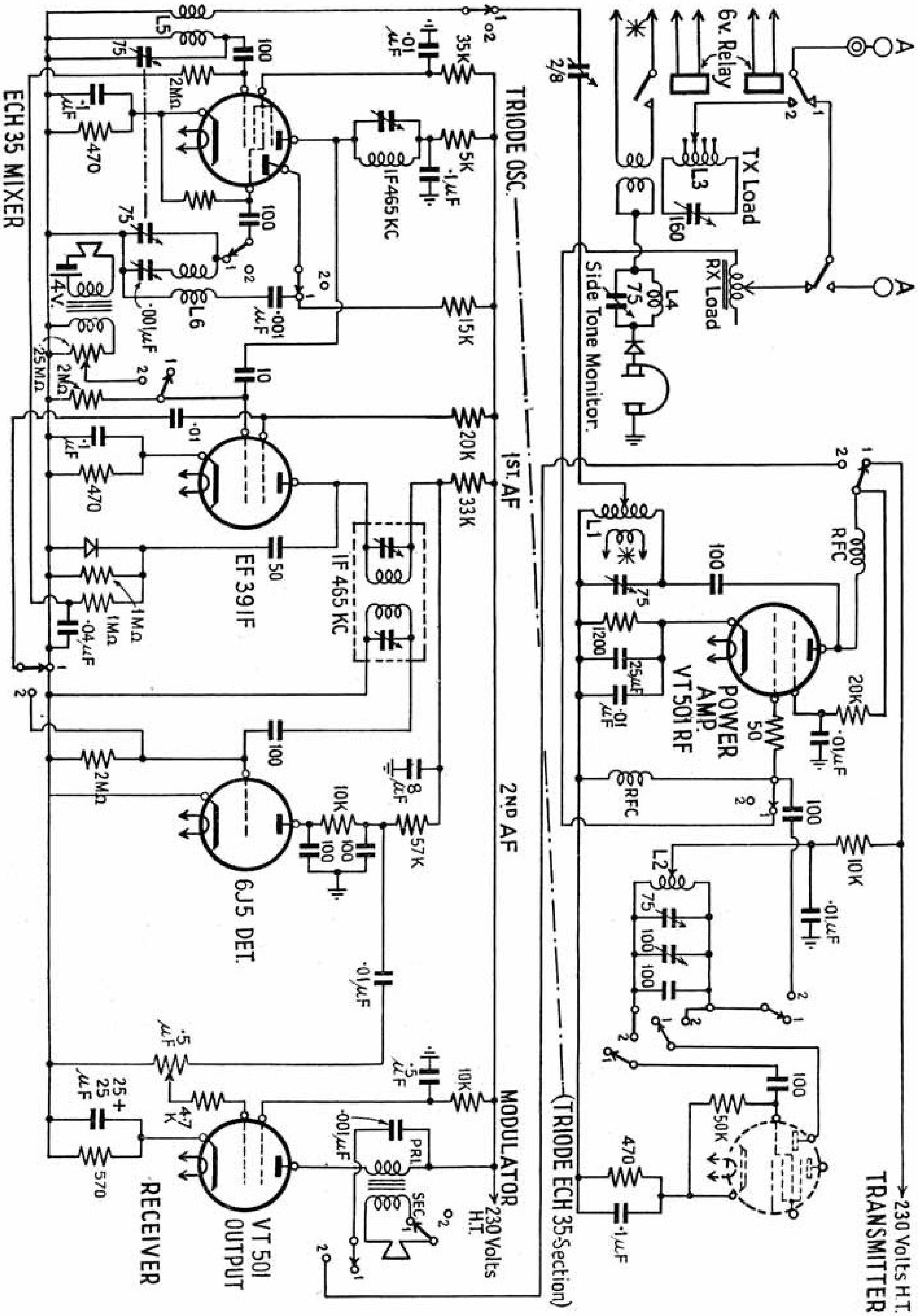


Fig. 1
Circuit diagram of the 1.8 Mc/s. mobile transceiver

also by the two pillars clearly visible in one of the illustrations is the aerial tuning unit 7in. x 7in. x 3in. high. On this is mounted the tapped aerial loading coil which is coupled by a 4-turn link to the tank coil mounted at the rear of the lower chassis. The aerial switching relays, the aerial loading condenser, two aerial binding posts, the monitor coil and detector and the microphone

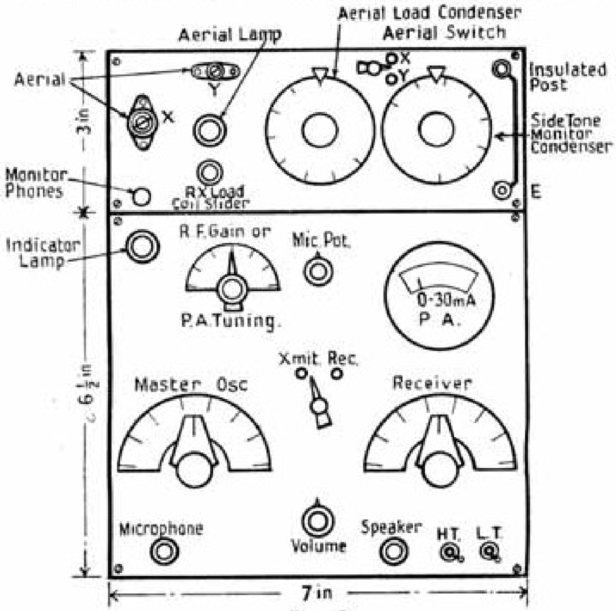


Fig. 2

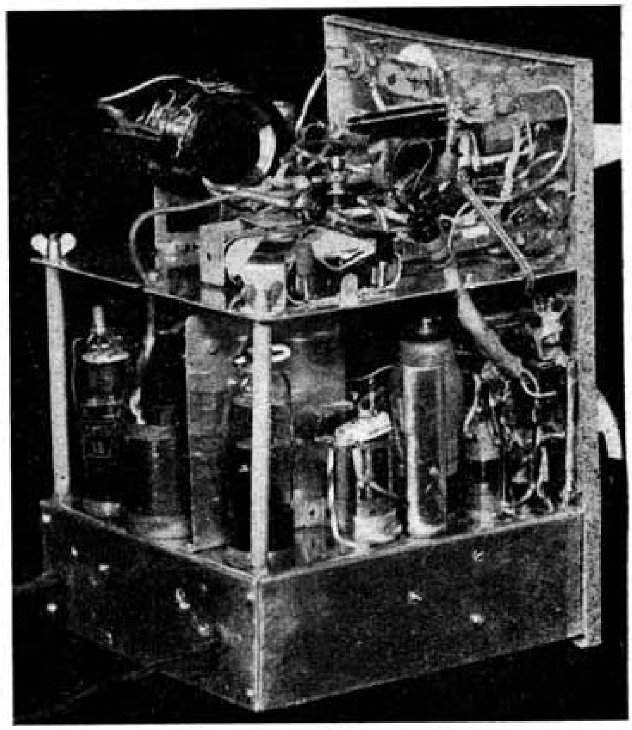
Front panel showing position of the controls.

battery are all placed on the top section. Wing nuts are used on the supporting pillars and all leads between the two sections are fitted with plugs and sockets to facilitate the complete removal of the aerial tuning unit when carrying out adjustments to the main assembly.

Mobile Aerials

As described and illustrated in the 1940 article, the original aerial consisted of 26 feet of wire supported on three 7 ft. masts of 1in. x 1in. oak clamped to the car bumpers. Two of these masts were normally mounted at the front of the car and the third, centrally, on the rear bumper ; the wire forming a "V" over the roof. Although this aerial functioned satisfactorily it possessed pronounced directional characteristics, and signals varied considerably in strength in relation to the position of the car and the receiving station. It was also, as can be imagined, somewhat unsightly and took some little time to erect : it also, incidentally, once led to G8TL being given place of honour in an evening paper as a suspected I.R.A. terrorist !

Alternative systems were therefore investigated. One of these, shown in Fig. 3, consisted of a loaded whip aerial some 4 ft. long fastened to



Rear view of transceiver

the top of a loading coil which in turn plugged into a socket on the front bumper. This gave uniform results in all directions and provided satisfactory signals up to about 10 miles distant. Signal strengths, however, averaged some 2 db. down on those with the "V" aerial. An increase in the length of the whip aerial to 100 in. resulted in comparatively little improvement.

A more elaborate array, consisting of two 100 in. whip aerials, one on the front and one on the rear bumper, joined with a wire across the roof of the car, gave a decided increase in signal strength, and was in fact equal in performance to the more clumsy "V" aerial ; transmissions have, in fact, been reported from up to 150 miles away.

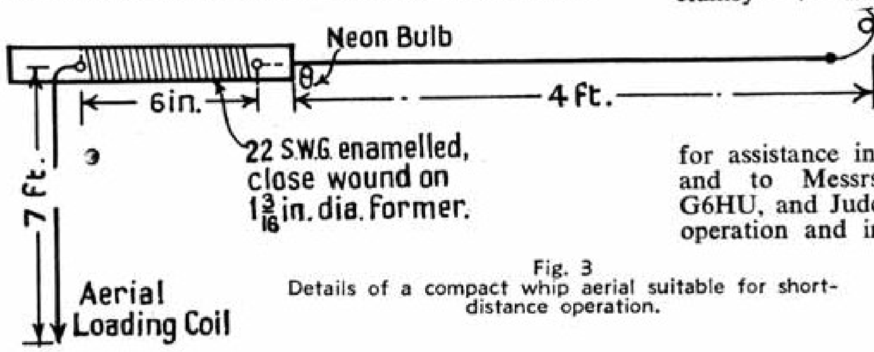


Fig. 3

Details of a compact whip aerial suitable for short-distance operation.

Acknowledgements

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Coil Data

L1	60 turns $1\frac{3}{4}$in. dia. 26 gauge S.S.E.
L2	42 turns $\frac{7}{8}$in. dia. 26 gauge E. (tapped at 16 turns from anode end).
L3	52 turns $1\frac{3}{4}$in. dia. 24 gauge E. (tapped every 6 turns).
L4	$\frac{3}{4}$in. closewound. $\frac{5}{8}$in. dia. 36 gauge E.
L5	*Wearite* PH6 or equivalent *Denco*.
L6	*Wearite* PO6 or equivalent *Denco*.

Power Consumption

Transmit :	L.T. 2.7 A.	H.T. 68 mA.
Receive :	L.T. 2.4 A.	H.T. 60 mA.

L.T. 6 volts. H.T. 220 volts.

Transmitter input 3 watts.