Army Sender Type 36

NOTES ON DESIGN AND CONSTRUCTION— MODIFICATIONS FOR AMATEUR USE ON 10-40 METRE BANDS

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As this article shows, the Type 36 "surplus" transmitter is a particularly interesting proposition in that it can be modified for CW/Phone operation on the four HF bands and is self-contained for power. Our contributor also makes suggestions for improving the general appearance of the equipment. No extensive reconstruction is necessary for any of these modifications.—Editor.

ONE of the better buys on the "surplus" market today is the transmitter known as the Sender Type 36. This was originally designed for use in the A.A. Defence System and covers a frequency range of 10-40 mc, thus taking in our 20, 15 and 10 metre bands. The power input can be run up to 65 watts on CW and phone, and it is one of the few "surplus" transmitters on the market which can be purchased as a *complete unit*—that is, with modulator and power pack.

The transmitter consists of two main units —an RF section which contains a VFO crystal oscillator, buffer/doubler and a PA stage. All the valves used in the three circuits of this section are 807's and the HT voltage to the VFO is stabilised by means of two type AW3 regulator tubes. An interesting feature is the use of tuning indicators ("magic eyes") in the tuning both of the crystal oscillator and buffer-doubler stages. The PA tuning is by means of a built-in 0-200 mA meter. The PA stage operates as a doubler on both bands, using two 807's in *push-push*.

The second main unit contains the power supplies, speech amplifier and modulator. There are separate HT circuits for the modulator and the RF stages and a separate bias supply feeds both the modulator and the RF stage grids. The main HT is brought on by means of a relay in the bias supply line which functions when the bias supply is earthed, to switch in mains voltage to the HT transformer. The three full-wave rectifier valves involved are type AW4.

On the audio side, the speech amplifier consists of a 6C5 transformer-fed from a carbon microphone and transformer-coupled to a pair of 6C5's in push-pull, driving a pair of 807's as modulators in Class-B. The modulation transformer is mounted on the RF chassis. There is provision for modulating the transmitter from a remote source and an arrangement for feeding the audio output from a receiver to the GPO handset which is supplied as standard and incorporates a "push-to-talk" switch.

A 16-point connector mates the two units *via* a massive screened cable. The units are each mounted in a heavy hardwood case with sliding fronts, on the back of which appear miscellaneous data and circuit diagrams, including operating instructions. The installation complete weighs 210 lbs.—so it is no lightweight.

Band changing is by means of plug-in coils in the buffer and PA stages. Band 1 covers 10-20 mc and Band 2 covers 20-40 mc. The VFO is also calibrated 40-60 mc, but coils are not available for this band. The fundamental frequency range of the VFO is 5-10 mc.

Modifications for Amateur Use

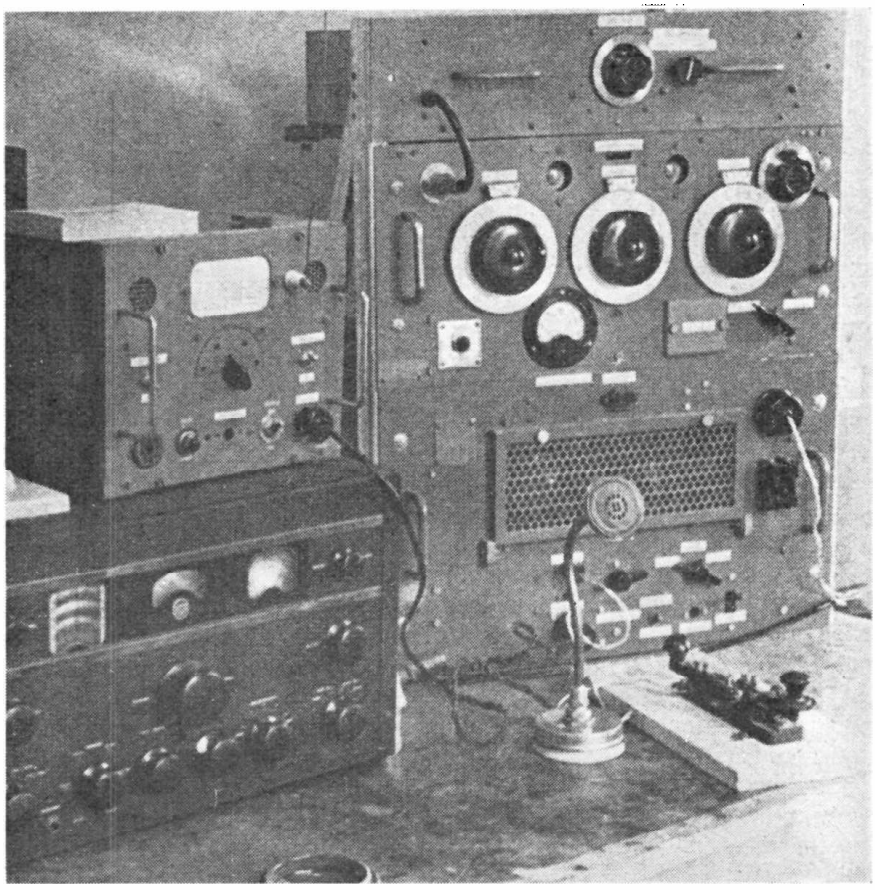
The transmitter can be used exactly as received without modification. But the fact is that there are several inherent disadvantages, namely :

(1) Bandspread is poor on the VFO and logging or tuning to a predetermined frequency (in an amateur band) is difficult,
(2) In spite of its very robust construction, the VFO is liable to drift,
(3) Harmonic radiation is excessive by any standards,
(4) Excessive provision of safety and interlock circuits make adjustment and testing difficult,
(5) Keying is not very well "shaped" and is inclined to be chirpy,
(6) A minor criticism is that the equipment is not very good to look upon when used in its cases, and
(7) The range covered does not include any of the "gossip" bands, in particular 40 metres.

Whilst some of these disadvantages may appear formidable, modifications to effect a cure are simple to carry out and quite inexpensive ; most amateurs will probably be able to raid the junk box for the few spares required.

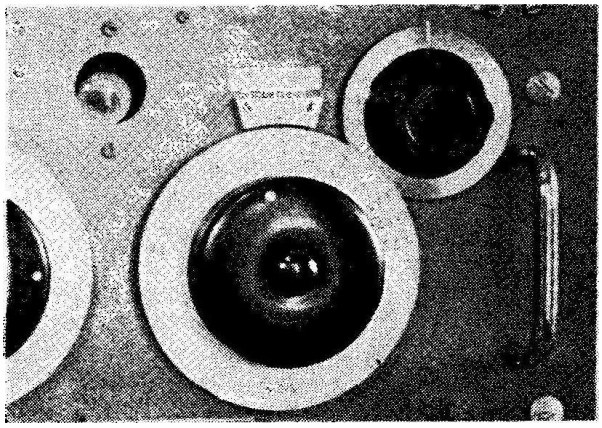
Increasing the Bandspread of the VFO.— It is quite a simple matter to increase the band-

spread of the VFO electrically, by putting a small variable condenser in parallel with the VFO tuning condenser. This condenser should be about 15 $\mu\mu$F, of robust construction and preferably with ceramic insulation; otherwise, almost any type will do. If a 15 $\mu\mu$F is not available, a larger one can be used with all the rotor plates, except one, removed. It is necessary to bore a hole in the front panel to mount this new condenser (as a precaution, all the valves should be removed whilst this is done). Make sure that all metal filings are cleared out from the VFO compartment when the job is finished. The dial knob used by the writer was an ex-Service type that happened to be available, with a 3 in. skirt calibrated 0-100, but any dial which will fit in is suitable and it may be directly calibrated if so desired. A lead should be taken, in heavy wire, from the stator of the new condenser to the spare solder tag on the front gang of the main tuning condenser. The chassis forms the earth return.



This photograph shows, on the right, the finished appearance of the Type 36 transmitter when modified as described by VQ2GF in his article. The general appearance of the Type 36 is very much improved by re-mounting the chassis in a framework made of 1½-in. aluminium angle, as explained in the text.

Calibration is simple and can be carried out by means of an accurately calibrated receiver. Set the receiver to 28,000 kc exactly, which should be verified by means of a crystal calibrator or frequency meter. The new condenser should be fully in mesh and the main VFO dial set at 14/28 mc band edge. The transmitter is switched to CW and all calibration is carried out in this mode, with the key circuit open—the following stages thus being inoperative. With HT on (allow the transmitter to warm up thoroughly before switching on the HT), unscrew the Philips beehive condenser on top of the main tuning condenser until the signal is heard in the receiver or maximum deflection of the S-meter is obtained, if one is fitted. If, with the beehive condenser fully unscrewed no signal can be heard, insert a small value mica condenser (say 20 $\mu\mu$F) in series with the new variable condenser. This should enable the signal to be tuned in with the Philips trimmer; reseal the latter (blob of wax on the screwed shaft) and recheck the calibration. The receiver should then be set at 28050 kc and the new VFO parallel dial adjusted until the beat is heard. This setting is noted and the process repeated until the condenser is fully out of mesh, having covered all the 10-metre band. The VFO is now calibrated and, of course, the reading if divided



View of the front panel showing the placing of the additional VFO dial, at upper right.

by two will give the transmitter frequency at 14 mc.

To calibrate the VFO for 15 metres, the main dial is set to 21 mc and, with the new condenser fully in mesh, a beat at exactly 21 mc should be tuned in. If not, carefully rotate the main dial, using the slow-motion drive, and mark the skirt accurately. This mark can then always he used to set up for this frequency. Dial calibration at 50 kc intervals is carried out as before.

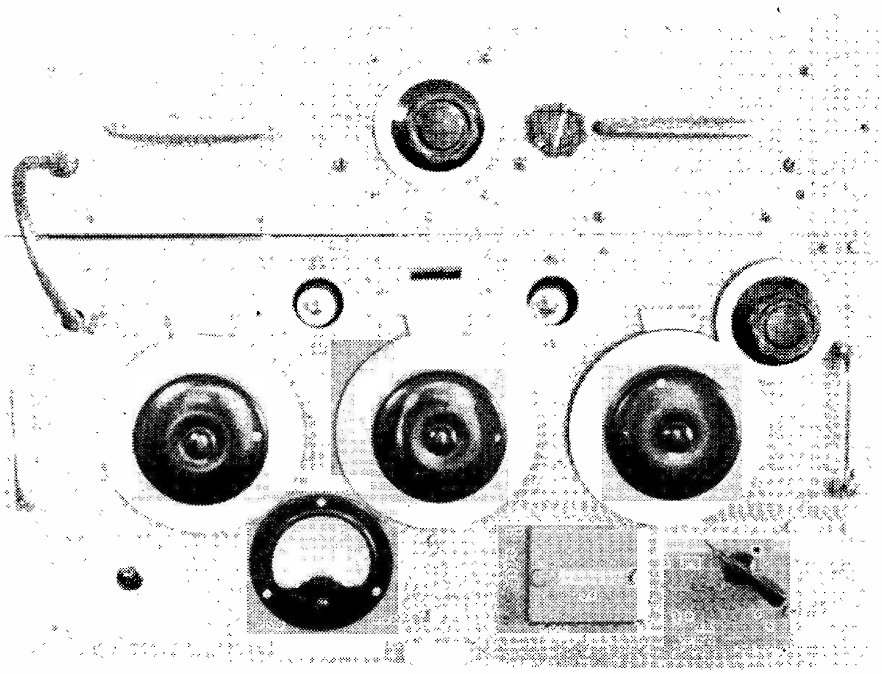
If the receiver does not respond to the beat from the VFO, switch the transmitter to "phone" and, using a dummy load, tune the following stages to resonance. Return the switch to CW and it will be found that the signal from the VFO will be very much stronger. In the case of a well-shielded (or an insensitive) receiver, a short aerial may be used, but in this case, make sure that the receiver is tuned to "Man.," *i.e.*, AVC off or the receiver may be over-loaded. It is now quite an easy matter to zero beat with any station on the band and the bandspread will be quite adequate for all normal purposes. If the dial is not directly calibrated the use of a graph is recommended so that any desired frequency may be selected.

The only thing to watch is that the main VFO dial is set exactly on 14/28 or 21 mc each time the band is changed.

Increasing VFO Stability: As it stands the VFO is not very stable and the potential frequency drift, especially at 28 mc, is somewhat alarming, to say the least! This instability is mainly due to over-heating and can be almost completely corrected by lining the three sides of the VFO compartment with some heat insulating material, such as $\frac{1}{2}$ in. softboard, thick felt, asbestos or thick cardboard. Also, $\frac{3}{8}$ in. diameter holes should be drilled at 1 in. centres at the top and bottom of the side of the coil compartment to assist in producing better air flow past the coil. If all this is done, the VFO will remain very stable and drift will be reduced to negligible proportions. If drifting still persists check the voltage at the "cold" end of the anode coil; it should be rock steady at about 230 volts. If the voltage varies, suspect the voltage stabilisers and check the associated resistors.

Suppression of Harmonic Radiation

Harmonics are radiated from this transmitter in considerable strength and TVI certainly rears its ugly head. Fortunately, the remedy is simple and involves a minor operation on the tank coils and their base and the provision of an aerial tuner unit, together with more effective screening. (There is an item called the Harmonic Filter Unit, which was originally supplied to A.A. Regts. with this transmitter, Part No. ZA-10791. This, however, is not available on the surplus market.)



Front view of the modified RF chassis, with the additional ATU (see circuit diagram) installed in the drawer. The coax cable at left pipes RF to the new aerial tuning unit. The knob to the right of the ATU dial is for switching in the dummy load. The switch to the left of the meter is mounted on a blanking plate over the hole formerly occupied by the 16-point connector (removed to the rear chassis drop). The secondary VFO tuning dial fitted is at upper right.

The original method of taking off the RF is by means of a tap on the tank coil and *via* a condenser to the aerial socket. This condenser should be unbolted from the chassis and its associated leads cut off; a link coil is now inter-wound with the tank coil; this coil consists of 16 gauge wire in insulated sleeving and is composed of two turns for the 20-metre coil and one turn for the 15- and 10-metre coil. The ends are connected to the two spare pins on the base (one of which was left by the removal of the tap from the tank). From this latter pin a screened lead is

taken to the aerial outlet socket and the outer braid is connected to the other pin and earthed. This new link coil should be interwound at the rear end of the coil when it is mounted in position.

The next stage is to construct an aerial tuner unit (ATU). The circuit for this is given in Fig. 1. A length of coaxial cable is used to connect the ATU to the coaxial socket on the RF chassis. The drawer previously used to house spares is ideal for mounting this unit. The coil and condenser can occupy the centre compartment and the right hand compartment may house a change-over relay or (as in the writer's own transmitter) a switch for bringing in a dummy load, for testing and setting up. The aerial socket is fixed to the rear of the drawer.

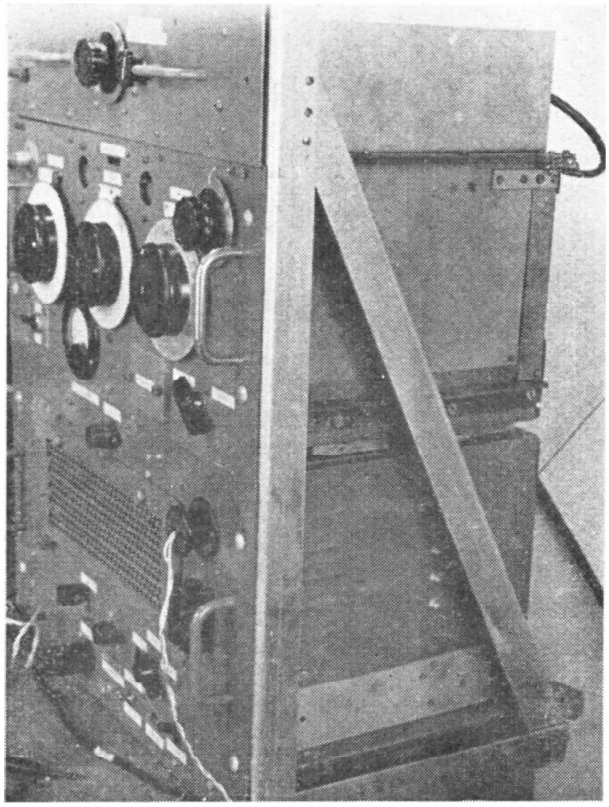
To load the transmitter, rotate C1, tune for maximum reading of the plate meter, retune the PA for maximum dip, and successively readjust on the ATU and PA until the transmitter is fully loaded. The dip at resonance should be very small (about 10 mA).

The third stage in the suppression of harmonics is to improve the shielding of the RF chassis. This was done by means of 18 gauge aluminium sheeting cut to size and fixed with self tapping screws in position along the back and alongside the PA stage. A lid for the drawer was made with a $\frac{1}{2}$ in. turn-down on all sides and is removable. There are no inherent difficulties associated with the shielding, and existing screws can be used in many cases to fix the sheeting. It should be noted, however, that with the shield for the side of the PA stage in position, it is not possible to use the coil clamps as they foul the side. These were therefore removed from the chassis.

After completing these modifications, the third harmonic was 60 dB down and could not be detected on a communications receiver 100 yards away.

Elimination of "Safety" Devices

This transmitter contains two switches which cut the HT if either the drawer is pulled or if the door on the front of the power unit is opened. As a licensed amateur knows what he is doing (presumably), such devices are an unnecessary luxury—in fact they are a confounded nuisance when it comes to checking HT voltages and general testing with power on. (In the original, these safety arrangements were incorporated to prevent tampering with the transmitter by "unauthorised Service personnel"—there being a distinction between operator and mechanics.) To eliminate these switches, terminals E and F are disconnected



Showing, from one side of the transmitter, how the new mount is constructed. Two frames are made like this, using 1½-in. aluminium angle, and the RF and power supply units are bolted on, using the original fixing holes. Note the heat-insulating pad under the VFO section for preventing drift.

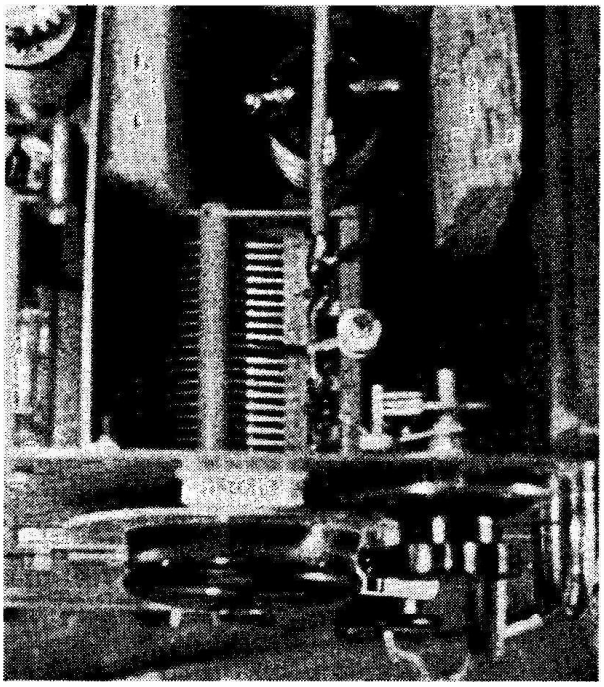
from the power plug, the wires soldered together, and the joint insulated. Similarly the wires to the pressel switch on the power pack door are removed from the switch and soldered together.

Keying Characteristics

There is a definite tendency, under certain conditions of loading, for a chirp to develop in the keying. This can be checked by obtaining a critical report from a nearby station. If there is a chirp, the remedy is to key the PA stage instead of the buffer, as normally wired. This is quite a simple job and involves disconnecting the lead from the cathode of the 807 buffer valve and earthing that cathode. The next step is to remove the wire running from the common cathode of the PA 807's to earth, and connecting the wire previously removed from the buffer to the PA cathodes. There were no apparent clicks emitted when this was done, and the chirp was completely absent. The usual key-thump filter should, of course, be fitted.

"Beautifying" the Type 36

The units when used in their cases are bulky



Looking into the modified VFO section, showing the new small tuning condenser immediately behind the panel, on the right. The Philips trimmer referred to in the text can be seen on top of the main tuning condenser assembly. The heat-insulating material for preventing drift is placed round three sides of the coil, as shown.

and unsightly, so it was decided to mount them on a rack. Two frames made up of 1½ in. x 1½ in. aluminium angle were devised, as shown in one of the photographs. The units were then bolted to the frame using the original mounting holes. The frame had to be cut away slightly to accommodate the various bolts, slides, and so forth which protrude from the sides of both units. The next step was to get rid of the untidy-looking cable connecting the two chassis together. First of all a 2 in. hole was bored in the back of the chassis of the RF unit and the socket was remounted there. This meant unsoldering all the leads, carefully marking them and refixing to the new position of the socket. Most of the leads can be shortened and one or two need replacing with longer lengths, but the job is not difficult if care is used.

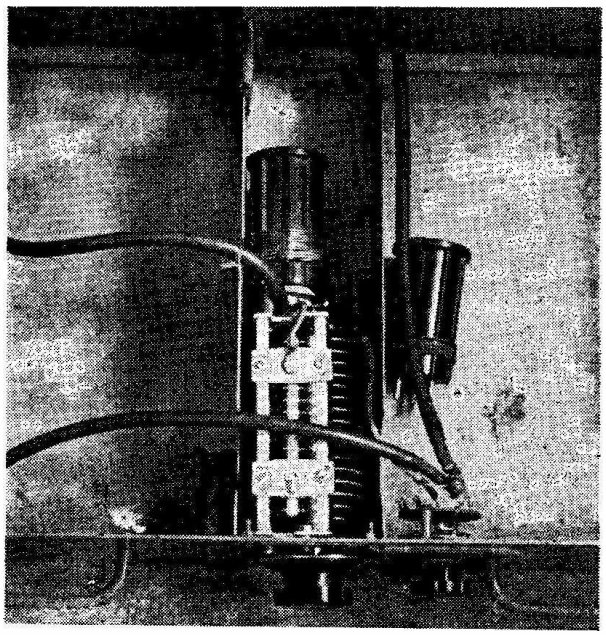
The same thing was done with the power pack. In this case most of the leads needed lengthening. The hole was cut in the thin sheet metal back. The cable was then shortened to 9 ins. by taking off one socket, removing the shielding and cutting all the wires to the correct length. As the writer is not a great believer in multi-point plugs, all the pins of the RF chassis socket were cut off and their wires soldered directly to the remaining stumps. The plug was retained at the power pack end.

Though cable shielding was dispensed with, there was found to be no radiation from the wires. The two holes left in the front panels were covered with a small piece of aluminium sheet bolted in place. The drawer fits in its original position and is withdrawn for coil changing.

Increasing Range to Cover 40 Metres

The final modification is to increase the frequency range to bring in the 40-metre band. This is the lowest frequency that can possibly be obtained, as the VFO runs at 5-10 mc. This could be accomplished by winding another coil similar to the 20-metre tank coil, but with four more turns. However, there are difficulties in obtaining or making the coil base, so it was decided to add a fixed condenser across the 20-metre coil, in parallel with the tuning condenser. A 2-pin (FT243) crystal socket was soldered directly across the pins connected to the ends of the coil, and a 200 $\mu\mu$F 1,000v. working silver mica condenser was fitted with two pins to mate with the plug.

The final modification (for 40-metre operation) is to incorporate a switch to cut out the heater of one of the 807's in the PA. It will be remembered that the PA is arranged in push-push ; this being so amplification is almost impossible at the fundamental frequency, but if one valve is switched out, that valve serves



Showing the new ATU installed in the drawer ; the coil holder is mounted on the end of the condenser. The loose coil unit is for tuning the 10-15 metre bands.

to neutralise the other, which does all the work. The switch was mounted in the blanking plate over the hole left by removal of the power socket, the unearthed side of the rearmost 807 was disconnected, and the two wires from the switch inserted in series.

To tune to 40 metres it is necessary merely to plug in the 200 $\mu\mu$F parallel fixed condenser and switch off the one 807 heater. The tank can now be tuned to resonance in the usual way. The power input should be about 45 watts when fully loaded. Efficiency is not very high, owing to the poor L/C ratio for 7 mc—but the point is that 40-metre operation is obtained in an easy way.

Conclusion

With all the modifications as described, this transmitter has been found to be extremely reliable. It is well constructed and even after twelve hours of continuous contest operating, no trace of electrical strain or serious overheating of any component was observed. Much DX has been worked on the 7-28 mc bands and excellent reports have been received from all Continents. CW reports have always been T9 and the modulation has often been favourably commented on without any prompting from the writer's end.

This equipment thus provides a complete transmitter, of a very business-like appearance. It should give many years of trouble-free service as all components are rated well above anything they may be called upon to stand. With the modifications described here the Sender Type 36 should prove a pleasure to use for even the most experienced operator.

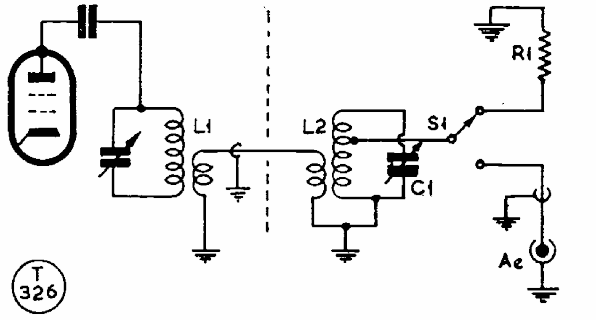


Fig. 1. Circuit diagram of the Aerial Tuning Unit suggested by VQ2GF for the Type 36 transmitter. That part of this circuit which is to the right of the dotted line is enclosed in the drawer — see photograph opposite.

CONSTRUCTION OF THE ATU

L1—Existing tank coil with pickup link (*see* text).
L2—Plug-in coils (Eddystone Cat. No. 580).
7 & 14 mc—10 turns 1½ in. dia., 1 in. long, tapped 3 turns from "hot" end, with 2-turn link.
21 & 28 mc—4 turns 1½ in. dia., ⅜ in. long, tapped 1 turn from "hot" end, with 1-turn link.
C1—100 $\mu\mu$F transmitting type variable condenser.
S1—SPDT rotary ceramic switch.
R1—75 ohm. dummy load, rated 50 watts.

NEW PLESSEY VHF/FM TUNER

A new addition to the wide range of radio units already manufactured by The Plessey Company Limited is the P.B.2 VHF/FM tuner. This is designed around a double triode valve, one section of which is used as an RF amplifier and the other as a self-oscillating mixer. The unit employs eddy-current tuning and is available in two main versions, one having a tuning range of 87-101 mc and the other having a range of 87-108 mc. Consequently, tuners suitable for use in the U.K., Europe or North America can be supplied.

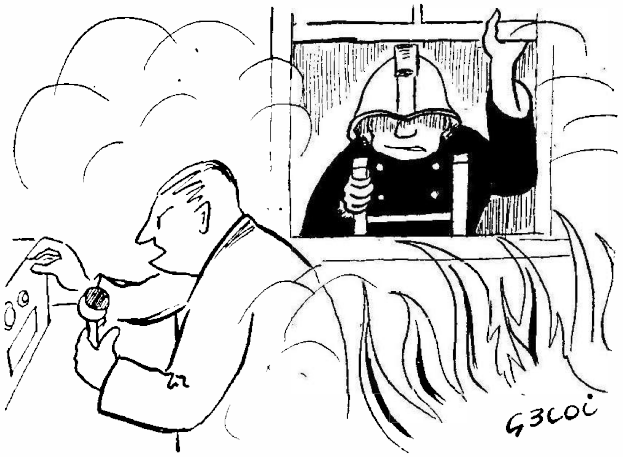
There are no oscillator drift problems with the unit and radiation is well within B.R.E.M.A. recommended limits.

THE MOBILE REGISTER

In the July, August, September and November, 1958, issues of SHORT WAVE MAGAZINE we printed lists of active /M operators, giving callsign with home QTH, band(s) worked, and make and registration number of vehicle. These four lists together registered about 100 known mobiles, and we already hold some more towards the next list. If you are operating /M, and intend to be out and about this coming Mobile season, let us have your QSL card, with the details for the Register.

INDEX—VOLUME XVI

This issue completes another Volume of SHORT WAVE MAGAZINE. As usual, every copy of the March issue, No. 1 of Vol. XVII, will include, as a free loose supplement, a complete cross-referenced Index to the recent Volume. We also hope to be able to say, in the next issue, what back-number copies are available of Vol. XVI, as some months were sold out and are now out-of-print.



" . . . Seems to be a smell of burning . . . "