The SHORT WAVE Magazine

2/6

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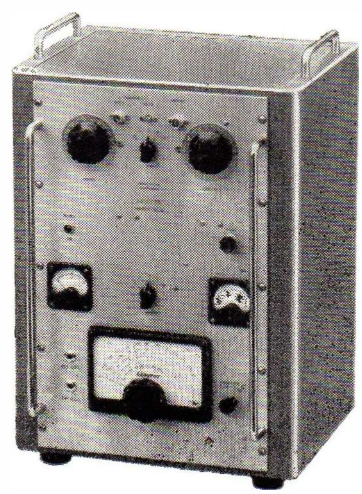

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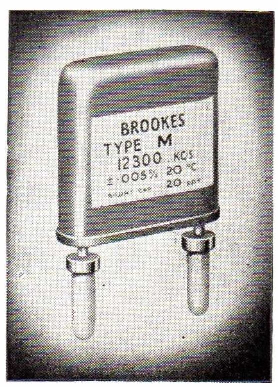

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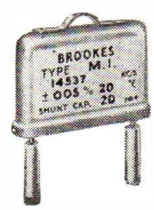

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INDEX TO ADVERTISERS

FOR THE EXPERIMENTER AND THE RADIO ENGINEER

The SHORT-WAVE Magazine

EDITORIAL

Mobile

The coming of weather fit for motoring for the fun of it is attracting many more radio amateurs to the possibilities of mobile operation. The /M enthusiast is rather like the keen caravanner — there is infinite scope for ingenious constructional work and much pleasure to be derived from rally activities.

Indeed, in the latter context, one can foresee the development of competitive events conducted under radio control, combining the interest of /M operating with the motoring side, to bring in D/F work, map reading and time-keeping.

Though all our bands are open for mobile working, activity in this country is mainly on 160 metres, on which very encouraging results are being obtained. There are also a number of installations on two metres, and some on 80 metres.

Potentially, however, one of the most interesting bands for /M activity is 10 metres, which so far has been largely neglected over here. The advantages of Ten are good local coverage, a simplified aerial fitting, and — now that the band is opening — the real possibility of working DX on mobile. As things are, it would be quite feasible for /M stations in this country to work American mobiles while actually on the move at both ends of the QSO. Many American amateurs are fitted for the band, and W mobiles on 10 metres have frequently been heard, and worked, from fixed stations in the U.K.

It is to be hoped, therefore, that the G's now interested in /M will turn their attention to the 10-metre band, and that we shall soon be able to record the first inter-Continental mobile contacts.

Austin Forsyth
G6FO

Self-Contained VFO Unit

FOR DIRECT KEYING—CIRCUIT AND CONSTRUCTION

F. ARMSTRONG (G3CNM)

This is a constructional article that will be of great interest to the many readers still searching for a good VFO, capable of giving a clean, sharp drive signal under BK operating conditions. The keying system incorporates an ingenious relay control circuit, which enables all receiver muting and transmitter switching to be done from the key.—Editor.

THE VFO described in this article was constructed in a last desperate effort, after several not-so-good and not-so-bad oscillators had been put together over the past eight years or so. Most had their drawbacks, and it was obvious that one or two important points had been overlooked in their design. A stable VFO was essential, and preferably it had to stand keying, as the writer's main interest lies in CW operation. The unit described here was eventually evolved, following a lot of experimental work and the experience gained thereby.

The circuit is a more or less standard Clapp oscillator, V1, followed by a buffer-amplifying stage, V2, with V3 as a cathode follower; V4 is the HT rectifier, and V5 supplies 150 volts stabilised for the screens of V1 and V2.

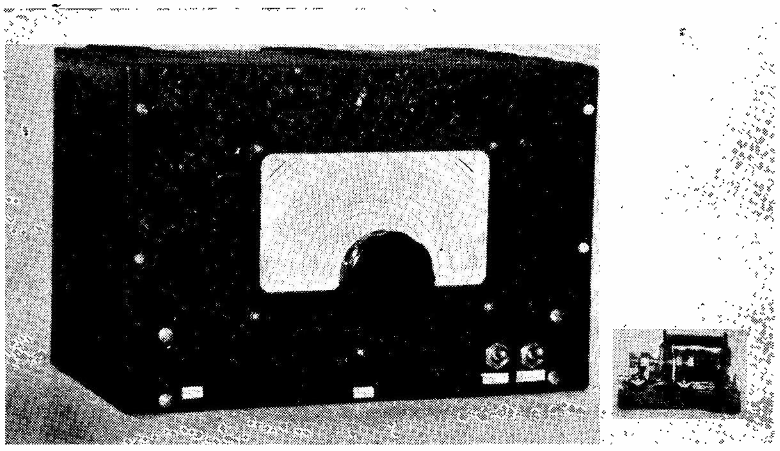
The tuned circuit of V1 has a lower L/C ratio than is normally used in this circuit in order to counteract the tendency of the Clapp to give an uneven output, falling towards the HF end of the tuning scale. No adverse effects have been experienced due to this, and providing that the tuned circuit is well isolated from any heat source, all should be well.

C1, the main tuning condenser, is a war surplus component which some readers may recognise from the photograph; it is a remarkably sturdy job with ball-bearing mounting at either end. C3 is a Philips 3-30 $\mu\mu$F trimmer used as bandset control; C4 is the "QSY control," a variable condenser of about 10 $\mu\mu$F maximum capacity which is used to facilitate small movements on the HF bands. Should it be necessary, it enables one to return more exactly to the original frequency; normally, this control is set at half-mesh with the pointer knob on the front panel vertical. It is moved clockwise for a change of frequency LF and *vice versa.* It will be found invaluable on the 14, 21, 28 mc bands where only a small change of frequency may be required which is difficult to judge on the main dial.

The anode load of V1 is the choke RFC and output is coupled *via* C8, a 15 $\mu\mu$F ceramic condenser, to the grid of V2; the coupling condenser being of such a low value, practically no load is thrown on the oscillator valve by V2. Indeed, it was found that this condenser could be reduced to as low as 3 $\mu\mu$F with quite a fair output still appearing at the cathode of V3. The screen grids of both V1 and V2 are keyed from a 150v. supply stabilised by V5.

Keying Control

Resistors R5 and R8, together with decoupling condensers C13, C10 and C15, delay condenser C14 and diode V6 provide a supply for the station receiver aerial relay (although the relay could equally well be used to switch any desired circuit within the limits of its contacts). When the key is pressed C14 charges through V6, R5 and R8 and the relay closes. The relay remains closed during the transmission of letters or words, but will open after a break in transmission of about two seconds



Front view of the self-contained VFO designed by G3CNM. An Eddystone dial assembly is used for the main tuning control; the loose item on the right is the control relay, the circuit for which is discussed in the text.

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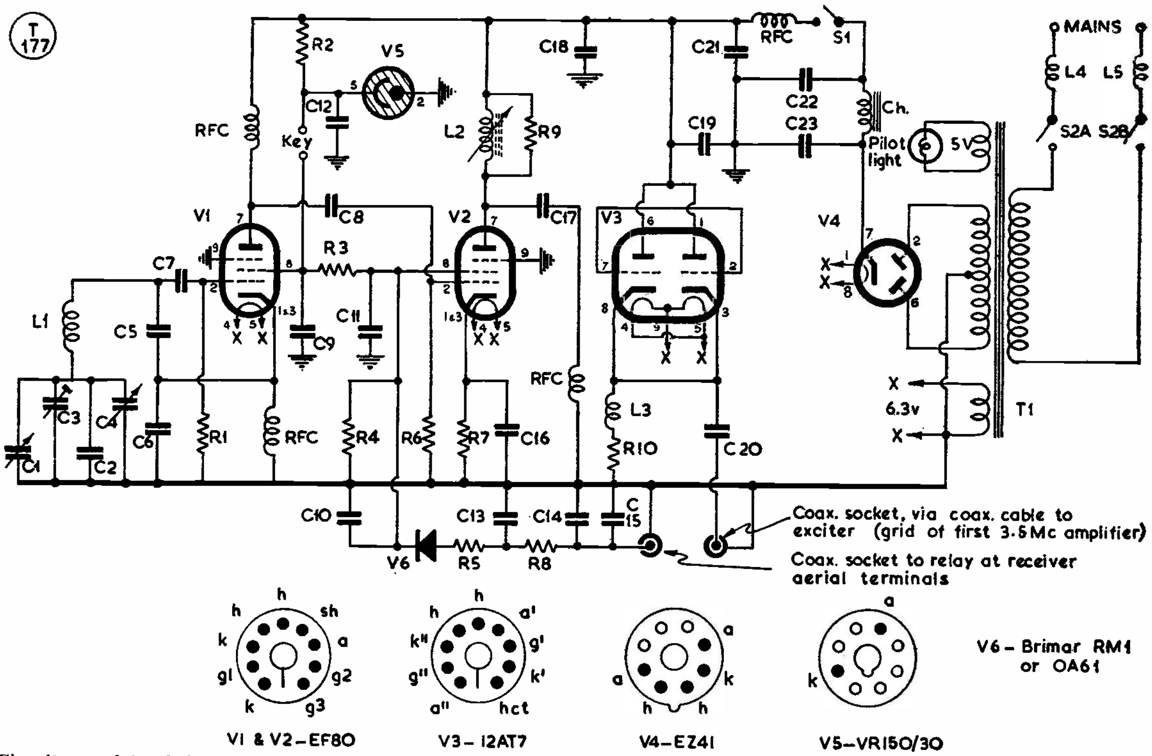


Circuit complete of the self-contained VFO described by G3CNM, the construction of which is illustrated in the accompanying photographs. That part of the circuit identified by V6, R5, R8, C13, C14, C15 is to control a relay to follow the keying; this could be arranged to perform all change-over functions, while permitting BK operation. In the author's case, the relay mutes the receiver. All values are given in the table.

Table of Values

Circuit of the Self-Contained VFO

C1	= 7-70 $\mu\mu$F air spaced variable
C2	= 200 $\mu\mu$F high stability mica (*Radiospares*)
C3	= 3-30 $\mu\mu$F Philips trimmer
C4	= 10 $\mu\mu$F air spaced variable
C5	= 670 $\mu\mu$F high stability mica (*Radiospares*)
C6	= 1000 $\mu\mu$F high stability mica (*Radiospares*)
C7	= 100 $\mu\mu$F high stability mica (*Radiospares*)
C8	= 15 $\mu\mu$F ceramic (*Radiospares*)
C9, 10, 13, 15	= 1000 $\mu\mu$F disc ceramic (*Radiospares*)
C11, 12, 16, 19, 20, 21	= .005 $\mu\mu$Fdisc ceramic (*Radiospares*)
C14	= 24 μF 200 volt electrolytic (*T.C.C.*)
C17	= 100 $\mu\mu$F mica (*Radiospares*)
C18	= 0.1 μF paper 500 volts (*Radiospares*)
C22, 23	= 16-16 μF 450 volt electrolytic
R1	= 100,000 ohms (*Radiospares*)
R2	= 5,600 ohms 5 to 10 watts (*Radiospares*)
R3	= 220 ohms (*Radiospares*)
R4	= 47,000 ohms (*Radiospares*)
R5, 8	= 33,000 ohms (*Radiospares*)
R6	= 22,000 ohms (*Radiospares*)
R7	= 160 ohms (*Radiospares*)
R9	= 6,800 ohms (*Radiospares*)
R10	= 250 ohms (*Radiospares*)
L1	= 27 turns 24 SWG enam. copper, close wound on ⅜ in. former
L2	= 55 turns 30 SWG DSC wire on ⅜ in. iron-cored former, last ten turns wound back over main winding to allow iron-core a more definite operating track.
L3	= One section of pi-wound standard RF Choke
L4/L5	= Radiospares Heavy duty mains filter choke.
RFC	= Standard 2.5 mh RF chokes (*Eddystone*)
Ch	= Smoothing Choke
S1	= SPST toggle (*Radiospares*)
S2	= DPDT toggle (*Radiospares*)

LIST OF PARTS

Elstone MT/M1 mains transformer (250-0-250 60 mA, 5v. 2 amps, 6v. 1.6 amps).
One Octal valve base
One B8A valve base
Three Noval ceramic bases.
One VR150/30
Two EF80
Crystal diode 0A61, or Brimar Metal rect RM1.
One 12AT7
One EZ41
Full vision dial (*Eddystone*)
Chassis 10 x 6 x 2 inches, 16 SWG, aluminium, 4-sided
Panel 11 x 7½ inches 16 SWG Alum.
6-volt pilot lamp and holder
Closed circuit key jack (*Bulgin*).
Tag strips, wire, sleeving and grommets.

(quite a long period at speeds of 18-25 w.p.m.). The crystal diode V6 serves to eliminate chirp which would otherwise be caused by C14 continuing to supply the screens of V1 and V2 when the key is lifted, whilst R4 merely serves to keep the screens of V1 and V2 at some definite potential with respect to their cathodes at all times should the relay be out of circuit.

The relay used at G3CNM is a "surplus" component with a resistance of about 11,000 ohms and labelled "Zenith BK35"; it is located close to the receiver aerial terminal and shorts the receiver input when the key is pressed. Connections from the VFO are taken *via* standard coaxial cable and the coaxial socket at the middle rear of the VFO chassis.

Coil L2 in the anode circuit of V2 is self-resonant about half-way through the 80-metre band and is heavily damped by R9 to encourage a more constant output over the range of the instrument.

Drive from V2 is coupled *via* C17 to the grids of V3, from which in turn output is obtained across L3/R10 and fed, *via* a coaxial socket, C20, and about 6 or 8 feet of coaxial cable, to the main transmitter.

Decoupling condensers, usually ·005 μF disc ceramics, are inserted in the wiring where any lead normally dead to RF has to travel for more than six inches or so, *e.g.* resistors R5 and R8, and the diode V6, are mounted some distance from the screen grid of V2 (actually on the spare tags of the voltage regulator valve-holder) so that the lead connecting the two points is decoupled at either end by C10 and C11.

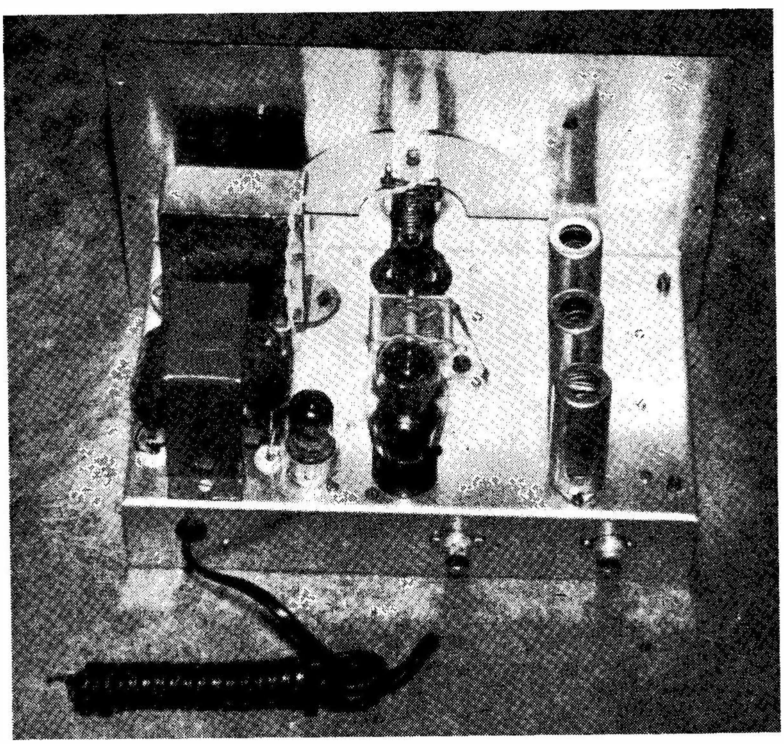
The pilot light shown in the circuit diagram and the top chassis view is fed from the 5-volt winding on the mains transformer for the sake of convenience in wiring and because the 5-volt winding is not otherwise in use.

Construction

The construction of the VFO is not very difficult provided that certain essential points are borne in mind.

The heater supplies to all valves should be carried by twin wiring and earthed at one point only, preferably at the mains transformer end. This prevents raw AC being carried by the chassis and eliminates any tendency towards modulation hum. All wires normally dead to RF should, where possible, be tucked away in the corners of the chassis, and no such wiring should be allowed near the grid circuit of V1. For convenience as much as anything else the grid of V2 should be made to "look at" the anode of V1—and so on. In fact, standard VHF wiring technique is a good idea, and serves as practice for ventures on 144 mc! The power supply section, including R2, is screened from the remainder of the unit by a small partition across the chassis from front to back.

The unit is mounted in a well ventilated metal cabinet 11 x 7½ x 6¼ inches, and Messrs. Smiths of Edgware Road obligingly cut a chassis and panel to fit it, at a very reasonable cost. The front panel was given a coat of crackle paint after all holes had been drilled and the semi-circular opening cut for dial illumination.



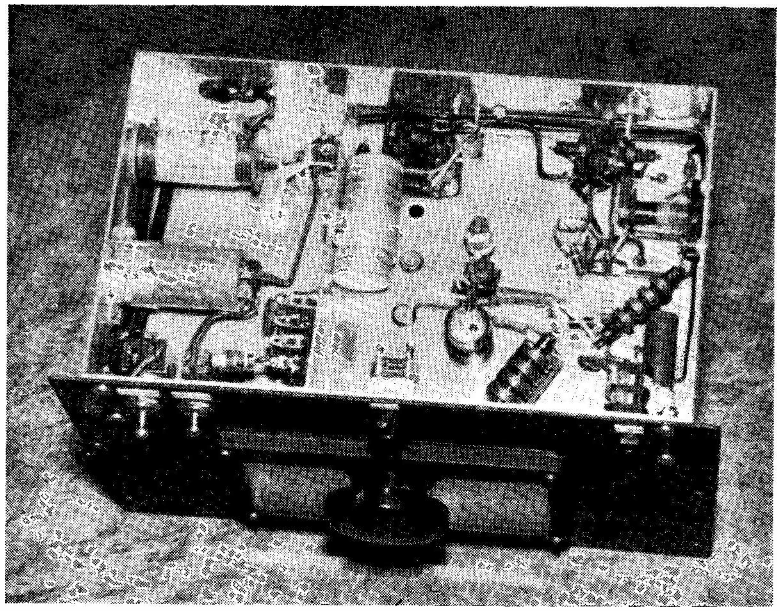
The power supply components are at the left, the valves in cans being, from the pane towards the near edge of the chassis: V1, the oscillator stage; V2, the buffer; and V3, the cathode follower output stage.

The vast majority of the fixed condensers and resistors were obtained from a local radio and television retailer. They are manufactured by the firm of Radiospares and are supplied to dealers all over the country, so no difficulty should be experienced in obtaining them. The mains transformer is an Elstone product and came from the same source. The smoothing choke is actually a "surplus" item, though the Elstone type SC/M choke can be used equally well. The reader is advised to use a choke with a DC resistance of less than 500 ohms if the VFO is to be absolutely free from chirp.

The RF choke in the HT line at S1 is actually a 3 mc boost choke from a TV receiver, but this was only used because it was to hand; a standard RF choke would do equally well.

The two projections seen above chassis in the corners near V1 and V3 are actually two feed-through insulators used to support the HT bus-bar below chassis.

If it is not desired to use the relay circuit shown in the circuit diagram the diode V6, together with R5 and R8, C10, C13, C14 and C15 can be dispensed with.



Under view of the VFO described by G3CNM, showing general layout. The small condenser in the centre foreground is C4, the control for close frequency shift. The power supply section is at the left, separated from the rest of the assembly by a screen.

Adjustment

With all wiring completed and the unit ready for test a wise precaution is to put an ohm-meter across the high tension line before applying power. This practice has been found to save many a rectifier valve or mains transformer from an untimely death and ensures that no bits of solder are lodged between HT points and chassis.

With power on, the HT switched in and the key pressed (or out of its jack), trimmer C3 should be adjusted to make 3·5 mc appear at one end of the dial (left or right hand extreme according to the choice and the position of the plates of the main tuning condenser). Complete rotation of the dial pointer should cover 3·5 to 3·8 mc with a slight margin either side. The writer's model was actually calibrated after the photographs were taken with the aid of the station receiver and a borrowed signal generator. During adjustments the "QSY control," C4, should be set at half-mesh with its pointer vertical. One end of R9 should be disconnected and L2 should be peaked somewhere in the middle of the band so that the output is reasonably constant throughout the band. R9 should then be re-connected.

The unit should be keyed and monitored on the station receiver on all bands 3·5 to 28 mc. If even the slightest chirp is noticed V1 and V2 should be interchanged, as the occasional EF80 exhibits a sort of "chirp factor," but it is not common.

Here then is a stable frequency source which *can* be keyed. The unit itself will not deliver sufficient power to drive a pair of 813's (!) but this was not the original intention. There is ample output, however, for the average 6V6/6BW6 exciter chain and, of course, the unit does not run "mad-hot" as is the case when 6V6 and 807 valves and such like are used. The would-be constructor can be assured of a VFO that can be built, set up for coverage, and then put into operation and forgotten.

FURTHER NOTES ON THE TA-12

Following the articles in SHORT WAVE MAGAZINE for December 1955 and March, we have had several queries regarding operation of the TA-12. In the first place, it is undoubtedly true that the VFO does radiate strongly on 160 metres when the aerial is directly connected; it is equally true that this can be much reduced by using link-coupled output, into a separate aerial tuning unit.

As regards the power supply connections, given on p.44 of the March issue, values as stated there are maxima for the utmost output, and are on the high side. It would be better to operate the transmitter with HT feeds as follows: Pin 11, 400v.; Pin 8, 600v. Modulation, for plate-screen control of the 807's PA, can also be applied at Pin 8. With these values, it should not be necessary to make any internal modification to the transmitter itself.

At present, the only further data available on the internals of the TA-12 series of transmitters is that contained in the *Surplus Conversion Manual*, Vol. II, as advertised by our Publications Dept. This manual covers a number of equipments besides the TA-12.

Surplus Aerial Relays

THEIR USE AND MODIFICATION

N. P. SPOONER (G2NS)

Another helpful article by our well-known contributor discusses the application of the Service-type aerial relays still to be found on the "surplus" market. Though originally designed for handling relatively high RF powers, and therefore of heavy construction, these relays are entirely suitable for amateur station work if adapted and modified in the manner here suggested.—Editor.

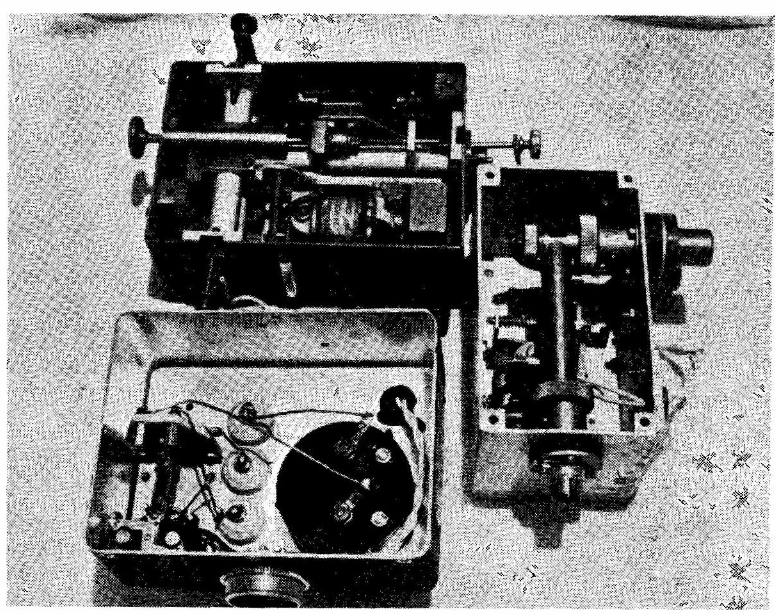
ONE of the most important switching operations required in an amateur station is that of being able to swing, smartly and efficiently, the aerial feeder from transmitter to receiver, and *vice versa.* No sleight-of-hand with croc. clip can properly replace a relay-controlled change-over system.

Except possibly in the case of BK working with strong signals both ways, the transmitting aerial should normally be used for reception, particularly on the DX bands. The reason for this is to ensure that incoming signals may be received under the same directional properties as the outgoing signals obtain from the aerial system in use. It is nearly always a waste of time to call, on the transmitting aerial, a DX station that is audible only on the particular aerial in use for reception—by the same token, there will often by signals coming in on the transmitting aerial which are unreadable, or very weak, on the receiving aerial. A few tests on these lines are well worth carrying out, if only to convince doubters and those who succumb to the easy convenience of the "separate aerial for reception here, OM." Even on the Top Band, big differences can be found on different receiving (or transmitting) aerials.

Twin and single-wire feeders present little difficulty in change-over, and in many instances, during the inter-war years, were switched by old car cut-outs and even GPO sounders adapted as aerial relays. To-day this duty can be performed by a modern relay of the 3000 or 600 type, but in view of TVI and the need to suppress harmonics, something even better is required for the amateur station.

In this particular context it may not yet be generally appreciated that the "surplus" market offers three excellent change-over units. The pair designed solely for coaxial feeders are the ex-Air Ministry "Switch Type 78A" and the "Switch Unit Type G," the former of which will handle, simultaneously, two entirely separate aerial systems. Both types are fitted with auxiliary contacts that bring a resistance into circuit to reduce the energising current after the armature has been pulled in, and both will work on 6 to 24 volts, depending on whether the purchaser first (purposely) weakens the armature return-springs, parallels the windings where feasible, re-winds entirely or prefers to use the relays as manufactured.

With both types in the de-energised "Receive" position, one face of the double-sided contact situated at the tip of the aerial blade rests against the receiver socket contact. Incoming signals thus pass into the aerial feeder



The aerial relay units discussed by G2NS. Top left is the Type 78A, lower left the American Type CCT, and on the right the Type G. All these are available as "surplus," and the way in which they can be adapted for amateur use is described in the article. For convenience, the output sockets as fitted should be changed to the standard Belling-Lee coax type, as shown in the Type G relay (right).

socket, along the aerial blade and out through the receiver socket to the receiver itself. In the energised " Send " position, the sharp movement of the armature thrusts the aerial blade over to part its contact from the receiver socket and make with the transmitter socket contact, against which it is firmly held while RF enters at the transmitter socket, passes along the blade and reaches the aerial through the aerial feeder socket. In other words, the action of the switch is a determined single-pole double-throw movement that smartly swings the aerial feeder between receiver and transmitter. If the relay is wired into circuit with the other switching devices such as the transmitter, receiver and monitor HT controls, the entire station can instantly be changed over by manipulating a single knob.

The third type to be described, also available as " surplus," is the American " Antenna Relay Unit Type CCT 29125 " which is designed for single-wire connections to the transmitter (TR), aerial (ANT), receiver (REC) in accordance with the designations on three front-panel spring-loaded terminals standing out from ceramic lead-through insulators. In this unit the auxiliary contacts perform a different function and provide useful protection during transmission bv shorting the receiver input to earth. When in original service, a pair of one-turn loops circling a grooved ceramic pillar, and tightened in coupling by a central iron plug, picked up and transferred sufficient RF to heat a separate thermo-couple meter, to give aerial current indications on the front panel. The writer's suggested modifications to this and the two coaxial relays are quickly and easily carried out.

Switch Type 78A

With the exception of any measures for voltage reduction, little need be done to the 78A beyond, perhaps, altering the original Pye sockets for Belling-Lee, as being more likely to suit popular coaxial cable diameters. The ability of this relay to handle two entirely separate aerial systems should appeal to operators who work on 144 mc and 70 cm. When high-impedance single or two wire feeders are in use the relay should be positioned between a low-pass filter and an aerial tuning unit, all inter-connections between transmitter, filter, relay, receiver and aerial tuning unit being made of course by short lengths of coax. The same coax inter-connections are used with low-impedance coaxial feeders to the aerial, but as the ATU is then rendered unnecessary, the feeder itself is plugged straight into the aerial

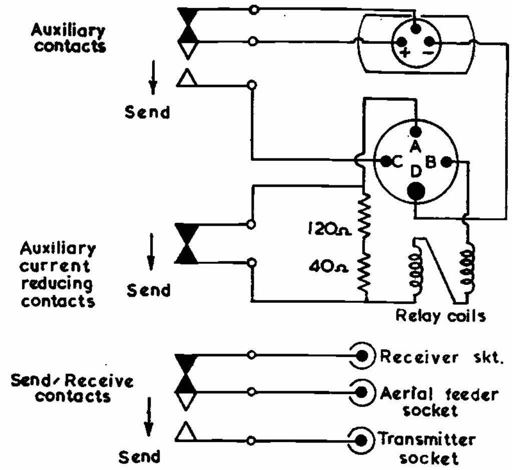


FIGURE 1A

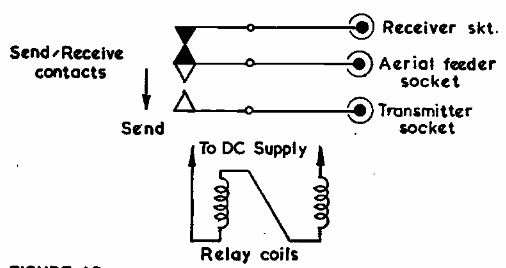


FIGURE 1B

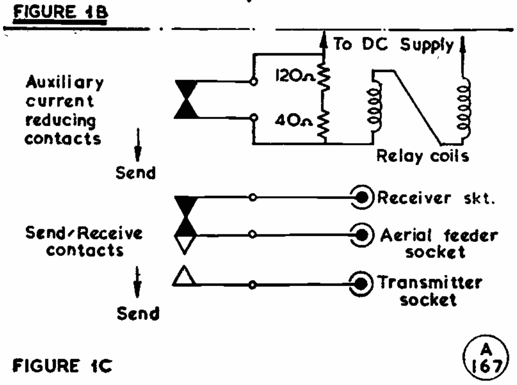


FIGURE 1C

Fig. 1A : Original circuit of the Switch Unit Type G. Fig. 1B : Modified send-receive wiring, Type G. Fig. 1C : Wiring for send-receive and current reducing contacts, with all remaining sockets and contacts removed. The action of the Type 78A relay is very similar to the above, and it also has provision for manual control. (This is the knob protruding from the case, seen in the photograph.)

socket on the relay.

Switch Unit Type G

If the head of the armature return-spring bolt is held. the far end nut can be taken off and the bolt withdrawn sufficiently to allow removal of the tensioning nut and return-spring. This may then be weakened by cutting off about half-an-inch and pulling the remainder out to the original total length. Alternatively, a new and weaker spring may be substituted but in either case it should be realised that alteration of the spring tension and length is liable likewise to alter the armature travel. As this in turn will affect the travel of the insulated arm that operates the auxiliary contacts for bringing in the current-reducing resistor during transmission (the energised position of the relay) re-alignment with additional packing to the auxiliary assembly may be found necessary. The current-reduction function can quite well be omitted, and, as in the present case, the auxiliary contacts and the 3- and 4-pin sockets at the side entirely removed. The exposed holes can be covered with an oblong of metal in which a rubber grommet allows entry for the DC leads to the coils.

The circuit then becomes that of Fig. 1B, the original circuit being shown at 1A, with 1C as the suggested wiring when the resistance and re-aligned contacts are to be retained. Whatever the new set-up, it is strongly recommended that the original sockets, which restrict users to an unusual and particular type of plug, should be removed and replaced by the Belling-Lee type. In the photograph, two of the original sockets have been purposely left for visual comparison with the new B and L mounted at the aerial feeder end.

If B and L's are decided upon, the following drill will make a good job of the substitution: Remove the cover from the unit and commence with the aerial feeder socket which is usually mounted at the end opposite to that bearing the reference and serial number-plate. In the side of the aerial blade barrel will be seen a small screw that should be loosened to release the inspection sleeve. Push the sleeve round to reveal the fixed end of the movable aerial blade protruding from the centre of its barrel. Unsolder the connection between this and the centre conductor of the aerial feeder socket. To remove the socket from the unit, unscrew the three fixing bolts and keep the loose insulation ring and the aluminium washer as distance and mounting rings for the proposed new B and L socket. Prepare this socket by soldering about half-an-inch of wire to its centre conductor; this will be needed later to complete the connection between the socket and aerial blade. Scrape the varnish from the metal washer where necessary, seat the prepared socket centrally upon the washer with the insulation ring below and register one of the socket fixing holes with any one of the three original holes in both washer and ring. Pencil-mark the washer at the spot where the second

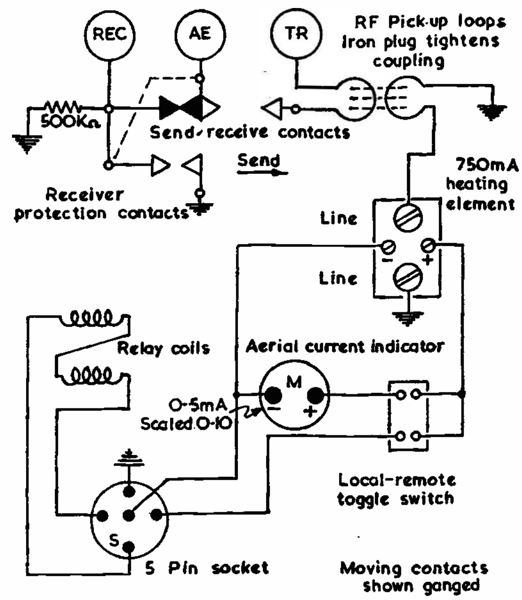


FIGURE 2A

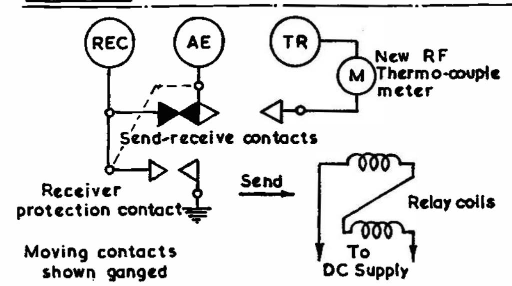


FIGURE 2B

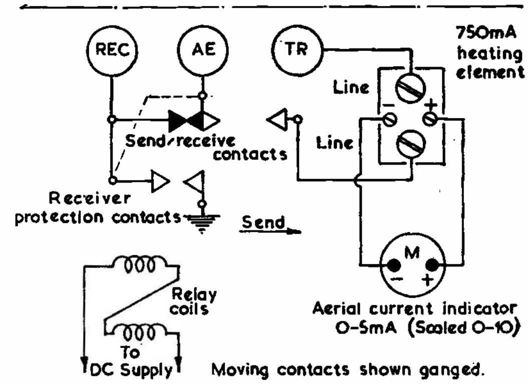


FIGURE 2C

A 168

Fig. 2A: Original circuit of the American "Antenna Tuning Unit" Type CCT 29125. Fig. 2B: Modified circuit of the Type CCT, with new thermo-couple type RF meter. Fig. 2C: A suggested circuit for the Type CCT if the RF meter and thermo-couple as originally fitted are undamaged.

socket fixing hole comes and drill through washer and ring; use the new hole thus made through both for a counter-sunk headed bolt that will hold the socket, washer and ring firmly together. These are then returned to the unit, using the three original holes for bolting back into place. The socket centre conductor wire is soldered to the aerial blade, the inspection sleeve is returned into position and secured once more by its holding-screw.

The same process is repeated with the receiver side of the unit while the new socket for the aerial feeder can be bolted directly to the unit without the ring. Like the 78A, the G relay should be positioned between the low-pass filter and the aerial tuning unit if the type of aerial necessitates the use of an ATU.

Antenna Relay Unit Type CCT

The original circuit connections are given in Fig. 2A, the "ganged" contacts indicating that they move together. Owing to the difference between Service and amateur operating procedures it may be found advisable to remove the RF pick-up coils and all internal wiring except that connecting the receiver (REC) terminal to the receiving contact and the receiver-protection moving contact. The connection between aerial (ANT) terminal and the moving aerial contact should also be left untouched. The re-wiring can thereafter follow that suggested by Fig. 2C providing the maximum expected RF current will not exceed 750 mA and the thermo-couple is intact when acquired. If found to be faulty (as it was in the writer's case) the circuit of Fig. 2B will accommodate a new RF thermo-couple meter; the original one (without thermo-couple) can then be ear-marked as a shunted meter for use in, say, a band-switched transmitter. Meters fitted in the type CCT may differ, but the one examined was found to give a full-scale deflection of 5 mA in series with a 4½-volt battery, a 2000-ohm resistor, and an accurate 0-30 milliammeter. The unwanted 50 μμF 5000-volt vacuum condenser mounted between ceramic lead-through insulators on the rear cover of the unit might make a good high-voltage capacity padder in a pi-network tank circuit.

Readers will find these three relays a good "buy," while those who have the time and facilities for making their own aerial or other relays may like to be reminded of the excellent article on this subject by M. D. Mason (G6VX) that appeared in the November, 1948, issue of *Short Wave Magazine*. The adaptation of car cut-outs was described by the present writer in the September, 1938, and January, 1947, issues of the *Magazine*.

Multi-Band Exciter for TVI Reduction

COIL VALUES, CONSTRUCTION, SETTING UP AND MODULATION

PART II

B. WARDMAN (G5GQ)

The first part of this useful article appeared in our March issue, to which there are certain necessary cross-references in the text below.
—Editor.

TURNING again to Fig. 4 on p.13 of the March issue, the oscillator is tuned, as in the standard Clapp, by the variable C5 of about 150 μμF with a 300 μμF silver mica in parallel. This totals a variable having a minimum capacity of just over 300 μμF and a maximum of 450 μμF; this combination will give the main 1·8 to 2 mc output and is also used on the 3·5 and 28 mc bands as described.

Now the tuning range of the circuit is mainly dependent upon the minimum capacity of the combination C5 and C6. At the moment we have made this a minmum of 300 μμF by putting the fixed condenser, C6, across it; without that fixed condenser the circuit would have a far wider tuning range, all in the higher frequency direction. Conversely (and this is what we need), making C6 larger means that the minimum of the combination is also larger and the tuning range less: equally, the circuit drops a little in frequency.

This gives us a nice simple way of spreading the 7, 14, and 21 mc bands. Put in the coil temporarily; don't bother to bolt it in position, but let it hang on its wire ends. Switch on and note the frequency range, and it will probably be from 6·8-7·6 mc, using the 7 mc set-up, *i.e.*, the oscillator will be working actually at a quarter of that frequency and one can either do the work at the fundamental, or at the fourth harmonic frequency required for output. Anyhow, at whatever frequency the test is made, too wide a band is being covered. Have a selection of 50, 100, 200 and 300 μμF silver mica condensers handy. Try a 300 across C6, making a total of 600. Measure again, and you may find it now tunes from 6·6 to 6·95 mc, giving a tuning range of 395 kc, which is too great. Try 250 μμF (a 200 and a 50) instead of the 300. That may give you from 6·8 to 7·1 mc, which is the spread required. Adjust the tuning slug, or take a turn off if the coil is not of the slug type, so that with full capacity of the variable, and this 250 μμF padder, it gets to 7 mc, and then, with the variable at minimum, it should just go up to 7·3 mc. That particular padder is now wired in permanently to its own coil circuit, so that padding on one band is quite independent of the others. It sounds a long job, but at the outside can be done within two hours. These padder condensers are marked CP in the circuit diagram.

Dealing with the oscillator coils, the 14, 21, and 28 mc (output are the easiest because they can be wound on the small ⅜-in. polystyrene formers with slug tuning adjustment. That means fundamentals of 3·5, 5·25, and 7 mc respectively. The 7 mc (output) is more difficult because it has to be set both on frequency and also bandspread. A small, one inch ribbed type of former can be used for this, but it does mean adjustment of the actual turns. A ⅜-in. former could be used, with the turns pile-wound; that is, indiscriminately wound on top of each other to get them on. However, owing to expansion during heating up, there might be sufficient movement in adjacent turns to cause frequency drift at 7 mc. This is the borderline case: depending upon layout, one might or might not get away with it.

On the 1·8 and 3·5 mc bands (450 and 875 kc fundamentals) the pile-wound coil is the only solution: anything else would take up far too much room. They are quite stable enough for those frequencies. As no padding has to be used, and also because losses are far less at these frequencies, it is possible to use one tapped coil for those two bands.

The coil used in the G5GQ version is one of those little honeycomb wound RF chokes from the TU5B. They are about 1¼-ins. across, about ½-in. deep and wound on a ⅜-in. ceramic rod, which is tapped at one end for mounting. It's a very nice and compact little coil. About half the wire should be removed for the 450 kc oscillator coil (1·8 mc output). However, most amateurs will have something available,

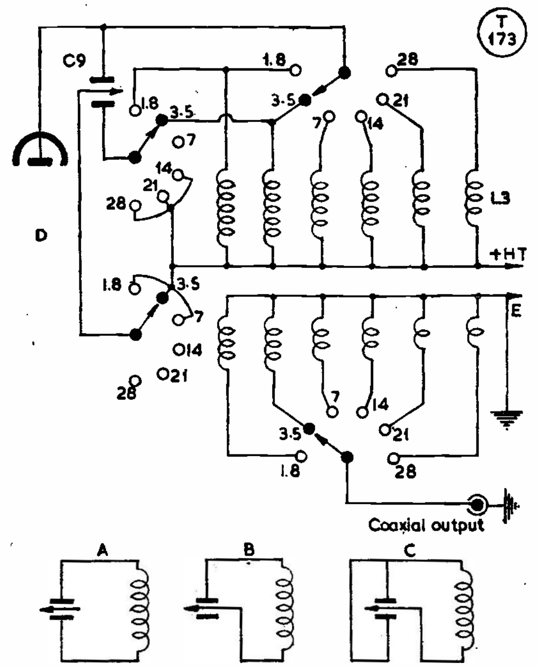


Fig. 5. Amplifier tank switching system, showing (below) how the double section condenser is used on various bands; in A, it is as a split stator on 14, 21, and 28 mc, 37.5 μμF; on 7 mc, B, one stator/rotor section only is used, giving 75 μμF maximum capacity; on 3.5 and 1.8 mc, C, the stators are in parallel, equal to 150 μμF. Three wafers are used for L2/C8 (not shown), and 4 wafers for C9/L3, with L4.

perhaps an old 450 or 465 kc IF unit, which can be adapted: if not, there are plenty of commercial substitutes available. Incidentally, the simplest way of checking and trimming the coil to 450 kc is on the harmonics. Everybody must have a receiver covering the normal BC and short wave bands, and so can pick up the harmonics and check that they are some 450 kc apart. When that has been checked and the coil is within 20 kc, the final adjustment can be made on its second harmonic, which will come near to the London National transmitter. Similarly, the 875 kc coil can be checked on fundamental against the same station.

If a tapped coil is to be used, to cover both the Top and 3·5 mc bands, *i.e.*, fundamental of 450 and 875 kc, the quickest way of finding the correct spot to tap is with the old pin method: Solder the switch lead temporarily to a small steel pin, which one digs into the coil to make contact. It will stay in position long enough to check the frequency and does no practical damage to insulation. These "country recipe" methods may be new to some readers and save them a lot of time, and so often such methods prove far quicker than using elaborate test equipment. (There is a time and place for everything !)

Construction

The standard type of chassis construction is not recommended for a unit of this type ; the various parts have to be fitted in carefully, otherwise the final size will be too large and leads too long ; with the normal chassis (which was tried) it was impossible to fit the parts and, if they had been fitted, it would not have been possible to adjust them for lining up purposes.

The easiest way is to start off with a flat sheet of 1/16th aluminium or dural: that used in the model is 10 x 8 inches. First, drill for the three valve holders and then, on top, mount the main VFO tuning condenser in the centre, and one of the split-stator anode condensers (oscillator anode) at its side. Fig. 7 shows the top layout for main items.

Underneath, immediately under the first split-stator, already mounted, fix the second one. At this stage, the power wiring to the valve holders should be done, and all the relevant by-pass condensers and resistances, etc., connected so that all that remains with them is to connect up their grids and anodes (plus cathode in the case of the oscillator) when the other components are ready.

Next, start wiring up the C1-C2 portion of the switch. This should be a five bank, 2-pole 6-way job, *i.e.,* 5 wafers each carrying 2-off 2-pole 6 ways for 6-band operation. When the full complement of bands is not required, simpler switching with fewer wafers may well be possible, depending upon the total number of coils used and the capacity combinations involved. Indeed, even full 6-band operation might be switched more simply if the effects of unwanted resonances arising from tapped or shorted coils could be balanced out. When ready, this switch will be mounted under the 10 x 8 inch baseplate, immediately under the VFO tuning condenser. Note which part will be in free air underneath. At the back of the switch, run a semi-circle of wire just away from the wafer, to provide an earth lead. C1 and C2 for each oscillator coil can then be doubled back on each other in the form of a "V," the open part of which points to the back. One point of the "V" is connected to the contact of the back switch wafer, to connect eventually with the grid ; the other point goes to the earth bar, whilst the joint of the V (where the two condensers are connected) goes to the last wafer but one. As this is the only really tricky part of the switch wiring, it is best to wire these in before mounting the switch bank. Behind the switch, a paxolin panel is mounted vertically on brackets, and upon this the oscillator coils are fixed. Fig. 8 shows this stage clearly, Fig. 8A showing the method of pre-mounting the C1-C2 bank, and Fig. 8B the underneath of the plate at that stage. The oscillator grid circuits can now be lined up whilst they are completely accessible. It is unnecessary to connect the oscillator anode up

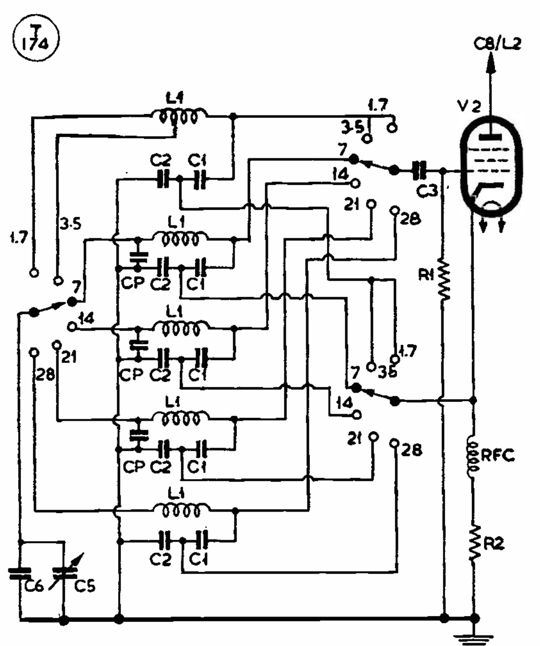


Fig. 6. Oscillator switching layout, with coil values in the table—and see text for discussion.

TABLE OF COIL VALUES

Coils for Oscillator Section

BAND	OSCILLATOR L1	C1 & C2
28 mc.	23 turns 22 SWG on $\frac{3}{8}$-in. former.	250 $\mu\mu$F
21 mc.	32 turns *do.*	300 $\mu\mu$F
14 mc.	45 turns 26 SWG *do.*	300 $\mu\mu$F
7 mc.	90 turns 26 SWG pile-wound.	500 $\mu\mu$F
3.5 mc. 1.8 mc.	*See text.*	1000 $\mu\mu$F

Cp = Padder condensers, *see text.*

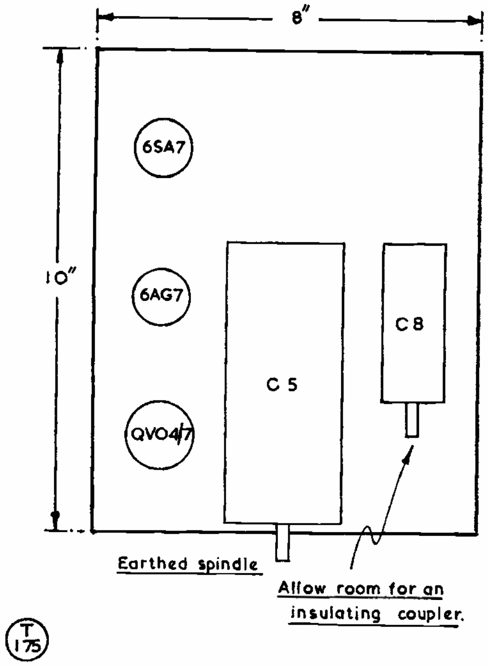


Fig. 7. Upper chassis layout for main items. As suggested by the author, if a sequence is followed in construction, it will make things easier.

for that purpose—the valve will oscillate without it and the cathode resistor will keep dissipation within maker's limits.

Having finished the oscillator (VFO) grid circuit lining up, other switch banks should be wired up to the two split-stator anode condensers so that those switch banks are now ready to be connected to their respective coils. The output feeder should also be connected to its wafer. We are now able to put in the two banks of anode coils. On the split-stator condenser (underneath the plate) a piece of aluminium is bolted, sufficient to take the coils required: they will be those for the oscillator anode doubler. Line them up before going further.

Finally, the second doubler anode coils are mounted on another small piece of aluminium which is supported about 2 inches below the QV04-7 valve holder by means of bolts. If parts are mounted in the order suggested, then all is accessible at the right moment, and even final testing may be done with everything within reach of a soldering iron.

Front and back plates are then bolted on to make a sort of "H" construction, these being pre-drilled to take spindles of the various controls and the sockets for the power and output. The whole unit can be slid into a simple dust cover.

Stand By

In use, this unit will warm up very quickly (the 6AG7 gets very hot from its heater alone) and soon reaches stability. One problem was to switch it off during "receive" periods and yet be able to turn it on again on the exact frequency. Cathode and screen switching methods were both tried, but, since they cut off all cathode current to have any effect, they let the 6AG7 cool down just a fraction on the "receive" position. On 21 and 28 mc, it meant that the unit would take about 10 seconds to regain its original frequency, during which time it would show a negative drift of about 8 kc, not sufficient for a contact to lose the signal on 'phone, but more than enough on CW when the signal was being copied through a crystal filter. An additional high value resistor in the grid circuit (to be switched out on "send") was also tried, but only caused squegging. Attempting to kill oscillations at a point of RF is too risky to both stability and output.

The method finally adopted was to cut off the HT to the oscillator anode and to the QV04-7 screen simultaneously, thus leaving the screen volts on the oscillator. In detail, with both screen and anode volts applied (on "send") the 6AG7 shows 12 mA cathode current, of which 9·5 mA goes to the anode, and 2·5 to the screen. When the anode volts are switched off, ("receive") the cathode current remains constant at 12 mA, the extra

TABLE OF COIL VALUES

Coils for Use with Circuit given in Fig. 4. (*See p. 13, March*)

BAND	L2	L3	L4 (link winding on L3)
28 mc.	20 turns 20 SWG ⅝-in. former.	9 turns 20 SWG ⅝-in. former.	1 turn.
21 mc.	28 turns *do.*	15 turns *do.*	1 turn.
14 mc.	40 turns 26 SWG ⅝-in. former.	20 turns 20 SWG *do*	2 turns.
7 mc.	80 turns 26 SWG pile-wound, ⅝-in. former.	40 turns 26 SWG *do*	3 turns.
1.8 mc.	150 turns 30 SWG on 1-in. former.	90 turns 30 SWG on 1-in. former.	5 turns.
3.5 mc.	80 turns 30 SWG *do*	50 turns 30 SWG *do*	*do*

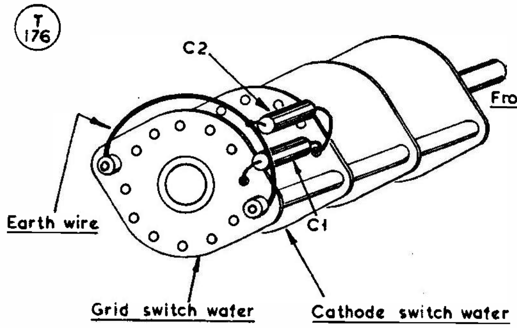


Fig. 8a Detail of C1, C2 Mounting.

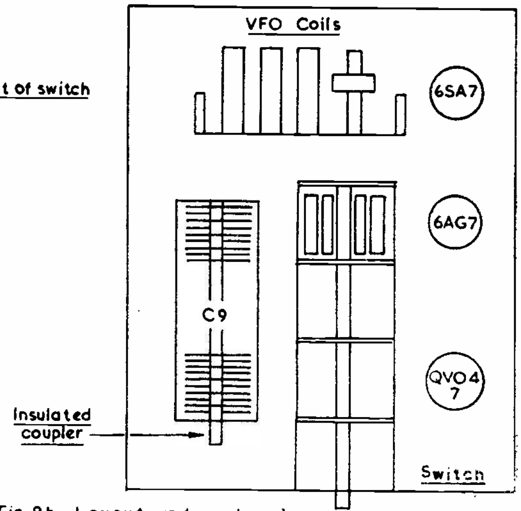


Fig. 8b Layout under chassis

Fig. 8. Some main constructional details as discussed in the text, which will be helpful for planning layout. There is no need to follow this exactly — though it will probably be found convenient to do so — for, as the author himself points out, the idea is to suggest a line of approach, rather than a cast-iron mechanical design.

being taken by the screen which just about runs within maximum dissipation. This keeps the heating constant under both conditions, and the VFO comes on and off within cycles each time. The 6AG7 does continue to oscillate even without anode volts, but on a frequency about 30 kc lower (on 21 and 28 mc), usually far enough away not to worry. Both anodes are cut off to make sure that this is not amplified up. Should, by a million-to-one chance, your QSO be on that stand-by frequency and the weak VFO does cut him up too much (at G5GQ it is used as a beat oscillator sometimes instead of the receiver BFO) then the wave-change switch can be flicked to the next band during receive periods and the VFO will still come back dead on frequency when wanted.

Keying

Keying should not take place in this exciter unit. If it is used to drive a stage such as 807's, then key in their screens. With this keying should be absolutely clean, and on the same frequency in both key up and down positions. Any significant change in frequency will be due to RF in the wrong places, *e.g.*, feeding back along the link coupling through bad mismatch, or a resonant circuit picking up output frequency at the actual VFO stage and so upsetting its operation that its fundamental frequency (at one quarter the output frequency) is affected.

Modulation

The 6SA7 reactance valve will cause no trouble at all. In this unit, it is switched in and out as required by cutting its heater. In general, it should be kept cold during CW sessions.

Many operators have experienced severe hum trouble with NBFM, which they have put down to insufficient smoothing in their normal microphone amplifiers. Actually, provided no hum can be heard in a headset connected to the speech amplifier, then no trouble should occur.

The speech amplifier should provide sufficient audio volts only for the job. At G5GQ, the amplifier consists of an EF50, pentode coupled, to which the crystal microphone is fed. A second EF50 is triode-connected. *Both these valves run at only 4·5 volts heater to keep down hum, and both are resistance coupled.* Output volts from the second EF50 are switchable either through a condenser to the 6SA7 NBFM modulator, or to a 6V6 triode-coupled which in turn drives the Class-B AM modulator. The gain control never requires more than about the half-way position. The NBFM drive must be taken from the second EF50: the output from the 6V6 is far too great and everything overloads and sounds like a buzz saw.

Provided this audio requirement is adhered to, no special smoothing is required with the amplifier. The main source of trouble is the anode feed to the 6SA7. The average RF choke tries to resonate and feed RF back to the speech amplifier, which it returns with interest as a loud buzz on the carrier. If one cuts out the RF choke and uses a resistance instead, then the 6SA7 tries to act as an audio amplifier at times, and that in an NBFM modulator again produces a buzz-saw carrier. To protect against both effects, two ordinary 2·5 millihenry RF chokes are used in series, and these are shunted by a 4000-ohm resistor which damps down possible resonances. This combination completely cured the elusive tendency to buzz-saw, a symptom which had been blamed on the speech amplifier because it only came up when the audio gain was increased from zero.

Of course, that effect can be caused by RF pick up at the microphone itself. Once certain that it is not coming in there, check the reactance modulator anode filter, despite all misleading indications that it is coming from the audio side.

Operation

This unit, with its associated PA using a pair of 807's in pi-parallel, was completed in early November, 1955, the two units being placed on artificial load for full power tests during the month. These being completed, the output was connected to the aerial matching unit, this being a simple tuning unit to couple the end-fed aerial system. Since the G5GQ location is in a block of modern flats, any visible sort of aerial is not allowed. Therefore, a "secret" aerial is run just away from the wall, outside the flat. This outside portion is only ten feet long and various odd lengths are available inside to load it up to a 10, 15 or 20 metre end-fed. The outfit was put on the air for the first time on December 3, 1955. The very first call raised W1QOO on Ten, who gave RS59-plus on the NBFM.

Whereas the previous transmitter (multi-stage exciter unit and 807's in push-pull) played havoc with the domestic TV receiver, no sign of this can be found on any band with CW or NBFM. With AM, there is the faintest background at times. The TV set in the G5GQ flat is a Rediffusion projector type, with both BBC and ITV. Adjacent flats have various types of receiver, but checking with them has so far revealed no trace of the transmitter.

It is not, however, claimed that this outfit is completely TVI-proof ! It *may* be found to be breaking through on receivers further away. But remember, it has *no* low-pass aerial filter, *nor* have local receivers been fitted with aerial rejectors.

Summing up, what is claimed is that the work that has been described in this article, together with the results obtained, provides the most convincing proof that an amazing amount of TVI can be generated, needlessly, in the transmitter itself, and that the simplest design to avoid these spurious generations (which reduce the transmitter efficiency anyhow) has proved extremely effective. May this work, and especially the history and explanation of the failures encountered, help others to enjoy more freedom of the air.

Suggestions

The writer regards this work as a stepping stone to simpler design. Having spent an awful lot of time on it, he is now going to relax for a while and enjoy operating what, for him, is a TVI-proof transmitter. Meanwhile, perhaps some others will take up the cudgels, and as lines for further investigation, the following is suggested:

(*a*) The use of wide band couplers to make for one-control tuning in the VFO.

(*b*) A better system of stand-by operation during which VFO oscillation is completely killed whilst valve dissipation remains constant.

(*c*) The development of a unity-gain all band isolator, to precede the parallel-pi 807's; that is, as first valve on the PA side, and not, as usual practice now, immediately after the VFO stage.

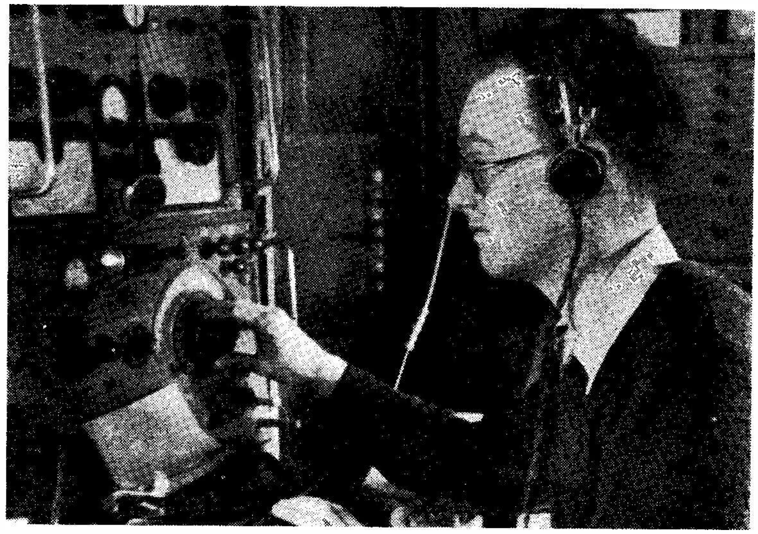
BACK NUMBER COPIES

With the exception of a few odd issues, we now have no back-number copies left of any volume before the last. A limited number of copies are still available for each issue of Vol. XIII—March 1955 to February 1956 inclusive—but this is the only complete series. For those who may be interested, we can arrange for the special reproduction, in full, of any article appearing in SHORT WAVE MAGAZINE since March 1937. But this is necessarily rather an expensive business, and in the first instance application should be made for a quotation.

MOBILE RALLY — OVERSTONE

With regard to Sunday's event at Overstone, near Northampton, we are asked to announce that the easiest way to find Overstone Solarium is to take the A.45 eastwards out of Northampton towards Wellingborough, and look for a public-house called the "World's End." This is the most convenient point from which visitors able to work mobile (on either 1896 kc, 3650 kc or 144.66 mc) can be talked in. Stations on the air for this purpose will be signing G2HCG/A and G3GWB/A—telephone number (Northampton) Moulton 324411. Gate admission is 6d. a head, and all visitors, whether operating /M or not, will be welcome. As it is now too late to book meals, bring a picnic.

DX COMMENTARY



G3DGN

CALLS HEARD, WORKED and QSL'd

L. H. THOMAS, M.B.E. (G6QB)

NO lack of interest or DX this month! Conditions have not remained at the level they attained early in the year, but all bands have been carrying heavy traffic and some unusual DX has been within our reach at various times.

Conditions built up to a remarkable peak in February, only to be washed out completely by the phenomenal solar eruption. According to our astronomer acquaintances, this latter event really was gigantic and probably represented the greatest solar disturbance ever observed on Earth. Within a few hours of its happening, all bands were dead and remained so for some hours. Commercial channels were closed down, high-power short-distance links were completely unreliable, one of H.M. submarines was temporarily posted "missing," and consternation reigned in many quarters.

A few days later the bands were more or less back to their normal state, but not to the *abnormal* propagation conditions which had preceded the disturbance. All this serves to remind us that cosmic rays are still our masters and that there is absolutely *nothing* we can do about them — at the present state of knowledge.

The DX Bands

Best of all, from the interest point of view, has been the ten-metre band, which has opened up wide for practically all parts of the world at different times. All continents have been workable, both on phone and CW. VK's, VU's, VS6's and (of course) thousands of W's have been available on many days. *Ten* now bears no resemblance to the old band which could be gently used for South America and South Africa—as it was at this time last year, or even in the autumn.

Fifteen has been better than ever, and has shown us that anything that could formerly have been done on Twenty can now be done even more easily on Fifteen. It is, however, plagued by a host of squidgy noises from jammers, and harmonics of "jingle-bells" stations, but there are still some clear spots. Perhaps because of the long period of disuse, it seems to have become the sink into which all these undesirable noises pour themselves. What on earth some of them are, one cannot even guess. They sound frightfully excited and important, but to us they are just a lot of soda-water syphons fighting a kind of Irishman's war in which all and sundry are invited to join. A high level of world-wide amateur activity under good conditions will probably shift some of them, at least.

Twenty remains much the same as ever, although the QRM level seems to be very slightly down owing to the increased occupancy of Fifteen. *Forty* may be improving a little from our point of view, as "it is understood" that the 7000-7050 kc portion should now be free of broadcasting stations! That's mighty kind of them, but their occupancy of 7150-7300 kc is now, apparently, legalised. So the sooner they get above 7150 and stay there, the more we shall be thankful for even half a band.

Only pre-war DX operators can have the slightest conception of what a wonderful DX band Forty used to be. In those days it was 300 kc wide and the only real menace was Continental phone (or spitch) which used to fade out with darkness and leave the band to the DX'ers. One well remembers sessions between midnight and 0600 in which all Continents were worked several times and contacts with VS6, VK, JA, China, Guam, KH6, KL7 and the like were dead easy.

Top Band

The Trans-Atlantics have practically faded out on us, after being very poor all through the season. The W's have had lots of fun, but we haven't, and during the freezing weather it was quite unprofitable to turn out of bed at 0500. Just the fortunate few with big and efficient aerials have managed to make the grade this year, and not very often at that.

The morning of February 12 was quite eventful in the States, with DL1DA and DL1FF sounding like locals and HB1CM/HE giving out a new country to many of the keen types who were looking for him. These stations apparently hit the States around 0450 and were gone by 0530 GMT. Not a single G station was heard over there that morning.

Unusual conditions were noted when W3RGQ was working YN1AA, and W2QHH (125 miles away) couldn't hear him. Then things were reversed with W2QHH copying the YN fine and W3RGQ only getting him at 229. On February 19, despite WWV's "N7" forecast, no Europeans were heard at all on the other side. VP1EE was on, but no one heard him either!

W1BB asks us to say that if anyone wants to try to contact U.S.A. on 160 metres, he will be happy to arrange a sked at any time likely to be satisfactory. Write to him direct and fix it. Also, W1BB states once more that he will *not* answer any calls made on, or near, his own frequency. Some of the hopefuls will *still* persist in trying this on, and it is a complete waste of time and effort, as well as being an extreme irritation to those attempting to work him off his frequency.

From the lack of enthusiasm on this side of the Atlantic this year, we conclude that these Top-Band Tests have outlived their usefulness in the present phase of the sun-spot cycle. One or two newcomers to the ranks of Trans-Atlantic workers have appeared, but on the whole this is now too difficult (not to say impossible for many) without the help of unusually good conditions and an effective 160-metre radiating system. However, looking through the record for recent years, it is plain that Top Band has served us well and there can be no question that our own series of Tests served to stir up DX activity that would otherwise never have happened.

TOP BAND COUNTIES LADDER

(Starting Jan. 1, 1952)

Station	Confirmed	Worked
G5JM	97	97
G2NJ	97	97
G3HIS	95	95
G3JEQ	93	93
G3HIW	92	93
G6VC	92	92
G3EUK	91	93
G3CO	91	92
G2AYG	86	87
G3HYJ	84	85
G3JHH	82	83
G3FAS	80	82
G3BRL	80	81
G3GGS	79	83
G3KEP	76	76
G3ABG	75	79
G3FTV	74	82
G3DO	74	74
G3AKX	72	73
G3JJZ	71	73
GM3DOD	70	71
G3JBK	69	74
G3FNV	64	71
G3JVL	62	77
G2HKU	62	62
G3FTV/A	60	69
G3KKZ	60	64
G3DGN	60	64
GW3HZZ	60	63
G2CZU	60	62
G3JNX	60	61
G8CO	54	66
G3EJF	54	59
GM3JZK	46	55
G3HQT	39	44
G2HDR	28	48
G3ICH	26	41
G3JZP	14	31
G3JSN	13	27

Other Top-Band News

G3AKX (Sale) wonders if anyone is active in Hereford these days? He comments on the terrific signal from GC2FMV on March 13, and adds that GM3KJA (Roxburgh) has been so unlucky with his cards that he will now only QSL on receipt of the other man's card.

G3JJZ (Compton Bassett) has been heard in U.S.A. but has made no QSO's. However, when he signed after a 35-w.p.m. contact with G2BB, he was called by ZB1HKO and given a 569 report. G2HDR (Bristol) has worked two OK's and an HB, and his quest for WABC continues (he was only licensed last October); he is in that part of Bristol which counts as Gloucestershire, by the way. G2HDR would like to hear more activity from Cumberland, Westmorland, GC, GD and GI.

G3EJF (Tottington) raised GM3KHH (Stirling) for a new one, and tells us that GM3KLA (Shetland) now scores 43/49 in the Counties table, relying entirely on wind-charged batteries. GM3KLA has worked GC3KAV, which is definitely the longest hop possible in the British Isles!

As if in answer to G3AKX's query (above), G3INR (Hereford) says he has no Top-Band transmitter at present; also that a good aerial up there is for him impossible. But he thinks G3DHS, G3ESY and G3NA, all in Hereford, still make occasional appearances.

G3KSL (Rochester) has received about fifteen cards from G's and OK's, but he has never operated on Top Band yet! So he must have a pirate dogging his footsteps; it seems to be a character giving QTH as "Wigan" and name as "Tom." The real G3KSL would be delighted to meet him, preferably at the end of Wigan pier . . . . .

G3JHH (Hounslow) says he thought he heard FA8OA calling CQ at 2350 on February 22, but no one else seemed to hear him, so he might have misread a commercial call-sign. A card from Roxburgh has put him up to 82/83, and one from Pembroke would make him complete.

G3BRL (London, W.5) reports once more; he is not very active, but has worked GM3KHJ (Inverness) and collected a QSL from Caernarvon. G3ICH (Leighton Buzzard) looks forward to the expeditions and would like to see a lot more activity from Northern

Ireland. He hopes to claim a WBC (but not WABC!) on cards received when he was DL2CH.

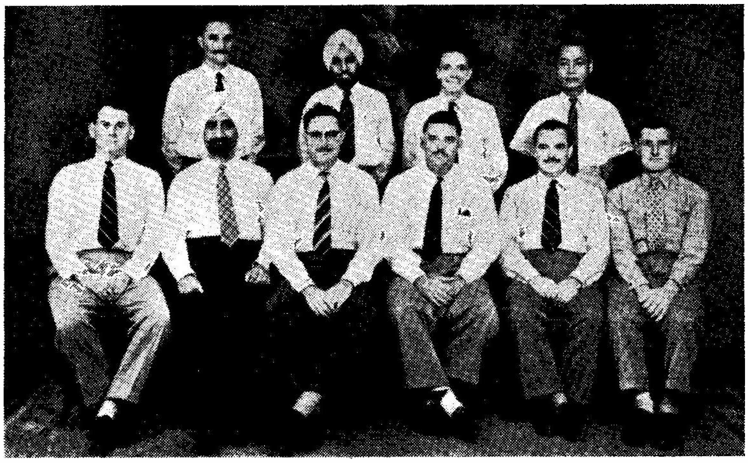
G3KMQ (Compton Bassett) is another who has returned from DL-land, and in a very few weeks he has worked 46 counties and ZB1HKO. G3JSN (Harrow) joins both the WABC and Five-Band Tables, although, as he says, he knows he will be the "Charlie" at the bottom of them both—but not for long, maybe. He has raised GC3KAV, GW3KSQ, GM3KBZ and numerous G's, but thinks activity on One-Sixty is falling off. (It's nice to find so many G3K's on the band, though, and we rely on them to fill the gaps caused by the retirement of some of the Old Gang.)

Sundry deletions from the WABC ladder mean that the stations concerned have not reported to us for *five* months. The original arrangement was that a report at least every three months would be necessary to hold one's position; we shall observe this in future, having thus given plenty of notice before removing calls from the list.

G2NJ, from his boat in Hunts., worked OK1KKD in the middle of a sunny afternoon. He also tells us that G8FW (Lincs.) raised G3BRA/M in Berwickshire and "drove home with him" to Northumberland. Yet another good one in daylight was with GM3KBZ (Glasgow) at 1600 GMT on March 19.

21-28mc MARATHON, 1956

Station	21 mc.	28 mc.	Total
G2CDI (Phone)	96	42	104
G3HCU (Phone)	77	24	85
G5BZ	60	34	60
G2DC	47	28	56
MP4BBW	40	33	52
GM2DBX (Phone)	37	37	4
G3GGS	18	11	24
ZB1HKO	15	8	20
G3IGW	14	3	17
G3GZJ	11	5	16
G3JVJ	11	2	11



Members of the Taiping DX Club, a group of VS2's. Seated in the front row, left to right, are: VS2ER, VS2EE, VS2EY, VS2DS, VS2DO and VS2EZ. In the back row, left to right, are SWL's J. Williams, Haruint Singh, T. Felton and Ah Kooi. This photograph was sent us by VS2DB, who is doing so much to foster the true amateur spirit in Malaya.

Incidentally, 160-metre CW men may like to know that the Grafton Radio Society has its own members' Top Band contest scheduled for 2230-0100, clock time, both week-ends April 21/22 and 28/29. Members of Grafton will call "CQ GRS" and will gain one point for every contact with a non-member station. Grafton, a London club with a large membership, runs this contest annually.

Ten-Metre DX

Most interesting trend of the month is the opening up of *Ten* to all parts. (Just before writing this your commentator was working W6's on the band with all the old *éclat* of 1947-48!) It would seem that this new cycle is climbing to its peak very rapidly, as we should hardly expect the present conditions to prevail until 1958.

G2CDI (Stokenchurch) raised on 10 metres, among others, CR6, CR7, CR9, FG7, HP, TI, VP1, VK, VS6, ZD6 and ZL, but reports that conditions really collapsed after February 27. (But they appear to be in full swing again at the time of writing.)

G5BZ (Croydon) collected CR6, FF8, MP4, OD and VU on CW; with phone he added CR7, FG7, HK, HP, MP4, VP5RR (Turks Is.), ZD3 and ZD4.

G3GZJ (London, S.E.23) worked W1, 4, 8, VE2, YO and ZB1. He says that no U.S. stations were audible during the week-end of March 10-11, but LU, ZS, CX and ZD3 were all good on phone.

G2DC (Bulford) reports March 10 as extra good for W contacts (curious, in view of the previous paragraph!) and that he worked all ten W districts in ten consecutive QSO's. He comments on VU2MD's excellent CW signal, emanating from 20 watts and a ground-plane. Others worked by G2DC were CE4AD, CR6AI, VK's, VP7NI, VQ2GW, VS6CT and ZD6RM. The VK's broke through in a big way on March 11, and at 1045 GMT that morning VK3PG was S9 and just like a local. G2DC also comments that out of about 200 W stations worked on the 10-metre band, 150 of them were using 150 watts or less—a symptom of TVI tribulations?

G3FPQ (Bordon) raised VS6DE on CW; on phone he collected CO2TV, CX5CV, FG7XB, HP1EH, KZ5DG, MP4BBW, SVØWE (Rhodes), OA1M and ZP5JE.

G3HCU (Chiddingfold) put his score up 12 points with CX, FG7, MP4, VK, VQ3 and 4, VP1, VS6 and a few others. G3GGS (Preston) raised plenty of W's on phone, including a mobile in Virginia. Others on phone were PY, CX, ZS, VE8MD and HP3DA.

and, on CW, KZ5CS, ZB1 and YO.

Fifteen Metres

Fifteen is gradually beginning to show up in its true colours, and for some years to come it might well be the best all-round band of the lot. We note that many stations from all over the world put out excellent signals without the use of a beam—we have heard some terrific wallops from the long wires, ground planes and even dipoles looking the wrong way.

G3JSN had only two contacts (OH and SM), but says it was interesting to hear FS7RT on a quiet band during the evening TV hours. (What is also interesting is that we don't know of anyone who worked him on this band, except G2CDI and G3HCU.)

G2CDI, on phone, raised VK9 (Norfolk Is. and New Guinea), VR2, FM7, YN, ZP, ET, KL7, the aforementioned FS7RT, and a KG1. The latter, on February 27, gave him his 100th country on 21 and 28 mc since January 1. The century in less than two months, on two bands . . . it certainly shows how conditions are shaping up.

G5BZ was on the evening before the solar storm flared up, and around 1900 GMT found KH6AFS coming in at S9+ ; he got a similar report, although he is badly screened from that direction. Others were CX, TF and ZB2 on CW, as well as VQ4 and 5, CO and KT1 on phone.

The best for G3HCU were FS7RT, FM7, KH6, KL7, KA, VR2CG, YN1KK, VP3YG, VP7NF and ZS3V—all on phone.

G3GZJ worked his way all round the States and Canada, with plenty of KN and WN stations thrown in. G3FPQ raised VP5RR (Turks Is.) for a new one. G3GGS worked HC1ES, VU2AT, VP6FR and KR6NP on phone, as well as OA4ED on CW, after trying to get an OA for a long time.

G2DC finds that 15 metres has settled down into a producer of DX for most of the day and, at times, well into the night ; he thinks the star station on the band is VS6CO, the RAF-ARS club station in Hong Kong. With 25 watts to a quarter-wave cubical quad, they put in a beautifully consistent signal. Others worked from G2DC were KG6AFY, OA4ED, VQ3JTW, VP9BM and the "usual gang."

G3ABG (Cannock) went in for a spot of phone with grid modulation and a "rudimentary ground-plane" — which, nevertheless, brought in FM7, OQ, VP6, KR6, VK, ZE, KL7, MP4, KH6, ZD2, 3V8, all VE and about 35 W States!

DX on Twenty

Some nice stuff has been round on the Old Reliable, apart from FS7RT on St. Martin, who practically caused an ionospheric disturbance on his own. G3FPQ, on phone, rolled in HK1DZ, TI2WZZ, VP1EK, VP5AK, YS1MS, HP's, YV's and the like. G3GZJ collected W's, VE's and OX3LD.

G5BZ managed to raise FS7RT, KL7, XE1CM, VE8, PZ1LM, PY3 and LUØDEL/MM—all CW. G3KMQ got around to the extent of TI, KL7, VQ5, MP4Q, CE, CX, VP8, PJ, LU, KV4, KZ5, VQ2 and ZL. Good ones missed on late-night excursions included YS, HC, FY, CR4, FQ8, KR6, KH6, VR3B, FB8ZZ, HI, VP2 and FK8 — as nice a list of gotaways as we have seen for a long time!

G3JEA (London, W.2) was amazed to find the band crowded one night at 0100 GMT, with CR6AI calling CQ at S9+, W6's in full force, VP2, 3, 4, 5, 6, 8, 9, HC and lots of South Americans. With the ground-plane he raised three PY8's, and LU, a VP8 and a W, and appeared to be the only European on at the time, as all the DX was surprised to meet him! This was a night of "Aurora conditions."

G3ABG had a few CW sessions, which brought in VK1RA, CR6AI, ZD6BX, VQ2JN and KV4AA. G3KSL started on the band "seriously" in February, with operating hours between 2300 and 0400, he being a shift-worker ; he has already booked in FM7, KP4, VP3 and VP9, W's in all districts and a PY ; 589 and 599 reports have been received from W's, with 50 watts and a 132-ft. aerial.

G2DC calls Twenty "the old pot-boiler band" and finds it continues to supply all and sundry with good DX. He hasn't raised any new ones himself, but heard YA1AM and AC5PN during the ARRL Contest, both with very good signals at 1600 GMT.

G3JJZ raised VK1RA, AP2HH, VQ2IM, OD5LJ, KG1KK, ZS9O

FIVE BAND DX TABLE
(POST-WAR)

Station	Points	3.5 mc	7 mc	14 mc	21 mc	28 mc	Countries	Station	Points	3.5 mc	7 mc	14 mc	21 mc	28 mc	Countries
DL7AA	711	101	160	220	122	108	225	G3INR	252	43	51	101	38	19	112
G5BZ	635	63	114	236	131	91	240	G6TC	230	17	61	113	12	27	122
G6QB	627	52	109	223	108	135	237	G3IGW	211	40	53	64	45	9	88
G3FXB	538	67	122	189	113	47	196	G2DHV	175	19	25	112	7	12	113
G4ZU	534	12	45	215	138	124	222	MP4BBW	134	1	4	43	53	33	76
W8KIA	530	55	141	251	4	79	251	G3HSM	129	14	43	44	25	3	63
G3DO	496	24	46	205	114	107	225	ZB1HKO	110	18	21	45	15	11	49
G2YS	427	61	79	146	87	54	161	G3GZJ	100	17	27	30	21	5	46
W6AM	418	23	34	262	51	48	262	G3JVJ	97	7	46	25	11	2	57
G3FPQ	402	50	54	142	113	43	160	GM3DOD	71	10	15	36	9	1	40
GM2DBX (Phone)	382	33	31	158	79	81	169	G3HEV	47	8	19	16	3	1	28
G3ABG	364	45	83	157	49	30	165	G3IDG	44	11	10	6	1	16	26
W6AM (Phone)	323	13	32	218	39	21	218	G3JSN	29	13	8	5	2	1	17
G6VC	254	26	31	125	45	27	122								

and ZD2JUP — all new ones for him.

Forty Metres

Perhaps we might get a little more sense out of this band, if eventually they really can move the broadcasting stations to the 7150-7300 kc section, which we have tacitly abandoned already. At present, however, only the lowest 50 kc can be said to be reasonably clear.

At the right time of day (or night) it *is* possible to find DX, and if you can hear it you can work it. G2DC raised some forty W and VE stations during the ARRL Contest (first leg), but nothing else of note. G3JJZ worked several W6 and WØ stations, also his first ZL — ZL3GU.

G3KSL got K2GFE for his first American on the band, and followed up with some fifteen others, all after 2300, but deserted when he had once sampled the joys of Twenty.

G3GZJ worked W, EA, EA9, CT1, CT2, YO, ZB1 and a UA1. He also heard several South Americans but found it a waste of time calling them. An FQ8 also arrived but was not worked. G5BZ raised PY6HL and PY7ME on CW. G3JSN finds both this band and Eighty behaving rather more as they did some seven years ago, especially Forty.

G3JEA went on during the Auroral display on February 25/26 and worked PY, LU, VE1 and 2, W1, 2, 3 and 4, and then moved on to Eighty, where he found some more DX.

G3ABG logged a character signing "AC4LP" on 7022 kc at 1250 GMT on a Sunday; he gave three lots of CQ calls, to which dozens of stations replied, and, having had his fun, disappeared. Even the Greeks didn't have a word for these types.

Activity on Eighty

There are very few reports concerning *Eighty*, but it seems to be in quite an interesting state. For instance, G2DC raised ZD1DR and some thirty W and VE stations, and a W6 on 21 mc told him that he was being consistently heard out there during the 0600/0700 period on Eighty. G3JEA managed VQ2, ZS3, CT2 and sundry W's and VE's. G3JHH, on QRP, raked in YO3RA and a couple of SM2's towards his WASM certificate.

G3ABG raised an LZ and a YO, but tells us that some time back he worked CR6AI on 3550 kc. The latter station will sked up there by arrangement, which should be easy, as he is to be found on 14 mc CW most evenings.

The Overseas Mail

MP4BBW (Bahrain) has found conditions somewhat better and has spent most of his time on Ten. East/West openings are much more frequent and there are not many days when he cannot work the East Coast of U.S.A. He also managed a VK and a KP4.

ZE1JG (Makwiro) is ex-G3KKX and already has a small rig in action. Despite having only one crystal, he worked 25 countries in his first ten days, including a horde of W6's, 4S7, VK, PY, LU, KH6, VP6 and a lot of Europeans. He hopes to put up a two-element rotary before long, to say nothing of more power and, possibly, phone.

VQ5GC is ex-VQ4GC, VS6AC, VS6CE and G3IAD. In his first week of activity, with a 50-ft. aerial six feet high, he had 500 contacts with 50 countries, as well as running nightly skeds with his father (G3CVG). He hears G's on Forty, but his only contact on that band has been ZD9AD (!) Ten has been very lively, and he heard GD3GMH and GD2FVC, both S9+20 dB, telling each other that the band was dead . . . As soon as the real aerial goes up, VQ5GC will be on all bands from Eighty down.

VS1GP (Changi) reports that X1NP, recently alluded to as a ship, is actually a pirate station on the Great Barrier Reef, and he has seen one of his QSL cards! VS1GP has worked about 65 countries, including ZD9AD and AC5PN, but says it is still something to hear a G. One of the strongest signals in Singapore is from 3W8AA, who says he is in Hanoi, but XW8AB in Laos says *No.* Most active CW stations in

". . . . OK Salop not in Yorks so where's de Isle of Ely . . . ."

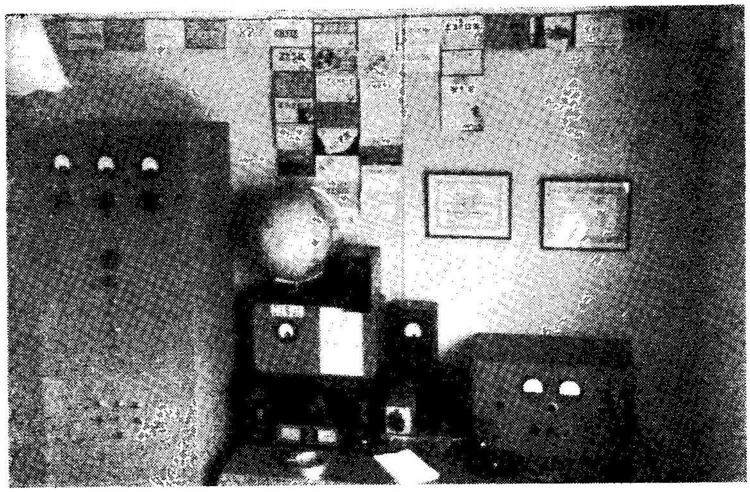
VS1 are given as VS1GU, 1GX, 1GZ, 1HC and 1GP himself. The latter two are always on Twenty in the evenings.

W6AM (Long Beach) puts his total up to 262 with FS7RT, and also worked FB8BR/FB in the Comoro Islands. FS7RT apparently left his equipment in Dutch St. Martin (PJ2) and says he will fly back to use it, if he gets a chance. (*Later*: Apparently he did, and nearly everyone missed him!)

As will be remembered, G3JXE's activities often take him into the region of Bear Island, and he now tells us that there is an amateur station in the making up there. He hopes his licence will be arriving by the next ship, and he will start up on Eighty and Forty with 35 watts, hoping to get going on Twenty later in the year. This type has a friend, LA9LC/P, who is on Hope Island, a little further north, active on Eighty QRP. (Apparently Norwegian stations only use the suffix /P to denote that they are in the *Polar* regions.) G3JXE, by the way, has got 63 counties confirmed (heard) on Top Band, all from his ship when within the Arctic Circle. His home QTH is Hull, and he has decided to apply for a /MM licence.

E. Elsley (S.T.S. *San Florentino*) wrote in despair saying that his batteries had given out. A later letter gave the result of a scrounge round the ship — he managed to raise a grand total of 50 volts instead of the required 120! With this he had a listen on Ten while in the Red Sea and the Persian Gulf, on March 1-3, and heard G3BID, GD3GMH and G5OV. During the period March 4-7, this time on Fifteen, he logged GM8MN, G3HSN, G6GO and G3JEP. Other DX from various parts was also logged, but we quote the G's in case they see their own call here.

From VS2DQ (Penang) we have received the current issue of the *Malayan Radio Amateur*, published by the M.A.R.T.S. This is now a very well-produced printed journal of some 36 pages, full of details of Malayan amateur activity and DX notes. One or two interesting quotes for the DX fraternity herewith: ZC5CA is QRT, but may be back on the air from Borneo in April . . . ZC5CT has left and is in G-land as G3DCT . . . Nearly all the VS6's and some of the XZ's now use Cubical Quads, made popular throughout the Far East largely by VS6CW's enthusiasm for this aerial.



ZE6JL, Gwelo, Southern Rhodesia, has been licensed for three years. The main rack-and-panel transmitter runs 100 watts into 807's, with push-pull 807 modulator, on 80, 40 and 20 metres. The VFO is 6SK7-6AQ5 with built-in power unit, and the receiver an HRO Senior, with an RF-24 unit modified as a pre-selector. The table-top transmitter, on the right, is a 35w. job for 40, 20 and 10 metres, running a single 807 modulated by a pair of 6L6's in AB2. ZE6JL is from Romford, Essex, and would very much like to arrange schedules with G's in that district.

AC5PN, who is genuine in Thimphu, Bhutan, has been worked by many VS1's and VS2's. VS4BA still appears in the local call book for Sarawak, also ZC5SF, 5SS and 5VS for British North Borneo. ZC2AC appears under the heading of Christmas Island. Whether any of them are active we do not know.

DX Gossip

From W6YY's monthly bulletin we quote the following items: ZL2GX has postponed his trip to the Kermadecs until he can be quite sure of transport—probably next year . . . FG7XA is active and in much demand on 14100 kc CW, around 1500 . . . ZS9G and ZS9O, the former on phone and on 21 mc . . . Europeans were heard in California, calling AC4TN, 14053 kc, 1500 GMT.

From the West Gulf DX Club's Bulletins, as follows: The projected Ifni expedition is "off" until much later in the year . . . Hope Island (*see* earlier paragraph) will count in the "list of countries" as Svalbard . . . FB8BR/FB operated from Comoro for six days, starting on February 24. Henceforth he will be on for one day each month . . . (*Later*—first or second Friday in April is quoted as a possible date.)

YJ1AA is now active again . . . YA1AM asks contacts to send his QSL's *via* ARRL . . . PJ2AA stated his intention of returning to San Maarten (presumably signing PJ2MA again) during March . . . VP2LH (St. Lucia, Windward Islands) is ex-VP5BM.

Some off-the-beaten track stuff worked by W stations with times and frequencies: FP8AK/VP2 (14160 kc phone, 0435 and 2200); FG7XB (28300 kc phone, 2330); FK8AC (21270 kc phone, 0130); KJ6BN (14046 kc, 0110); KB6BA (14080 kc, 0430); VR3B (14030 kc, 0630); ZK1BS (21005 kc, midnight); KM6AX (14054 kc, 0140); W4IKC/KW6 (21135 kc, 2340); CR9AH (28360 kc, 1220); KX6AF (14040 kc, 0340); KX6AF (21060 kc, 2230); YA1AM (14067 kc, 1350).

Some of these might possibly help to put someone on the track of a new one . . . at any rate, it's interesting to know what the other man is hearing and working.

From KV4AA: Danny Weill, VP2VB/P, and the *Yasme* are bound, by now, from Tahiti to the British Phœnix Islands, where Danny has fairly high hopes of raising a VR1 permit. Thereafter he will be making for Nauru, a rarer spot for which he has already been granted VK9TW, thanks to the help of VK2DI. The unfortunate part of the whole *Yasme* expedition is that no one seems to be able to receive Danny's signals over here in Europe. Perhaps the newly-improved conditions and the coming of Spring DX will change all this. In the meantime, KV4AA on about 14100 kc is in daily contact with *Yasme* at 0230 GMT, with signals up to 589!

FW8AB, Wallis Is., is said to be on 14040 between 0600 and 0800, particularly Sundays . . . FB8BK, Tromelin Island, suffered some damage to his shack which kept him off the air. However, he mentions possible FB8 activity from the Glorieuse Islands, probably in April . . . The Russian stations in Antarctica will use the call UPOLS . . . Two spicy bits of DX heard recently are phoneys—PJ2MB and EAØI/Ifni. Both said "QSL *via* W6BP," who has never heard of either of them!

Strays

G2DHV has had a card returned from VQ6LQ, who says he has never been on 21 mc and must have a pirate shadowing him . . . G3KSK (Westbury) was lucky enough to hear his very own "pirate" working DJ1PK and signing himself as "Bert" in Bristol . . . LU4ZV is in Hope Bay, Graham Land, "Argentine Antarctic"—heard on Twenty, 2100 GMT.

G3JJZ is playing with an electronic key using a pair of OC71 transistors instead of valves. Dots and dashes are easy, but the mark/space ratio presents problems.

G3INR queries LJ2K, Trondheim. Just another Norwegian; LB, LF, LH and LJ prefixes have all been heard at various times and do *not* denote separate countries or territories.

Long lists of calls heard are acknowledged from SWL's R. Crisp (Canvey Is.), J. F. Fulford (Bournemouth) and R. W. Crisp (London, S.E.6). Unfortunately, we cannot print such lists these days, but we are always glad to see them as confirmation of the general summing-up of conditions. Reception of some outstandingly rare individual station is another matter, of course, but run-of-the-mill lists of DX calls heard can no longer be accommodated.

Details, Please

G3HCU (Chiddingfold) suggests that all stations putting in claims for the various ladders should state in detail the stations worked—not so much to substantiate their claim, but because it is always of interest to others to know what they have been missing. He also asks what List of DX Countries, if any, we work to. The answer is the officially accepted list for DXCC and other awards, as agreed between the ARRL and other bodies—except, of course, that certain countries that the Americans are not allowed to work are still open to us and therefore do count. Does that help anybody? Perhaps we had better get down to a new List of Countries!

On the theme of conditions, a last-minute note to add in here is that on the afternoon of March 21, W6's and W7's were banging in on 21 mc as early as 1400 GMT. A check on 20 metres showed that they were also there. What was even more astonishing: East Coast W's were coming in on 7 mc (yes, old Forty) as early as 1830 GMT, that same evening.

Deadline for the next issue is first post on **Friday, April 13,** which is pretty soon after you see this! For the month after it will be *May 18*, and it would help a lot if the airmails from overseas could reach us by then. Address everything to "DX Commentary," *Short Wave Magazine*, 55 Victoria Street, S.W.1. Good Hunting, 73 and BCNU next month with another collection of news.

AMATEURS IN CEYLON

Through the courtesy of 4S7MG, we have recently received the full list of radio amateurs licensed in Ceylon, as at mid-February 1956. There are seven stations permitted to use 100w. input, the maximum allowed: 4S7AE, 4S7DJ, 4S7JB, 4S7KH, 4S7MG, 4S7MP and 4S7NG. In addition, to the total of no less than 69, there is a long list of stations licensed for 20 watts; these include both Singalese and British operators. The sole YL representative is Mrs. Soma Wickramasinghe, of Piliyandala, who, appropriately enough, has been given the call-sign 4S7YL.

The stations known to be active on the DX bands are: 4S7BR, 4S7BW, 4S7EB, 4S7FG, 4S7GD, 4S7GE, 4S7JB, 4S7LM, 4S7MG, 4S7MR, 4S7NX, 4S7SS and 4S7YL. We shall be glad to have activity reports from those 4S7's who may chance to see these lines.

STRESA CONFERENCE — HOLIDAY ABROAD

We are informed that the North-Eastern Travel Agency, 12 Cliff Street, Bridlington, East Yorks—under the direction of G3DQ—offers an attractive holiday plan to take in the European (Region 1) Amateur Radio Conference at Stresa, Italy, in June. The conference itself, attendance at which is open to all licensed amateurs in Europe, only lasts two or three days, but it happens that Stresa on Lake Maggiore is a *very* pleasant place for a conference of any sort—and Venice is within reach.

CONTRIBUTOR NOTE

All would-be contributors to the technical pages of SHORT WAVE MAGAZINE are asked to read carefully the article on p.432 of the October 1955 issue before sending in their manuscripts. This will not only help them in the preparation of acceptable work, but will also help us in dealing with it.

Converter for Ten Metres

CIRCUIT AND VALUES

With the trend of DX conditions rising into the 10-metre band, the need for a good 28 mc receiver is being felt at many stations. A number of the "surplus" types do not tune Ten at all, and some of those older receivers that are supposed to are not very effective above about 20 mc. This article discusses an efficient 10-metre converter which, used with any receiver capable of tuning across two megacycles round the 8 mc mark, will give very good results on our 28 mc band.—Editor.

A POPULAR method of extending the range of a communications receiver is by the use of a broad-band converter with which the tuning is done on the main receiver. Once the primary adjustments to the converter section are completed it only remains to be switched in and out as and when required. Such a unit can easily be built for the ten-metre band and a circuit is shown at Fig. 1, together with values.

The converter can be built on a small screened chassis and operated either external to the main receiver or—with some constructional ingenuity—space might be found for it *inside* the cabinet of the receiver with which it is to work, after the manner of the design on p.295 of the July, 1953, issue of SHORT WAVE MAGAZINE. In many cases, the power requirement for the converter, which is small, can be taken off the main receiver power pack.

Use of this type of converter with a receiver such as a BC-348, R.1155 or R.107, gives the equal in performance to many commercial sets specially designed to cover Ten.

Circuit Points

One section only of a 6J6 is used as a grounded-grid RF amplifier and a 6J6 is also employed as a combined mixer-oscillator. Due to the low value of cathode resistance required for the 6J6, care must be taken in obtaining a correct match. The circuit given permits the matching of a wide range of impedances and offers little reduction in gain over a band-width of approximately three megacycles. The mixer circuit is quite conventional and follows the lines of others discussed by various writers in SHORT WAVE MAGAZINE. The oscillator for the 10-metre converter is on approximately 22 mc

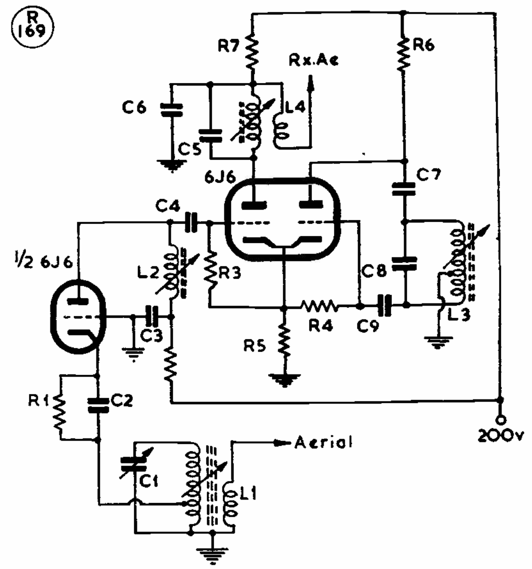


Fig. 1. Circuit for a 10-metre converter for use with any communications receiver which can be tuned across 8 mc. A grounded-grid triode (for convenience, one section of a 6J6) feeds into another 6J6 as mixer-oscillator, the output being taken at L4. If the converter is operated externally to the main receiver, it would be better to use coax feed from the link winding on L4. Values and coil data are given in the tables.

COIL TABLE

TEN-METRE CONVERTER

L1	12 turns No. 24 enamelled, tapped 2 turns from earth end for cathode. 3 turn link PVC 20 SWG, at earth end
L2	16 turns No. 24 enamelled, closewound
L3	7 turns, No. 16 bare, spaced 1 in., tapped 2 turns from earth end
L4	30 turns No. 28 enamelled, with 5 turn link.

All coils on ⅜-in. dia. slug tuned formers.

Table of Values

Fig. 1. Ten-Metre Converter for Main Receiver

C1	= 5 μμF, ceramic	R2	= 4,700 ohms, ½-watt
C2	= 500 μμF, ceramic	R3	= 100,000 ohms, ½-watt
C3, C6, C7	= .002 μF, mica	R4	= 47,000 ohms, ½-watt
C4, C9	= 50 μμF, mica	R5	= 200 ohms, 1-watt
C5	= 15 μμF, mica	R6	= 1,000 ohms, 2-watt
C8	= 100 μμF, zero temp. coeff.	R7	= 10,000 ohms, 1-watt
R1	= 47 ohms, ½-watt		

and permits the band to be covered over 6-8 mc on any communications receiver. Careful screening of the output *must* be ensured and it is advisable to fit a cover over the aerial terminal of the receiver in order to avoid, when tuning around 29 mc, picking up old G3??? who is on 40-metre CW a few doors away. If the exact frequency range is required to be known, the oscillator can be put on to 20 mc and tuning of the receiver will then give the IF as from 8 mc to 9·5 mc—or by putting a "mental 2" in front of the dial reading, direct calibration can be obtained. This avoids the 40-metre QRM, but does *not* mean that input screening can be dispensed with. In the case

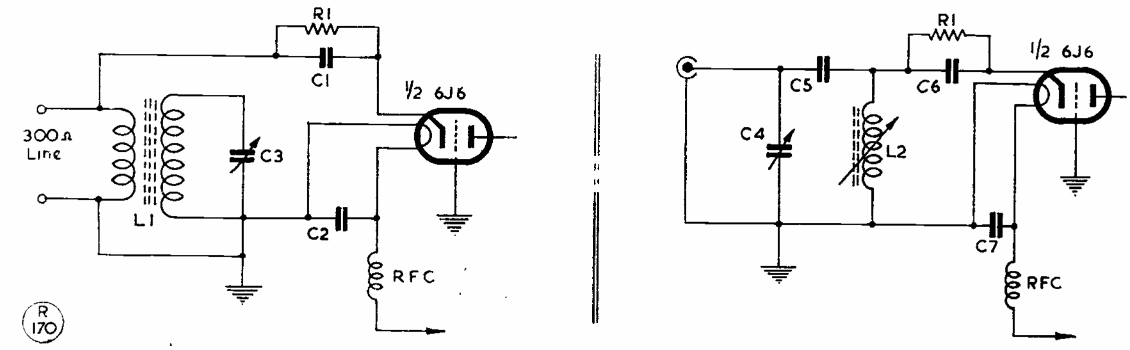


Fig. 2. Alternative input circuits for the grounded-grid 6J6, depending upon the aerial feeder to be used. Values are given in the table.

of the 20 mc oscillator, tune the output or IF coil to approximately 8·5 mc for most uniform response over the band. If the 22 mc oscillator is used, tune the output coil to 6·5 mc.

If the reader is interested in CW reception on 10 metres the best course then is to tune the output coil to the CW end of the band, although only a slight gain in sensitivity will be obtained.

Objections may be raised due to the possibility of beats between the receiver's own local oscillator and the converter, which may give rise to strong interfering signals. This is only likely to be noticed if the converter is mounted in the same cabinet as the receiver and, if possible, the converter should be mounted in a case of its own, properly earthed. The choice of IF has, of course, a lot to do with this.

Setting Up

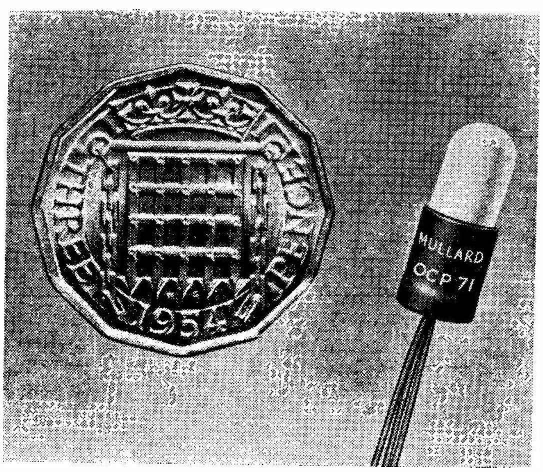
The suggested input circuit is similar to the famous " R9-er " and the adjustment required closely follows that given by *QST*. Preliminary checks consist of making sure that the oscillator is perking on the frequency chosen ; then, with the oscillator working, the slug coil L4 is varied until a maximum in output noise level is obtained on the receiver output. L2 is then peaked for maximum noise and the aerial is connected to the input plug on the converter. All the slugs are then retuned for maximum noise, the receiver having been set at that point which has been previously decided as representing 29 mc. The receiver should then be tuned over the whole band and checked for variation in noise level over the band. Stability should be checked by listening to a CW signal of known stability and noting any change in beat. It may be found necessary to introduce a voltage stabilised circuit across the power line (VR150 and VR105 in series), but this is not general. If this has to be done, a separate power supply will be required.

Table of Values

Fig. 2 Alternative Input Circuit for Converter

C1, C6	=	500 μμF, mica	L1	=	28 turns 28 SWG, ⅜-in. diam. slug tuned former, 3-turn coupling coil.
C2, C7	=	300 μμF, mica			
C3	=	25 μμF, air padder			
C4	=	50 μμF, air padder			
C5	=	25 μμF, mica	L2	=	6 turns 22 SWG, ⅝-in. diam. slug tuned former
R1	=	100 ohms, ½-watt			
RFC	=	VHF choke			

An alternative input circuit is shown (Fig. 2), and this may prove more satisfactory when using a co-ax feed line ; the input impedance on 10 metres may vary from 70 ohms up to about 500 ohms without necessitating any " frigging " with the input, but if a low impedance input is desirable on the HF bands, the alternative circuit is recommended.



The Mullard OCP71 photo-transistor compared in size with a 3d. piece. The OCP71 is the first British photo-transistor and is a germanium p-n-p junction, of high sensitivity to visible and infra-red light. For many applications, the OCP71 can simply be connected in series with a relay and a DC supply of 12-18 volts. When light falls on the photo-transistor, the current increases from a standing value of about 300 μA to 5-10 mA, thus actuating the relay. The current increase can be controlled by a bias voltage on the base circuit.

Basic Signal Source

SIMPLE SIGNAL GENERATOR

G. WHITBY

Every well-equipped amateur station should have a modulated RF source capable of producing a signal at a given level on a known frequency—in other words, a signal generator, or something very like it. Commercial instruments up to laboratory standards are necessarily relatively expensive. From the amateur point of view, such an instrument is difficult to construct and is not easy to calibrate. On the other hand, something much simpler, within the amateur range, is very often entirely adequate for ordinary bench work. This article discusses an instrument which, while not being a signal generator in the usual sense, gives modulated RF output over a wide frequency range at an acceptable degree of accuracy. Thus, it is very useful for a variety of purposes. —*Editor.*

SIGNAL generators are rightly regarded as being amongst the more *élite* pieces of test equipment which are difficult for the amateur to construct; this is mainly because the fundamental requirements of the instrument are highly accurate frequency calibration and an output attenuator which is completely reliable down to a few microvolts output.

Other essential factors are high stability, with a marked absence of harmonics, and as nearly as possible perfect screening in the RF sections of the instrument.

The reason for this high accuracy is that the true signal generator is a laboratory instrument which is used for the measurement of stage and amplifier gain, and other specialised applications, in addition to receiver and apparatus alignment and tests. Nevertheless, there are on the market many signal generators which, whilst achieving a high standard, do not attempt to approach the extreme accuracy of the laboratory types and could be more properly termed "Signal Sources," for they are used mainly by service engineers and those who require no more than a reasonable standard of accuracy for realigning receivers and calibrating other equipment.

This article describes the design and construction of an instrument of this type which can be built cheaply and, due to its simple design, presents no undue problems in adjustment.

The Design

The design problem was to build a Signal Source which, for receiver alignment and similar work, would be several steps ahead of that yeoman instrument, the Grid-Dip Oscillator, but was not necessarily so accurate as a signal generator proper. The instrument demanded the following basic requirements, beyond the obvious one that it should be both economical to construct and easy to adjust:

(*a*) Good frequency stability and a minimum range of 150 kc to 30 mc, with second harmonic coverage to 60 mc, a desirable feature which was not specifically included in the design requirements,

(*b*) Facilities for internal and external modulation in addition to an unmodulated signal, so that the oscillator could be used to align ordinary broadcast receivers,

(*c*) The modulating signal to be available in addition to the RF signal.

(*d*) Complete absence of "pulling" and maximum frequency stability on all ranges.

The design demanded that the instrument should be as simple as possible and, as a result, the double-triode ECC32 was adopted as a combined RF and AF oscillator (although any double triode valve will do) with the semi-variable-*mu* pentode 6SG7 used as a buffer output amplifier to remove all possibility of "pulling."

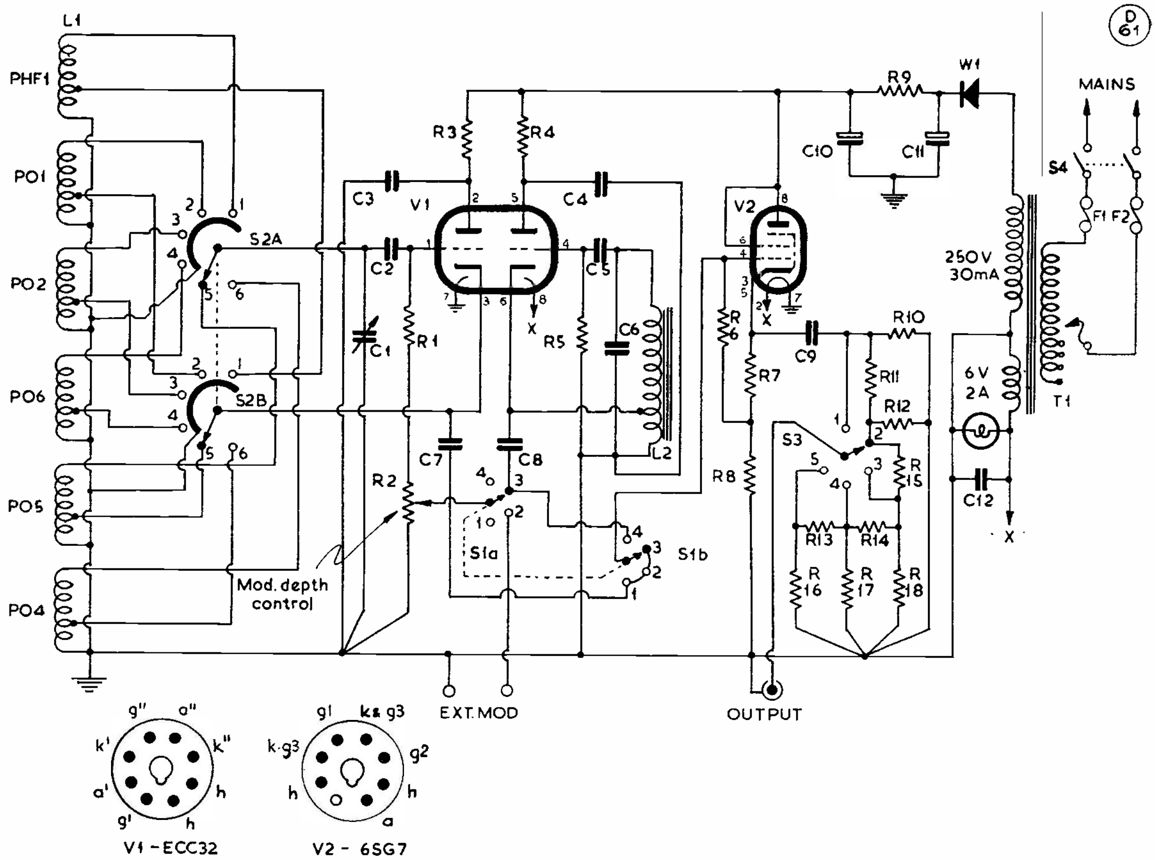
The use of a cathode-follower buffer amplifier simplifies the output stage and is easy to construct, in addition to being extremely economical in the use of components; this amplifier was designed with a pass-band of 30 mc width, both AF and RF oscillators being switched to the output stage as required.

The resultant design, shown in Fig. 1, presents no complications either in its initial adjustment or under working conditions.

The RF Oscillator

This is a Hartley oscillator of conventional design in which R1 and R2 constitute the grid-leak resistance and, in order that grid modulation may be applied, R2 is variable and appears on the front panel as the Modulation Depth adjustment, although R2 can be a fixed, pre-determined value if the control is deemed unnecessary. However, it has been found useful when used in conjunction with an oscilloscope to obtain a measured percentage of either internal or external modulation for test purposes.

The oscillator output is taken from the



Circuit of the simplified signal generator described in the accompanying article. As our contributor explains, as a test instrument it can be rated as coming mid-way between the laboratory type of signal generator and a well-built and carefully calibrated GDO. Most receiver adjustments can be carried out with the instrument as described here, and it would be an extremely useful adjunct to the test gear at any station.

cathode-tap *via* C7 to the switching circuit connecting the oscillator to the output stage.

The bandswitching arrangement is shown in detail in Fig. 1, and Wearite "P" coils are employed on all ranges. All coils save one are of the "PO" series, and the exception is on the lowest frequency range, where a PHF1 is used, connected as shown; this is because the equivalent oscillator coil (PO1) has insufficient inductance to cover the desired range.

The ranges, when the coils are used with a 500 μμF condenser C1, are:

(1) 150 kc — 400 kc
(2) 360 kc — 1.1 mc
(3) 775 kc — 2.0 mc
(4) 1.5 mc — 4.3 mc
(5) 3.3 mc — 10 mc
(6) 10 mc — 30 mc

and the wafers S2A and S2B of the range switch are fitted with earthed shorting rings which short out (to earth) the coils which have a greater inductance than the one in use—coils of lower inductance being left open without detriment to the operation of the instrument.

Table of Values

Fig. 1. Circuit of the Basic Signal Source

C1	= 500 μμF, variable	R4	= 15,000 ohms, 1 watt
C2	= 300 μμF	R5	= 470,000 ohms, ¼ watt
C3	= 0.01 μF	R6	= 470,000 ohms, ¼ watt
C4	= 0.1 μF	R7	= 100 ohms, 1 watt
C5	= 0.01 μF	R8	= 400 ohms, 1 watt
C6	= 0.1 μF	R9	= 5,000 ohms, 2 watts
C7	= 0.001 μF	R10	= 200 ohms, ¼ watt
C8	= 0.03 μF	R11	= 80 ohms, ¼ watt
C9	= 0.1 μF	R12	= 100 ohms, ¼ watt
C10	= 24 μF 350v.	R13	= 80 ohms, ¼ watt
C11	= 8 μF 350v.	R14	= 80 ohms, ¼ watt
C12	= 0.03 μF	R15	= 80 ohms, ¼ watt
R1	= 8,000 ohms ¼ watt	R16	= 100 ohms, ¼ watt
R2	= 2,000 ohms variable	R17	= 100 ohms, ¼ watt
R3	= 15,000 ohms, 1 watt	R18	= 100 ohms, ¼ watt

Internal Modulation

The second half of the ECC32 is also built into a Hartley oscillator which provides a 400-

cycle audio tone with which the RF oscillator can be internally modulated. The design of this stage is identical with the RF oscillator save for certain obvious modifications in component values to accommodate the different working frequency.

The tuning inductance L2 is a 12: 1 output transformer with a 0·1 μF condenser C6 shunted across it to give the correct resonant frequency—the exact value of this condenser depending, of course, on the inductance of L2.

The oscillator output is again taken from the cathode-tap *via* C8 to the selector switch which either applies the oscillator frequency to the Modulation Depth Control R2, or direct to the output stage.

The Output Selector

The various output conditions obtainable are:

Position 1 — Unmodulated RF.
„ 2 — Externally modulated RF.
„ 3 — Internally modulated RF.
„ 4 — 400-cycle audio output.

These are selected by a four-way, two-pole Yaxley-type switch S1, the traveller of wafer S1B being connected to the grid of the cathode-follower stage and that of wafer S1A being taken to the Modulation Depth Control.

External Modulation is applied through the "Ext. Mod." terminals shown in the circuit diagram.

Wide-Band Output Stage

This stage is an aperiodic (untuned) buffer amplifier with a pass-band of 30 mc. R7 is the bias resistor, with the lower end of the grid-leak R6 connected to the junction between R7 and R8, both of which serve as the amplifier load resistance. The output is taken through C9 to the attenuator unit. This could be a simple potentiometer if the resulting output impedance variations can be tolerated, but which is, in the constructed instrument, an attenuator of suitable design controlled by a Yaxley-type switch, the output impedance being 80 ohms.

The attenuator provides steps of: unity, 0·1, 0·01, 0·001 and 0·0001, and as the stage gain is less than unity (approx. 0·25), this attenuator has been found adequate for nearly all purposes. If more attenuation is necessary then R8 should be made variable and C9 disconnected from the cathode end of R7 and taken to the slider of the potentiometer.

The values of R7 and R8 are somewhat critical, since the cathode load determines the width of the pass-band of the cathode-follower; in general, the lower the value of the output

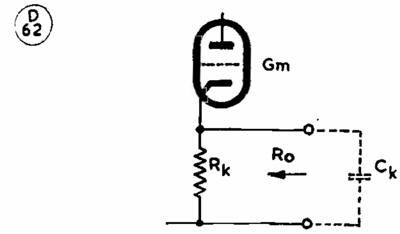


Fig. 2. The pass-band of the cathode follower is determined by the cathode load Rk — see text for discussion.

capacitance Ck, and the value of the cathode load resistance Rk (*see* Fig. 2), the wider will be the pass-band, and as it is impossible to reduce the output capacity below a certain minimum, the cathode load resistance must be sacrificed, with a consequent reduction in stage gain and output impedance. The load resistance of 500 ohms used in the design is the correct value for an amplifier employing a 6SG7 with a pass-band of 30 mc.

Power Supplies

This is a straightforward half-wave rectifier circuit involving an RC smoothing network with a total attenuating factor, at 50 c/s, of about 28 dB, which in practice reduces the hum to an acceptable level, despite the fact that the filter elements do not constitute very heavy smoothing.

The mains transformer is required to supply 250 volts at 30 mA, and 6·3 volts at 1·25 amp., the LT consumption including 0·35 amp. for illuminating the dial. The HT line voltage after smoothing is around 100 volts.

Mechanical Construction

The main consideration is that the RF coils and components be carefully positioned to find the placing for the shortest leads; care *must* be taken if good operation is expected at the upper frequency limit. The higher frequency coils should be adjacent to the range switch, with lower-frequency coils placed further away, because the wiring capacity of the latter will not be of such great moment.

Similarly, the cathode-follower wiring and that of the selector switch must be as short as possible to minimise high-frequency losses, and *all* the variable components, and the output socket, must be as physically near to their associated circuits as possible. The successful operation of the instrument depends greatly upon the care and ingenuity that is exercised in placing the components.

Additionally, it is important that all the earthed points of the RF oscillator be connected to chassis at a common point, as suggested by Fig. 1 ; where an earth line is employed, then *both* ends of it must be connected to chassis.

The operation of the cathode-follower at HF will also be improved by using a common earthing point.

The frequency stability depends, amongst other things, upon the rigidity of the cabinet and chassis, and they should be constructed of duralumin, cast aluminium or 18 gauge steel. The cabinet should be totally enclosed, and rubber feet mounted on its base to damp out any vibrations which may occur.

The mains lead should, if possible, be of the screened, twin-core type and the screen itself taken to the earth pin of a three-pin plug and the other end connected firmly to chassis. An earthing terminal should also be fitted on the front panel, for use if an independent earth is available.

The output must appear on a suitable co-axial socket, fitted so that a good connection is established with the front panel (enamel or paint being removed from the immediate vicinity of the hole through which the socket is mounted) and the output leads must be of two types—a straightforward AF lead terminating in a co-axial plug, with crocodile clips at the other end ; and an RF co-axial lead, similarly terminated, but fitted with a "dummy aerial" as shown in Fig. 3, with separated output leads fitted with crocodile clips.

Calibration

There are various ways in which this may be done, but one of the best is to beat the unmodulated carrier against a 100 kc crystal calibrator, using a suitable rectifying and monitoring circuit to pick out the signals—this could be a receiver covering the required range. Care must be taken to identify the various points and the dial setting (which should previously have been marked in degrees) noted.

Before the dial is engraved with the various frequency points, the calibration must be checked, through the main receiver, on all bands against transmitted signals of known frequency. These signals will seldom coincide with the noted 100 kc settings, but they *will* provide a check in case an odd "pip" has been missed.

An easier method involves feeding the modulated signal into a communication receiver through the dummy aerial with the signal output at a minimum and noting the dial settings for the different frequencies. A wavemeter can also be used for the purpose, and extrapolation can safely be employed on ranges which are beyond the calibrating equipment, providing that one full range can be calibrated to determine the shape of the frequency/capacity curve.

Whatever method is used, calibration must commence at the lowest frequency and gradually work through each range in turn, as many calibration points as possible being noted.

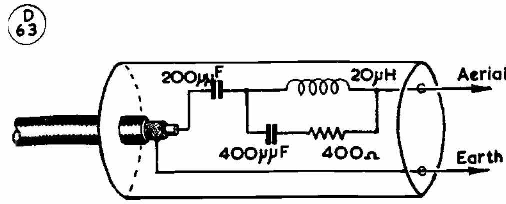


Fig. 3. Arrangement of the "dummy aerial" for the simplified signal generator, as explained in the article.

Operation

The instrument is very satisfactory and there is no difficulty in attaining 30 mc and, on second harmonic, the 60 mc signal is quite adequate despite the reduction of output after 30 mc due to the cathode-follower characteristics.

Modulation is good, although the Modulation Depth Control must be adjusted to avoid over-modulation ; the application of external modulation presents no problems beyond this adjustment. The unmodulated signal is clean, whilst the AF output is good enough to use for signal tracing through audio equipment.

The RF signal is quite stable, and tests on a communication receiver show negligible drift after the instrument has warmed-up (about five minutes) and "pulling" is completely absent on all ranges.

"NEW QTH's"

Operators newly licensed in the U.K., or those who have changed their address, are reminded that they can make use of this feature merely by sending in the details. Notification to us of a new call-sign/address ensures its appearance in the American *Radio Amateur Call Book*, the world directory of radio amateurs, for which we are sole agents in Europe.

"VHF BANDS" HELD OVER

Due to heavy pressure of other work on A. J. Devon, and a general slackening of activity on the VHF bands since the Contest, we much regret that A.J.D.'s feature is being held over till next month. We shall then present a full report on the recent VHF Contest, on which A.J.D. is already at work. ***Editor.***

One-Wire Multi-Band Aerial System

WITH ALL-BAND COUPLER CIRCUIT

This is a radiating system, not new, and first published many years ago, which is at once simple but highly efficient. It enables an accurate match to be obtained at any frequency on any band, which is the first requirement for true multi-band operation. The actual radiating efficiency depends, as with any amateur aerial system, on the site factor. The design as described here might not give better results, on 14 mc, than a dipole cut for that band—but if the need is for an aerial that can be used on several bands, including 20 metres, then this is the system to try.—Editor.

THE subject of aerials is a never-ending problem for the amateur transmitter. Whether it is an attempt to improve results, overcome some local difficulty, or just the fascination of " trying a new aerial," there is always something to be said or written or done in connection with that outside circuit on which at least 75 per cent. of our reliance must be placed.

A particular problem is the multi-band aerial—something which will do well on several of our frequencies without a lot of matching and stubbing and tuning being necessary. Most of us know the usual methods of getting out on one or two bands, and there is very little difficulty about feeding a dipole on one frequency. But it is quite another matter to evolve a system which radiates reasonably well on frequencies lower than the fundamental, as for instance, 1·8 mc when less than 100 ft. of wire can be erected. So far as 1·8 mc is concerned, the secret is an aerial-earth system, tuned Marconi fashion, with as much wire out as possible. This has been axiomatic amongst 1·8 mc operators for many years.

The Matched End-on

At most amateur stations, the problem is still some form of multi-band aerial, operated as conveniently as possible. Look, therefore, at the diagram herewith, which will be recognised as being derived from the well-known Collins coupler arrangement.

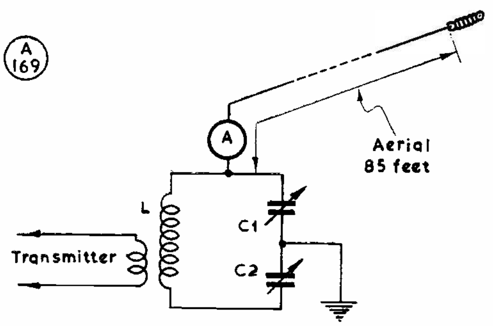
Because it will work well from 160 to 10 metres, this the nearest thing to an all-amateur-band system that one can reasonably expect to get where the available space is limited to a run of wire of 30 yards or so.

The way it works is that the *earth* tap (the junction of C1, C2) is moved, electrically speaking, up or down the coil, depending on the settings of C1, C2 when adjusted to give resonance on L at the transmitting frequency.

The coil L is linked to the transmitter output tank in the usual way and tuned with the two condensers C1 and C2, adjustment being as follows: With the link at the transmitter end disconnected, the output stage is tuned to dead resonance, *i.e.*, to minimum dip on no-load. With C1 and C2 at minimum capacity, the link is then put on and C1 gradually rotated towards maximum till the plate current begins to rise. As it comes up, C2 is adjusted to keep the circuit in resonance, *i.e.*, minimum obtainable plate mA. Suppose PA plate current at dead resonance is 12 mA: On moving C1 it might be pulled up to 35 mA ; then by resonating with C2 it can probably be brought back to about 25 mA (on these figures). The process is continued till the normal loading of the PA is obtained, C1 being used to " draw," and C2 to " resonate." The degree of loading is thus controllable within very wide limits, and it will be seen that the adjustment procedure is exactly the same as for a pi-section coupler. A little preliminary experimental work with the links at transmitter and aerial tuner ends is desirable to ensure that there is enough coupling to allow the tuner to draw fully from the PA tank.

Of course the usual precautions against overloading must be taken. The amount of draw should not be such as to " kill " the RF in the tank ; the setting for highest output is where the RF as indicated by a loop-lamp (or neon) held near L as at maximum. If this is over the required input, either the links can be backed off or condensers C1 and C2 adjusted for lighter loading. It does not matter which, so long as *resonance* is maintained.

All the adjustments are made with the aerial on. Opening the aerial switch after tuning will cause a large change in plate current—whether it is positive or negative depends upon the settings of C1 and C2 in relation to one another and the PA tank, and has no bearing on the operation of the system, since disconnecting the aerial puts the whole circuit out of tune. The point is that there should be a change of plate current, one way or the other, when the aerial is switched out—showing that it is taking load. Also, after having tuned the



Link-coupled aerial tuning unit for matching an end-on aerial on any amateur band. As explained in the text, the "all-band" characteristic is obtained by making the aerial 85 feet long from aerial coil to far-end insulator; while two or three feet either way will obviously not matter much, the nearer one can get to the preferred length, the better. If the coupler is to be used on all bands from 160 to 10 metres, the value of C1, C2 should be 500 $\mu\mu$F each; this will make adjustment tricky on the HF communication bands (7 mc and up) for which values of 200 $\mu\mu$F are more suitable. The adjustment procedure is exactly the same as for a Collins coupler — C1 is used to draw, and C2 to resonate – and the correct setting for any frequency is obtained when aerial current in the RF meter A (0-0.5 amps) is a maximum, within the limits of normal PA loading. These maxima will vary widely from band to band, and are only valid for the band on which the system is set up. Coil values, which depend somewhat on the length of the earth lead, are given in the text; some experiment with the value of L, and the linkage, will be necessary for each band. Once all this is done, the system is truly multi-band.

aerial side, it should be found that the PA tank condenser is still at dead resonance; that is, it ought not to be possible to reduce plate current any further by adjustment of the PA tank.

The theory of this system is simply that the circuit C1-C2-L can be made to match, within reason, any wire to any frequency. Experiments under practical conditions have shown that there is a certain amount of magic in the length of 85 ft. Hundred-foot aerials do not take well to the higher frequencies like 14 and 28 mc, and 60-70 ft. wires are difficult to load up on 1·8 mc.

What it comes to is that if one can get up 85 feet of wire (measured from the coil to the insulator at the far end of the aerial) and use it with this matching circuit, effective radiation can be obtained on all bands 1·8 to 28 mc.

Values

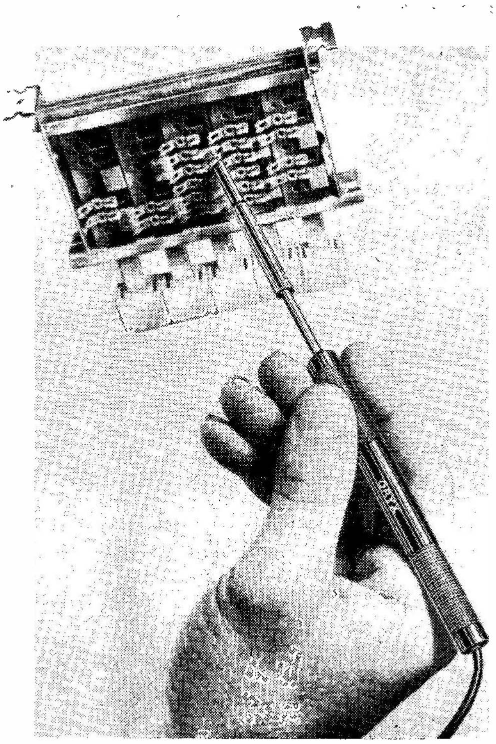
As to values, if the 160-metre band is required, C1 and C2 should be not less than ·0005 μF and of a good low-loss design, and the coil L as follows: 1·8 mc, 24 turns, 3 in. diam., link 5 turns; 3·5 mc, 14 turns, as for 1·8 mc, link 3 turns; 7 mc, 7 turns, 2 in. diam., link 2 turns; 14 mc, 4 turns, 2 in. diam., link 1 turn; and 28 mc, 3 turns, 2 in. diam., link 1 turn.

The length of the earth lead will affect these values to a considerable extent, so that they should be taken as approximate only; suitable coils which may happen to be available can be used to determine the best ratio for any band by shorting out a section turn by turn and then making L up accordingly.

RF Indication

Since the system works by adding sufficient inductance to the aerial to make it resonant at the required frequency in terms of quarter-waves, it follows that the ammeter A will show different readings from band to band, since its electrical position in the system will alter considerably; this will even be so when large frequency changes are made on, say, 80 metres. That these readings are high, low or different is no indication whatever of the radiating efficiency of the aerial and should only be used as a tuning guide when coming back to a particular band from time to time.

At any particular frequency, however, the adjustment of C1, C2 should be such as to give maximum RF current on the ammeter, within the limits of normal PA loading.



The new Oryx Model 18 low voltage (6-volt) soldering iron has a detachable 3/16-in. bit, specially shaped for small work. The power consumption is less than 20 watts, but the heat capacity is that of an iron of ordinary size. The weight of the Oryx Model 18 is only one ounce, and the construction is simple and robust.

AMATEUR RADIO — For The Beginner

PART XIII

STATION LAYOUT AND CONTROL

By **A. A. Mawse**

THIS is an important subject, especially for the beginner, and one which is too often neglected or allowed to develop in a vague or haphazard manner. The end-result is a tangled maze of leads with no certain way of identifying the control circuits.

You are going to spend a considerable portion of your spare time in the shack during the next few years—for many, it is to be hoped that it will be a (natural) lifetime!

Therefore, a little careful thought and preliminary planning at an early stage will have a number of beneficial results. It will increase your personal safety and that of your equipment; it will certainly increase your comfort and the pride you can take in your gear; and in the long run it will save you money and it will very definitely improve your operating efficiency.

Lay-Out

This expression can be taken as defining the manner in which, in general, the equipment is set up for use so that each piece of apparatus can be controlled readily and conveniently. Very obviously, no hard-and-fast rule can be laid down, and much will depend upon the available space. However, there are a number of salient facts which will help you to decide upon the pattern. The central feature must obviously be the receiver. This should be installed in a position where the controls come easily to the left hand and where they can be handled without strain. Plenty of space must be left in front for such items as note-pads, the log-book, an ash-tray (!) and, of course, the key. The latter should be so placed that it does not interfere with writing space, and set well back so that the arm has sufficient room to rest naturally and comfortably on the table top. It is surprising how an easy operating position will prevent strain and improve sending capability, especially if a long session is being undertaken.

The general positioning of the remaining equipment will depend, very largely, upon the space available and also upon the nature of the control system decided upon. What one should aim at is that *everything* should be controllable from the operating position, either directly, or from a control panel embodying manual or remote control, or a combination of both.

We have seen some amateur station lay-outs where the receiver has been recessed into a cradle cut out at the back of the operating bench, and inclined at an agle of about 45°. This not only makes for a very pleasing effect: it also saves space and receiver control is made easier.

Construction

A console form of construction can be undertaken quite readily by using "Formica" or builders' hardboard sheets for the table top and the back and side panels; the whole is supported on a framework of 2in. x 4in. wooden battens or by "Dexion" steel angle. A suggested lay-out of this kind is illustrated in Fig. 1, the various items being identifiable by reference to the associated key in the caption.

It will be seen that the receiver is shown here in the recessed position, as described earlier, and that immediately above is a shaded strip lamp of the type employed for illuminating shop windows. The sheet of plate glass is useful, in that beneath it can be kept, for easy reference, such items as country prefixes, a copy of the Q-Code, a calendar and other relevant notes of general interest.

The main on-off switch, which should be of the single pole and neutral switch-fuse type, is readily accessible and can *be kicked off instantly,* thereby rendering everything dead at one stroke. (If young children are around, the secret key switch recommended in the July 1955 article in this series should be incorporated.) Remember, you owe it to yourself and to your family to make your installation absolutely *safe*.

The whole console, as illustrated here, is set forward sufficiently from the back wall to enable wiring and servicing to be undertaken by squeezing round to the back; in this connection, a single bayonet-cap batten type lamp-holder can be fixed to the back and *wired to the mains independently* of the main switch 17, so that light at the rear is available with the gear in a safe condition.

Additionally, refinements would include a shallow shelf or drawer fitted below the operating desk for the reception of log-book, *Call Book,* emergency cigarettes, fuse-wire, and the like. Also, a red warning lamp or neon could be incorporated, wired across the

Key to Fig. 1, Station Layout

1. Bench for transmitters, power packs, etc.
2. Manual aerial change-over switch.
3. Receiver muting control.
4. Light shelf for aerial tuning unit, loudspeaker, monitor, frequency meter, field-strength indicator, books, etc.
5. "Countersunk" Communication Receiver.
6. Ribbon light under shade.
7. Speaker/Headphone control.
8. S-meter.
9. Main change-over switch.
10. Selector panel of switches.
11. Field strength meter.
12. Key.
13. Clip of notes
14. Plate glass sheet.
15. Phone jacks.
16. Phones.
17. Main switch on skirting board.

output of the mains from switch 17 and fitted in a prominent position. This tells you and everybody else in your household when the gear is live.

Finally, a set of terminals carrying heater and moderate HT supplies and controlled from one of the selector switches 10, can be made available on the rear panel. These will be found useful for testing items of equipment that may be under construction from time to time.

Control

Again no hard-and-fast rule can be laid down, but the object to aim at is *one switch change-over,* or, at the most, two, if manual aerial switching has to be employed. The choice of manual or relay control of the various circuits will depend upon the powers and operating voltages contemplated. A 2-bank 3-pole paxolin wafer switch can be made to take control of all but the most complicated switchery, and HT values of up to around 250 volts can be directly switched in this manner. For higher voltages, however, the writer prefers the use of suitable relays mounted on the various pieces of gear, and it is certain that most readers will, sooner or later, come round to full relay control.

For those who have followed these articles and have built the various items described in the series, Fig 2 gives a suggested two-knob manual control system which, with a little forethought, can be made the basis for subsequent expansion into the more elaborate system described later.

A 2-bank, 3-way, 3-pole Sorad ceramic rotary switch should be chosen for the S1, S2, S3 combination. This will provide extra contacts for expansion and will directly switch up to 1,000 volts DC if need be, so long as the circuits are not too heavily loaded. The "non-shorting" type of contact should be specified. The aerial change-over switch S5 should also be of the ceramic low-loss type, but situated remotely on the back panel in the interests of efficiency.

The sequence of events, then, in Fig. 2 when

THE "BEGINNER" SERIES

With this issue, we bring the long series of Articles for the Beginner in Amateur Radio temporarily to a close. There are two reasons for this: To give those interested in the series time to catch up on their constructional work; and to allow A. A. Mawse himself a period of rest to prepare further material.

Our "Beginner" series started with the April issue last year and has appeared every month since. A great deal of ground has been covered, to a carefully prepared programme, and the treatment throughout has been essentially practical, based always on actual experience rather than on theoretical expectation.

In this way, A. A. Mawse, himself a radio amateur of great experience, has rendered signal service to those for whom his articles were intended — and we feel sure his readers will look forward to hearing from him again soon. *Editor.*

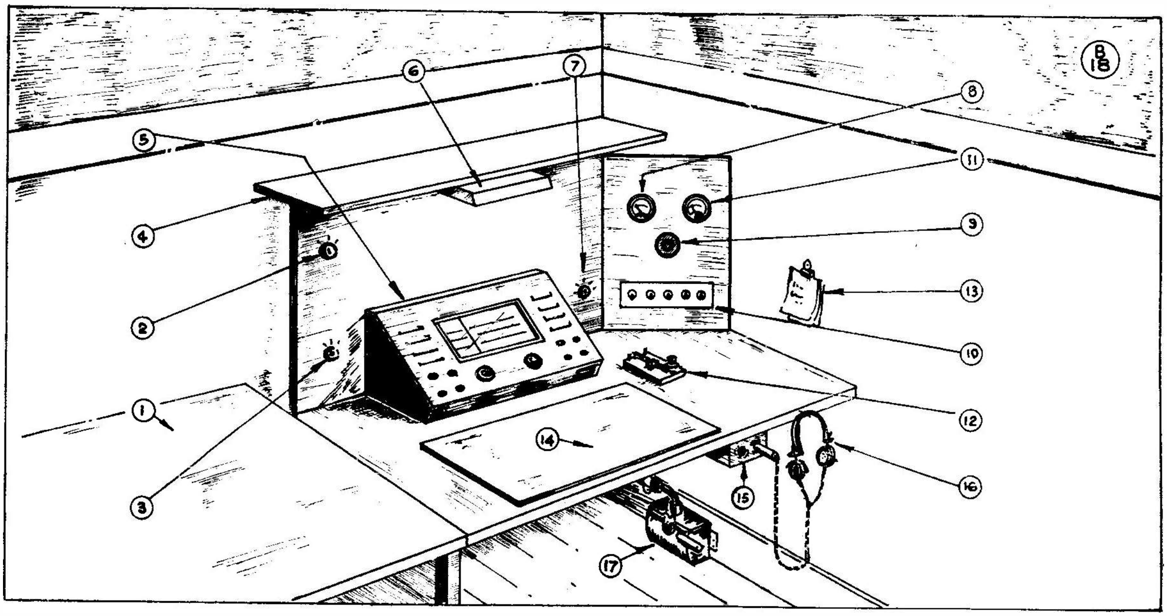


Fig. 1. A layout for the operating position, as suggested in the text. Of course, many other arrangements are possible, and in any case that finally evolved will be dictated by the shape and size of the available space. This is a corner-of-the-room suggestion, with the bench for the gear, and the working space, along the left-hand wall. (Incidentally, our draughtsman queries the absence of QSL cards on the walls of this shack !).

starting up is: First, check that the change-over switch is in the central position (position B); close the mains switch and turn on the receiver; close L1 which "lights the gas under the power pack" and generally sets the wheels in motion.

In position B the receiver is in operation and the VFO is live and will operate if the key is pressed, but HT is disconnected from both the PA and Modulator stages. S5 should, of course, be in the "receive" position. To transmit on CW, S5 is changed to the Tx position and the change-over switch to position A. This has the effect of bringing the receiver muting device into operation—of which more anon—and connects HT to the PA anode and screen. On closing the key, the transmitter will then radiate.

For Phone operation, the change-over switch is placed in position C, when the receiver is switched to "stand-by"; the key is closed and HT transferred from the PA direct to the Modulator.

Some readers may, like the writer, make use of a separate and small aerial for reception purposes, in which case the main aerial can be kept permanently connected to the transmitter (an earthing switch should always be provided). In this case, S5 can be dispensed with, so far as its function as a *change-over* switch is concerned, and the whole system operates as a one-knob control unit.

Receiver Muting

Most, if not all, modern communication receivers incorporate a "receive/stand-by" switch on the front panel. This usually operates by breaking the HT line to the RF and, possibly, first IF stages, and may be arranged to control a relay through contacts on the rear panel. If not, it is generally a simple matter to get at this switch and to bring out a pair of leads terminated in a two-pin socket. Fig. 3 shows a convenient circuit for providing variable muting connected to one of the poles on the change-over switch. In position B the receiver is fully operational. In position A ("Transmit CW") the potentiometer is connected in series with the HT supply and the front-end sensitivity of the receiver will then depend upon the setting of this control. If the distant station is of reasonable strength, this will enable break-in working to be achieved and/or it is possible to monitor one's own keying—a great help if one is a little shaky on the key! In position C ("Transmit Phone") the receiver is killed so that audio ringing round is eliminated.

For those readers who wish to operate with full break-in ("BK") the circuit shown in Fig. 4 is suggested. This depends for its operation upon the fitting of a pair of insulated contacts to the back stop of the key. In the key-up position the receiver is at its normal gain setting; on key-down, the gain is reduced as before to a pre-determined value, depending upon the potentiometer setting. To minimise back-contact key-clicks, a resistor-condenser combination is fitted across the key contacts, as shown. Their values will be a matter for experiment, but resistors of the order of 50-150 ohms in series with a condenser of a value between 0.05 and 0.5 μF should be tried until the best combination is found.

Whilst on the subject of receivers, one other control is worthy of mention for attachment to the back panel. This is a switch for cutting out either speaker or headphones at will.

Relay Control

Relays can be used in a number of different ways and are most convenient for bringing into operation remote pieces of equipment when it is inconvenient or inadvisable to run long HT or RF leads to the control point. If such relays, suitably chosen for their current and voltage carrying capacities, are mounted directly on the relevant piece of equipment and wired up across any manual control that already exists, a dual purpose is served in that, by the use of the latter, testing and servicing can be simplified. In other words, over-ride switches should be fitted in appropriate positions.

Most relays require a source of low-voltage DC for quiet operation, and this can be obtained from a disused battery-charging unit or a simply constructed metal rectifier-low voltage transformer combination. A word of warning, however, to those who contemplate the use of relays: They are *not foolproof* and have been known to stick on occasion. This might mean that a circuit under test is unexpectedly carrying a high voltage when the appropriate switch says "Off," so watch this point. For example, the contacts of a relay breaking an HT supply to a loaded transmitter will sometimes develop an arc which, at best, is highly detrimental to the points, if not more serious in other directions. This is because the magnetic field in the energising coil tends to decay rather slowly and, in any case, the gap between the points when open is relatively small. In most cases, this can be cured by fitting a similar R/C filter to that recommended in Fig. 4. As the contacts open, the surge of current is absorbed in charging up the condenser, by which time the gap is sufficiently wide to be safe. On closing, the fully-charged condenser discharges slowly through the series resistance with little, if any, sparking at the contacts.

Incidentally, those readers who have broken up the T.1154 "surplus" transmitter will probably find a ready use for the really excellent change-over relay which is included in this equipment; it will handle high-voltage circuits in absolute safety.

Power Supplies

As development of the station proceeds, the need for additional power requirements usually becomes pressing. The circuit given in Fig. 5 is a suggested lay-out for a combined power pack, remotely controlled by relays and incorporating one or two novel features.

As will be seen, T1 comprises the main transformer—a sturdy affair rated at, perhaps, 750-0-750 volts at 250 mA with a robust heater winding; T2 is a light-weight job rated at, say, 100-150 volts at 50 mA, and is intended purely for producing grid bias.

The main rectifier valves can be of the Osram U19 type; these are very reasonable in price and would be well under-run at the ratings given. The bias

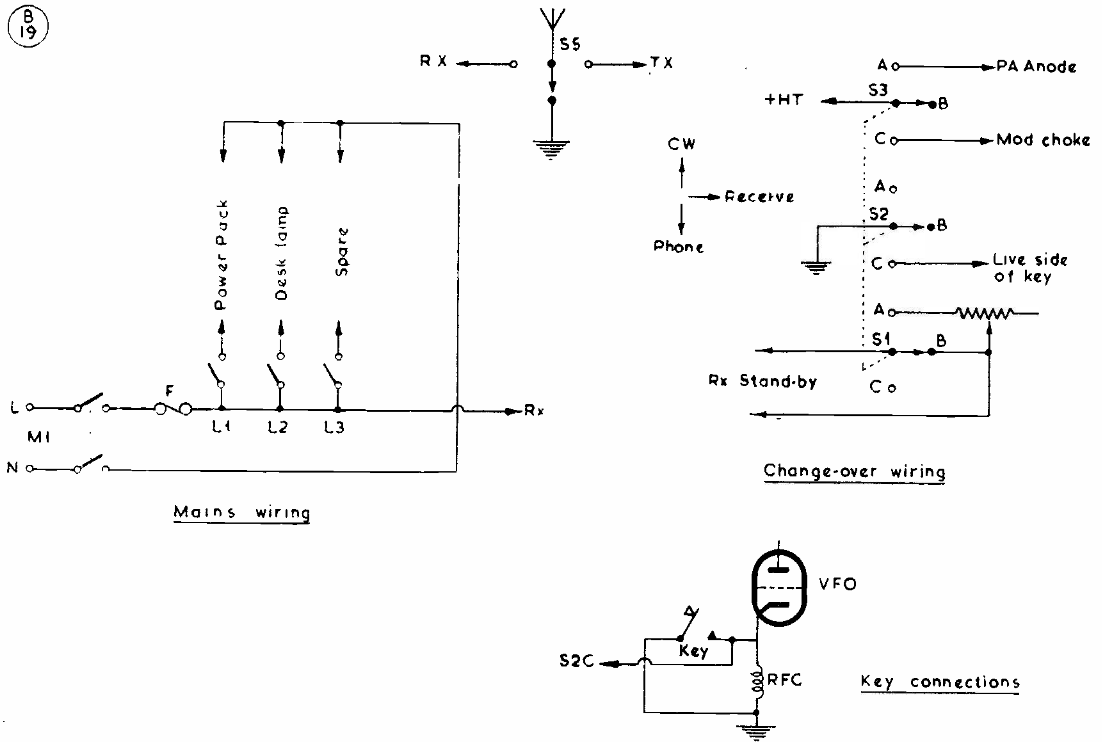


Fig. 2. General arrangement for a manually-operated station control system, with a three-position switch for the main change-over, giving "receive," "transmit CW," "transmit phone," with separate aerial switching. The main on-off, controlling the whole station, is wired to break both sides of the mains.

rectifier can be practically anything capable of passing 10-15 mA; an old 6V6 with partial loss of emission would serve, with all electrodes strapped to the anode.

Provision is made for supplying two stabilised HT outputs by means of the VR tubes in series; the usual bleeder resistor is connected across the highest stabilised voltage point and earth. Choke input has been proposed as giving better voltage regulation, and the VR tubes at all times prevent the HT volts from rising above the critical value and "running away."

Three relays are shown: Ry1, Ry2 and Ry3. Ry1 operates automatically by virtue of the current flowing in the bias rectifier circuit, and it will be seen that this relay will not close until bias has been supplied to the transmitter stages, thereby preventing any possibility of damage to the power valves by the premature application of HT volts.

Ry2 is the remotely controlled HT switch, and, if desired, this can be extended to control also the higher of the two stabilised outputs by using a double instead of a single contact relay at this point. This would enable the screen grids of the PA stage to be supplied from a stabilised source, but this can only be done providing this line is switched as described.

It is desirable to leave the lower stabilised output unswitched so that the VFO can be kept powered so long as an operating session is in progress.

The function of Ry3, the contacts of which are connected across the output of the modulation transformer (assuming plate-and-screen modulation) and which is likewise controlled from the change-over switch, is to short-circuit the output from the modulator when the transmitter is switched for CW operation.

It should be noted that two potentiometers are fitted to the bias supply, thereby enabling two different and variable grid potentials to be available if required.

Other safety measures provide for fuses, both in the live mains lead and in the positive HT line, and a warning indicator lamp connected across the main heater supply.

It should be stressed that the relays selected should be adequate for the job, both as regards current carrying capacity and their insulation resistance to earth. This last point applies particularly to Ry3, which has to withstand modulation voltage in addition to the normal HT potential.

As sooner or later it will probably be desired to run two separate transmitters, the various outputs from this combined supply can be connected to a multi-pole two-way switch, thereby enabling both transmitters to be permanently wired up or, alternatively, to enable one transmitter to be kept in the stand-by position whilst power supplies are instantly available for testing new equipment. The previous remarks on voltage and current ratings also apply here—particularly so as regards current, since there may be several amperes of heater current to be carried.

Controlled Expansion

It follows that, with the addition of supplementary power supplies, the control panel requirements become more elaborate, and this should not require any major change, providing provision for possible expansion had been made when the control system was laid out originally. Fig. 6 illustrates the switchery necessary to control the power supply just described. Some of the wiring shown in Fig. 2 remains undisturbed whilst additional switches, and spare contacts on the main change-over switch, are utilised for the extra operations. The auxiliary power pack controlled by L6 and switched by the group A1, A2 and A3 could be the original Power Pack described in this series (July 1955) and now relegated to feed ancillary apparatus. The aerial change-over is shown as being controlled by the relay Ry5 with a manually-operated selector switch S5 if two transmitters are contemplated. It can be seen, therefore, that apart from the *initial selection* of transmitters, which is performed manually by changing over only two switches, all other operations can be performed from the operating position by closing the appropriate switches on the Selector Panel and thereafter by single-knob control. As indicated earlier, infinite combinations are possible, but it is hoped that this survey will suggest ideas from which a particular combination most suited to individual needs can be selected.

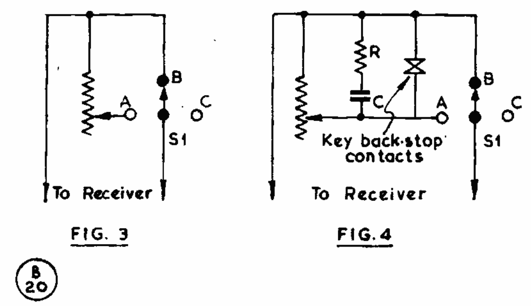


Fig. 3. Receiver muting circuit, explained in the text. Fig. 4. Circuit for BK operation, incorporating receiver muting — see text for discussion.

Above all, when making a start, do remember to make adequate provision for eventual expansion. Spare switches and/or spare contacts, or, at least, provision for them in the future, will save much gnashing of teeth and time lost on the air during an unnecessary rebuild!

When carrying out the first installation, it is also important to rough out, on paper, a wiring code. By using two-way (twin) and three-way (L, N, E) flexes, single-wire leads with coloured insulation finishes and sleeved leads where voltages higher than mains pressure are involved, it is possible to produce for record a complete station layout wiring chart. This

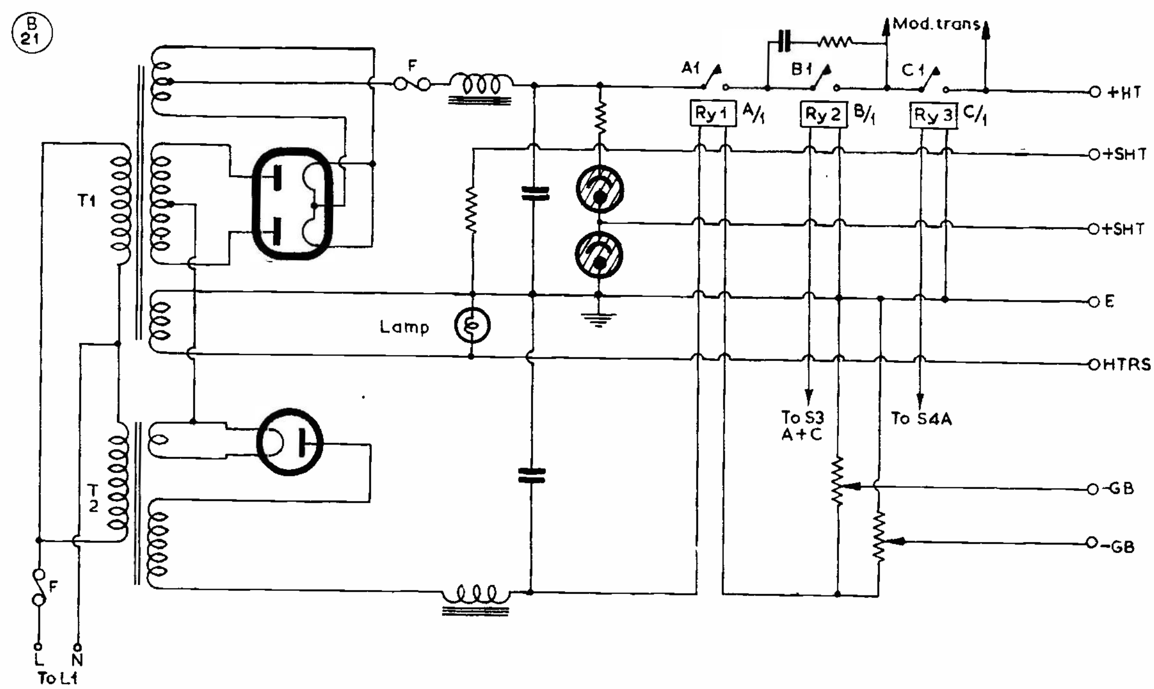


Fig. 5. Typical power-supply unit, incorporating a bias pack and relay control from the main switching layout shown in Fig. 6. The salient features of this arrangement are discussed in the text. For the relays Ry1, Ry2, Ry3, the P.O. 600 or 3000 types would be suitable.

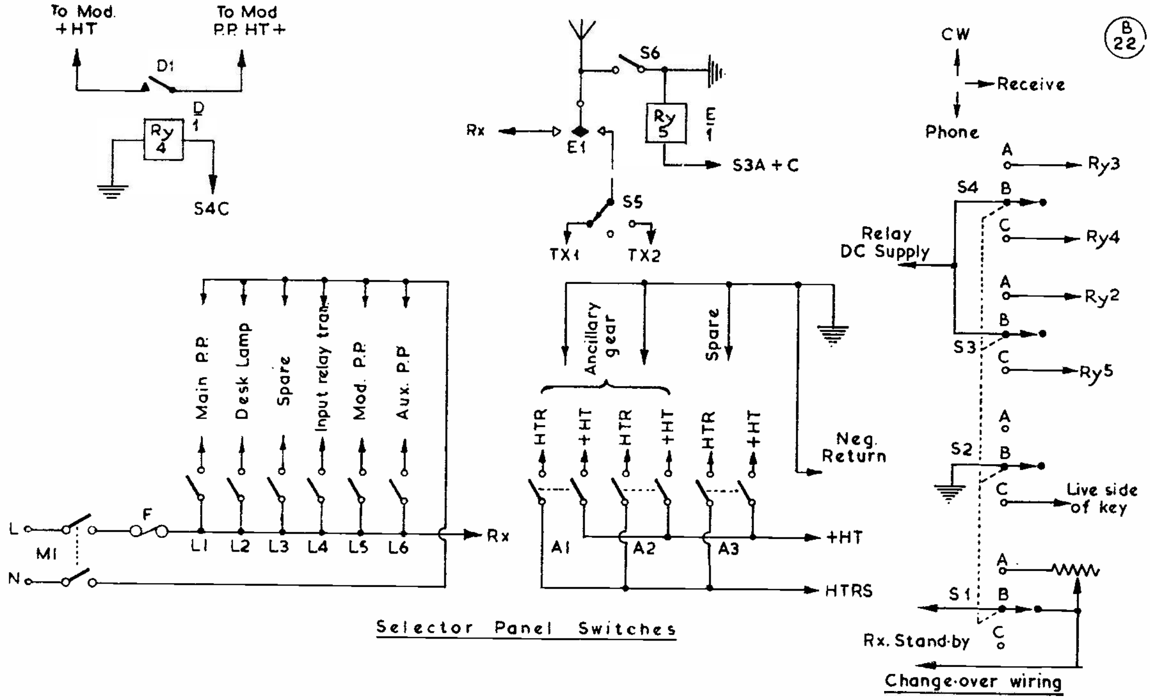


Fig. 6. This is a rather more elaborate station control system than that suggested in Fig. 2, and should be read in conjunction with Fig. 5. The switching sequences are explained in the article. As readers will appreciate, many variations of these layouts are possible to meet individual requirements. At many stations, the switching is built up piecemeal, as dictated by circumstances. Our contributor explains why it is better to work to a planned layout from the outset.

will not only greatly simplify fault-finding, but will also facilitate the wiring-in of additional equipment, without the unnecessary duplication of leads. When the main wiring has been completed, it should be neatly laced into a "cable form" over all sectors of the run where several leads come together.

Finally, and at the risk of seeming to labour the point, a further word on the importance of Safety. It is only too easy to become indifferent to the fact that lethal voltages are involved. A severe shock has a most salutary effect—it could even be fatal. The sensible thing is to avoid such possibilities!

Key to Figs. 2 and 6

M1	Main isolator switch	5 amp. SP & N switch-fuse.
L1	Transmitter power supply	3 amp. } Single-pole On-Off Toggle Switches
L2	Desk lamp	1 amp.
L3	Spare	3 amp.
L4	Relay transformer	1 amp.
L5	Modulator power supply	3 amp.
L6	Auxiliary power supply	1 amp.
A1, A2, A3	Auxiliary heater and HT supplies	1 amp. double-pole On-off Toggle switches
S1-S4	Main Change-over switch	2-bank 3-way 3-pole ceramic Sorad rotary (*Southern Radio*)
S5	Aerial selector switch	One pole 3-way Ceramic
S6	Earthing switch	One pole porcelain or ceramic knife switch.
Ry4	Modulator HT relay	
Ry5	Aerial change-over relay.	

"TIDYING-UP DEPT."

In a long series of articles of this kind, there inevitably arises a certain amount of correspondence, some of it critical in character and some of it asking for further information, while there are also some "second thoughts" here and there. The present moment seems a good opportunity to tidy up some points which have come to light and which appear to be of general interest to those who have been following this series.

The GDO — August, 1955

A 22- or 23-turn coil wound on the same sized former will cover the 7 and 14 mc bands and, with care, might be squeezed down to include 21 mc. It is not recommended to try to get higher in frequency with this particular instrument owing largely to the size of the tuning condenser originally specified.

The Transmitter — September, 1955

A few readers experienced a little difficulty due to the somewhat unstable tendencies of the 807. As far as is known, this trouble was overcome in every case by the inclusion of a stopper resistor of about 100 ohms fitted right at the top cap anode connection. It is gratifying to know that quite a number of these transmitters have been heard happily bashing away on the Top Band!

The Frequency Meter — November, 1955

The only criticism received has been in respect of the difficulty in obtaining a suitable SLF condenser, as specified. The actual condenser used in the model was a Cyldon, and it does seem, unfortunately, that this type is not readily obtainable. However, this condenser (C4 in the diagram on p.490) could be replaced by a 100 $\mu\mu$F variable of the more normal plate-shape, so long as it is realised that the resulting curve will no longer be linear in character. This would call for rather more careful plotting of a larger number of points before completing the graph, but, in other respects, the results would be just as satisfactory. In other words, use an SLF type if you can get it, but an ordinary one will do as well if you cannot.

VFO — December, 1955

An unfortunate error has shown up, in that C4 in the diagram on p.532 was omitted. A correction appeared on p.659 of the February issue.

Principles of Modulation — January, 1956

The writer has been taken somewhat sharply to task by one expert reader and, in some respects, not without justification, so he hastens to make amends. The figure 1B on p.585 shows only one cycle of the modulation wave, whereas, of course, this should have been *two* cycles over the same time period. This same correspondent also opines that the various classes of modulation have not been clearly defined.

In Class-A, the operating point is set and the signal input so limited that at all times only the linear portion of the curve is utilised. In Class-B, the bias is set further negative and the signal input increased so that, for a certain portion of the cycle, the valve is biassed beyond cut-off. The suffix " 1 " denotes that at *all* times the valve operates *without* grid current. The suffix " 2 " denotes that, for some portion of the cycle, the valve operates with grid current and thereby requires power, as opposed to voltage, to drive it.

A Class-AB amplifier is therefore one which is biassed somewhere between Class-A and Class-B. AB1 denotes this midway stage operating without grid current, and AB2 the presence of grid current.

From the above, it follows that Fig. 3 on p.586 should be more correctly described as Class-AB2, since it is not biassed back sufficiently negative to be classified as true Class-B.

Finally, the circuit shown in Fig. 4 on p.587, which was described as Class-B, indicates the use of auto-bias, which, of course, must not be used in this mode owing to the wide fluctuations of anode current under varying input levels. A source of fixed and well-regulated bias must be employed unless the valves selected are suitable for operating at zero-bias.

It is to be hoped that these remarks will make clear any possible misunderstanding that may have arisen!

Choke Control Modulator — March, 1956

The circuitry given in this article indicates a blocking condenser between the 6J5 and the 6L6 stages of a value of .005 μF. Whilst the equipment works perfectly satisfactorily thus, it has been found in practice that, with some operators whose voice lacks natural bass, this value does tend to accentuate top unduly and, in such cases, a more natural response is secured if this condenser is substituted by one of .01 μF capacity.

LEARNING TO SEND MORSE

Those who, in increasing numbers, are seeking to graduate to the transmitting fraternity know that they will first have to attain a Morse speed of 12 w.p.m. It may therefore be of interest if one whose own ticket is of fairly recent date outlines some of the tips that are helpful in obtaining the necessary Code speed.

The first step is the construction of a suitable audio oscillator on which the operator can send to himself. Such an oscillator is preferable to a buzzer because it reproduces more or less the kind of signal that issues from the station receiver. Any audio transformer of the intervalve coupling type can be used to provide the feedback, and most types of battery triode are suitable. The values of the leak and condenser may be altered to produce a note to one's personal taste, and unless accumulators are normally in use, a 9-volt GB battery with a series rheostat is probably the most convenient way of heating the filament and lasts for months. Phones are preferable to a speaker, unless it is desired to undermine the sanity of one's family and neighbours, for Morse is very penetrating!

Having memorised the code by the recommended " dit-dah " method (so that " A" is thought of as the sound " dit-dah " instead of being associated with the printed symbol), the operator then sends to himself all the dot symbols, E, I, S, H and 5, until he can run them off in a neat sequence. The procedure is repeated with the dash symbols, T, M, O, and 0, making sure that each dash is three times as long as the dots previously sent. This can be achieved by counting to oneself " One, One Two Three " as sequences of alternate dots and dashes are sent. Figures 5 and 0 are the only ones that should be introduced until the letters have been mastered; otherwise, confusion may result.

The symbols consisting of one dot and one dash (A, N) are then practised alternately, and subsequently interspersed with the ones previously sent. The next step is to introduce letters like U and D, leaving the longest symbols such as F, L and B to the last. Once all the symbols have been mastered and come easily off the key, random groupings of five letters should be sent, spacing them as words with an interval equivalent to five dots between each group. These groups are better than plain language for practice purposes, for the sense of the matter sent tends to distract the operator's attention from the niceties of spacing and correct keying. It is advisable always to send the letters fast, slowing down the message by increasing the spaces between

Table of Values

Morse Practice Oscillator

C = 300 $\mu\mu$F
R1 = 4 megohms
R2 = 50-ohm potentiometer
T = Intervalve transformer (*see text*)
V = Any small triode.
(*Key is inserted in negative HT lead*).

the letters to two or three times their proper value. which is, of course, three dots. The spaces can then be progressively reduced until their correct value is attained.

Practice

The most difficult part of learning Morse is the problem of obtaining sufficient *regular* practice in receiving. It will be found that one's speed of reception generally lags behind one's sending speed by about 5 w.p.m., so the more practice is put in on sending the better. Lacking the services of a patient friend willing to send QRS for half an hour a day, the budding operator's best friend is certainly the series of Morse gramophone records Columbia DB 1995-DB 1998, which can be purchased separately or as a set of four. For maximum benefit they should be used with a variable speed motor, but radiogram motors of the fixed-speed type can be made to run slow by the judicious insertion of a resistance of a few hundred ohms in the motor leads.

By listening to strong CW signals on the station receiver and taking down simply call-signs and RST reports, much progress can also be made. It will also be observed that the majority of amateur CW contacts follow a definite pattern. For instance, nearly everyone's first transmission ofter a successful CQ begins: "Tnx fer call OM—ur sigs RST 589 . . . ." or whatever it may be. Abbreviations such as 73, BCNU, QTH and so forth, also become familiar through frequent hearing, and call-signs are always repeated several times, so that is a help to the listener. Incidentally, do not listen for long spells—half an hour *every* day is far more valuable than two or more hours at a stretch with long intervals in between.

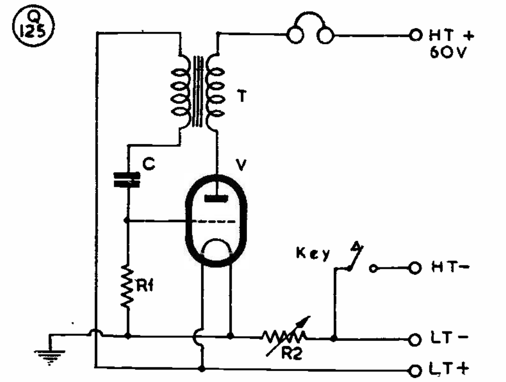


Fig. 7. A simple audio oscillator for Morse sending practice. The key is in the —HT lead and the pitch of the note can be adjusted by variation of the R1 and C values. This oscillator will go off on HT as low as 9v. from a bias battery. Any difficulty in getting it to work is usually because the connections to the transformer are in the wrong sense. If audio oscillation cannot be obtained when the circuit is first set up, the leads on one side of T should be reversed.

EDITORIAL NOTE: The article in this series in our issue for April 1955 discusses an easy way of learning the Morse Code so that sending practice can be embarked upon with accuracy and confidence.

Choice and Application of Fixed Condensers

AND TWO USEFUL TEST CIRCUITS

J. N. WALKER (G5JU)

THIS article discusses in a general way the characteristics and circuit applications of the more usual types of fixed condenser — incidentally, the terms "capacitor" and "condenser" are interchangeable in this context, though the tendency nowadays is to use the former as being more descriptive of the function.

While the notes below are intended to help the newcomer to Amateur Radio, it is hoped that they may also give some information, and perhaps even guidance, to the more experienced reader of *Short Wave Magazine.*

The following different types of condenser are likely to be found in many amateur equipments:

Electrolytic	Moulded Mica
Paper (high capacity)	Silvered Mica
Paper oil-filled (high capacity)	Ceramic (actually silvered ceramic)
Paper (low voltage tubular)	

There are others — for example, the recent designs with polythene dielectric and those with tantalum electrodes—but they are not yet in extensive use and will not be discussed here.

Electrolytic Condensers

These are useful components and have a number of well-known applications, amongst which may be mentioned HT smoothing, audio by-pass in anode, screen and cathode circuits, and, very occasionally, as coupling capacities. In the latter case, an electrolytic may be used only where a slight direct current leak is of no consequence, but where a high capacity is essential. A typical example is cathode coupling or cathode follower output at low impedance (and, of course, at audio frequency). A condenser for anode to grid coupling (discussed later) should have extremely high insulation resistance.

Two voltage ratings are generally given for high voltage electrolytic types. One is the surge voltage and the other the normal working voltage, both also being subject to the operating temperature. The component is only intended to stand up to the surge voltage for a very short time—say, whilst valves are warming up. It is wise to be always on the safe side and to make sure the actual working voltage applied to the condenser is well below its rating.

The insulation of an electrolytic condenser is by no means perfect and a small direct current will flow through it. Allowance for this will have to be made in the few cases where the direct current flowing in the circuit is itself low, as, for example, in the screen circuit of a high-gain voltage amplifying pentode.

At radio frequencies, an electrolytic condenser is lossy and undesirable resistance is introduced — hence, one should never be included by itself in a circuit carrying radio frequency current.

There is, however, the occasional situation where both radio and audio frequency currents flow and then a mica condenser should be wired in parallel with the electrolytic one—actually a case of one capacitor being used to by-pass the impedance found in the other.

A word about the actual capacity of an electrolytic condenser: The tolerance is usually very wide, a typical figure being −20% and +50%. In the circuits appropriate to these components, such variations are permissible.

After lying idle for some time, the electrodes of an electrolytic capacitor are liable to lose the chemical surface deposit, and, if operated in the normal way in this condition, a high current will flow, much heat will be developed, and the component will quite likely burst open —at any rate, it will very quickly become useless. It is quite an easy matter to re-form the electrodes and the accompanying circuit is suitable for the purpose. When the voltage is first applied, through the limiting resistor, the electrolytic condenser will look like almost a short circuit, but gradually the current flowing will drop. When it has reached a low and

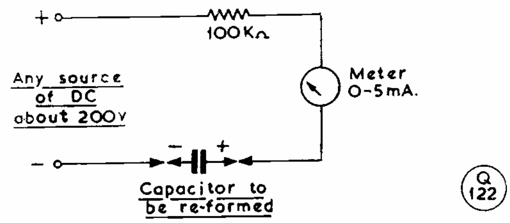


Fig. 1. Circuit for re-forming an electrolytic condenser. Several in parallel, if of similar type, can be dealt with simultaneously. The DC voltage must be considerably reduced when processing the LV high-capacity cathode by-pass types, such as 25 or 50 μF rated at 25-50 volts. Any test meter having a suitable range can be used to measure the current flowing.

consistent value, the capacitor may be put into normal service. In some instances, chiefly where an old one is being re-formed, the current will not drop much, indicating that the re-forming process is not taking place properly. There is then no alternative but to throw the thing away.

High Capacity Paper Types

These are generally employed in smoothing circuits where the applied voltage is above the limit of electrolytic capacitors, which in practice means anything much above 500 volts. The dielectric may be waxed paper or oil impregnated paper, the latter generally being the more reliable. Paper condensers are often used where extremes of temperature are encountered and are much to be preferred where atmospheric pressure varies considerably, as, for example, in aircraft equipment.

It should be borne in mind that, in a smoothing circuit, the reservoir capacity (the one immediately following the rectifier) is called upon to pass a certain amount of alternating current, since an AC ripple voltage, of some magnitude and at twice the supply frequency, will be applied to it, in addition to the standing DC voltage. With an electrolytic condenser a limit is usually specified for this current, the figure usually being 100 mA (although some will stand up to 200 mA). Where any doubt exists and where high reliability is sought, it is better to use a paper condenser in the reservoir position, as there is usually no restriction on the magnitude of the alternating current flowing through it.

Small Paper Condensers

These are available in a wide range of sizes and capacities. During recent years, much research and manufacturing effort has gone into improving these types, especially in reducing the physical size for a given capacity, and increasing the insulation resistance. The majority of paper capacitors are of tubular shape, with wire ends, and are thus convenient for placing directly in the circuit wiring.

Small paper condensers are generally used for audio coupling and by-passing, the actual values depending on the characteristics required. Such applications are well known and call for no further comment.

In many instances, paper types are suitable for inclusion in RF circuits, but only for decoupling purposes. For example, on the lower frequencies—say from 1000 kc downwards—better by-passing will be achieved with a 0·1 μF paper capacitor than with a mica capacitor of lower electrical value, whilst of course the latter, in the larger values, tends to be expensive. But a good non-inductive type should be chosen, preferably metal-cased, and the connecting leads should, as usual, be as short as possible. Some physically small paper condensers, of values between ·001 and ·01 μF, are also satisfactory at higher frequencies up to about 10 mc. But it is better to use the small "Hi-K" type of ceramic condenser in such applications, as they will undoubtedly prove more effective.

Again, the voltage rating should be adequate, since a break-down of a coupling capacity, with a relatively high voltage across it, is likely to prove expensive in valve replacement. The special types, rated to work on AC, should be used in filters, suppressors and where surges are encountered, as for example in a key-click filter unit.

Amateurs being what they are, second-hand condensers are often pressed into service. The main fault with small paper capacitors is a tendency for the insulation resistance to drop with age and so it is always well to measure the resistance of any component which has seen previous service. There are several ways of carrying out such a measurement and one is illustrated.

Only those components showing practically infinite resistance should be used in coupling applications, but often some use can be made of condensers with resistances down to 10 megohms (anything below this value means the useful life is finished) in positions where a slight leak is of no consequence.

Moulded Mica Condensers

Little need be said about this well-known type. Usual applications are in radio frequency coupling and decoupling circuits, where the capacity does not have to be critical — the normal tolerance is ±20%. The larger values are often useful in audio frequency service, giving the advantage of extremely high insulation resistance. Power loss is generally low, but it can be adversely affected by age and exposure to damp.

One thing to remember about the ordinary small receiving type of mica capacitor is that it is rated at 250 volts DC working. Many amateurs use them in transmitting equipment, with voltages running anywhere between 350 and 500 v. (often *plus* considerable RF current), and get away with it, but this is hardly the way to achieve high reliability !

Silvered Mica Condensers

Deservedly, silvered mica capacitors are very popular. They introduce very little loss, even compared to an air-dielectric condenser ; when inserted in an oscillatory circuit, take up little space, and hence are often convenient to employ when a certain amount of fixed capacity is necessary, as in a VFO, for example. A wide range of both capacities and tolerances is available and, with series/parallel arrangements, it is not difficult to make up almost any special value likely to be required in practice. The larger sizes are excellent for by-pass applications where very low loss is essential, as in many VHF circuits.

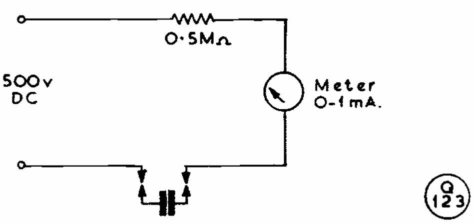


Fig. 2. A simple method of measuring, roughly, the DC resistance of a condenser. The high voltage can usually be derived from a transmitter power unit, taking due care when handling the leads. After the initial switch-on surge, the current flowing should be very small indeed if the condenser is a good one. A steady current of a tenth of one milliamp or more indicates too low a DC resistance for the condenser to be of practical use.

A word of caution is desirable here. Where the silver coating is very thin or uneven, a silvered mica condenser can show quite appreciable loss, leading both to poor circuit performance and to frequency drift. Therefore, only high quality types should be chosen where the capacity is to form an actual part of the oscillatory circuit. And again the reminder that the ordinary small types are rated at 250 volts DC working.

Ceramic Capacitors

Although briefly termed "ceramic capacitors," the electrodes are actually formed of finely divided silver particles, as with silvered mica types.

There are two main kinds of ceramic condenser. One, generally in the smaller values, has a high quality dielectric, is made to a close tolerance, and is usually offered with different degrees of temperature coefficient ratings. This latter attribute, in particular, affords a ready means of correcting frequency drift. These types are very useful in VHF receivers and transmitters, where often very low values of capacity, down to 1 $\mu\mu$F, are required. A trouble known as "scintillation" sometimes develops, minute changes of capacity occurring due to imperfections in the silver coating, and giving rise to random variations of frequency. The only cure is to discard the offending component and replace it.

The other type of ceramic condenser is made in comparatively high-capacity values and is intended solely for by-pass applications. The high capacity is secured by the employment of a special quality ceramic dielectric, hence the term "Hi-K." The component is very small physically and, besides the usual applications with valve amplifiers and oscillators, it finds many uses as an interference suppressor, particularly at very high, *e.g.*, television, frequencies, in which class of service it can be fitted actually inside such offending pieces of equipment as electric razors, electric drills and similar appliances.

BOOK REVIEW

Beam Antenna Handbook

It is generally accepted nowadays that the aerial system is the most important feature of the efficient amateur station, and it is also well known that there is a multiplicity of arrangements, of varying degrees of complication, available to those who are prepared to take the trouble to master their mechanical and electrical details.

No longer is it possible to describe every type of aerial, including all the rotary beams, in one handbook of reasonable size—not, that is, if it is desired to cover the several kinds of beam in detail.

The *Beam Antenna Handbook,* by William I. Orr, W6SAI, confines itself to beams and contains a mine of information on all types. Angles of radiation, array gain figures, SWR measurements, operating band-widths, matching systems and complete dimension charts for all amateur bands are given, complete with detailed constructional data and photographs.

The book opens with a lucid and comprehensive chapter on propagation, introducing the reader to MUF, skip distance and angles of radiation as controlled by ground reflection patterns. The simplest forms of aerial—dipoles and, later, parasitic reflectors and directors—are then discussed, with an unusually detailed description of the behaviour of a parasitic element from the *receiving* point of view. Feed point resistance, power gain and front-to-back ratio are then brought into the picture.

The chapter on transmission lines covers parallel conductors, twisted pairs, shielded pairs and co-ax, and develops the familiar, but not always understood, argument concerning resonant and non-resonant lines.

Matching devices of all types are next discussed, leading to the chapter on the complete parasitic beam and thence to "Operational Characteristics." The latter chapter covers angles of radiation, effects of nearby objects, stacking effects, and miniature beams.

The section on "Array Design" includes several tables of data for pre-tuned beams, including graphs showing SWR against frequency of operation for each design. For every design, fuller data are given than we have hitherto seen on this subject.

Constructional details are not shirked, and the various formidable forms of hardware involved in matching complicated systems are shown in both diagrammatic and photographic form. Composite structures in both wood and metal are also given in great detail.

We particularly approved of the final chapters on "Antenna Evaluation" and "Test Instruments," comprising, between them, a full study of the means whereby the owner of a beam can find out what he really wants to know—does it work as the book says, or is it free-lancing on its own?

One has nothing but praise for this most comprehensive little work, covering, as it does, a subject that presents considerable difficulty to many amateurs. Most of the bogies are removed, and with more than 100 charts, diagrams and photographs, it should be possible to fill up the blank spaces in one's aerial knowledge and to eliminate the guesswork in the construction of future beams.

Beam Antenna Handbook, by William I. Orr (W6SAI). pp.128 octavo, fully illustrated, with index, published by Radio Publications, Inc., Wilton, Conn., U.S.A., obtainable from stock, price 22s. 0d. post free, from the Publications Department, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

L. H. T.

Short Wave Magazine is an Independent Publication with a World-Wide Circulation

NEW QTH's

This space is available for the publication of the addresses of all holders of new U.K. callsigns, as issued, or changes of address of transmitters already licensed. All addresses published here are reprinted in the quarterly issue of the "RADIO AMATEUR CALL BOOK" in preparation. QTH's are inserted as they are received, up to the limit of the space allowance each month. Please write clearly and address on a separate slip to QTH Section.

DL2ZD, Sgt. K. B. Shaw *(ex-ZD4BS / MF2AD / DL2CU / D2CU),* 62 Coy. R.A.S.C.(M.T.). British Forces Post Office No. 45, B.A.O.R.

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G3KFN, A. R. Baker, 35 Adelaide Street, Stonehouse, Plymouth, Devon.

G3KME, P. G. Pennell, 32 Shelley Road, St. Mark's, Cheltenham, Glos.

G3KPN, W. M. Nicholson, 231 Holm Garth Drive, Bellfield Avenue, Hull, Yorkshire.

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G3KSR, R. E. Edwards, 14 Leaside Way, Southampton, Hants.

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G3KUD, J. R. Duncan, Maymore. Everton Road. Hordle. Lymington, Hants.

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G3KVB, J. K. Savage, 18 Brisbane Street, Kirkdale, Liverpool, 4.

G3KVE, T. K. Wright, 6 Wesley Street, Waterloo, Liverpool, 22.

GI3KVQ, S. K. Orr, School Residence, 1 Union Place, Dungannon, Co. Tyrone, N. Ireland.

G3KVR, S. Davis, 3 Coronation Road, Banwell, Somerset.

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G3ALQ, H. E. Pointeer, 14 Meadfield, Edgware, Middlesex.

GM3BN, A. E. Sutton, 18 Clifford Street, Ibrox, Glasgow, S.1.

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G3COR, P. F. Cornish *(station at Iver, Bucks.*—please QSL *via* G3COR/A.)

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G3EWP, A. B. James, 302 Carterknowle Road, Ecclesall. Sheffield, 11, Yorkshire. *(Tel.: Sheffield 50712).*

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G3HIV, A. C. Williams, M.S.Ch., 19 Neville Street, Oakhill, Stoke-on-Trent, Staffs.

GM3HMU, W. L. McIntyre, 15 Pearson Drive, Renfrew, Renfrewshire.

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G3KRP, E. G. Powell, 64 Vicarage Lane, Humberstone, Leics.

G4TX, F. H. Walker, 27 Dale Road, Walton-on-Thames, Surrey.

G6QC, E. T. Pethers, 32 Tuckett Road, Woodhouse Eaves, Nr. Loughborough, Leics.

CORRECTION

G3IKN, Sgt. V. A. Stagg, 59 A.M.Q., R.A.F. Station, Marham, Kings Lynn, Norfolk.

The Other Man's Station G4FN

FOR the guidance and information of those who may wish to know, we are told that the lady in the photograph in the centre of this picture is indeed La Munroe. The identity of the exotic creature in the pin-up on the left (and we *don't* mean G4FN) has not, however, been revealed!

Anyway, here we have the station of G4FN, owned and operated by C. T. Wakeman, Broadwater House, Clifton Terrace, Southend-on-Sea, Essex, who is well known on the amateur bands, and particularly in the DX world. He became interested in Amateur Radio in rather a curious way—a desire to hear at first-hand the ring-side broadcasts of the big fights from across the Atlantic. Being in the early days, this compelled him to build a short-wave receiver, and on this he was able to get the amateur transmissions to be heard at that time. The AA ("artificial aerial") call 2DZS soon followed, and the full call G4FN at the beginning of 1939.

Early work was experimentation with aerial systems, and that is still the main interest, although it is at present difficult to indulge it because the location of the station is actually a flat.

From left to right in the photograph, we see the AR88 receiver, on top of which is a Variac with a wide-scale voltmeter, for keeping the mains just so; next to this is an aerial tuning unit for 160 metres, to an early SHORT WAVE MAGAZINE design; this, says G4FN, "has been a boon since its inception." The two cabinets centred on the bench will be familiar to readers as the Labgear LG.300 assembly complete—the modulator and power unit on the left, and the all-band transmitter on the right. The transmitter feeds into the aerial tuning unit on the QSL filing cabinet, this ATU being designed for 10-80 metre operation. On the lower shelf there is a 6SJ7-6V6-807 transmitter for 160 metres; this is modulated by an ex-Navy "loud hailer" unit modified to accommodate a crystal microphone pre-amplifier, the output from the "loud hailer" amplifier then being sufficient to plate-screen modulate the 807 PA in the 160-metre transmitter; these items are powered from a 300-volt pack standing between them.

There are three keys on the desk—a straight pump-handle, an ordinary bug, and an electronic key to the design by OZ7BO. Other items of equipment include a B2 Tx/Rx unit, a transmitter built into a 2-oz. tobacco tin (used for playing with QRP) and an Avo multi-range test meter. The aerial at present in use, for all-band operation, is a 14 mc dipole radiating E/W, and tuned against ground on the ATU's when operated off the fundamental.

G4FN is a keen member of the F.O.C., winning their marathon contest two years running, and has also gained a number of achievement certificates for DX work—including our WABC, obtained in 50 hours' operating, evenings only. However, his interest in DX work as such has waned somewhat, and G4FN is now happy to spend his time on the air working whatever may come his way, whether it be stations in distant parts, or a local wanting a gossip.

THE MONTH WITH THE CLUBS

By *"Club Secretary"*

(Dead-line for May Issue: APRIL 13)

NOTHING is more important to a Club (apart from a good secretary, and him we mentioned last month) than a permanent headquarters of its own. It is all very well to call a handful of amateurs together, to discuss forming a Club, and even to meet for the first year, in a café or "small back room"; but for continued existence and expansion there is nothing like having your own headquarters. A room in which a work bench and cupboard are provided, which can be locked up from one meeting to the next, is all that is wanted.

Sometimes a member owns, or knows of, such a room; sometimes one has to chase round the town to find one; but there is always one there, *somewhere.* Enterprising Club members should go to almost any lengths to persuade their fellow-members that something of the sort is essential, and then things can really go ahead. From the weekly building of simple gear by members to the communal building of a complete amateur station, installed and operated on the premises, is but a short step.

Expenses in running a Club this way are undoubtedly higher than those of having a cosy chat in a café every now and then; but think how much more the members are given—for this, they could not object to a corresponding increase in the subscription rates. Another advantage in having a room of one's own is that more frequent meetings are also possible, quite apart from the fact that the greater interest and variety of the activities will encourage laggard members to turn out more often.

Clubs with their own headquarters always have some improvement to strive for; Clubs *without* them should devote their entire energy to the next step—a permanent home.

ACTIVITY REPORTS

The British Amateur Television Club (**Midlands** Group) is now well established, with 25 members. At their March meeting it was hoped that Grant Dixon would be able to show Colour TV. A visit to Sutton Coldfield is envisaged in the near future; interest is keen all round and there are plans to get a live TV camera under construction. The next meeting of the **Chelmsford** Group of the same Club will be on April 12 at 10 Baddow Place Avenue, Great Baddow, when Mr. M. Morgan will talk on 465-mc Television Links. The last meeting took the form of an interesting demonstration by Ivan Howard with his Telecine equipment. He showed a number of 16-mm. films and transmitted the pictures to the Royles (G2WJ/T) at Dunmow.

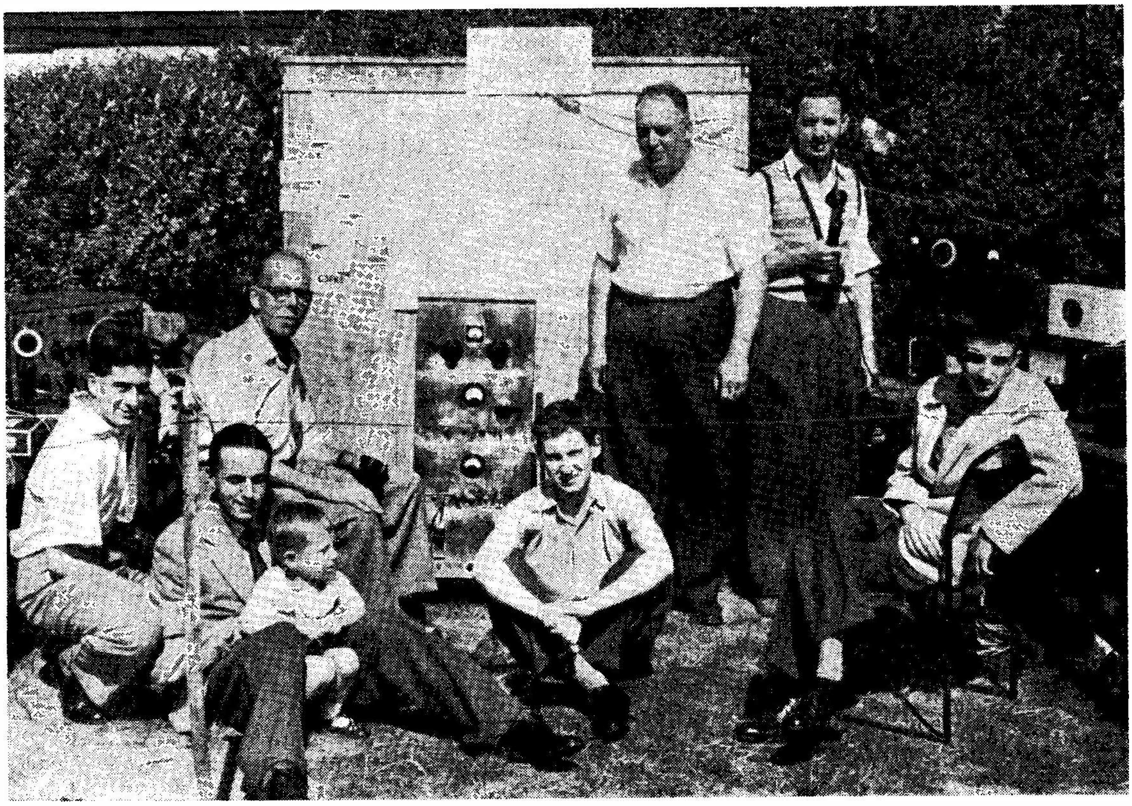
Next two meetings at **Bury** are on April 10 and May 8. The first will be a Questions and Answers session, with G3QV, G3BQT and G3DQQ as The Brains. The second will take the form of a talk on VHF Gear, by G3EPW. Both meetings are at 8 p.m. in the George Hotel, Kay Gardens, Bury.

At **Chester** the meetings will, in future start at 8 p.m. sharp with the business proceedings. At 9 p.m. there will be the usual tea break, which will split the lecture/demonstrations. At the end of the meeting the Chairman will express his appreciation and two members will rise to propose and second a vote of thanks. This air of "slightly more formality" is being aimed at deliberately to give purpose to the meetings.

Clifton have a talk on Direction Finding by G3HZI on April 6, and during the meeting details will be given of the 1956 Clifton series of D-F Contests. April 13 and 27 are constructional evenings, and on April 20 there is to be a Junk Sale, conducted by G3FNZ. All meetings at 7.30 p.m. in the Clubroom at 225 New Cross Road, London, S.E.14.

[*over*

Reports for this feature are welcomed from all active Clubs. For the May issue, they should reach us by April 13, addressed "Club Secretary," *Short Wave Magazine*, 55 Victoria Street, London, S.W.1. Closing date for June will be May 18.



Foretaste of Summer. When Liverpool Oddfellows ran a charity garden party last August Bank Holiday, Liverpool and District Amateur Radio Club staged an open-air demonstration, with G3AHD/A operating on 80 and 160 metres. Contacts were made with G stations all over the U.K. by Club members G3ELL, G3EWZ, G3IQO and G3JMH. There will be many similar outdoor events this coming season.

Coventry have a talk by G5GR on Aerials and Relays for April 9 and an Open Night on April 23. April 15 is the date of the annual MARS/CARS Contest.

Grafton are running a Top-Band Contest during the last two week-ends in April, mainly to encourage their many newly-licensed members. Details appear in this month's "DX Commentary"—the times are from 2230 to 0100 on April 21/22 and again on April 28/29.

Hastings have now taken over their own premises at 22 Middle Street, and future meetings will be held *every* Tuesday. Fridays are an additional night for free activity. When the workshop has been fully organised, the Club premises will be available to members at any time. Rebuilding of the Club station G6HH will be undertaken, and G3HCK has offered the loan of a rig to get the station on the air. Light refreshments will be provided on regular meeting nights. Subscriptions, in future, will be at the rate of £1 per annum, plus 1s. for each meeting attended.

North Kent held a successful Junk Sale on March 8, with G3JBK disposing of his surplus gear before moving. On March 22 a Film Show included a prize-winning Canadian documentary. The next main item of interest is a combined Hobbies Exhibition on May 12, in the Congregational Hall, Bexleyheath, where the Club hopes to have at least one station on the air. The Club celebrates its tenth anniversary this year, having been launched by G4CW, the original Hon. Sec., in 1946.

Plymouth have elected G3KFN as Chairman, G3GRA as Treasurer and G3JYB as Secretary. They have decided to meet on the first and third Saturdays, 7.30 p.m., at the Tothill Community Centre, St. Judes, Plymouth. Their ambition is to find a club-room of their own in the town centre.

Purley held a Junk Sale on March 16 ; for the April meeting it is hoped to arrange a talk on FM.

The **British Two-Call Club** welcomes as new members G3KPY/VS2DQ, G3JHX/DL2UH and G3JJP/DL2XY. The 1956 President is G3DGN/VS7IT and the Vice-President Ken Ellis, G5KW and innumerable other calls! Member ZC5CT is now home as G3DCT.

Ravensbourne are holding an exhibition of home-built gear from April 9 to 14 (evenings) at Durham Hill School, Downham, Kent. All visitors will be welcome. Stations G3HEV and G2DHV/A will be active on all bands.

Slade meets on April 13 to hear G6CJ on Aerials, and on April 27 two members will talk on non-radio topics. **Spen Valley** had a turnout of 42 for their Annual Dinner, at which the Swindon Trophy for services to the Society was awarded to G2SO. Equipment donated by leading manufacturers was shared by free raffles, and every member received at least one piece of gear for nothing. At the AGM, G3GJV was elected Chairman, G8OK Vice-Chairman, and Mr. L. A. Metcalfe Treasurer.

Sutton and Cheam will be holding their AGM on April 17 at the Harrow Inn, Cheam Village. Their Eighth Annual Dinner and Ladies' Festival was a very successful event at which visitors were welcomed from the Thames Valley and Mitcham Clubs. G2CZH presented the Scott Trophy, for annual competition between the Sutton and Mitcham Clubs. Sutton won it the first time, and it is expected to promote some keen rivalry between the Clubs.

North West Kent meet to discuss field day activities on May 4, at Shortlands Hotel, Station Road, Shortlands, Bromley, 8 p.m. **Surrey** (Croydon) hold their AGM on April 10 (Blacksmiths Arms, South Croydon), and if this catches the eye of any former member or old member who is now off the mailing list, the Hon. Sec. hopes they will do something about it. The talk on Models had to be postponed, and its place was taken by a Quiz, run by G2RD.

Mitcham, at their recent AGM, elected G5UX Chairman, G2DTO Treasurer and G3JYV Secretary. On April 6 they will hear G4DH on Aerials and Feeders, and future lectures include such subjects as Hi-Fi, Valve Design and Technique, Measuring Instruments, Noise and its Suppression, TVI Causes and Cures. **Medway** continue to meet at The Golden Lion, High Street, Old Brompton, on alternate Monday evenings, 7.30 p.m. A Social Evening is being arranged — date to be announced later.

NAMES AND ADDRESSES OF CLUB SECRETARIES REPORTING IN THIS ISSUE:

BRITISH AMATEUR TELEVISION CLUB:
CHELMSFORD GROUP: D. W. E. Wheele, G3AKJ, 56 Burlington Gardens, Chadwell Heath, Romford.
MIDLANDS GROUP: F. J. Rawle, G3FHZ, 16 Kings Road, New Ossett, Sutton Coldfield, Birmingham 23.
BRITISH TWO-CALL CLUB: G. V. Haylock, G2DHV, 63 Lewisham Hill, London, S.E.13.
BURY: T. C. Platt, 64 Holcombe Avenue, Bury, Lancs.
CHESTER: D. J. Rickers, GW3HEU, 97 Ruabon Road, Wrexham.
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COVENTRY: J. H. Whitby, G3HDB, 24 Thornby Avenue, Kenilworth.
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PLYMOUTH: C. Teale, G3JYB, 3 Berrow Park Road, Peverell, Plymouth.
PURLEY: E. R. Honeywood, G3GKF, 105 Whytecliffe Road, Purley.
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The British Railways main line electrification scheme, recently announced, envisages the use of an overhead system operating at 25,000v. AC—compared with the 660v. DC third-rail conduction now working over 1,800 track miles of the Southern Region, and regarded hitherto as the standard.

While a good case has been made out for what is a radical change in the feed system—claimed to be a bold step forward, which indeed it is—what may have been overlooked is the enormous potential for radiated electrical noise inherent in the proposed high-voltage system. Everyone living near an electrified line knows how radio reception, at any frequency, is affected every time a train goes by—and this is on low-voltage DC. It is not unreasonable to suppose that with high-voltage AC, the area of interference will be far greater. The locomotive collectors will be sparking and arcing into what will, in effect, be well-insulated long-wire aerials. This could spread a high level of new noises over hundreds of square miles.

It is true that HV railway electrification systems have been tested in other countries, but none is as densely populated as Britain, with main-line track running through extensive built-up areas. The first section of British Railways to be electrified at 25,000v. AC collected is the line between Manchester and Crewe. In terms of radiated electrical noise on all radio and TV channels, the results should be interesting!

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We are glad to be able to say that this is now available from our Publications Dept., price 31/6, post free, immediate delivery from stock. As usual, the *Radio Amateur's Handbook* is a mine of essential information on the theory, practice and technique of Amateur Radio in all its manifestations. While it is for us to stress the purely amateur interest of this manual—for more than 30 years the standard guide to the subject—the fact is that the *Radio Amateur's Handbook* is also widely used in research laboratories, technical institutes and teaching establishments throughout the world. The reason for this is simply that it gives the quick, practical answer to many a technical problem in the field of radio communication. The 1956 issue runs to 570 pages of text, followed by some 40 pages devoted to valve data alone. The theoretical and constructional treatment is right up-to-date and, as ever, it is the essential "buy" for every radio man, amateur or professional. This year, we have bought in a bigger stock than ever before, but already much of it has been sold.

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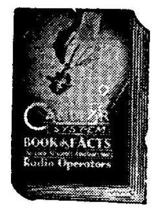

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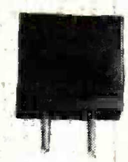

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1S5	7/6	6J5M	5/–	6SG7M	6/6	12SK7	8/6	D1	5/–	QP25	6/6
1T4	7/6	6AM6	9/–	6X5GT	8/6	12SR7	7/6	D41	5/–	QP21	8/–
1A7GT	10/–	6AG5	7/6	6SH7	6/6	14A7	8/6	D42	5/–	QP230	8/–
1A5GT	10/–	6BA6	8/6	6SA7	8/6	25A6G	10/–	D63	5/–	SP61	4/–
1H5GT	10/–	6F6G	7/6	6SQ7	8/6	25Z5	8/6	EA50	2/–	SP41	4/–
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1Q5GT	10/–	6V6GT	7/6	6SJ7	8/6	35Z5GT	8/6	EF36	6/6	U17	5/–
1L4	7/6	6V6M	10/–	6SK7	7/6	35L6GT	8/6	EF39	6/6	U19	10/–
1LN5	7/6	6J6	9/–	7C5	8/6	50L6GT	8/6	ECH35	12/6	U22	8/6
1LD5	7/6	6AK5	9/–	7A7	8/6	50B5	10/–	SP13C	4/–	U52	8/6
2X2	5/–	6U5G	7/6	7C7	8/6	50C5	10/–	VP13C	4/–	VP23	6/6
3A4	9/–	6J7G	6/6	7H7	8/6	42	8/6	FC13C	10/–	VP41	7/6
3Q4	9/–	6J7M	8/6	7B7	8/6	46	10/–	EF91	9/–	VU133	4/–
3V4	7/6	6K7G	6/6	7S7	10/–	75	8/6	EB91	9/–	VU120A	[illegible]/–
3S4	7/6	6K7GT	6/6	8D2	4/–	80	8/6	EF50 (Ex-Units)	5/–	VT501	7/6
3Q5GT	10/–	6K7M	7/6	9D2	4/–	807E	7/6			VR105/30	8/6
5U4G	8/6	6K6GT	8/6	4D1	4/–	807USA	10/–	EF50 (Red Syl)	10/–	VR150/30	8/6
5Y3GT	8/6	6G6G	6/6	12A6	7/6	803	35/–			STV/280/40	15/–
5Z3	8/6	6H6GT	4/–	12C8GT	7/6	805	35/–	EF54	6/–	S130	7/6
5Z4G	8/6	6H6M	5/–	12H6	7/6	813	105/–	EL32	7/6	VS70 (7475)	7/6
6A7G	8/6	6K8GT	9/–	12K7GT	8/6	866A	12/6	GU50	12/6	XH (2v)	4/–
6A6	10/–	6L6G	10/–	12AH7GT	8/6	872A	21/–	KTW61	7/6	XP (1.4v)	4/–
6C6	6/6	1622 (6L6)	11/–	12K8GT	8/6	9001/2/3	6/–	KTW62	7/6	Y63	8/6
6D6	6/6	6L7M	8/6	12Q7GT	8/6	9004	6/–	KTW63	7/6	TZ40	35/–
6AC7	6/6	6N7GT	7/6	12SA7GT	8/6	9006	5/–	KT33C	10/–	R3	8/6
6AG7	10/–			12SQ7GT	8/6	954	5/–	KT61	10/–	OZ4	7/–
6B8	7/6	6Q7GT	8/6	12SG7	8/6	956/7	6/–	KT66	12/6	OZ4A	7/–

SPECIAL REDUCTION FOR SETS OF VALVES

1A7GT, 1N5GT, 1H5GT, 1A5GT (or 1Q5GT or 3Q5GT)	40/–	Set
10 EF50 (Ex-Brand New Units) 5/– each	45/–	„
10 EF50 (Red Sylvania ex-new units) 6/– each	55/–	„
6K8G, 6K7G, 6Q7G, 5Z4G, 6V6G ..	37/6	„
1R5, 1S5, 1T4, 1S4 or (3S4 or 3V4) ..	27/6	„
DK96, DF96, DAF96, DL96	35/-	„
6K8G, 6K7G, 6Q7G, 25A6G, 25Z5 (or 25Z6G)	37/6	„
12K8GT, 12K7GT, 12Q7GT, 35Z4GT, 35L6GT (or 50L6GT)	37/6	„
12SA7GT, 12SK7GT, 12SQ7GT, 35Z4GT, 35L6GT or 50L6GT	37/6	„

62A INDICATOR UNIT

Containing VCR97 with Mu-Metal Screen 21 valves :—12EF50, 4-SP61, 3-EA50, 2-EB34, Plus Pots., Switches, H.V. Cond., Resistors, Muirhead S/M Dial, Double Deck Chassis and Crystal. BRAND NEW ORIGINAL CASES, 67/6. Carr. 7/6.

INDICATOR UNIT TYPE 182A

Unit contains VCR517 Cathode Ray 6in. tube, complete with Mu-metal screen 3 EF50, 4 SP61, and 1 5U4G valves, 9 wire-wound volume controls and quantity of resistors and condensers. Offered BRAND NEW (less relay) at 67/6. Plus 7/6 carr. "Radio-Constructor" 'scope circuit included.

OBSOLETE TYPES (Available from Stock)

LP2	3/6	VP2	8/6	TDD2A	8/6	U10	8/6	PENDD4020	12/6	MU14	8/6
210LF	3/6	SP2	8/6	FC13S/C	10/–	GL466A	25/-			MH4	5/–
P2	4/–	VP2B	8/6	FC13C	10/–			354V	5/–		
215SG	4/–	TP22	8/–	MS/PEN	7/6	42SPT	6/–	ML4	7/6		

LATEST TYPES NOW IN STOCK

EBC41	10/–	UCH42	12/6	PL82	10/–	12AT7	9/–	EF86	10/-	DAF96	10/–
EY51	12/–	UBC41	10/–	PY81	10/–	12AU6	9/–	EF89	10/–	DF96	10/–
EF41	11/–	DK40	10/–	EM80	10/–	12BA6	9/–	ECF82	15/–	ECC84	15/–
EL41	11/–	EZ80	10/-	6X4	8/–	12BE6	10/–	PABC80	15/–	6AQ5	10/–
EZ40	10/–	EABC80	10/–	PY82	10/–	12AH8	12/6	6AU6	9/6		
EM34	10/–	ECC85	10/–	PCC84	12/6	35W4	8/6	117Z3	8/6		
UL41	11/–	EF80	10/–	PCF82	12/6	PCF80	15/–	12AX7	10/–		
UY41	11/–	ECL80	12/6	12AU7	9/–	EBF80	11/6	DK96	10/–		
UF41	11/–	PL81	12/6	12AT6	8/–	EF85	10/6	DL96	10/–		

CRYSTAL MICROPHONE INSERTS

POST FREE
5/–
Ex-Units

POST FREE
8/6
Brand New & Boxed

Ideal for tape recording and amplifiers. No matching transformer required.

CATHODE RAY TUBES

VCR138A (with screen)	35/–
VCR139A. 2½in. C/R Tube. Brand new in original cartons (carr. free)..	£1.15.0
VCR97. Guaranteed full T/V picture (carr. 2/-)	£2.0.0
VCR517C. Guaranteed full T/V picture	£1.15.0
MU-METAL SCREENS for VCR97 or 517. P.P. 1/6	10.0
6in. ENLARGER for VCR97 or 517. P.P. 1/6	17.6
VCR97. Slight cut-off. Carr. 2/-.....	15.0
3BP1 Brand new	£1.10.0

AN/APA-1 CATHODE RAY INDICATOR AMPLIFIER UNIT. Complete, comprising 3BP1 C.R.T., 7-6SN7gts, 1-6H6, 1-6G6, 1-2X2, 1-6X5, valves. Brand new. £4/19/6 plus carr. 7/6.

MINIATURE I.F. STRIP TYPE "373" 9.72 M/C's

Brand new miniature I.F. Strip, size 10¾in. x 2¼in. x 3in. high. Valve line-up: 2 EF92, 3 EF91 and EB91. Band width 180 kcs. Ideal for F.M. circuit supplied. 7/6, p. & p. 1/6.

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