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*The*  
**SHORT WAVE**  
*Magazine*

VOL. XII

JUNE, 1954

NUMBER 4



WORLD WIDE COMMUNICATION

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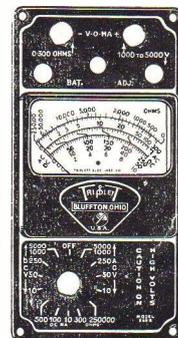
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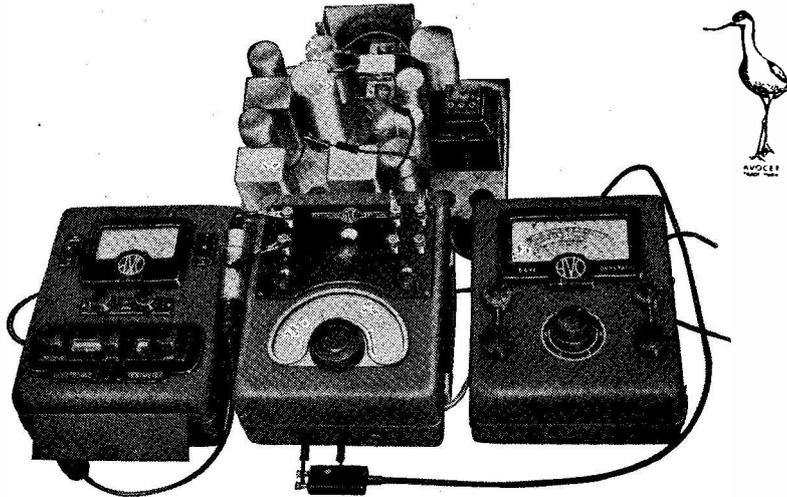
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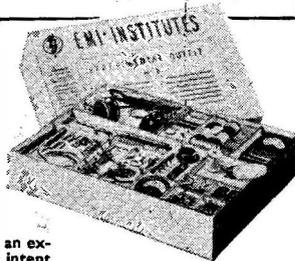
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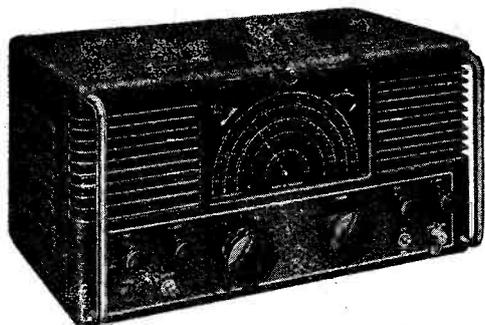
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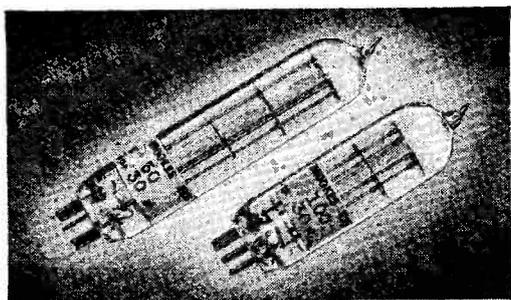
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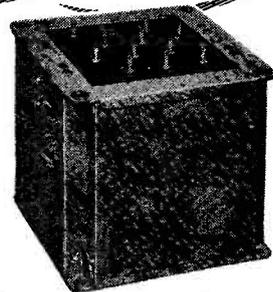
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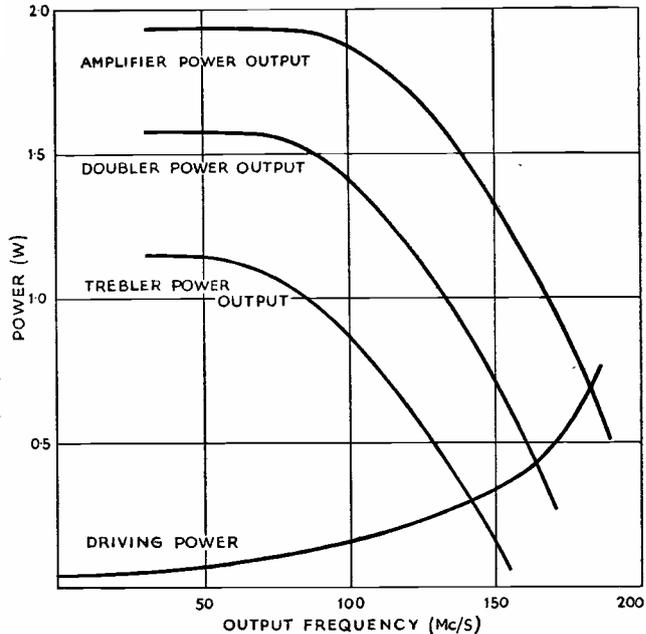
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$V_{g1}$	-20	-20	-20 V
$I_a$	11.3	10	10 mA
$I_{g2}$	3.2	3.2	3.2 mA
$I_{g1}$	1.0	1.0	1.0 mA
$P_{out}$	1.7	1.2	0.6 W

Write for data on the Z77 to the  
Osram Valve & Electronics  
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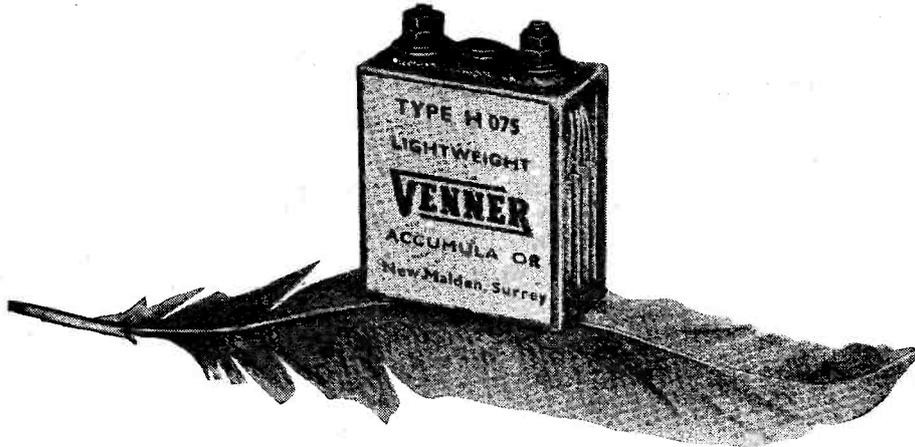
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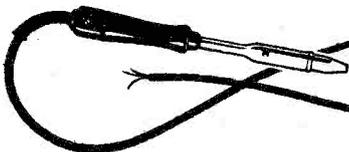


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# The SHORT-WAVE Magazine

## E D I T O R I A L

**Justice** *The level of unauthorised commercial operation on our communication bands today fully justifies the warning—often given in this space over the past five or six years—that as amateurs we might eventually find ourselves forced off frequency areas which are legitimately ours.*

*Our own administration is apparently unable to protect us from encroaching foreigners; the Services, who actually depend upon amateurs as an emergency reserve, appear no longer to heed our interests; and the propaganda broadcasting organisation, under Foreign Office control, is allowed to plant high-power stations where it will.*

*This state of affairs makes utter nonsense of all the carefully negotiated agreements bound up in the New Licence. On the face of the situation as it actually is (and not what it is made out on paper to be) why should an amateur transmitter bother to keep within the bands at all? He is being squeezed on his own bands by unauthorised commercials. Why should he observe any input limitation? He has to compete with high-powered broadcasters. Supposing his licence is revoked on these two counts, does it rob him of his technical knowledge and operating skill, or prevent him coming up with a self-allotted callsign? Of course not! And if this is so, why should anybody pay a fee to take out a licence? In brief, why should it always be the radio amateur (who made it all possible in the first place) who alone must observe the law in these matters?*

*The proper answers are, of course, obvious—and two wrongs have never yet made a right. The British amateur has always accepted the regulations embodied in his licence. These regulations are fair and reasonable—if he himself is getting a square deal. But here we see developing yet another instance of the law being brought into disrepute by reason of its manifest injustice.*

*How can the situation be eased? The first step is for the Postmaster-General to make a clear and unequivocal statement as to what he can—and can not—do to get our bands cleared of stations having no right to be in them.*

*Austin Forth  
G6FO.*

# Aerials and Common Sense

PART III

THE MARCONI—THE  
GROUND PLANE—MATCHING  
DIPOLES—THE FOLDED  
DIPOLE

## THE OLD TIMER

*This concludes a short series of practical articles on the design of aerial systems for the amateur bands. The intention has been to give advice and guidance, based on experience as well as on theory, as to the operation of those systems which will produce good results when properly matched and fed. The aerial is still a great deal more important than either the transmitter—mere power will never overcome aerial inefficiency—or the receiver, which cannot produce signals not presented to it by the aerial. Hence, time and study given to the subject of aerials will always pay a big dividend—and it is worth noting that, in terms of hard cash, the aerial system is the cheapest part of the whole installation! It is true to say that the logical approach to successful Amateur Radio operation is to design the station from the aerial inwards, rather than from the transmitter outwards—so long as the latter can produce a few watts of RF, it matters little what form it takes. Previous articles in this series appeared in our April and May issues.*

—Editor.

THE last instalment dealt almost exclusively with what we used to call "Hertz" aerials, the broad definition of a "Hertz" being something of which all the radiating portion is up in the air, with feeders taking the RF up to it. There is still a considerable interest in "Marconi" aerials, which differ from the former in a very important way: an earth connection, or a counterpoise, forms part of the radiating system.

There is a very good reason for their existence. No aerial is a true form of "Hertz" unless the radiating part, whether horizontal or vertical, is at least half a wavelength long. Whether it is fed in the centre or at the end matters little, but we can take it as a rough definition that the term "Hertz" does *not*

apply unless the wire is a dipole or something longer.

Those who can find the space for a dipole (270 ft.) for the Top Band are very few indeed, and even those with the necessary 136 ft. for an 80-metre dipole are not exactly legion. So, for such people, the only practicable aerial is the old original conception of a transmitting aerial—a piece of wire, probably "inverted L" in shape, which is tuned to resonance by a normal tuned circuit, the bottom end of which is earthed.

Although aerials of the Marconi type were in use long before the Hertz type was generally adopted (owing to the fact that long waves were used for many years before short waves were "discovered"), it is easier to understand the Marconi if one already knows the theory of the Hertz.

Consider, then, a vertical dipole for, say, 40 metres. This would be 67 ft. high, and could be fed at low impedance in the centre, or at high impedance at the bottom end. If we now halve the length of this aerial, what we do, in effect, is to bring the former centre down to ground level; and we can feed it, at low impedance, between the end of the wire and the earth itself.

The earth, having moderately good conductivity, serves as a mirror, and one half of the former aerial has now "gone to ground" in the form of a mirror image of the quarter-wave that is left.

If the vertical part does not happen to be an exact quarter-wave, but is considerably longer or shorter, it can still be brought to resonance by suitable loading at the bottom end. When the condition is reached in which the wire itself, plus the tuned circuit it is attached to, behaves as a quarter-wave, we have resonance. Fig. 1(a) shows a typical installation of this type, and although the inverted L aerial is shown as being a quarter-wave long, it may be longer or shorter than that. If you were to go back to 1920 or thereabouts, you would find very few transmitting aerials, either amateur or commercial, which did not look just like that. To-day, you will still find plenty of 160-metre aerials of the same type, but for the shorter wavelengths on which DX is sought, a rationalisation takes place.

## Vertical "Unipole"

In Fig. 1(b) we find a vertical quarter-wave and no tuned circuit. Provided that a really good, low-resistance earth connection can be made near the bottom of the wire, the system

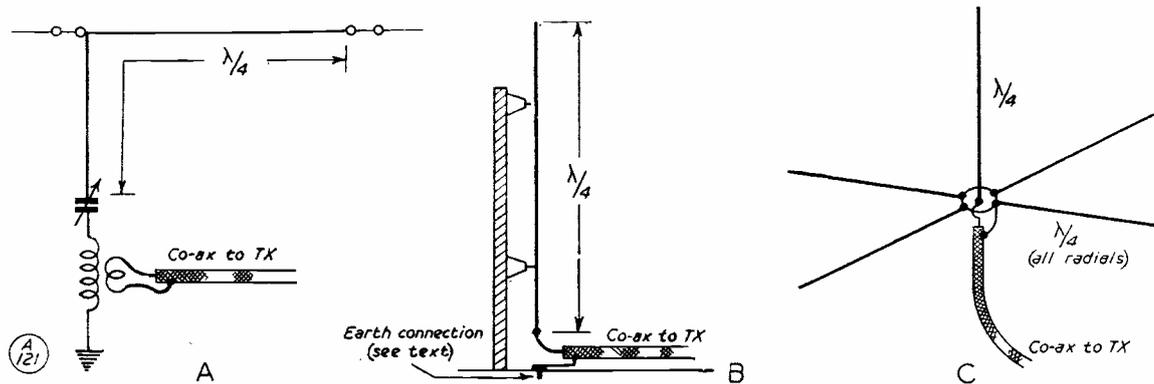


Fig. 1. Showing forms of what is known as the "Marconi Aerial." In (a) the total length of a quarter-wave is obtained by bringing the lower end in to the operating position and resonating by means of a series-tuned circuit; (b) A vertical quarter-wave, with a direct earth connection immediately under it, and coax feed from the transmitter (not using 72-ohm line, however); (c) The ground-plane is an elevated Marconi with horizontal radials taking the place of a direct earth connection.

can be directly fed with co-ax (*not*, however, of the 72-ohm variety). The radiation resistance of a quarter-wave, with earth connection, is of the order of 36 ohms, and it can therefore be fed by two lengths of 72-ohm cable in parallel. The earth connection is *not* just a spike driven in the ground—such a connection would have much too high a resistance. Remember that the earth resistance is now in series with the radiating system and will eat up precious watts of RF from the transmitter.

A system of buried radial wires, carefully laid at a depth of a foot or more, can often prove satisfactory if the soil is not excessively dry. Sometimes a very long spike with a small "basin" at the top, filled with light gravel and kept watered, will prove quite efficient. Generally speaking, however, the provision by the amateur of a really low-resistance earth connection is a difficult matter, and in some cases not practicable at all.

Thus we find that actual usage tends to split up into two camps. Where the wire is "any length," as in Fig. 1(a), a counterpoise is often used; this is merely a wire, roughly the same length as the aerial and running in the same direction, insulated at its supports and stretched a few feet above the ground.

Where the wire is a true vertical quarter-wave (unipole), the whole thing can be hoisted up above the ground and the earth connection replaced by four or more horizontal radial wires, each a quarter-wave in length.

This is the aerial known as the "ground-plane"; it is becoming very popular among those whose space is limited, and it is very efficient for all-round DX working. Fig. 1(c) shows the basic arrangement.

### Ground-Plane Details

One of the characteristics of a vertical aerial is that its radiation is vertically polarised. A ground-wave must be vertically polarised, and so it follows that a vertical aerial is useful for 160 metres, where all daylight transmission is dependent on ground-wave.

Another characteristic, however, is that the main lobe of radiation (in the vertical plane) of a vertical quarter-wave aerial is at a very low angle to the horizontal—a most desirable condition for DX work, and one that is difficult to obtain, on the 40-metre and 80-metre bands especially, with normal horizontal aerials.

So a ground-plane arrangement, with its low angle of radiation, is eminently suited to long-distance work on 40 and 80 metres, and, when used on the receiver too, has the great advantage of reducing the strength of signals received from medium distances.

The various amateur handbooks and aerial manuals all give constructional details for ground-plane aerials, and the very title of this series of articles explains their scope; so we will content ourselves with saying that one must strike a compromise between height above local surroundings and convenience of erection. A 40-metre ground-plane, with its bottom end a few feet off the ground, and its four radials all some 33 ft. long, can make a complete mess of any garden! But on the flat roof of an apartment building it would probably be an ideal arrangement. On the other hand, the 33-foot vertical can possibly be raised (if copper tubing is used) half-way up a wooden mast, so that the bottom of the aerial is some 16 feet above ground. The radials may then be allowed to "droop" slightly in order to anchor

them to fences, small trees or whatever convenient supports present themselves.

The radiation resistance of a ground-plane is low (it can be as low as 27 ohms). A figure of 36 ohms or thereabouts is a fair average, and hence the most convenient method of feeding is again to use two lengths of 72-ohm co-ax in parallel. Quite often, however, a single length of 50-ohm cable is used. Allowing the radials to droop will increase the radiation resistance somewhat, but there should never be a very serious mismatch if the figure is assumed to be 36 ohms. The length of the radials is not very critical, except that they should not be *less* than a quarter-wave. Typical figures that have been found, by practical methods, to approach the optimum are (for 40 metres) a vertical of 33 ft. and radials of 33 ft. 10 ins. A twenty-metre affair, being just half this size, is much easier to cope with and may be hauled higher up the mast or even mounted rigidly on a chimney-stack.

Coverage is "all-round," in the horizontal plane, with a low angle of radiation. On the receiving side it is necessary to use a matching unit between the 36-ohm co-ax feed and the normal receiver input; an extra tuned circuit with a one-turn link for the aerial connection has been found satisfactory, as have several versions of the "R 9-er," with variable input and output impedances.

### Dipoles Again

After this brief and (we hope) refreshing diversion into the realms of Marconi aeriels and their descendants, we return to a few miscellaneous points concerning dipoles. It is not always convenient to feed a dipole with 72-ohm co-ax; sometimes, when the wire is suspended between two points a considerable distance apart, it is awkward to have to suspend so much weight from the centre.

Various types of 300-ohm ribbon are available, and another important point is that 300

ohms will match straight into the average receiver, while 72 ohms will not.

Once we have grasped the basic fact that a dipole shows a low impedance at the centre and a high one at the ends, it becomes obvious that one can match feeders of almost *any* impedance into it by tapping them across two points equidistant from the centre. Fig. 2(a) shows a 300-ohm ribbon feeder connected in such a way, making use of what is normally called a "delta-match."

An open 600-ohm line can equally well be dealt with in this way, and it then becomes a "flat" line—not one which needs tuning at the bottom end, as in previous examples.

In the case of a 20-metre dipole, the optimum tapping points for 600-ohm line are roughly 4 feet either side of the centre, and for 300-ohm line approximately half this distance. The "V" section connecting these separated points to the normal feeder should be slightly longer than this in each case—some 10 feet for 600-ohm line and 5-6 feet for 300-ohm line. This section of the line, viewed from the aerial downwards, has a continuously decreasing impedance and is, in fact, the matching section between the points tapped on the aerial and the line itself. (In fact, the points on the aerial are, for this reason, chosen to have a *higher* impedance than the actual feeder.)

Fuller details and formulæ for delta matches may be found in most handbooks.

### Stub-Match

Another method of matching 600-ohm lines into a dipole is shown in Fig. 2(b). There are many different possibilities on these lines, and this sketch shows one of the simplest. A quarter-wave open stub is hung from the centre of the aerial; and we are already familiar enough with transmission lines to realise that its impedance will be low (72 ohms) where it joins the aerial and high (some thousands of ohms) at its open end.

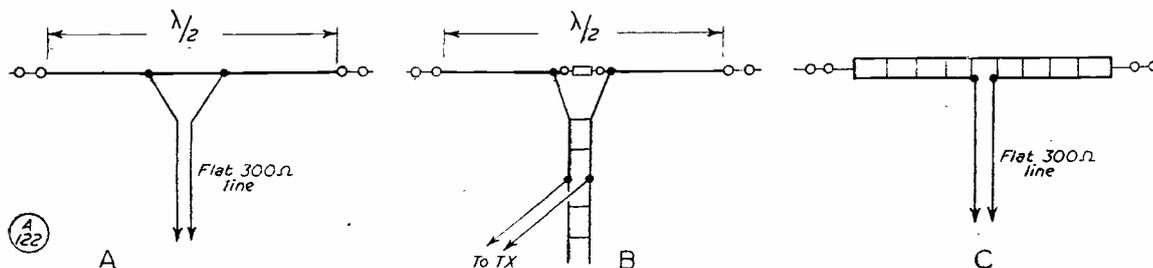


Fig. 2. Dipoles not fed with 72-ohm coaxial line. In (a) is shown the delta-match system, whereby a feeder of almost any impedance can be matched to the dipole; (b) Matching by means of an open stub suspended at the centre of a dipole; (c) The folded dipole, which gives an almost perfect match to 300-ohm feeders.

There must be some intermediate point on this stub, therefore, where feeders of almost any impedance can be connected without causing a mismatch.

Such stubs (and, in fact, the delta-match system) are of most use in the case of multi-element beams. In aerials of this type the centre impedance of the radiating dipole comes down to figures much lower than 72 ohms, and it is necessary to use matching stubs or some similar system to produce a match even for 72-ohm line.

Stubs may be of various lengths, open or closed, and may be used for many different purposes when connected either to aerials or feeders. Their complete story would demand a number of articles and is outside the scope of the present series, inevitably compressed by considerations of space.

### Folded Dipoles

Very many stations all over the world use the folded dipole, but it does not follow that all the operators understand its operation, or even that they are working it correctly.

If we split an ordinary dipole into two separate wires, connected at their ends, then the radiation resistance of this aerial *as a whole* will still be 72 ohms. But the RF flowing along the dipole is now shared between the two wires—half of the original value will flow in each.

If we connect our feeder at the centre of *one* of these wires, then, from the feeder's point of view, the normal amount of *power* passing up it will be causing only half the usual *current* to flow. Reference to Ohm's Law will confirm that this means that the impedance is *four times* as high as it was before. So a 300-ohm line gives an almost perfect match.

As a matter of fact, it is a convenient plan to make the whole system—aerial and feeder—out of 300-ohm flat line. Alternatively, the dipole itself can be a length of 600-ohm feeder, complete with spacers, with the ends connected together and the 300-ohm feeder introduced at the centre of one of the wires (Fig. 2(c)).

Advantages of the folded dipole over the normal dipole fed with 72-ohm co-ax are that the 300-ohm feeder is more convenient for matching directly into a receiver, and also, in some circumstances, into the aerial tuning unit for the transmitter as well; and that the whole system is less frequency-sensitive than a normal dipole. If you wish to operate equally often in the phone band and the CW band, then

a folded dipole cut for a frequency midway between them will operate with high efficiency in both areas.

Putting the latter statement in another way, we can say that the reactance of a folded dipole varies only slowly as the frequency is moved either side of resonance. As a matter of interest, it should be added that a folded dipole is not confined to two wires—any number may be used, with the impedance at the centre rising as the square of the number of conductors. A very large number of conductors, suitably spaced round a ring at either end, will give an aerial with a very wide range of operation—although such an arrangement is of more value to commercials than to amateurs, whose bands are so far apart in frequency.

### Finale

It has been the purpose of this short series to try to explain, in simple terms, some of the points that puzzle the man who is not an aerial expert. Many more types remain, but they are outside the scope of the present offering.

The various types of beam used by amateurs, for instance, can all be explained in terms of the dipole; the usual rotary consists of one dipole as the actual radiator with other dipoles associated with it in such a way as to increase the radiation in certain directions (obviously at the expense of other directions). The long wire has been covered, and explained as a series of dipoles connected end to end; the Vee-beam and Rhombic are elaborated forms of long wire, so placed that they reinforce each other's radiation.

"Curtains," "collinears" and all the large commercial types, when examined with a little knowledge of fundamentals, turn out to be combinations of resonant long wires or combinations of dipoles.

This present series may, therefore, be said to have covered the subject "from A to B" or thereabouts, and it is hoped that it may be possible, later on, to analyse some of the more complicated types and to present them in simple terms. Meanwhile, the average amateur still finds himself worried mainly by practical considerations — which direction suits him best, what length, what height and what type of feed.

If the hints dropped in the last three months may have eased the difficulties for a few of such readers, then this elementary series will have served its main purpose.

# HF Preselector Unit

## FOR TEN/TWENTY COVERAGE

*Most receivers in use on the amateur bands have only one RF stage and, being designed for a relatively wide frequency coverage, become less effective at the HF end of the tuning range. A pre-selector is an additional front-end RF amplifier which will live up considerably the performance of almost any receiver on the 14 and 28 mc bands. The advantages of such a unit—easy to build and in many cases capable of being powered from the main receiver—are discussed in the text.—*  
Editor.

**B**EFORE dealing with the design of a preselector, it may help the reader if information is given on the benefits to be obtained from the use of an instrument of this kind.

First of all, some may ask what is the difference between a preselector and a converter and why is it that sometimes the use of one instrument is recommended and sometimes the other? The answer depends mainly on the characteristics of the receiver. In brief, a converter is employed when it is desired to receive signals on frequencies not covered by the existing receiver. A preselector is used when it is desired to improve the sensitivity and signal-to-noise ratio of the existing receiver.

The preselector amplifies incoming signals and passes them on to the receiver proper at the same frequency. The converter accepts a signal, amplifies it, changes the frequency, and passes it on to the receiver at a much lower frequency, usually between 1.6 and 10 mc.

A converter is sometimes employed to give a better performance than that obtainable from the receiver by itself. This applies especially at the higher frequencies where the choice, in a converter, of special valves and circuit values, combined with the absence of switches, results in increased efficiency.

Also, sometimes, the existing receiver may not possess an adequate degree of bandwidth for amateur needs and the simplest answer is to add a converter, when it is a fairly easy matter to arrange for any desired degree of bandwidth.

If the receiver is fitted with two RF stages, the performance should be good and it is doubt-

ful if the addition of a preselector will be worth while — except possibly when local circumstances dictate the use of only a very small aerial. Where, however, no RF stage exists and the aerial works direct into the frequency changer, very considerable benefit will be obtained from a preselector—sensitivity will be much greater, selectivity will be improved, image interference will be much reduced, but, of more importance than any of these, the signal-to-noise ratio will definitely increase, making it possible to receive intelligible signals that were previously barely audible above the general noise level.

Where one RF stage is already provided in the main receiver, the benefit is still very definite at the higher frequencies, where the degree of internal RF amplification falls off to some extent. But little is gained by the use of a preselector at frequencies lower than 7 mc.

### Practical Preselector

It is not difficult to design a preselector which is reasonably easy to build, economical in the number of components used and capable of a good performance. A single tuned stage does not permit full realisation of the benefits to be obtained from the preselector. Three stages are hardly necessary and would result in undue complexity—there would undoubtedly be considerable difficulty in maintaining stability (freedom from self-oscillation) over the full frequency coverage. Two stages are entirely satisfactory for all normal requirements. It is important that the two stages should be maintained in accurate alignment. In this connection, it should be remembered that quite a small variation in frequency will affect the loading imposed by the aerial on the first tuned stage (unless it has been purposely designed for a wide bandwidth). This, in turn, will affect the tuning of the stage.

In the present design, the two tuning condensers are ganged to give ease of control, but a small separately adjusted condenser is provided for peaking the input circuit, to ensure optimum results irrespective of aerial or frequency in use.

The complete circuit of the preselector is given in Fig. 1. The first EF50 valve is employed as a high gain amplifier, the input stage being carefully and thoroughly screened in a compartment of its own. The second valve, also an EF50, is a cathode follower, to ensure a good match into the receiver aerial terminals.

The single coil/condenser combination in each stage gives a frequency coverage from

**Table of Values**

Fig. 1. Circuit of the EF50 Preselector

C3, C4, C5, C8, C9, C10, C11 = .001 $\mu$ F Moulded Mica (T.C.C. Type CM2ON recom- mended)	R1, R3, R6 = 12 ohms R2 = 220 ohms R4, R8 = 47,000 ohms R5 = 470 ohms R7 = 100 ohms
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(All resistors are  $\frac{1}{2}$  watt rating).

**COILS**

Tuned winding 8 turns 22 SWG enamelled copper, following threading. Other winding, 4 turns spaced  $\frac{1}{4}$  in. from main winding.

**LIST OF PARTS**

1 Microdenser 15 $\mu$ F (C1), Cat. No. 580	Eddystone
2 Microdensers 100 $\mu$ F (C2, C7), Cat. No. 585	Eddystone
2 Coil Formers Threaded, Cat. No. 648	Eddystone
1 Chassis, Cat. No. 643	Eddystone
1 Direct Drive Dial, Cat. No. 638	Eddystone
1 Flexible Coupler, Cat. No. 50	Eddystone
1 Pointer Knob and Dial, Cat. No. 425	Eddystone
1 Lead-through Insulator, Cat. No. 695	Eddystone
1 Concentric Trimmer 30 $\mu$ F max. (C6)	Mullard or Philips
2 Valves, type EF50	Mullard
2 Valveholders B9G, List L.500/C	Belling-Lee
2 Retaining Rings and Bases, List L.658/R and L.658B, Tag Strips, Coaxial Cable, etc.	Belling-Lee

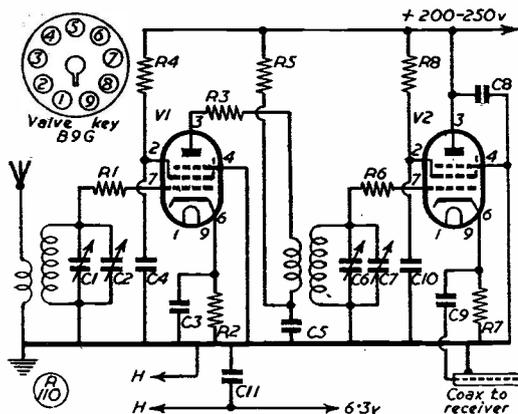


Fig. 1. Circuit of the two-stage preselector, for which full details are given in the text. It will considerably improve the performance of most receivers over the 14-28 mc bands.

13.75 to 29.5 mc. Three active amateur bands (and several of the more interesting short wave broadcast channels) are thus included, whilst the design is kept reasonably simple. To increase the coverage would entail the use of a special type of Yaxley switch and more coils, which additional complexity is considered hardly worth while, since the benefit secured from the preselector is less with decreasing frequency.

**Construction**

One piece of sheet metal (brass or aluminium) is required to act as a front panel (unless the instrument is enclosed in a cabinet), and another for a screen beneath the chassis. Dimensions and drilling details are given in Fig. 2. The hole in the screen to take the tuning condenser must be lined up accurately with the hole in the front chassis wall. This is best done as follows: Bolt the screen in position, noting that the slot over the valveholder gives no more than adequate clearance over the tags; fit a bush to the hole in the front panel and pass through it a  $\frac{1}{4}$ -in. diameter rod, of sufficient length to reach the screen, and mark the point at which the hole should be made. The screen is then demounted and the hole drilled out. A small hole is also required for the LT lead to the valveholder.

The only holes in the top of the chassis are two  $1\frac{1}{2}$ -in. ones for the valveholders, positioned as shown in Fig. 2, with the spigots located parallel to the length of the chassis. A hole for a lead-through insulator (or coaxial socket) to take the aerial connection should be made in the left-hand wall of the chassis about  $1\frac{1}{2}$  ins. from the front.

**Wiring**

With a high-gain valve such as the EF50, coupling between the anode and grid circuits must be reduced to an absolute minimum, if good stability is to be achieved. The complete screen around the input circuit is effective in preventing direct coupling, but it is very necessary to pay proper attention to the by-pass condensers—their position and their quality—to prevent inter-electrode coupling. T.C.C. Type CM2ON are small, possess low inherent inductance and are strongly recommended. In any case, make quite certain that the condensers used are good ones—a single poor condenser may lead to trouble.

Fig. 3 indicates exactly how the valveholders should be wired. Small stopper resistors are included in places, to prevent VHF parasitic oscillation, which might otherwise occur, parti-

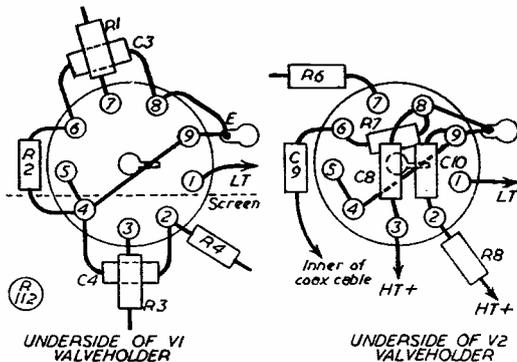


Fig. 3. Showing wiring around the valveholders (underside view) for best screening effect. The circuitry on the grid side of V1 (Fig. 1) is fitted inside the screened compartment.

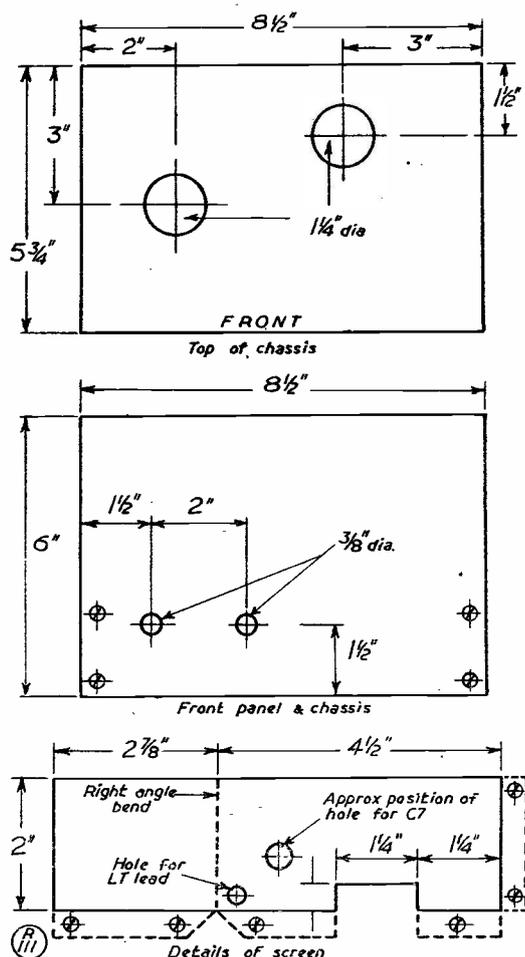


Fig. 2. Chassis drilling detail and sub-chassis screen for the two-stage preselector. The screen is fitted across V1, as indicated by Fig. 3.

cularly when the tuning condensers are at minimum.

When the valvholder wiring is complete, the tuning condensers can be fitted. The large flexible coupler is slipped over the rear spindle of the front condenser before the rear condenser is bolted in place. If the screen has been positioned correctly, the coupler will fit properly over both spindles.

The lead to the receiver takes the form of a piece of  $\frac{1}{4}$ -in. diameter coaxial cable (72/80 ohm), the length of which is not important.

The two coils should be wound to be as nearly identical as possible. They are soldered directly in position between a lug on the tuning condenser and an earth point on the associated valvholder.

### Preliminary Adjustment and Operation

The power supplies required are small—6.3 volts 0.6 amperes for the heaters and 200/250 volts 12/15 mA HT—and it will usually be possible to draw these from the receiver power unit.

To align the preselector, the tuning condensers should be set at maximum (tuning dial at 100 deg.) and the aerial trimmer at half-mesh. Rotate the receiver tuning control until resonance with the preselector is indicated (by generally increased liveness) and adjust the concentric trimmer (C6) for maximum signal strength. The frequency should be slightly below 14 mc.

With the preselector dial set at zero, the frequency should correspond to 29.5 mc, and the ganging should hold well, possibly with some slight movement of the trimmer C1.

It may be mentioned that the optimum setting of C1 should be quite definite. If this control is flat, it indicates that the aerial is loading the input circuit severely and some reduction must be effected. The simplest way to do this is to insert a small condenser between the aerial terminal and the coil—a value of 10  $\mu\mu\text{F}$  fixed, or preferably a 3/30  $\mu\mu\text{F}$  trimmer, will be satisfactory.

### PASSING OF A PIONEER

With deep regret we have to record the death of John Edward Nickless, G2KT, who passed over on the evening of May 2, 1954, at the age of 75. One of the real Old Timers, and a contemporary of that select band of pre-1914 enthusiasts, he started his Amateur Radio activities in 1911. He was by profession an engineer, M.I.E.E., and associated before his retirement with the well-known firm of Bullers, Ltd., the ceramics manufacturers. In fact, the last time he was seen by the writer of this piece was at their stand at the R.E.C.M.F. Exhibition in April, when he talked over plans for his future activities in Amateur Radio. In latter years, he was probably best known for his regular appearance on 1875 kc in the Top Band; many of his unseen radio friends, transmitter and SWL alike, gathered for his funeral at Southend-on-Sea on May 8. Active to the last, he had attended, as usual, the meeting of the Southend and District Radio Society only a short time before the sudden illness that took him. G2KT was a kind and generous man, always ready to help and advise the beginner, and he was of the generation that made radio history and helped to lay the foundations of the great electronics industry. A daughter is the wife of G2YI, and to them and all his family we offer our respects and our sincere condolences.—A.J.F.

# All about Crystal Grinding

## AMATEUR PROCESSING TO REQUIRED FREQUENCY

H. C. WOODHEAD (G2NX)

*It is many years since the grinding of quartz crystals for radio purposes was first undertaken in amateur circles. In the mid-20's it was possible to buy, for a few shillings at any optician's, quantities of old-fashioned spectacle lenses made from Brazilian quartz. Many of these lenses exhibited good piezo-electric properties, usually with resonance points in the medium-wave broadcast band. It was then a matter of grinding the lens flat and on to a usable frequency in the 160-metre band. In at least one station we know, crystals so produced are still in regular use. Nowadays, the probability is that the crystals, usually obtained as "surplus," start as mounted oscillators on some frequency useless for amateur purposes. The problem is still to get them on to a usable frequency, the home-technique for which is fully explained in this useful practical article. With care and experience, it is possible to acquire the skill to "wipe on" as many kilocycles as may be required.—Editor.*

IT may be thought that the title of this article is a trifle misleading since clearly it should encompass the whole process of crystal manufacture, from the selection of suitable natural crystals from which blanks are cut, to the production of the finished article. On the other hand, there are very few radio enthusiasts who would wish to cut their own blanks, however interested they might be in reading a description of the processes involved.

It is much more likely that the average amateur has by him one or two crystals, probably obtained by way of war surplus, which are nowhere near any frequency that is suitable for amateur purposes. He would perhaps welcome information which would enable him to bring these crystals to usable frequencies within fairly fine limits—but without the existing 99% certainty of ending up either with several small irregularly-shaped pieces of quartz or a whole piece that declines to perk.

The purpose of this article is to provide the necessary information; but it should be made

clear at the outset that the author must of necessity decline responsibility for all failures as there is a certain amount of "personal element" involved in the operation which no amount of detailed instructions can cover. No doubt each of us can think of somebody who is renowned amongst his closer acquaintances for his heavy-handedness, and whose very presence would be likely to cause a fragile crystal to break! Anyone recognising these symptoms in himself would be well advised not to read any further. One can rest assured, however, that with relatively simple tools—and the foremost of these will be patience and care—the operation can be quite successful in the hands of a novice.

It will of course be appreciated that the two major surfaces of the crystal must be flat—optically flat, and also parallel. Of these two the former seems to be the most important which is indeed fortunate for it is the easiest to ensure. With care and experience in the technique one can make the surface flat to within 1/100,000th of an inch, but the greatest accuracy one can ensure with an ordinary micrometer, with vernier, is only 1/10,000th, and this then will be the absolute limit of parallelism which we can hope to achieve.

### Preliminaries

First of all it is necessary to get some preliminary experience in the making of optically flat surfaces; that is, in our case flat to within 1/100,000". This experience is best gained by the making of a set of backing plates for the crystals it is proposed to grind. It is rather a risky business to grind the crystal on its own on the lap because uneven pressure will flex the crystal and produce an uneven surface. Also, of course, the crystal is somewhat fragile and it can be handled much more satisfactorily if it is held on some support which is quite flat. The backing plates should be roughly the size of the crystals and about 3/32" thick. They can be made of brass and should be cleaned up all round the edges with a file and should have a pad of the same thickness soldered in the centre of one side, as shown in Fig. 1.

Next make a spike with a wooden handle (a shoemaker's awl with the end rounded off is very suitable for the purpose) as Fig. 2. Obtain several pieces of plate glass about 4" square and at least 1/4" thick, preferably thicker. Motor car windscreen will do at a pinch provided it is *not* the safety kind. For abrasives

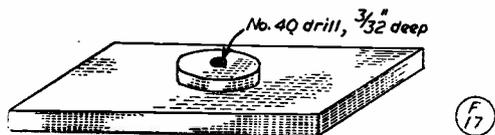


Fig. 1. Backing plate for "holding" crystal during the grinding process — see Fig. 2.

we shall need some 300 Carborundum and some flour emery.

Select one of the pieces of plate glass and put on it a pinch of emery flour, about as much as will go on a  $\frac{1}{8}$ " screwdriver blade, together with about a dozen drops of water and distribute well over the surface. Place the brass

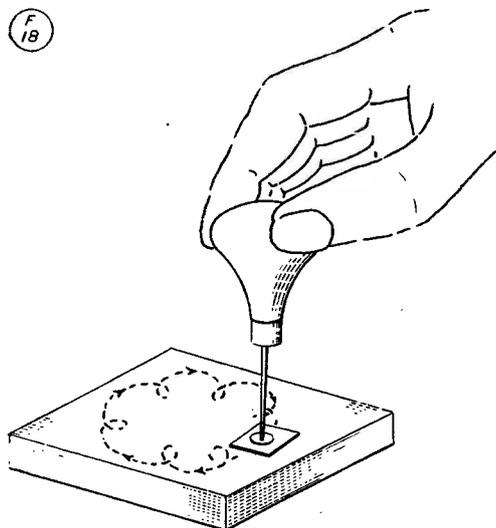


Fig. 2. Motion for crystal grinding. The crystal to be treated is under the brass pad.

plate face down on the glass and using the spike in the hole at the back, work it all over the surface with a circular motion, as shown in Fig. 2. All this sounds very easy, as indeed it is, but there are several pitfalls for the unwary, and to ensure optically flat surfaces the process must be understood.

### Some Pitfalls

Know then that the most thing one can do is to *apply pressure*. The plate should be pushed around by the spike with little more than its own weight. Use only sufficient weight to make sure that the spike does not slip out

of the hole. Sooner or later the temptation will come to hasten the process by putting on more pressure; so we might as well find out here and now what will happen if we do. The surfaces we are grinding are not in contact at all; they are actually separated by a layer of grains of carborundum all roughly the same size, and as these irregular grains, which are very hard, roll between the two surfaces their sharp corners, of which they have many, chip small particles away from the glass and quartz, as in Fig. 3(a). During the process the grains of carborundum get broken up themselves, slowly, and they have to be replaced with fresh. The amount of grinding then is decided by the size of the abrasive grains. If we apply too much pressure to the centre of the plate the tendency is, first, to spring the plate, ever so slightly perhaps (but remember we are working to  $1/100,000$ " ), and secondly to crush the abrasive in the centre so that it no longer cuts. See Fig. 3(b). If too much pressure is being applied it will be found that the abrasive breaks down very quickly indeed and that it is cutting at the edges and hardly at all in the centre, producing a convex surface.

When the grinding is proceeding normally there will always be a gritty grinding sound. Too much pressure soon results in a smoothness that is almost silent, and experience, bearing these rules in mind, will quickly show what is required.

Another thing to remember is that both surfaces are ground away and though a good piece of plate glass may be flat to within  $1/100,000$ " at the start, grinding will soon make it concave, and it will then tend to make crystal surfaces that are convex. So work all over the glass surface in turn and not too much in one spot. Ultimately one may have several grades of plate: One which has had quite a lot of grinding and can no longer be regarded as flat, but which will do for rough grinding; another which is still fairly good; and a third

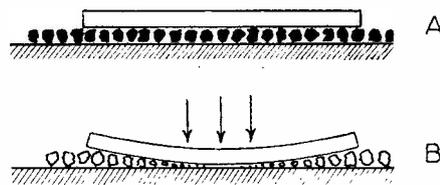


Fig. 3. The effect of too much pressure on the crystal during the grinding process is shown here — and see text. It is essential not to attempt to hurry things by applying more grinding pressure.

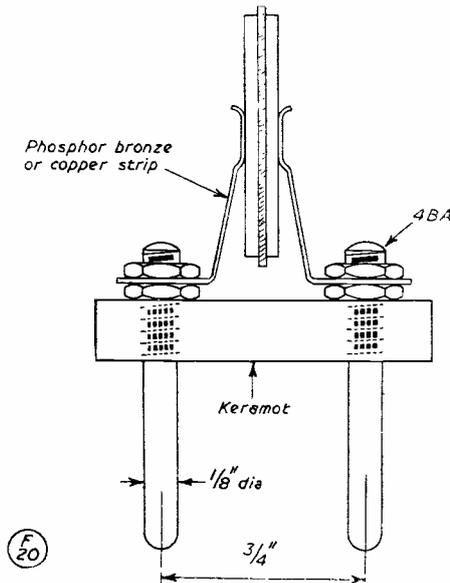


Fig. 4. A home-made experimental mount for the quick checking of processed crystals. For final calibration accuracy, the crystal must be checked in the holder and circuit in which it is to be finally used.

which is hardly frosted with grinding at all and which can be used for finishing.

### Grading Emery

A word or two about flour emery. This is sometimes of doubtful quality if it comes from the local ironmonger and it may contain coarser grit. The particles of the finest grit may be extracted from it as follows: Take a tall glass vessel which we will call No. 1, fill it with water, put in a good tablespoonful of flour emery and stir well. Allow to stand for 30 seconds, then syphon off the top three-quarters of the contents into another vessel, No. 2, holding the syphon about  $\frac{1}{2}$ " below the surface.

Again fill vessel No. 1 with water, stir up the existing sediment, allow to settle for 30 seconds and syphon off into vessel No. 2 as before. Repeat this latter operation until the syphon no longer carries off much of the finer emery particles, and the sediment settles quickly leaving clear water at the top.

No. 2 vessel will now contain all the finer particles of emery which are too small to sink to the bottom in 30 seconds. All the larger particles will be in vessel No. 1. Leave vessel No. 2 to settle completely and decant the clean water. Spread the sediment out on a clean tray and dry in the oven. Store when dry in

an airtight tin and keep well apart from coarser grits. This is 30 sec. emery.

### When is a Flat Flat?

Now to return to the backing plate: If the surface is very irregular to start with, use 300 carbo, but if it is fairly good then 30 sec. emery will suffice. In any case it must be finished with 30 sec. emery. The emery or carbo will break up as the grinding proceeds and must be washed away and replaced with fresh. When the brass plate appears to have a matt surface all over and there is no sign of the original surface markings, wash and dry both surfaces. Continue rubbing using very light pressure, but with the surfaces quite dry. The matt surface will quickly take a polish which, while far from perfect, will serve to indicate where the surface of the brass is in actual contact with the glass.

If little grinding has been done on the glass it may be regarded as flat, and if the brass plate is flat also it will show signs of polish all over. If it polishes only in the centre, the surface is convex and probably the result of too much pressure.

This test will show up errors in flatness of  $1/100,000$  of an inch *if done with care*. It will be clear that the backing plates must be made quite flat or they will distort the crystal, as shown in Fig. 3(b), and it will be impossible to produce a flat surface. A plate should be made for each size of crystal to be ground.

All these preliminaries may seem superfluous at first sight, but they will bring experience in the production of flat surfaces which will save disappointment later in crystals which refuse to oscillate.

### Checking the Frequency

The next step is to select a crystal which requires grinding, but before starting any grinding at all it is as well to check that it oscillates readily and to measure its frequency. To this end it is essential to have at hand an RF oscillator unit into which the crystal may readily be slipped because in the later stages of final adjustment it will be necessary to carry out checks fairly frequently, and to fit the crystal in its holder and screw it up *every time*



Fig. 5. Marking a crystal to identify the flat side. This is desirable when changing the frequency of manufactured crystals, as it provides a "reference flat" and prevents that side being disturbed during the grinding process.

becomes somewhat tedious. Therefore a plug-in type of holder, similar to that shown in Fig. 4, is recommended for rough frequency and activity tests. It will be found that the type of holder will affect the frequency slightly so that the final adjustment, if accuracy is essential, must be done with the crystal in its proper holder.

Similarly, the frequency will be affected by the circuit constants of the oscillator and it is therefore as well to make the test circuit identical with that in the transmitter in which the crystal is intended to work. The circuit recommended is that shown in Fig. 6 and is a modified Pierce, which will be found to give excellent performance and to be rich in harmonics in its anode circuit. The cathode current is a measure of the performance of the crystal and will be found to be about 3 to 5 mA in a new crystal. Crystals which oscillate but feebly will have a much higher current than this and when the crystal is removed or ceases to oscillate, the current will be about 20 milliamps.

If the crystal oscillates satisfactorily in the first place, it may be assumed to have two flat sides parallel with each other. It is as well to preserve one of these in its original condition and do all the work on the other one. It saves ending up with two surfaces to work flat and having no reference surface. For identification purposes therefore, it is suggested that a small flat be ground on one corner in the case of rectangular crystals, or on one edge (as shown in Fig. 5) in the case of round ones. This can be done with a small hand carborundum stone.

### The Grinding Technique

Make sure that the crystal and backing plate are quite clean and clear of dust and put a very thin smear of vaseline on the flat surface of the plate and on the crystal surface which is to be preserved. Slide the two surfaces together very gently and press evenly all over when the two are together. With too much vaseline they will slide easily one on the other. With too little they will fall apart. But with just the right amount they will adhere quite firmly throughout the grinding operations. Experience will show the correct amount, which is extremely small—just a smear. Proceed now as with the backing plate grinding, using 300 carbo if a large amount of quartz is to be removed, or with flour emery if only a small frequency change is required.

It is recommended that, for a first attempt, a crystal should be selected which requires a

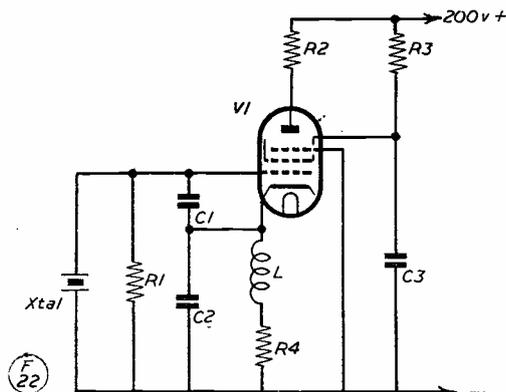


Fig. 6. This is the Pierce, a very useful general-purpose test oscillator which will go off with any active crystal.

### Table of Values

Fig. 6. Pierce Oscillator for Crystal Checking.

C1 = 30 $\mu\mu\text{F}$	R2, R3 = 1,000 ohms
C2 = 200 $\mu\mu\text{F}$	R4 = Meter shunt
C3 = .001 $\mu\text{F}$	L = 0.5 mH (or RF choke)
R1 = 1 megohm	V1 = EF50 or similar

lot of grinding, but that the work should commence with emery until some experience has been gained. After, say, 5 minutes' grinding remove the crystal carefully from its backing plate by sliding it edgewise, wash it thoroughly in clean carbon-tetrachloride (obtainable anywhere as "Thawpit") and dry it. Try it in the test holder to see if it oscillates as readily as before. If the anode current is higher than before then there is something wrong with the technique, for with another 15 minutes grinding in the same way, it probably will not oscillate at all. Make sure first, however, that the crystal and holder are quite clean and free from grease. If the current is still high, try and find out what is wrong. Is the crystal central on the backing plate and is the hole in the pad on the back of the plate central? If not, the crystal will become wedge shaped. In all probability, however, the snag will be too much pressure having produced a convex surface. Check the centre and edges of the crystal with a micrometer and if this is found to be the fault carry on grinding for another 10 minutes with less pressure. If the crystal now oscillates more readily then the fault will have been rectified. When, after say 15 minutes of grinding one can bring the surface sufficiently flat to oscillate readily, then one can consider the technique

to have been mastered and success breeds confidence.

### Final Adjustment

The problem of final adjustment to an exact frequency is just a matter of care and patience and only a very small amount of grinding must be done at a time for fear of going too far. It is a great help at this stage to keep a log of minutes spent in grinding (or even to count rubs) in the final adjustment, and a note of the frequency measured at the end of each spell. With patience a crystal can be produced which is as accurate as the frequency measuring device available. For great accuracy the final checks

must be done in the permanent holder.

It may be of interest to know that the professional crystal grinder usually makes a whole batch of perhaps a dozen blanks in one operation, all of the same frequency. His backing plate will be much larger and probably made of plate glass. Since he can measure the thickness of crystals at either edge of the backing plate fairly accurately with a spherometer, he will have a much finer check on parallelism than we shall. Nevertheless, as stated earlier, the limits of measurement in grinding individual crystals mentioned here will be found to be sufficiently accurate for amateur purposes, and the result should be entirely satisfactory.

## Simple S-Meter Fitting

### COMPARATIVE CHECKING DEVICE

E. JOHNSON (G2HR)

THE ear is notoriously an inaccurate means of estimating signal level, and despite the admitted shortcomings of an S-meter, most amateurs appreciate a visual method of giving comparative reports. An S-meter as such is of no great value in measuring *actual* signal strength, as this is dependent on the type of receiver and aerial system, and the reference level to which the meter itself is calibrated. The overall sensitivity will inevitably vary from band to band, and to compare an S8 report on 20 metres with a similar report on Top Band has no useful meaning. The personal element is also an important factor, as whatever a meter may indicate, it is a safe bet that purely aural estimates will vary widely between various listeners.

The writer therefore prefers a meter with an arbitrary scale which will enable him to advise a station whether he is "up" or "down" after carrying out tests, or to compare his level with some other station. A method will, however, be described later which will enable the user to mark the scale reasonably accurately in dB or "S" points with reference to a selected datum level.

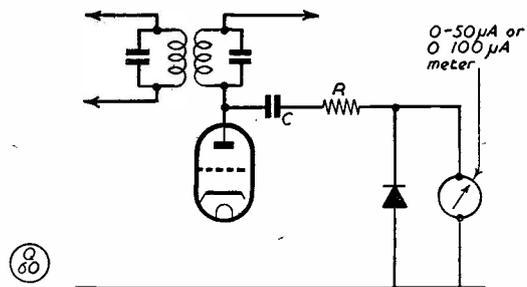
### Add-On Unit

The S-meter described calls for a minimum

of components and requires absolutely no alteration to the wiring of the receiver. Reference to the diagram will show that basically the circuit consists of a condenser, resistor, and germanium diode, all connected in series from the "hot" end of the last IF transformer secondary to ground, the meter being connected in parallel with the diode. The selection of component values is largely a matter of trial and error, but in the interests of preserving circuit alignment the condenser should not exceed  $50 \mu\text{F}$ , and the resistor may be of the order of 100,000 ohms if a sensitive meter is used. In the writer's case a  $50 \mu\text{A}$  movement is employed. A less sensitive meter will require a lower resistor and/or higher capacitance.

### Calibration

If the user wishes the meter scaled other than in a purely arbitrary manner, it is suggested that the assistance of a local amateur be sought, who can adjust his power *output* reasonably accurately. On 160 metres this is not at all



As explained in the text, with this S-meter circuit C should be made as low and R as high as possible consistent with the desired range of readings.

difficult. First of all the meter should be marked with a "zero" level which may well correspond with the average noise level. After all, we are far more concerned with signal strength over noise than any absolute value which has no real meaning, and is of even less use.

The collaborator should make a careful note of aerial current reading. At the receiving end the meter is marked with a personal estimate of the "S" value (for what it's worth!). At the transmitting end the power output is then quadrupled, remembering this represents *double* the previous aerial current, which in turn indicates a 6 dB increase in signal level, or "plus one S point." This process can be repeated if one starts at a low original level.

It is important that the collaborating station should not be too near, as readings will be vitiated by direct radiation from the transmitter unless it is well shielded.

The scale is unlikely to be linear, as the germanium diode falls in resistance with increasing applied voltage. This is, if anything, an advantage as it gives a large measure of

protection to the meter with an excessive applied voltage, and at the same time gives a much wider range of readings.

### Aid to Alignment

The slightly increased capacity thrown across the IF transformer will necessitate a "touch" on the trimmers. This process is now extremely simple: With a steady applied signal one merely adjusts for maximum deflection! In the writer's case the entire receiver has been re-aligned from the "front-end" onwards with excellent results. For this purpose alone the meter fitting is well worth while.

*(NOTE: If more elaborate calibration is desired, it would be possible—with an instrument such as an Avo signal generator—to put a scale on the meter in terms of microvolts, with dB values also referred. These values would not be absolute but would give accurate comparative readings as between different stations, and on aerial tests and transmitter experiments. By using signal-generator calibration at known (variable) levels, all receiver variables, excepting only the aerial itself, are taken in account. —EDITOR.)*

## MULLARD VALVES FOR FM/AM RECEIVERS

Mullard Ltd. now have available a complete range of noval-based valves for use in combined FM and AM broadcast receivers. The design of such receivers, which make possible the choice of FM or AM by switch selection, has been facilitated by including in the range some versatile dual-purpose valves. FM/AM receivers using five Mullard valves and a rectifier—only one more valve than conventional broadcast receivers—will make the reception of FM broadcasts in Band II (87.5-100 mc) an economic possibility. Care has been taken in the design of these valves to ensure that full advantage can be taken of the potentially high quality of FM broadcasts. An improved output pentode provides 6 watts of audio frequency power, and a new VHF double triode for use in the early FM stages minimises receiver noise and local oscillator radiation.

The range of valves comprises the new high-slope double triode ECC85 for use as FM RF amplifier and frequency changer; the triode-heptode ECH81 (with separate electrode structure for triode and heptode) which is used as an FM IF amplifier or AM frequency changer; the high-slope variable-mu RF pentode EF85 for AM or FM IF stages; the triple-diode-triode EABC80 (FM detector, AM detector, AGC detector and AF amplifier); the new output pentode EL84; and the power rectifier EZ80.

**FM Reception.** When a typical FM/AM receiver is switched to "FM," the function of the valves will be as follows: One triode of the ECC85 will be used as a grounded-grid or neutralised grounded-cathode input stage. The other triode will

act as a self-oscillating frequency changer. This arrangement results in extremely low noise, so that FM signals of the order of 1 microvolt can produce an output of good entertainment quality. In addition, the ECC85 has been carefully designed to minimise leakage of the oscillator to the aerial via the valve capacities. With a typical IF of 10 mc, the oscillator second harmonic falls in Band III, and it is therefore important to avoid radiation, which might interfere with the television broadcasts that will ultimately take place on these frequencies. The ECC85 contains an inter-valve screen which reduces the anode-to-anode capacity of the two triodes to 0.04  $\mu\text{F}$ . The use of an external screening can further reduce this to less than 0.008  $\mu\text{F}$ .

The next valve in the FM receiver will be the heptode portion of the ECH81 connected as an IF amplifier, followed by a second IF stage using the EF85. (The triode portion of the ECH81 is not used for FM). The receiver is completed by the EABC80 (two of the diodes being employed in a radio detector circuit, while the triode portion acts as an AF amplifier), and the EL84 output pentode. The EZ80 supplies the H.T.

**AM Reception.** When the receiver is switched to "AM," the first valve is the ECH81, functioning as a conventional frequency changer and oscillator. The EF85 forms a high gain IF stage, followed by the EABC80, one diode being used as detector and another as AGC source. The AF amplifier and output valve circuitry remain as before.

# DX COMMENTARY

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

**A**LTHOUGH conditions on the HF bands have quite noticeably improved this month, this remains largely a Top Band commentary. As we have remarked before, bad conditions breed inactivity, inactivity makes the bands sound even worse, and the whole thing becomes cumulative.

And now another phenomenon is added to the hazards already besetting DX—the increasing reluctance of DX-chasers to discuss their doings! With the bands apparently in such a bad state, someone discovers a slight crack in the armour, and at XX hours GMT he works a (*shh!*). He fixes a sked for (*censored*) and makes it a three-way with (*Top Secret*). So terrified is our successful plodder that a horde of spivs will descend on the band in search of his spoils that he doesn't even tell his best friends what he has been up to.

This must be very frustrating for the type of chap concerned; never one to brag about his DX, he now finds that he can't even mention it! Presumably when the QSL cards turn up he will allow someone to have a look, but maybe by then they will no longer be interested.

We know that this is true—we have heard many interesting QSO's going on, but have seen no mention of them anywhere at all. Our monitoring station will have to be up-graded, re-staffed and become much more watchful!

## Aftermath

You will have gathered, from last month's description of the Trans-Atlantic Tests, that Top-Band DX conditions were excel-



W2RCN

## CALLS HEARD, WORKED and QSL'd

lent in December, but tailed off thereafter, being almost useless from our point of view in February and March.

The falling-off at this time was unfortunate, because conditions apparently improved as soon as the Tests were concluded. Through G6LB (Chelmsford) we hear that G6BQ (Gravesend) worked W1JJY as late as April 4, with the W using phone. G6GM (Holsworthy) also got through on the same morning. The time was around 0600. Then, on April 11, both G6LB and G6BQ logged W1LYV and W4HQN, and G6GM was calling W3RGQ.

A Petts Wood SWL who always gets interesting results during the Top Band tests continued his watch into April, and writes to say that March 27 was a very good morning. He logged W1BFT, 2GGL, 4CKD (calling XE2OK), 8KIA, 8GDQ, 8LO, 9NH, VE1EA, 2AIE, VP7NM, KV4AA and 4AQ. The next morning, March 28, brought in only four W's, VE1EA and KV4AA. On April 3 W1AW, 3EIS and 8ANO

were logged. VP4LZ's card (for February 21) was received with much joy!

We have always suspected that, if the activity could be guaranteed, North American signals could be logged here right round the calendar. Several were heard last year in August and September, and it may even be that a peak in conditions occurs during the summer. But there is always trouble with static.

W2QHH (Hamilton, N.Y.), using 30 watts on the band, worked KH6MG, KH6IJ and ZL3RB! But no KH6's have yet been heard in Europe, so far as we know.

## Top-Band Non-DX

Since the end of the Trans-Atlantics the band seems to have filled up even more than before, and it seems that the fascination of finding and working British counties on One-Sixty has even attracted several erstwhile DX-chasers from the HF bands. It is certainly true that the WABC scores have been mounting

steadily, thanks to the various "expeditions" such as those laid on by GM3HLQ and the "Welsh boys"—GW5PP/P, 3IWF/P and 3GMN/P, to whom the thanks of all interested are due.

Top place now goes to GM3OM (Larbert), who made the most of these expeditions and found himself with the astonishing score of 90 worked, 89 confirmed! He remarks on how good conditions have been, and says that during April he was copying GC3EML (589) at 1815 GMT. Another surprising one was GW3IWF/P on April 19—he was worked by GM3OM at 1235/1250 GMT. GM3OM says that there is a possibility of GM3JNW (Alloa) becoming /A in Peebles during the summer.

Finally, he mentions the considerable trouble that GM3HLQ went to, sending out telegrams before his visit to Nairn, and fifty-five QSL's *direct* afterwards. Despite all this, he had only received three QSL's back at the time of writing—not much encouragement for undertaking other portable sorties that he had in mind.

Incidentally, GM3HLQ packed up at Nairn around midnight, and he and GM2CAS returned to Aberdeen by road. At 3.30 a.m., back in Aberdeen, they listened, and there was a station still calling GM3HLQ . . . . Wonderful what a spot of real enthusiasm will do!

The former occupant of the top of the ladder was GM3IGW, whose final score was 88 worked and 88 confirmed. But he is now G3IGW (Halifax) and starting again the hard way! Nevertheless, he already has 65 worked and 46 confirmed, so another WABC is doubtless on the way. Regular Top-Banders know how grateful they should be to him for his contacts from Clackmannan and his various expeditions.

G3IVH (Norwich) tells us that G5PP contemplates more portable operation from Rutland over the Whitsun week-end. IVH cashed in on the Welsh portables at Easter to score 73 worked.

G3HZM and G3HMF (Manchester) have started a small private duel at the lower end of the WABC ladder, and they announce that anyone else wishing to join in the fun will be welcome (an Irishman's fight, obviously!)

G3CO (London, S.E.14) wants to thank the promoters of the Easter expeditions and hopes that in return it will be possible for him to organise a trip to Alderney and Sark during the late summer. No definite news yet—but Watch This Space!

G2YS is now installed in his new home at Filey, Yorks., but only has room for a 66-ft. top, and finds the TV signal very poor compared with Chester. However, he has already heard HB9T in broad daylight (1840), and he also logged F8YN calling CQ on the

**TOP BAND DAYLIGHT TEST**

Another "MDT" on the Top Band, Sunday and Monday, June 6 and 7, 1600-1800 GMT each day. Call "CQ MDT," look for stations over 100 miles distant, and report your results next month, with distances to the nearest five miles.

Top Band—any gen. on this one?

One of the few G3J's to write in so far is G3JKO (Nottingham). In the last few weeks he has been working a fine string of GM's, OK's, HB's and the like, and seems a certain candidate for a WABC award. He, and many others, want to see more daylight activity on the band, and doubt whether it will materialise unless we organise something for the chaps. Now see next paragraph!

**Another MDT**

Although the dates come so soon after the appearance of this issue, we feel that Whit Sunday and Whit Monday would be suitable days for an effort of this kind. Not everyone spends the Whitsun holiday in the open air, and those who have put in a morning's gardening might possibly get a permit to spend two hours in the shack later in the day. So we suggest a couple of two-hour sessions, 1600-1800 GMT on Whit Sunday and Whit Monday, June 6 and 7. Call "CQ MDT" (*Magazine Daylight Test*) and work all you can. Send in your results and quote distances, if possible, to the nearest five miles.

G3DO (Sutton Coldfield) worked the three Welsh portables and GM3OM for four new ones; he is now over the 60 mark but still awaits five cards. G3ITY (Chester) has also topped the 60 but is short of QSL's. G3BRL (London, W.5) is up to 66, with 63 confirmed.

G3CMH (the Yeovil Club station) has been active on the band, best QSO's being with GD3UB and GW3ITD (Carms.). G6VC (Northfleet) caught some of the portables and boosted his score accordingly (now 84, sharing

**FIVE BAND DX TABLE  
POST WAR**

Station	Points	3.5				7				14				21				28				Countries
		m	c	m	c	m	c	m	c	m	c	m	c	m	c	m	c					
DL7AA	649	85	154	216	90	104	221	354	408	462	516	570	624	678	732	786	840	894	948	22		
G6QB	587	52	107	220	73	135	234	306	360	414	468	522	576	630	684	738	792	846	900	23		
G5BZ	558	60	110	227	96	65	233	318	372	426	480	534	588	642	696	750	804	858	912	23		
G2VD	493	47	89	178	70	109	187	282	336	390	444	498	552	606	660	714	768	822	876	18		
G2WW	479	23	70	190	89	107	197	264	318	372	426	480	534	588	642	696	750	804	858	19		
G4ZU	473	12	45	203	93	120	210	246	300	354	408	462	516	570	624	678	732	786	840	21		
G2BJY	459	48	77	141	77	116	179	234	288	342	396	450	504	558	612	666	720	774	828	17		
G3FXB	456	64	117	174	62	39	178	216	270	324	378	432	486	540	594	648	702	756	810	17		
G3DO	440	24	46	195	68	107	221	216	270	324	378	432	486	540	594	648	702	756	810	21		
G5FA	406	34	118	150	31	73	166	174	228	282	336	390	444	498	552	606	660	714	768	16		
G6QX	404	51	96	144	56	57	166	174	228	282	336	390	444	498	552	606	660	714	768	16		
G2YS	380	52	68	142	74	44	158	166	220	274	328	382	436	490	544	598	652	706	760	15		
G2BW	353	24	57	144	85	43	155	163	217	271	325	379	433	487	541	595	649	703	757	15		
G3GUM	328	31	38	168	90	1	177	185	239	293	347	401	455	509	563	617	671	725	779	17		
GM2DBX*	319	21	31	154	32	81	163	171	225	279	333	387	441	495	549	603	657	711	765	16		
G8VG	279	36	76	123	18	26	140	148	192	236	280	324	368	412	456	500	544	588	632	14		
G2DHV	177	20	23	108	11	15	112	120	164	208	252	296	340	384	428	472	516	560	604	11		
4S7XG	160	1	27	110	18	4	110	118	162	206	250	294	338	382	426	470	514	558	602	18		

\* (Phone)

the top G position with G5LH). VC has been keeping a look-out for 3A2BB on Top Band, but has not heard him, or anyone calling him, as yet.

G2HKU (Sheerness) got his share of the /P activity round the rare counties, and is now 48/50.

### DX on Twenty

The chief change in *Twenty* since last month has been the arrival of early-morning DX. Around 0700 GMT we have heard KB6 and KW6 (on rare occasions, it is true); a little later the KH6's are very active, staying in until 0930 GMT or thereabouts. And by mid-May the old familiar pattern is showing, with really strong signals from W6 and W7, even as late as 0800 or 0900. On May 17, around 0830, W6DXX and W7BD were both S9, with the characteristic flutter of West Coast signals in the morning (they don't seem to have quite the same tone in the afternoons and evenings).

Far East signals are nearly always to be heard on the band at lunch-time, with JA's, KA's and VS6's among the best. East Coast W's are not numerous until later in the day; if you hear them at mid-day you can be sure that they are the "big boys" with good aerials and plenty of power. VK's sometimes show up in the early afternoon, but ZL's now seem conspicuously absent.

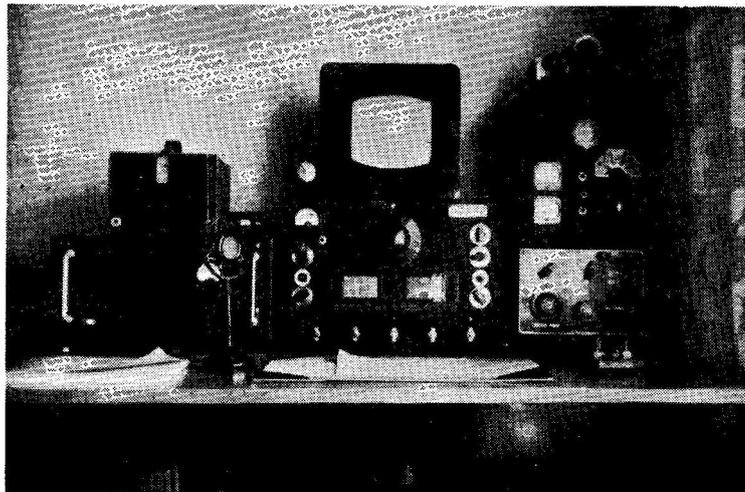
G3FXB (Hove) has really got going from his new QTH and has worked MP4ABW (Qatar) and MP4QAH (Hallu), both on phone. Others, also on phone, include CR6AI, EA9DE, VQ2AB and 3EO, ZE3JP, ZD4BF, ZS3BC and 4S7LB.

G3CMH, on phone, raised VP2DN and 6WR, VU2RC, YV5AB, CT2BO, CR5SP, EA0AC, MP4QAH and ZC7DO, who is believed to be in Jordan.

G5BZ (Croydon) has had little time to spare and has found no new ones, but CW activity has brought in VU, VK, W6, HS1D, ZD2IAG, EA9DF, F18AM and a host of others.

### Fifteen Metres

For 21 mc, we have a small batch of reports and claims. This



Station of G3GTR, Whitehouse, Co. Antrim, first licensed in July 1950. The transmitter, says he, "is a much-modified G09 with straightforward circuitry and runs an unpretentious 25w. to an 807." Phone is by crystal microphone into a 6SJ7-6J5-p/p 6L6 modulator, the receiver is an HRO, and the aerial a 132-ft. long wire. Control is by relays throughout, operation is exclusively on 80 metres, CW and phone, and DX is never chased — though it is worked when it presents itself.

band is still the mainstay at G2WW (Penzance)—but the third-harmonic relationship between Wenvoe TV and 21 mc makes things a bit tricky. As G2WW remarks, these viewers are trying for a TV signal at 145 miles, and, of course, there is QSB, with vision and sound fading independently at that, yet they expect satisfactory reception. However, in spite of this local hazard, G2WW rolled in MP4BBL (Bahrein) and VP2KM (St. Kitts) for firsts for him on 21 mc.

G3HCU (Chiddingfold) turns in an impressive list of stations worked on Fifteen in one month to May 13; it totals up to no less than 51, with CR4AE, EL2X, IT1BXX and VS2UW as new ones, the latter looking like a G/VS2 "first" for this band. More than 30 different prefixes are involved in this *tour de force* by one of the most active G's on the 21 mc band—and he is going out for more with a 4-element beam.

On the other hand, ZS2AT (East London) has found conditions "too stinko to report," and only garnered one more for the 21 mc Marathon. He has got his WAZ and has cards for the EDX as well.

The usual openings, mostly North-South, have occurred on 21 mc, but, rather surprisingly, VU's have been worked from time to time. G3FXB reports VU2EJ, and we have heard VU2RX and a couple more, mostly on Sunday mornings.

G3CMH worked CE2AY, CR4 and 6, FF, LU, OD, OQ5, PY, VP6, VQ2, 4 and 5, ZD4 and ZS—all on phone. Gotaways were CP5EK, EL2X and TI2BX. G3FXB worked EL2X, OD5, VQ4, VU, ZE, ZS and ZS9G—also on phone.

### DX Strays—and DXpeditions

Unknown to all but the keenest types, the FO8AJ expedition to Clipperton Island *did* come off—on April 23. W0NWX, 0NUC and 0VDQ, after a hazardous journey and all sorts of hardships, finally made it. They had several QSO's with W6's, 7's, 9's and KV4AA, and managed to operate, during their brief stay, on *Twenty* CW and Phone, *Forty* CW, *Eighty* CW and Phone and *Fifteen* CW. They left the island at daybreak on April 26, but succeeded in making 1050 contacts during their three days of activity. (If any G's worked them, we have not been

### TOP BAND COUNTIES LADDER

(Starting Jan. 1, 1952)

Station	Confirmed	Worked
GM3OM	89	90
G6VC	84	84
G5LH	84	84
GM3EFS	83	85
G16YW	81	81
G13HFT	81	81
G2NJ	80	80
G3HLS	77	80
G3HIW	71	79
G3CO	71	73
G3IVH	70	73
G2AYG	69	70
G2YS	68	75
G5JM	66	80
G8TS	64	69
G3JEO	63	75
G3IOX	63	74
G3BRL	63	66
G2DVD	61	63
G3JEL	60	73
G3FTV	60	68
G3EUK	60	68
G3HYJ	60	65
G3CFG	60	62
G3LP	60	60
G3DO	55	62
G3ITY	52	61
G2HKU	48	50
G3IGW	46	65
G8VG	46	60
G5FA	37	52
G3JKO	36	53
G3HZM	26	39
G3HMF	17	20

notified). We heard them, coming through the East Coast W QRM, several layers down, but the East Coasters were giving them S9 at the time.

The FO8AJ attempt in March was foiled because damage to their sextant prevented them from even locating the island; on this second attempt they beached on April 14, but were blown 50 miles from the island by a storm, and what with diesel failure and the rest, it took them eight days to regain the shore! They may be pardoned if they are all going around muttering "The things we've done for hams . . . ." No medal has yet been struck. (Thanks to KV4AA

for the above information.)

Another exotic trip in prospect is that planned by W4COK/2 to Navassa Island—and do you know where that is?! Navassa Is. is American territory between Cuba and Haiti, and it is reported that the ARRL have agreed to accept it as a "new country"—if W4COK can get there. Should this venture materialise, and if you can work your way through the barrage of W's, look for Navassa Island (prefix unknown) in about three weeks' time. This is scanty information, but we have told you all we know ourselves.

The Argentine Expedition to the Himalayas, LUØMA, has actually been operating from Nepal, we are told, but no QSO's are yet claimed.

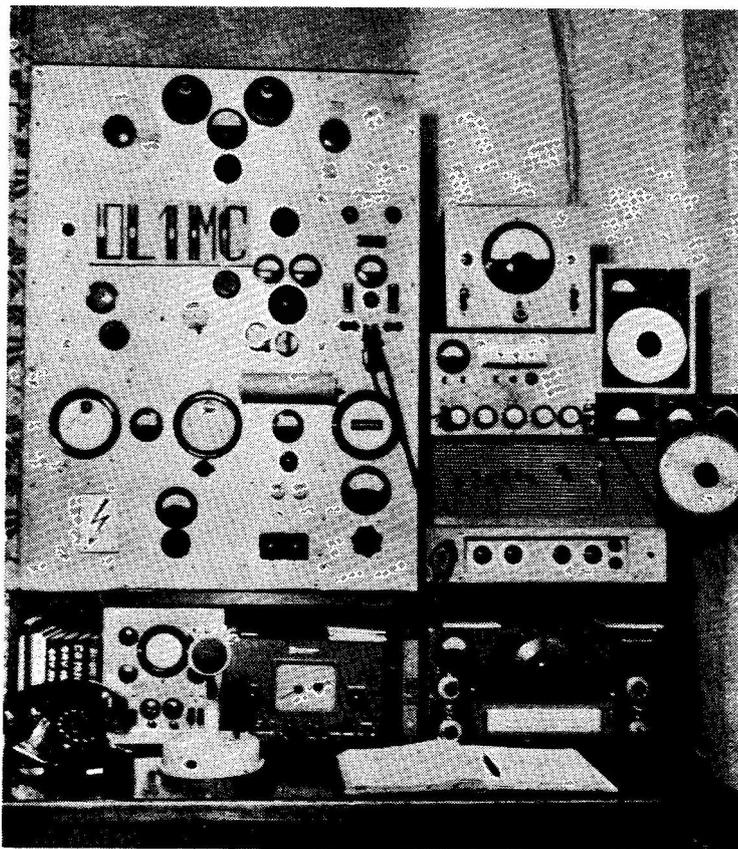
A phone signal signing AC4LM has been reported by listeners in

VU and VS7, but no one over here seems to have heard or worked him yet.

Various expeditions are being discussed in subdued whispers, but we understand that new spots are now so difficult (a) To find, and (b) To get to when you have found them, that the expedition traffic is slowing down.

#### News from Overseas

VS6CW (Hong Kong) is GW3IVS, serving a two-year tour out there with the RAF. In the first two months as a VS6 he has worked some 47 countries, and says the best time for G at present is 1700-2000 GMT. G3HEJ has arrived there to keep him company and is also applying for a call; between them they hope to keep activity at a high level, with 150 watts of phone and CW.



Since the photograph on p.542 of our November issue was taken, DL1MC of Regensburg has rebuilt his station to the layout as shown above.

VS6CW, whose QTH is Box 541, Hong Kong, sends 73 to his friends in the Liverpool/North Wales area.

ZB1EB (St. Julians, Malta) is G3IJU (and G13IJU/A), and he offers a little advice to others proceeding to the George Cross Island. No import duty is imposed on equipment previously used as personal gear, but a check with British Customs will help any intending traveller. Components and spares are *not* plentiful. G stations are S9 or better from early in the morning until about 1000 GMT, after which they fade out; *Twenty* is not good, though, with high noise level and lots of local QRM. Activity on *Forty* and *Eighty* seems low, but ZB1EB is willing to fix any skeds. (He would also much appreciate any details about the Collins MA35 transmitter).

### 21 mc MARATHON

(Starting July 1, 1952)

STATION	COUNTRIES
VQ4RF	108
G5BZ	96
G4ZU	93
G3GUM	91
DL7AA	90
G2WW	89
G4ZU (Phone)	88
G2BW	85
G3HCU (Phone)	83
G2YS	74
G6QB	73
G3TR (Phone)	69
G3DO	68
ZS2AT	67
G3CMH	64
G3CMH (Phone)	62
G3FXB	62
G6QX	56
ZE3JO	55
G2DPY	38
GM2DBX (Phone)	32
G5FA	31
G8VG	18
4S7XG	11
G2DHW	11



“. . . . Meet G9XZ — he's a CW-only man . . . .”

DL2SU (Butzweilerhof) is returning to the U.K. pretty soon; he has been working mainly on 7 mc with a B2, and has been hampered by the lack of a good aerial system. On his return he will be busy getting G3ICH on the air, and his XYL is also licensed as G3JAA; they both hope to be working Top Band and chasing a WABC. (Incidentally, he says that all DL2 licences have now been amended, and there is *no* Top Band operation out there any longer).

From DL2UO an apology about non-QSL'ing; he is still awaiting his cards, and will get them off as soon as received.

#### The Other Bands

Hardly anyone mentions *Eighty* or *Forty* this month. G6VC managed to work VE1HJ and VE1ZZ on *Eighty* one night, squeezing through the cracks in the commercials, and G3FXB raised HZ1HZ and ZB1BF for two new ones on the band. In the second leg of the ARRL Contest he worked over 30 W's and VE's up there.

On *Forty*, though, 'FXB has been rolling them in with his new ground-plane, and the list includes CX, EL, KV4, KZ5, VP2, 4, 5 and 6, VQ3 and 4, VS9, VU, VK, TI, 4S7 and all sorts of nice ones. EA9AR, CN8MM, PJ2AA and HP3FL were worked up there on phone. For G2HKU, ZL3GQ, ZL3KN and TI2WR were nice ones on 7 mc.

#### Don't Panic!

We well remember the saying, long before the war, that if you could work AC4 you could work Mars. Well, the jest has become the true word, and the KP4 and KV4 stations in the U.S. MARS Network have been given the prefix AC4! KZ5 stations use AC5. These stations are, of course, *outside* the amateur bands.

For the Certificate enthusiasts, two new ones appear from Sweden. The "WAV" (Worked all Vasteras) is available to those submitting proof of contact with 10 SM5 stations in the town of Vasteras. Likewise the "WGSA" comes to those who work 10 SM6

### Short Wave Magazine DX CERTIFICATES

The following have been awarded since the publication of the last list, in the April issue:

#### WFE

- No. 16 ZL1HY (Waihi)  
W6BYB (Sebastopol)

#### WNACA

- No. 67 OH2QQ (Helsinki)  
ZL1HY (Waihi)  
SM6ID (Gothenburg)  
KP4CC (Santurce)

#### WABC

- No. 59 G3HYJ (Norwich)  
60 G3JEL (London, N.7)  
61 G3EUK (Bath)  
62 G3JEQ (Great Bookham)  
63 GM3HXT (Fochabers)  
64 G3FTV (Wakefield)

#### FBA

- No. 36 G6UT (Bishops Stortford)  
37 G2DPY (Shoreham)

General conditions for claiming MAGAZINE DX AWARDS and CERTIFICATES appeared on p.419 of the September, 1953 issue.

stations in Gothenburg. Full particulars available from SM5WI and SM6ID respectively—not from us, please!

As regards certificates, G2WW

—a very keen collector—now has his DPF (No. 250), and it is apparently the first issued to a G for phone. Coming along is the CDM, and G2WW also says that he was told by IT1TAI that he is the first G to apply for WASP.

And that just about concludes another of these “lean times” Commentaries. We have no doubt that the incoming news will increase proportionally with the DX, and we have every hope that the DX will be on the up-grade from now onwards.

Let us close on a note of optimism. It has been known for years that the magnetic field surrounding individual sunspots changes its polarity with each successive cycle, and that the sunspots of each new cycle appear first at high latitudes on the sun. In February last, one of the first sunspots of the new cycle was observed—its latitude was high and its magnetic field reversed in polarity! This, together with independent predictions that the minimum of the present cycle will occur in the autumn, is a pretty clear indication that we shall start to climb before long. Also, it is worth

### TOP BAND DAYLIGHT TEST

Another “MDT” on the Top Band, Sunday and Monday, June 6 and 7, 1600-1800 GMT each day. Call “CQ MDT,” look for stations over 100 miles distant, and report your results next month, with distances to the nearest five miles.

remembering that the “climb” is usually very rapid; sometimes the maximum of the cycle is reached three years after the minimum—followed by eight years of slow decline!

It may well be that we have already passed the worst month of the present cycle—the worst month in the memory of many present-day amateurs.

Next month's dead-line is **first post on Friday, June 18**, and for the following month it will be *July 16*. Address everything to “DX Commentary,” *Short Wave Magazine*, 55 Victoria Street, London, S.W.1. Until then, Good Hunting, 73 and BCNU.

### PARADISE FOR SALE

The following advertisement appears in the March issue of the New Zealand “Break-In,” the journal of the N.Z.A.R.T.:

*Leaving for health reasons.—4½ acres flat land; modern fully-furnished residence and two other house-size buildings; concrete paths, garages for three cars, two workshops with large radio-room adjoining. Four professionally constructed 80-ft. masts, three 55-ft. masts, two 66-ft. towers with rotary beams. Three miles from Tauranga; beautiful views. Would like to sell to appreciative amateur.*

The advertiser is David Mitchell, ZL1MP (ex-GW6AA), who for many years has held an amateur licence and was very active in this country until 1939. He is on the move again, and we shall be hearing of him with an exotic call-sign from some tropic isle when he leaves New Zealand.

### AERIAL EARTHING ARRANGEMENTS

It is just about this time of year that special care must be taken to earth down outdoor aerial systems, not only during local electrical storms, but as a matter of course when the station is not in operation.

A “lightning arrestor” or easy leakage path should be provided to drain away the heavy charges built up during thunderstorms and the (much more dangerous) “dry” electrical storms which have lately been sweeping the country. Very large voltages can develop under such conditions, and as an instance it might be mentioned that at a station in the South Midlands, on the occasion of a recent “dry” storm, the voltage at the end of a 276-ft. aerial was jumping an effective gap of more than one inch.

### M.V. “ARIES” — GRVM

The yacht *Aries* is an RNLI lifeboat, ex-Padstowe, now on a radio survey trip across the Atlantic, manned by a crew of four naval officers, with G3JQQ, a Sub-Lt. RNVR, as radio operator. The task of the *Aries* is to test a wide range of HF and VHF apparatus, CW and phone, under the practical conditions of a long Atlantic crossing, using normal ship-working frequencies. Additionally, *Aries* is fitted with VHF phone equipment, operating on 118.1 and 121.5 mc, with which to communicate with the Atlantic weather ships. It is expected that this voyage will produce much valuable practical information on the problems of radio equipment for small sea-going vessels.

# TRANSISTOR TOPICS

Conducted By **G3HMO**

THE most interesting news item this month is the 160-metre Transistor Test which took place on the night of May 4-5. This test was arranged between G3CCA (Leicester), G3HMO (Buckingham) and G3IYX (Bradwell, Bucks.), all using transistor transmitters, with G3CFG (Kirby Muxloe, Leics.) and G6FO (Maids Moreton, Bucks.) as linking and control stations. Also keeping watch on the frequency were G2AA, G3DVP, G3GVK and G3IZS, all of the Leicester Radio Society. The purpose of the test was to attempt a two-way QSO with transistor transmitters over the range of 45 miles.

Contact G3CCA-G6FO was established at the first call, with G3CCA RST-579 on his transistor transmitter on 1820 kc. In the course of a 1½-hour test, G3CCA remained solid copy at G6FO, except for a break of a few minutes while he changed a faulty transistor in the VFO. Phone from G3CCA was RS-45 at G6FO when static and general QRM allowed it to be audible at all.

G3CCA succeeded not only in putting transistor signals down into the Buckingham area—received by G3HMO and G3IYX, as well as G6FO—but towards the end of the test he was able to receive phone from G6FO on a transistor receiver of the superhet type; G3CCA was getting RS-55 to RS-57 signals on a headset, the G6FO transmitter being his normal 9-watt Top Band rig using a half-wave aerial.

Thus, G3CCA became the first all-transistor station to transmit and receive signals, of R5 communication quality, over a distance of more than a few miles.

During the test period, G3IYX was received on CW in the Leicester area by G3CCA, G3GVK and G3IZS at RST-339, using the transistor transmitter shown on p.163 of the May issue of *Short Wave Magazine*. A QSO G3CCA-G3IYX was attempted, and though they had heard one another on their transistor transmitters, static noise and the level of interference prevented an actual contact being obtained. This was most unfortunate, as such a contact—over 45 miles—would possibly have constituted a new world record, there being transistors at both ends.

G3HMO made several transmissions (with home-constructed transistors in the transmitter) and was identified at RST-229 by G3IZS in Leicester. He was using the transmitter circuit described on p.165 of the May issue of the Magazine.

During the period of the test, conditions on the Top Band were poor, with a high level of static and much interference. It was evident that without the efforts of the linking stations, G3CFG and G6FO, and the maintenance of a very high standard of net discipline at both ends, it would have been very difficult for any contacts to have been established—except, perhaps, in the case of G3CCA-G6FO, which was actually a prearranged schedule.

The equipment at G3CCA is described briefly (*over*) with the aid of the block diagrams. It will be seen that the sequence in both transmitter and receiver could apply to a normal valve-operated station. However, we anticipate that the circuits will not turn out to be quite as orthodox. It is interesting to note that transistors are being used in push-pull in the PA to get more RF output. The VFO evolved by G3CCA is very stable and the keying is a good T9. On phone, also, the results are very good with no tendency to FM. It is the first really satisfactory transistor VFO we have come across, and shows that, with properly designed circuits, a crystal is not essential for stability.

In the receiver there are two points of interest. We see that diodes are used for mixing and detecting, leaving the transistors for the amplifying stages. The other point to note is the use of junction-type transistors in the IF strip. This type is normally specified for audio use owing to the *alpha* cut-off occurring at rather low frequencies. It will be interesting to hear what intermediate frequency G3CCA is using. His receiver may be of academic interest only to many, as the cost of a set of commercial transistors would be prohibitive. (The retail price is about £13 at present). However, in the future G3CCA is hoping to produce some equipment around home-made transistors.

## Reports and News

Other members of the Leicester group are also getting going on transistors. G2AA will be on 1801 kc with a single stage CO Tx, and has also started to make his own transistors. G3GVK (Rothley) hopes to be on shortly. G3IZS has under construction a CO driving a pair of transistors in push-pull on about 1805 kc.

A very interesting report comes from G4AP (Swindon). He has been experimenting now for about three months with transistors for both transmission and reception. It seems that his may actually have been the first all-transistor station, although at present he is limited to ranges of ten miles or so by a rather poor aerial. So far, best DX for G4AP is a report from 35 miles away. He is using a Mullard OC51 point-contact transistor as a CO running 50 mW input in an earthed base circuit. The collector tank circuit is inductively coupled to a series tuned aerial. The receiver also has an OC51 in a tuned emitter reacting detector circuit feeding a Mullard OC12 junction-type transistor as an earthed emitter audio output stage. The general trouble with all transistor receivers so far seems to be flat tuning, and therefore lack of selectivity. This is particularly the case, of course, with only one tuned circuit. However, G4AP has received CW from all over the

## TRANSISTOR CONTACT RECORD

TRANSISTOR STATION	Band mc	Phone CW	Input mW	Dist. miles	Station Reporting	RATING m.p.w.	COUNTIES Worked
G3CCA, Leicester	1.8	CW	50	135	G3JES, Canterbury	5,400*	11
G3CCA, Leicester	1.8	CW	50	130	G3GGN, Littlehampton, Sussex	2,600	
G3CCA, Leicester	1.8	Ph.	50	95	G3IQO, Liverpool	1,900	
G6FO, Maids Moreton, Bucks.	1.8	CW	65	112	G3PU, Weymouth, Dorset	1,850	
G3CCA, Leicester	1.8	CW	50	45	G6FO, Maids Moreton, Bucks.	1,800*	
G6FO, Maids Moreton, Bucks.	1.8	CW	65	100	G6QB, Bexhill, Sussex	1,550	3
G3IYX, Bradwell, Bucks.	1.8	CW	80	120	G3JML, Huddersfield, Yorks.	1,500	7
G3IYX, Bradwell, Bucks.	1.8	CW	80	103	G3IDZ, Locking, Som.	1,300	
G3HMO, Buckingham	1.8	CW	40	34	G6XH, Chorleywood, Herts.	850	
G4AP, Swindon, Wilts.	1.8	CW	50	35	? ? ?	700	
G3IYX, Bradwell, Bucks.	1.8	CW	80	45	G3IZS, Leicester	580	
G3IYX, Bradwell, Bucks.	1.8	CW	80	9	†G3HMO, Buckingham	220	
G3HMO, Buckingham	1.8	Ph.	100	15	G5RZ, Leighton Buzzard, Beds.	150	

**NOTES:**

Col. 7 is the Power-Range Rating, expressed as miles per watt. Thus, a report at 100 miles with an input of 50 milliwatts (mW) rates 2,000 miles per watt.

\* Denotes transistor receiver in use for QSO ; power-range rating doubled.

† Denotes transistor transmitter in use by reporting station ; power-range rating doubled.

Col. 8, Counties Worked, is on the basis of two-way contacts made with a transistor transmitter in use at the claiming station.

Entries for "Transistor Contact Record," under the headings shown, are invited from operators using transistor equipment. This Table is not competitive ; it is intended to record progress in transistor communication.

country and the Continent on a headset, and takes locals on the speaker.

G4AP is using an 1863 kc crystal and would appreciate any contacts or reports. He suggests that we publish a list of transistor stations and their frequencies. G4AP is another who intends to go into production on home-made transistors.

### Transistor Contact Record

Readers will see that we have now started the Table for recording transistor contacts. If you have had QSO's on any amateur band with transistorised equipment, please send in your claim, set out as it should appear in the Table. Power input is the collector input to the last stage. It would seem that

collector volts times collector milliamps is *not* a fair measure of the input to the stage as a whole. If there is a current stabilising resistor (and there usually is) it is an essential part of the circuit, and power wasted in it should still be counted as part of the power input to the final stage. It is suggested that the voltage used in the calculation should be the fixed potential feeding the stage. This will be either the battery or, where a potentiometer is used across a source of higher voltage, the HT at the slider.

The power-range rating is self-explanatory and seems a fair way to estimate QRP results. As a further mark of achievement, this figure should be multiplied by the number of pieces of transistorised equipment taking part in the QSO, e.g for transistor Tx one end and transistor Tx and transistor Rx at the other, multiply the power-range rating by 3; with a transistor transmitter or receiver at both ends, multiply by 2; and for a contact between two all-transistor stations multiply by 4.

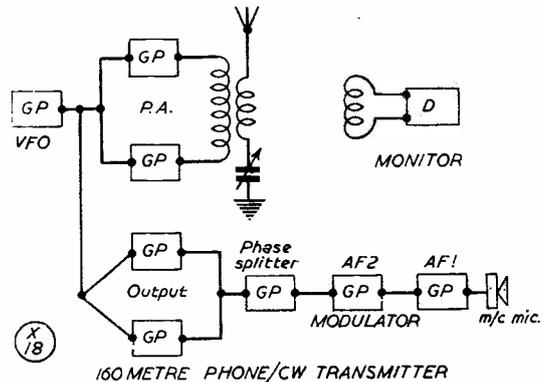
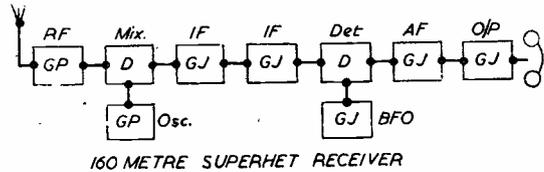
To start with, we are including in the Table a selection of recent results in addition to the best DX. The object of this is to show that results so far are not just freakish and that, QRM permitting, consistent contacts can be obtained. For example, G3HMO and G3IYX run a bi-weekly schedule in which transistor transmitters are almost always used, with no thought of warming-up the "high-powered valve gear." We shall soon get round to a regular Counties Worked table at the present rate of progress. G3CCA has worked eleven counties (including four using the transistor receiver), mostly on phone. G3IYX has covered no less than seven on his single transistor, and until recently has only had an 80ft. aerial. However, his best DX has been worked on a new half-wave aerial.

On the subject of battling with the QRM, and identifying transistor transmissions, attention is drawn to an interesting letter in the correspondence columns elsewhere in this issue; it will no doubt be agreed that G5CV's suggestion is both useful and practical, and all transistor operators are advised to use "CQ TTX de . . ." as their calling procedure.

**Transistor Developments**

An Atomic Battery has been produced experimentally by RCA. The output is at present very small—5µA at 0.2 volts. A radio active source of high energy electrons produces by multiplication 200,000 electrons for each initial electron penetrating an adjacent silicon p-n junction. While this has no immediate connection with a transistor, the battery has been shown driving a transistor audio oscillator. It foreshadows the day when one will be able to go portable for twenty years with no power problem!

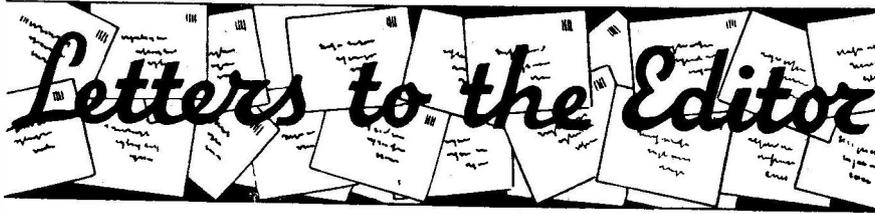
An interesting discovery, also from the other side of the Atlantic, is that very high frequency oscillations may be generated *internally* in a point-contact transistor. The effect, reminiscent of the Barkhausen-



Block schematic of the transmitter and receiver arrangement at G3CCA, Leicester — using transistors and crystal diodes throughout, and possibly the first all-transistor station in the world. On the night of May 4-5, on the 160-metre band, G3CCA worked G6FO, nr. Buckingham, on the transistor transmitter and was able to receive phone from G6FO at R5 on the transistor superhet receiver; the distance is 45 miles.

Kurz theory, may be explained by the equivalent of the Miller action in a transistor. The phase relation between collector and emitter is such that the internal collector capacity is reflected into the emitter as inductance. This can, if *alpha* is high enough, resonate with the emitter self-capacitance to produce oscillation around 20-60 mc, strong enough to be detected by a GDO near the transistor! The oscillations can be stabilised by an external tank in the collector. Frequency multiplication up to 600 mc has been obtained in the high *alpha* samples of the RCA 2N33 transistor.

That's all for this month, except to draw attention to an error in the table of values on p.165 of last month's *Short Wave Magazine*: C9 should have read 2 µF, as it is an LF by-pass to a low impedance circuit. Incidentally, some improvement may be obtained by omitting the condenser C1. Next time we shall give the transistor VFO circuit developed by G3CCA. Entries for the Table and other reports for inclusion in the July issue are requested by June 16, addressed to "Transistor Topics," c/o The Editor, *Short Wave Magazine*, 55 Victoria Street, London, S.W.1.



# Letters to the Editor

Letters published are those which seem to us to be of general interest, but should not be read as necessarily being in accordance with our own views on the subject. We welcome readers' comments.

## MW BROADCAST RECEPTION AND 160-METRE DX CONDITIONS

SIR,—I have just been reading the excellent report on last winter's results on Top Band. Though I have no first-hand operating experience of the 160-metre band, since early autumn I have been monitoring the (closely related) medium-wave broadcast band. I am convinced that some of my results could be turned to good account by Top Band DX'ers. The medium-wave band is 540-1600 kc, but best DX reception is usually obtained above 850 kc. Some conclusions drawn from my own findings are: (1) Good signals from North America can be heard as early as the beginning of October; during two autumn spells of N7 conditions forecast by WWV, broadcast stations in the W7 call area were heard on 1000 and 1510 kc, 0600-0800 GMT; more would doubtless have been logged but for American East Coast QRM. (2) When WWV forecasts N7, very strong signals are often received before midnight from American East Coast broadcasters. (3) These results correlate closely with short wave conditions—when they are good, plenty of DX BC stations can be heard in the medium-wave band. Average conditions may produce Cuba and Puerto Rico; poor conditions invariably result in reception of Argentina, Brazil and Uruguay; on at least one occasion, East Coast U.S.A. has given way to Middle West, which in turn has faded down in favour of West Coast (W6/W7), all in the space of an hour or two, in much the same way as happens on our 14 mc band. (4) South American broadcasters are well received in spring and early summer, from about 2300 GMT; stations using 1 kW or less are often heard. (5)

Conditions for North America were very favourable during last autumn, and also for most of December; but they were very poor for the first three months of 1954. Spells of good conditions—N7 seems to be the best we can hope for at this stage of the sun-spot cycle—tend to recur at 27-day intervals, i.e. they are connected with the sun's period of rotation.

These observations lead me to suggest that the plans you have already announced for next season's Top Band DX Tests might be modified as follows: (a) Start the Tests at the beginning of October. (b) The regular Tests should be held every three weeks; if tests are taking place at monthly or fortnightly intervals, it is quite possible that a test period may never coincide with a good spell. (c) If WWV is sending "N7" as its forecast at 2319 GMT any night, an "unofficial" attempt should be made; WWV should, in fact, be checked every night on 5 mc during the season, as it is on "N7 nights" that best results will be obtained. (d) When conditions are favourable, attempts should be made at a much earlier hour than seems to have been usual in the past. (e) If possible, South American amateur stations should be brought in—particularly CX, LU and PY—but owing to the static level in those parts, conditions for them would be best in April and May.

C. S. S. Lyon, G3EIZ, 30 Aigburth Drive, Liverpool, 7.

## TOP BAND DX—BIT OF HISTORY

SIR,—We hear so much about Top Band DX these days, it might be interesting to remind readers of a series of Trans-Atlantic Tests held in 1936, eighteen years ago. As far as I can remember, these

Tests were organised by G2II in conjunction with W1BB; it is good to know the latter still takes a leading part in current events, and he certainly deserves the tributes you offer him. According to my logs, during the 1936 Tests nine British stations got across: G2DQ, G2II, G2IN, G2XC, G6GL, G6PF, G6UJ, G6WQ and G6YQ, also EA4AO and FA8BG. Eight American stations made G contacts; and Canada was also represented, by VE1EA.

H. G. Collin, G2DQ, 32 High Street, Wickford, Essex.

As G2DQ implies, DX on the Top Band is no new thing. The first "crystal controlled ten-watt" Trans-Atlantic contact on 160 metres was actually made three years earlier than the time of which he writes—by G6FO/W1DBM at 0750 GMT on February 19, 1933, 21 years ago, G6FO then being located at Newport, Mon. This was in the course of some privately-organised tests, in which the other participants were G5UM, G5WU and G6PA. It was for these Tests that the 5-minute calling-and-listening procedure, in defined frequency areas, was first tried, as used in the Magazine 160-metre Tests today. Following the 1936 series, W1BB became the regular organiser on the American side, and he acted in this capacity for the first Short Wave Magazine tests arranged for the winter of 1938—and so he has continued ever since.—Editor.

## PAGES FOR THE SWL

SIR,—Over twenty years ago I was a keen listener on the short waves and collected an imposing array of QSL cards. Recently, I have begun to get interested again, and decided it was about time to build myself a set and see what present-day conditions are like.

The first thing I did was to buy a copy of May SHORT WAVE MAGAZINE and came right up against your Editorial! You are quite correct in one respect, anyway—the Magazine now is unfortunately right over my head, and I am wondering how on earth I can catch up with the wasted years. You write that the solution is as far off as ever, but surely this is too pessimistic? Would the Magazine suffer much if you devoted, say, two pages a month to the SWL? How else are you to catch this category of reader and improve his knowledge? Anyway, I do hope that you will be able to worry something out which will not upset the advanced types.

S. W. Stevens, 5 Digdons Rise, Woodcote Green, Epsom, Surrey.

### VOLUNTARY LIMITATION

SIR,—I suggest that you start a QRP Section, with all members agreeing to a maximum input of 10 watts. The function of the section would be to review each band, discuss gear and aerials for obtaining the highest efficiency under the 10-watt limitation, arrange contests and, in general, to further the QRP interest to the ultimate benefit of the amateur of this country. It would do much to overcome the TVI problem if you started a QRP Club, for licensed members only, all undertaking not to use more than 10 watts; this would not in any way cut across the use of high power and should not upset anybody!

C. H. Walker, G3AZT, 34 Westfield Road, Rugby.

### TRANSISTOR CALLING PROCEDURE

SIR,—In view of the current interest in the use of transistors for amateur communication and the number of such transmissions now on the air, would it not be a good plan to identify these transmissions with some easily distinguishable group, such as "TTX"? If a station, using this suggested system, were to call

"CQ TTX de G— . . ." anybody receiving the signals would at once know the type of transmitter being used. He would also know that a report would almost certainly be welcomed by the operator and, it is to be hoped, he would desist from transmitting near to this frequency.

My own experiments with transistors date back to August last year when, I think, I made the first transistor transmission in this country. They have all been confined to small portable transmitters and receivers working on the 3.5 mc band and powered by a tiny Ever-Ready Type 122 (22 volt) deaf-aid battery. With a single crystal-controlled 3604 kc modulated GET-1 transistor, and using only a 3ft. 6in. whip aerial, a distance of one mile on phone (received by G2DVD, Slinfold, Sussex) has been achieved. The input then was just over 20 mW.

I am a firm believer that owing to the low power requirements and the small physical size of the transistor, it is particularly suitable for portable transmitters. To me it seems absurd to operate a battery-driven transistor Tx next to a mains supply—unless, of course, one is out to claim an impressive list of "DX Firsts." But it will be an exciting day when a transistor spans the Atlantic!

In conclusion, I would like to pay tribute to your enterprise in starting a feature devoted entirely to transistor topics.

D. Walters, G5CV, Greenfield, The Drive, Godalming, Surrey.

Clearly, the suggestion put forward by G5CV will commend itself to all who are attempting contacts using milliwatt transmitters, which are in the ultra-QRPP category and have to compete, in the main, with transmitters operated at something like 150 times the power input—for that is the ratio between the average transistor transmitter and its valve-operated counterpart on the Top Band. Our correspondent is, of course, well known for his pioneer work in this country in the field of transistor transmission. —Editor.

### (SLIGHT) PROBLEM OF BCI!

SIR,—Can any reader please suggest a means of curing phone BCI on a neighbouring BC receiver? I should explain that this receiver is an 0-V-1 and is 12 feet away from our Club transmitter. (Yes, we know we could buy them a new set!).

M. Dransfield, G3JKO, Nottingham University Radio Society, Union Room, The University, Nottingham.

Broadly speaking, the only answer is to buy them a new set! —Editor.

### THE M.P.W. FIGURE OF MERIT

SIR,—On the subject of miles-per-watt, in view of propagation characteristics, a better figure of merit appears to be miles-squared per watt. I feel that the man who covers 2,500 miles with one watt puts up a better show than the man who achieves 1,250 miles with half-a-watt; in fact, in free space the performance is twice as good. The best approach to record-making under the present scheme is to reduce power to a minimum for oscillation and take whatever range results. However, this is not really my field, and I am not particularly serious about it—though something over 4,000 m.p.w. for a radiosonde transmitter seems a useful figure!

A. H. Hooper, G3EGB, 202 Totterhoe Road, Dunstable, Beds.

### EIMAC LITERATURE

SIR,—We take pleasure in sending you a copy of our booklet, "The Care and Feeding of Tetrodes," as well as some other material which we hope you will find useful. Should you be in need of further information, we shall be happy to have you write to us. It will be appreciated if you will advise your readers that this literature is available free on request.

John L. Reinartz, Director, Amateurs Service Bureau, Eitel-McCullough, Inc., San Bruno, California, U.S.A.

# Getting on Two Metres

## MODIFYING THE RF-27

*One of the best surplus equipments "modifiable" for Two Metres and still freely available at a price around 40s. is the RF-27 Unit. This is a well-designed and built type of converter assembly, tuning 65-85 mc in the original, with an IF which can be set anywhere in the range 7-8 mc. It can thus be used with almost any existing short wave receiver functioning as IF/AF amplifier and the only problem is modifying the tuned circuits of the RF-27 to cover the 144-146 mc band. This article shows in detail how it can be done. The result is a reasonably effective two-metre front end which will enable the initial forays to be made on VHF until such time as experience demands the construction of a more modern type of converter. In other words, the modified RF-27 is suggested as being one easy way of making the first approach to Two Metres; eventually, in the average station it would become a useful stand-by against something better in the way of two-metre receivers.—Editor.*

**I**N dealing with the problem of receivers for 2 metres and 70 cm, it would seem that there are three methods of approach.

First, a separate receiver for each band. Secondly, converters working into the station receiver(s), and thirdly, converters working into a common IF-AF unit.

Considering each of the possibilities in turn, the third method gives the most satisfactory solution from the amateur's standpoint.

The first method—that of separate receivers—is the ideal, but has the disadvantage of being costly, not only in initial outlay, but also in maintenance. Furthermore, considerable time would have to be spent on each receiver before optimum performance could be secured; generally speaking, time is at a high premium with all amateurs.

The second method—that of converters working into the station receiver(s) is, on first consideration, attractive. In the case of sensitive receivers, however, it is difficult to eliminate breakthrough from stations working on channels adjacent to, or on, the IF frequency. Also, due to the relatively high selectivity of the IF strip in the main receiver,

even with the selectivity control in the "broad" position drift due to one cause or another will entail retouching the converter tuning from time to time.

It would seem, therefore, that the use of a common IF/AF strip, with a certain amount of bandwidth control, plus a good BFO, noise limiter and AF section, should give the best results with the minimum monetary outlay, with a saving in that other ever-short commodity—time. Any converter built could then be arranged to have the required IF, and also to draw its supplies from the unit—as in the G2BVW design.

### Approaching the RF-27

But the quick approach, to get on the two-metre band, is to modify a Type 27 RF unit, which has often been the subject of conversion designs in *Short Wave Magazine*. Inspection of the RF-27's internal layout with its good screening, robust construction and sound circuit, led to the belief that it would be possible to modify it for two-metre operation, as it is designed for 65-85 mc.

For optimum performance the modifications proved a little more comprehensive than were at first envisaged. The performance of the unit now, however, compares very favourably with others, using valves of the 6J6 and 6AK5 type.

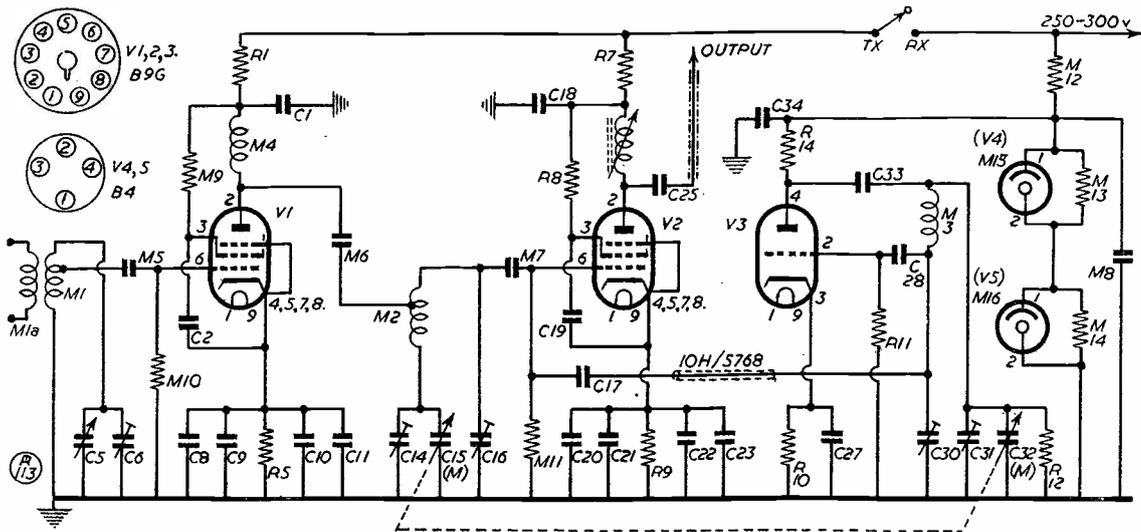
The initial conversion took only a matter of three hours, including the location of the band, but the performance, and particularly mixer noise, left a great deal to be desired. By circuit changes, and ensuring that the local oscillator was the requisite amount LF of the signal, the performance was improved beyond all recognition, and the mixer noise was reduced to a fraction of its former level.

The circuit diagram is that of the modified unit, and the details following, coupled with inspection of an RF-27, will enable conversion to be easily accomplished.

### RF Stage Alterations

It will be seen that the RF stage has been converted from series to parallel tuning, the circuit being tuned to resonance by a panel trimmer. The original RF section of the three-gang tuning condenser is no longer used. The setting of the panel trimmer (which is that originally in the unit) is quite broad over the band, and generally need not be touched after the initial adjustments.

The conversion from series to parallel tuning gave a better match to the feed line, and also



Circuit of the RF-27 Unit as modified for Two Metres. In this and the table of values circuit elements marked "M" are the modification items. Stabilisation of the oscillator V3 is very important for the best results. The existing IF section tuning can be adjusted on the slug for any frequency between 7 and 8 mc.

an improvement in gain. The screen resistor of this stage has been reduced from 10,000 ohms to 4,700 ohms, and the original 10,000-ohm anode load replaced by an RF choke. A further improvement was obtained by isolating the tuned circuit from the grid by means of a 27  $\mu\mu\text{F}$  condenser, and tapping this condenser down the tuned circuit.

In the original circuit, the required bias was fed to the RF and mixer grids *via* the coil through a resistor in parallel with the series tuning condenser. It is felt that this practice is to be deprecated at the frequencies concerned, since it makes operation considerably more noisy; hence, in the modification the grids of both the RF and mixer stages were isolated from the tuned circuit, and a suitable resistor placed directly from grid to ground for the purpose of bias feed.

The choke used in the anode circuit of the RF stage in place of the original 10,000-ohm

**Table of Values**

Fig. 1. The RF-27 Unit showing modifications for Two Metres

Original Components	R8, R12 = 100,000 ohms
C1, C2, C8, C9, C10, C11, C18, C19, C20, C21, C22, C23, C27, C34 = 500 $\mu\mu\text{F}$	R14 = 5,600 ohms
C5 = 6.5 $\mu\mu\text{F}$	R5 = 150 ohms
C16, C31 = 7.5 $\mu\mu\text{F}$	R10 = 100 ohms
C6 = 13.5 $\mu\mu\text{F}$	R9 = 1,000 ohms
C14, C30 = 15 $\mu\mu\text{F}$	R11 = 10,000 ohms
C28 = 20 $\mu\mu\text{F}$	
C15, C37 = 75 $\mu\mu\text{F}$ (modified)	Modification Components
C33 = 100 $\mu\mu\text{F}$	M1, M1A, M2, M3 = See Coil Details
C25 = 10 $\mu\mu\text{F}$	M4 = RFC
V1, V2 = EF54	M5, M6, M7 = 27 $\mu\mu\text{F}$
V3 = EC52	M8 = 8 $\mu\mu\text{F}$
R1, R7 = 2,200 ohms	M12 = 2,000 ohms*
	M9 = 4,700 ohms
	M10, M11, M13, M14 = 270,000 ohms
	M15, M16 = VS70 Stabilisers

\* Dependent on HT line voltage. Correct value given by M12 adjusted for 200 v. on load.

resistor was obtained from an IFF set and has the reference number 10C/5741. If this choke is not available it can be made by winding 27 ins. of fine wire on a 1/4-in. former to a length of 1 in.

**Mixer and IF Stages**

The original coupling condenser between RF and mixer stages was 100  $\mu\mu\text{F}$ . A large amount of the mixer noise first experienced was found to be due to the high damping this condenser imposed on the mixer grid circuit. By suitably reducing its value, and tapping down the mixer coil, a reduction in noise was effected, and an increase in signal level obtained.

**COIL TABLE**

**RF STAGE**

- M1. 1 1/2 turns 18 SWG, 5/16 in. inside diameter to length of 3/8 in. Grid tapped down 1/2 turn from "hot" end.
- M1A. 4 turns 24 SWG, polystyrene insulated, 5/16 in. inside diameter.

**MIXER**

- M2. 1 1/2 turns 18 SWG, 5/16 in. inside diameter to length of 3/8 in.; input from RF stage tapped down 1/2 turn from grid end.

**OSCILLATOR**

- M3. 2 1/2 turns 18 SWG, 5/16 in. inside diameter to 1/2 in.

The mixer grid circuit is series tuned, but the section of the three-gang condenser concerned is considerably reduced in capacity by the simple expedient of removing all but one of the rotor plates. The oscillator section of the tuning bank is also reduced in capacity until only one plate is left on the rotor. (The plates not required can easily be removed by gripping them one at a time in a pair of long-nosed pliers, giving a slight twist, and a sharp pull. The plates left are, in each case, end plates.)

Apart from coil changes, and the addition of stabilisation, the oscillator circuit is unmodified. Consideration was at first given to the idea of harmonic mixing, thus allowing the oscillator to work at a lower frequency; it was decided, however, to try the existing oscillator circuit at the required higher frequency. The performance far exceeded all expectations, and apart from warm-up creep over the first ten minutes, the oscillator drift is negligible.

### Receiver Coupling

The link between converter and main receiver is 80-ohm coaxial cable. In order to eliminate IF breakthrough as far as possible, the original coax line in the RF-27, which terminated at the Jones plug at the rear, was taken out. A new length of coax was run through the hole left by the removal of one of the spring spikes (rear of unit) and connected to the output coupling condenser, as was the original coax. This new run of cable must be of sufficient length to connect directly to the receiver A and E terminals.

The IF coil in the unit trims between 7 and 8 mc by means of the iron core, and the writer has found that 7.6 mc was the best frequency to use to avoid breakthrough. (Some IF coils are loaded with a 10,000-ohm resistor, which should be removed.) It will be found that the peaking of this IF coil is quite sharp and consequently it is impracticable to tune the receiver; but by leaving the receiver set, and tuning the converter, IF breakthrough is minimised. In the version of the RF-27 as converted the range 144 mc to 146 mc spreads from 50 deg. to 150 deg. on the dial. That is 100 divisions of the 180 division dial—a spread which is quite adequate.

### Setting Up

To get the converter operational, the receiver and converter should be switched on 20 minutes prior to alignment. By means of the slug in the IF coil, and with the receiver

set on 7.6 mc (or the chosen IF) the IF coil should be peaked for maximum hiss in the receiver. One could rely upon received local signals for the alignment procedure, but this method is most unsatisfactory. The use of an accurate signal generator is advised, which if not already in the possession of the constructor, should be "begged, borrowed or otherwise acquired."

After allowing the generator time to become stabilised on a frequency of 36 mc or 72 mc, the latter being preferable, the output lead should be laid near the mixer coil. With the dial set to about 150 deg., the oscillator trimmers should be set so that the modulated tone of the generator is heard. During the alignment operation, the receiver RF gain should be fully on and the AF gain suitably reduced. The receiver S-meter can be used as a reliable guide to output.

By means of the attenuator control on the signal generator, or if this is not too effective, by increasing the distance between generator and converter, the input signal should be kept down to a reasonable level. An S5 meter signal is convenient.

Having now set the oscillator, the mixer trimmers can be adjusted for maximum output. In all probability there will be a great increase in output as the circuit is brought into line, and the generator output must be reduced in step, by either of the methods described in the preceding paragraph.

Finally, the RF stage trimmers are adjusted, as are those of the mixer, with the panel trimmer at half capacity. At no time should it be necessary to make a direct connection between the unit and the generator's "hot" output lead. It should only be necessary to "show" the hot lead to the coil concerned.

### Final Adjustment

Once signals are being received, the final trimming of the RF and mixer stages can be undertaken using these signals, in order to get that "last ounce." Note, however, that strong local signals should *not* be used for this purpose.

The input to the converter is designed for 300-ohm line, since this has only small losses at these frequencies. Comparison between figures for 75- to 80-ohm line and 300-ohm line proved rather enlightening:

75-ohm line—attenuation per 100 ft. at 144 mc is of the order of 7 dB, while its capacity per foot is approximately 19  $\mu\mu\text{F}$ .

300-ohm line—attenuation per 100 ft. at 144 mc is of the order of 3 dB, while its capacity per foot is approximately 6  $\mu\mu\text{F}$ .

### Input Arrangements

Most of the original work on the unit was done with a simple dipole made from wire strung tautly between insulators on a wooden batten, and fed into the converter with a short length of 75-ohm line. Aerials are, however, of major importance on Two Metres! On the erection of a simple three-element beam coupled through 300-ohm line, the improvement in all S-meter readings was astounding—not only due to the theoretical gain of 9 dB of the beam, but also because of the use of more efficient feed line.

Since it is impossible to determine how much use the valves in a purchased RF-27 have had, it is advisable to obtain spares. While some EF54 valves function satisfactorily at lower frequencies, they may not do so in the converter due to the higher frequency of operation. Should the converter fail to give good results, therefore, please try changing valves before writing to the Editor!

It is hoped that this article will encourage more activity on Two Metres, and also that it will show that simple gear can be made to give good results.

### WARNING — “TRIPLER FOR SEVENTYCEMS”

It has been suggested that in the circuit on p.142 of the May issue, half the filament of the 8012 would be shorted to earth if grounded coax with a pick-up loop is used to apply 2-metre drive. Hence, the 8012 should be operated either with both sides of the AC supply “in the air” (with centre-tapped LT for the cathode return) or a blocking condenser of about 500  $\mu\text{F}$  be used between C1 and the Pye socket. Some further notes on this point will appear in our next issue.

### HIGH STABILITY VARIABLE FREQUENCY OSCILLATOR

Demonstrated at the Physical Society's Exhibition by Mullard Ltd. was a commercial VFO, which enables the frequencies of transmitters in the high frequency broadcast bands to be made infinitely variable, while complying with the regulations of the International Telecommunications Union. These require that deviations from the nominal value should be less than  $\pm 0.003$  per cent. To attain this degree of stability it is usual to resort to crystal control, which has the disadvantage that new crystals must be obtained when channels are re-allocated. The Mullard Variable Frequency Oscillator overcomes this disadvantage.

The oscillator output, which is variable between the limits 1.0 to 1.7 mc, is passed through a tuned buffer amplifier to a frequency multiplier that produces either the second (2-3.4 mc) or third (3-5.1 mc) harmonic as required. A final wideband power amplifier delivers 0.5w. into 70 ohms. The oscillator proper is housed in a simple oven, the temperature of which is controlled to  $\pm 1^\circ\text{C}$ . In conjunction with high stability components, notably the Mullard Precision Variable Capacitor (which is particularly suitable for an application of this sort), this degree of temperature control is adequate to keep frequency variations within the required limits.

Frequency is set up by rotating the Precision Variable Capacitor through a slow-motion drive, which may be locked. A vernier inductance trimmer is used for the final adjustment. During this process the oscillator frequency is continually measured by

a displaying frequency monitor, and in this way it is possible to set up to any frequency in the range within a tolerance of  $\pm 0.0001$  per cent. in a few moments. The frequency monitor may be used to check the frequency wherever necessary, and is, of course, available when the other oscillators in a transmitting station require adjustment.

In its final form, a Centralised Transmitter Drive Unit would consist of banks of High Stability Oscillators driven from common power supplies and employing a single frequency monitor for adjustment purposes.

### WN/KN CALL-SIGNS

In the American amateur licensing set-up, the N in either the W or K prefix indicates Novice—that is, a licence issued for a period of one year only to an amateur who has passed a simplified test (5 w.p.m. Morse, and elementary theory) entitling the holder to operate CW only in the 3700-3750, 7175-7200 and 21100-21250 kc portions of the amateur bands, with phone on 145-147 mc. When the general-class licence is obtained (13 w.p.m. Morse and the regular technical examination) the N is dropped from the call-sign. The K prefix is, of course, used in those licensing districts for which the W series has run out.

### XTAL XCHANGE

Below are the offers of those who would like to exchange crystals. This space is free for such notices, which should be set out in the form shown here—buy-or-sell announcements can *not* be accepted for appearance under this heading, and all negotiations should be conducted direct.

G2ATD, 5 Sussex Road, North Heath, Erith, Kent.  
Has Bliley 5257 kc crystal, mounted and certificated. Wants any Top Band frequency 1800-1850 kc.

G3GEN, 113 Stroud Road, Gloucester.  
Has 3500 (octal based), 6006, 6008 (FT-243), 6059, 7000, 7040 and 8000 kc (3/4-in. mounting) crystals. Wants frequencies 2250 and 5750 kc.

G3LJU, 1 Dragon Junction, Harrogate, Yorks.  
Has crystals 5910, 6021, 6160, 6270, 6550, 6561, 6630, 6790 and 8000 kc, all 3/4-in. mounting. Wants 3515, 3525, 3540, 3550, 3565, 3575, 3580 and 3585 kc, same mounting.

WHILE we are still waiting for a sustained spell of really good EDX conditions, things were not too bad for GDX and the nearer Europeans during May 9-13, and there have even been flashes of excitement—with, however, activity rather on the low side during most of the period.

One of the most interesting, and significant, occurrences was the appearance of an EA on the two-metre band in the late evening of May 10. He was heard by GC2CNC (Jersey, C.I.) calling G6NB at about 2230 BST, but only at RST-338 and in QSB, on 144.2 mc; unfortunately, at the moment of signing, he was too thin to be positively identified; Bill had just put out a CQ, so this unknown Spaniard was evidently receiving G6NB all right, and from this we may take it that he has a reasonable receiver and aerial system. At the time of writing, it has not been possible to check back on EA activity on VHF at that period, so it must remain rather nebulous.

However, assuming this EA is a live one, it means that the immediate possibilities for new countries workable on Two Metres are now Finland, Luxembourg and Spain.

Sunday, May 9, saw the RSGB Field Day event, with fine weather, quite good conditions, and a very reasonable level of activity. From our reports, some 50 stations actually operating /P are logged as having made contacts, with G3GWB/P (nr. Northampton) probably the outstanding performer; very smooth operating, with few opportunities lost, contributed to a high total score from a site near the middle of England. Interesting GDX possibilities during this event were GM2HCJ/P, giving Kirkcudbrightshire and worked by many, and G2DKH/P for Co. Durham. From the Isle of Wight, G5TZ/A worked no less than 30 portables and heard about 12 more; EI2W gave contacts to five /P stations, including G3GWB/P; G3WW (Wimblington, Cambs.) scored for 11 portables, with G2BAT/P down in St. Agnes, Cornwall, as a very nice piece of GDX. High signal levels

# VHF BANDS

A. J. DEVON

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Conditions Remain Patchy—

EA Reported on Two Metres—

EDX Opening on May 12—

Station News and The Tables—

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were usual, and during the morning and late afternoon there were enough stations on to make fast operating essential for maximum scoring.

G5MA/P was on from his Rutland site and had a good day—he also had the unusual experience of someone else (G2HDU, Oakham) turning up to work /P from the same site; but it was mutually agreed that it would be better for both if they separated; so G2HDU/P found another hill in the not-very-large county of Rutland.

## Survey of Conditions

Apart from the portables, conditions on May 9 were good enough to give G3BW (Whitehaven, Cumb.) a mid-day contact with G6NB, and G5TZ/A worked G2HGR, G3CC and G6XM for excellent contacts up in the North.

Good GDX conditions continued into the 10th and 11th, when, in addition to the EA/G6NB episode, EI2W heard GC3EBK on the 11th; during the latter part of that evening no less than 20 stations were logged at EI2W, with G8OU (Ashted, Sy.)

a very good signal at midnight.

On the evening of May 12, we in the southern part of the country had a very good—but rather short and somewhat localised—spell of EDX. The coverage apparently did extend up into Lincolnshire, as G5BD (Mablethorpe) worked six F's in about three hours. Conditions were exceptionally good further south, with F's and ON's coming in at very high signal levels, there being no fading at all; it was a rare opportunity for quite a number of G's in S.E. England, some of whom were able to make their first Continental QSO's.

G5MR (Hythe, Kent) remarks that "in my 5½ years' experience on two metres, I have never heard such colossal signals, even from local stations." As well as the Continentals swamping his receiver, several stations in the London area not usually strong in Hythe were coming in at S9. New stations worked by Vernon were F9SM (Paris) and ON4VP (Ghent). An interesting comment in his report is that signs of abnormal *visual* refraction were noticed over the Channel by G5MP (also in Hythe) during the evening of May 12.

No doubt met. man G3EGB will have the answer to all this in our next, but, in the meantime, see his comments in "VHF Weather Report" relative to this particular period—they are interesting.

## The Tables and Calls Heard

The total of movements claimed this time is 33, and we also have some very useful lists in the Activity Report.

Here your A.J.D. must have one of his periodical moans—only three of the calls h/w lists were received in anything like the form which enables them to be pasted down without having to be tidied up, sorted out and typed with "call-signs in alphabetical and numerical order." Could we *please* have them, too, on a sheet separate from the report or letter itself, and with call-sign and location at the top of the list, period covered at the bottom, and the call-signs in the correct order in between—in fact, if you write

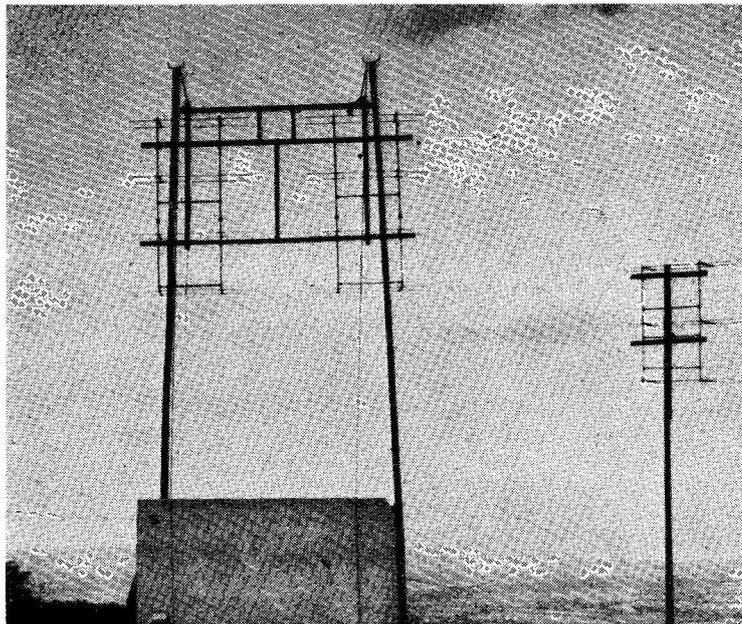
out your list just as you expect to see it in print, you just cannot go wrong (and it saves A.J.D. hours of perspiring profanity). So would you do it thataway, please—*thank* you!

Harold keeps G5YV just in front in All-Time Counties, and is comfortably in the lead in the Annual table. The latter shows several new entrants this time, as well as 16 movements.

We would again ask all who qualify for the Tables to let us have their scores, so that the records can be kept up-to-date. It is probably true that by now there is a certain amount of dead wood in All-Time Counties, but it is proper that every station who has ever reported should be kept in, since this—like all our other achievement tables—is a record of results, and the purely competitive nature is a secondary consideration. One is well aware that there are those who affect to despise what they call “ladders and contests” and deride what they describe as “county chasing” (and they are entitled to their opinions)—but what is often forgotten when such an argument arises is that those who do not record their results somewhere are withholding statistical information which one day may be of the utmost importance for the future of Amateur Radio. Your old A.J.D. has not spent the best part of 30 years in Amateur Radio and thinking about its problems without finding out by now which way the wind blows; all who may be reading this bit can take it that the *Magazine* Tables, in which so many call-signs now figure, have a significance far beyond what might be called their immediate operational interest.

### Reports and News

GC2CNC in Jersey has managed to work (with G5TZ/A as linking station) GC3EBK in Guernsey, and since then GC2FZC, also in Guernsey . . . G3CCH (Scunthorpe) reports for the Tables, and is making steady progress, with consistent activity. G3FIH (nr. Bath) is in a new QTH, so is starting all over again in Annual Counties—he found conditions



The 32-element fixed-direction beam at EI2W (Dublin), specially built and orientated to radiate on the heading for Scandinavia. Supported between two poles, it can be raised or lowered easily by means of a rope-and-pulley arrangement. To the right is the 12-element beam in normal use at EI2W for general coverage. This photograph gives a good impression of the clear get-away from the EI2W site.

better during the warm spell, May 10-12, getting a good signal from EI2W on the 10th, and hearing F's on the 12th.

G3BNC (Southsea) also notes Europeans on May 11, with “French stations rolling in at anything up to 40 dB over S9.” Two more counties add to the score, with GW5MA/P and G3IOO. G3IOE (Newcastle) says that “to show how things are, G6NB has only been heard twice and very weakly at that.” He has been trying for EI and GI, but cannot receive either EI2W or GI5AJ when others are reporting big signals from them. G3JGJ (Plympton) asks us particularly to say that he would welcome any SWL reports; he is still working (and hearing) only semi-locals.

G3WW (Wimblington, Cambs.) did not realise that the grounded-grid section of his 6BQ7 had gone down, so for some days was only getting locals, direct on the mixer side; when this was remedied G5MA was S9+, and on April 26 G3WW had good contacts with the Midlands and G5TZ/A;

on May 8, some 16 stations were heard or worked in an hour and a half, with G2BM an interesting new one in Wakefield, Yorks.; on May 10, G3WW stalked G3GNJ (Bristol) without success and heard G3BW; on the 11th, EI2W was worked for the first time in months, G3GNJ was tried for again (same result), but G3FW (Market Harborough), newly on the band, was worked, their last contact having been on 40 metres in 1939.

EI5Y will probably be pleased to know that he has been heard by G3IER (Cheltenham), who reports May 10-11 as good evenings, with several new stations worked. G2CZS (Chelmsford) was there for the EDX on May 12, and having worked G3CC in Hull, went on to knock off three F's and ON4IE—all this during TV-time that evening; says G2CZS, “it was hard luck on those who watched TV all the evening, but really they have only themselves to blame for missing the best conditions.” The score at G2CZS is now 121S worked, but only 51

QSL's to hand, with cards still owing for contacts QSL'd over a year ago.

G3DO (Sutton Coldfield) reports three new counties worked—G2BMZ for Devon, G5MA/P for Rutland, and GW3GWA for Denbighshire; G3DO raises a query brought up at regular intervals: How does EI2W score? Answer: He gives his county and his country, as do all Irish stations.

G3HHY, who spends most of his time in London but puts in bursts of intensive activity when at home in Solihull, is one of those who likes two-metre operation for its own sake; though he has never yet experienced a real DX opening, he is working away to improve his gear at every possible opportunity. He now has his beam at 50 ft. at a site 490 ft. a.s.l. and clear in all directions; a 26-valve triple conversion receiver with three RF stages; 23 "honest watts" of RF into the beam; 30 dB of speech clipping in the range 500-2,500 c/s; works CW as well as phone, and when at home is on the band irrespective of activity, time of day or conditions! His next appearance is to be June 4-8 inclusive, and he will be looking for QSO's with all comers.

### Whitsun Expedition

This issue should be in the hands of most VHF operators soon enough for us to pass on the information that during Whitsun week-end, June 5/6, Bob will be over in Carmarthen signing GW5MA/P and operating on the Saturday and Sunday. From the home pitch, he was glad to work GW3GWA for a new one, assisted by G3IOO.

G8VN (Rugby), still with his indoor beam, heard G3BW, peaking to S7, on April 18, and since then has noted a general improvement in conditions, with more activity, particularly in the Midlands area; his calls h/w list—see Activity Report—speaks for itself in this respect, representing as it does less than a month's operating.

G5YV has not had any workable EDX, though he has, of course, heard southerly stations—

## TWO-METRE ACTIVITY REPORT

(Lists of stations heard and worked are requested for this section, set out in the form shown below, with call signs in alphabetical and numerical order).

G3IUD, Wilmslow, Cheshire.

WORKED: G2COP, 2CYN, 2HCJ/P, 2HGR, 2XV, 3A0O, 3APY/P, 3ATZ, 3ATZ/P, 3AYT/P, 3BPI, 3CUZ, 3DA, 3DQO, 3EAW, 3EGW/P, 3EJZ, 3EPW, 3ETI, 3FMI, 3GB, 3GB/P, 3GMX, 3GNC, 3GNI, 3GWB/P, 3HWF, 3HYH, 3HZK, 3IOO, 3IPH, 3IPH/A, 3IPZ, 3IWJ, 4JJ, 4SA, 5MA, 5MA/P, 5TH, 5VN/A, 5YV, 6FK, 6LC, 6MI, 6WF, 6XM, 6XX, 8QY/P, 8SB, 8SB/P, 8TR, G2HCJ/P, GW2CCU, 3GWA, 5MA/P.

HEARD: EI2W, 6A, G2AK, 2BMZ, 2DCI, 2FZK, 2HIF, 2HOP, 2HQ/P, 3BZK, 3BW, 3CC, 3CNY, 3DIV/P, 3DO, 3FIH, 3FRY, 3GHO, 3WW, 5BD, 5BM, 5UO, 5TZ/A, 6AG, 6NB, 6RH, 6VX/P, 8KL, 8OU, 8VZ, GM3EGW, GW2ADZ. (April 14 to May 13).

G3BRX, Wanstead, E.11.

WORKED: G2DUV, 2LW, 2MV, 3AEX, 3JLV, 5TZ/A, 5UM, 5YK, 6TA, 6FO, 6XH, 6YP.

HEARD: G5BD, 6AG, 6NB, 6RH.

GC2CNC, Jersey, C.I.

HEARD: EA4??, F8GH, 8TD, 9OK, G3AUS, 3GSM, 3GVF, 3JHM, 4PS, 4SA, 5TZ/A, 6NB, GC3EBK. (During early May).

EI2W, Dublin, Eire.

WORKED: EI2A, 3L, 5Y, 6A, 9C, G2AK, 2BWW, 2COP, 2DCI, 2HGR, 2HIF, 3ABA/P, 3AGS/P, 3BW, 3CNY, 3CRH, 3CUZ, 3CVK, 3DO, 3FRY, 3GB/P, 3GWB/P, 3GZM, 3IER, 3IPH/A, 3IWJ, 3WW, 4SA, 5TZ/A, 5VN/A, 5YV, 6NB, 6WF, 8KL, 8ML, 8OU, 8SB, G13QB, 5AJ, GM2HCJ/P, 3DIQ.

HEARD: G3BKQ, 3IUD, GC3EBK. (April 21 to May 12).

G8VN, Rugby, Warks.

WORKED: G2ATK, 2COP, 2FXK, 2HOF, 3ABA, 3APY/P, 3BIQ, 3BKQ, 3CKQ, 3CRH, 3DO, 3EJO, 3FD/P, 3FW, 3FUW, 3GHO, 3GNI, 3GWB/P, 3HHY, 3NL/P, 3WW, 4JJ/P, 5BM/P, 5IU, 5ML, 5YV, 6AG, 6CL, 6FO, 6VX/P, 6XM, 6YU, 8QY/P.

HEARD: G2FJR, 2HGR, 2OI, 2XV, 3A0O, 3BW, 3FAN, 3FMI, 3GEI/P, 3HWJ, 3IOO, 3IUK, 4SA,

5BD, 5MA, 5UF, 5YK, 6WF, 6XX. (April 18 to May 12).

G3IOE, Newcastle-on-Tyne, 3  
WORKED: G2DKH/P, 2DRA, 3CC, 3CCH, 3EGW/P, 5BD, 5YV, 6XM, GM3EGW. HEARD: G3APY/P, 3COJ, 3GWB/P, 3MY/P, 4JJ/P, 6NB, 6XX. (April 18 to May 9)

GW3GWA, Wrexham, Denbighshire.

WORKED: G2HIF, 2HGR, 3AGS/P, 3A0O, 3APY/P, 3ASC, 3ATZ, 3AYT/P, 3BOC, 3BW, 3CUZ, 3DA, 3DO, 3EPW, 3FMI, 3GB, 3HZK, 3IER, 3IOO, 3IUD, 3IWJ, 3PY/P, 3WW, 4SA, 5MA, 5TZ/A, 8KL, 8QY/P, 8TR. HEARD: G3BKQ, 3GNI, 5YV. (March 3 to May 13).

G3CGE, Southampton, Hants.

WORKED: G2ATT, 3ARL/P, 3BHS, 3FAN, 3GAV, 3GEG, 3ION, HEARD: G2MBZ, 2HCG, 3AGA, 3AWY, 3BNC, 3FIH, 3GHO, 3GVF, 3IIT, 3IRA, 3JFR, 3JHM, 4SA, 5NF, 5TZ/A, 6AG, 6NB, 6UH, GC2FZC. (During April only).

GC2FZC, Guernsey, C.I.

WORKED: G3JHM, 5TZ/A, GC2CNC, 3EBK. HEARD: G3BEX/P, 3BNC, 3FIH, 3FRG/P, 4JJ/P, 6AG, 6NB.

G3GVF, Harley Wintney, Hants.

WORKED: F8OB, G2AHL, 2DIO, 2DVO, 2IT, 2UJ, 3BEX/P, 3CCP, 3DJX, 3EGV, 3EUQ/P, 3FGB, 3FIY, 3FRG/P, 3FRY, 3FYY, 3GAV, 3GWB/P, 3HAZ, 3HXS, 3HZI, 3IOO, 3IRA/P, 3JFR, 3JHM, 3YZ/P, 4AU, 4PS, 4RO, 4SA, 5BD, 5NF, 5RZ, 5UF, 5YK, 6OU, 6XX, GW5MA/P.

HEARD: EI2W, F9CQ, G2AHP, 2BMZ, 2HCG, 2UN, 3APY/P, 3BKQ, 3DLU, 3DO, 3FIH, 3GNI, 3WW, 4KD, 5DS, 5LK, 5TZ/A, 5YV, 6AG, 6FO, 6JK, 6NB, 6RH, 6SG, 6TA, 6UH, 6WF, 8DA, 8OU, ON4BZ. (April 16 to May 15).

G2BRR, Woodford, London, E.18.

WORKED: G2BPC, 2CD, 2JU/P, 3AEX, 3CGQ, 3DFP, 3DIV/A, 3DVQ/P, 3EOH, 3JLV, 3JMA, 4CW. HEARD: 2AIH, 2ANT, 2DUV, 2FSY, 2MV, 3AGR, 3ANP, 3AWY, 3BEX/P, 3CWW/P, 3DIV/P, 3DJX, 3EUQ/P, 3FAN, 3FIY/P,

3FRG/P, 3FRQ/P, 3FSH, 3FYY, 3GOP, 3GSM, 3GVF, 3IOO, 4AU, 4HQ, 4HQ/A, 4JJ/P, 4RO, 5DS, 5LK, 5MA/P, 5TZ/A, 6AG, 6CB, 6JP, 6LL, 6NB, 6NF, 6RH, 6YP, 8GD, 8KW, 8KW/P, 8LN, 8OU. (April 3 to May 14).

G3FYY, London, N.W.2.

WORKED: G2ABD, 2AIH, 2BBN, 2BPC, 2DUV, 2FTS, 2FZU, 2UJ, 2UJ/P, 3ABA/P, 3BEX/P, 3DIV/A, 3DIV/P, 3DVQ/P, 3FD/P, 3FGB, 3FIY/P, 3FRG/P, 3GHS, 3GSM, 3GVF, 3GWB/P, 3HSC, 3HWJ, 3ISA, 3JFR, 3JLV, 3JMA, 3JQN, 4HQ, 5LK, 6AG, 6JP, 8KW/P, 8TB. (April 12 to May 9).

G3FIH, Bath, Somerset.

WORKED: G2BAT/P, 2BMZ, 2FTS, 3BNC, 3DIV/P, 3DO, 3EUQ/P, 3FAN, 3FKO, 3FMO, 3FRY, 3GAV, 3GNI, 3GOPP, 3HSD, 3HSD/P, 3IER, 3NL/P, 4NC, 5BM/P, 5FF, 5LK, 5US, 6AG, 6RH, 6VX/P, 6XX, 8OU, GW2ACW, 3EJM/A, 5BI, 8UH.

HEARD: EI2W, F8OB, G2AIW, 2YB, 3APY/P, 3BHS, 3EPW, 3HWF, 3IRA, 3MA/P, 3YH, 4SA, 5MA, 5NF, 5TZ/A, 6NB, 6WF, 8QY/P, GW8SU. (April 21 to May 15).

G2CZS, Chelmsford, Essex.

WORKED: F3DW, 3LQ, 8GH, 8KF, G2DIO, 2FQP, 2KF, 2MV, 2UJ, 2UJ/P, 3CC, 3CGQ, 3DIV/A, 3DIV/P, 3EMU, 3FD/P, 3FSD/P, 3GJZ, 3GVF, 3IEX, 3IPG, 3IRW, 3JMA, 4HQ, 5TZ/A, 6AG, 6CB, 6RH, 6SG, 6TA, 6YP, 8KW/P, 8LN, 8OU, ON4IE.

HEARD: F9MF, G2BMZ, 2FXK, 2XV, 3CWW/P, 3FAN, 3FIY/P, 3FRG/P, 3HSM, 3INU, 5BD, 5JO, 5MA/P, 6NB, ON4HN. (March 22 to May 13).

G5MA/P, Nr. Oakham, Rutland.

WORKED: G2AIW, 2AK, 2BWW, 2DKH/P, 2FCL, 2FNW, 2FOP, 2FTL, 2HDU/P, 2HOP, 2HQ/P, 2XV, 3ABA/P, 3APY/P, 3AYT/P, 3BK, 3CC, 3CCH, 3DO, 3DOV, 3EGW/P, 3FAN, 3FD/P, 3FUL, 3FZL/A, 3GWB/P, 3HWJ, 3HZE, 3IIT, 3IOO, 3IUD, 3IUK, 3IWJ, 3WW, 4BP/P, 4JJ/P, 5BD, 5BM/P, 5DS, 5JO, 5TZ/A, 6MN/P, 6NB, 6UJ, 6XM, 8NM, 8OU, GW2ADZ. (May 9 only).

and even some as far North as G5BD—in QSO with Continentals. Harold has changed from an 829B in the PA to a QQVO6-40; this required plate lines no less than 3½-ins. longer than those used with the 829B, which, in

terms of RF efficiency, obviously says something. He is building the G3HAZ tripler for 70 centimetres, as also is G3DA (see p.227).

Another comprehensive calls h/w list this time is from G3IUD (Wilmslow, Ches.), who stakes

**SEVENTY CENTIMETRES**

ALL-TIME COUNTIES WORKED  
Starting Figure, 4

Worked	Station
23	G3BKQ
15	G4RO
13	G2XV
9	G2HDZ, G3IOO
6	G5YV
5	G3FUL, G3IRW
4	G2DDD, G2HDY

*On working four Counties or more on the 70-centimetre band, a list showing stations and counties should be sent in for this Table, and thereafter new counties worked notified as they accrue*

claims for the Tables, and has himself been giving a lot of people an interesting QSO; he runs 50w. on 144.48 mc and hears a number of GDY stations he would like to work if only they would come back to his calls! G3IUD is also on 70 centimetres, frequency now 433.5 mc.

GW3GWA (Wrexham, Denbighshire) is still running 20w. with his indoor 4-element beam, but is beginning to feel the need for getting it outside, which he hopes to do this summer; the new converter at GW3GWA is EC91-EC91-6AK5-12AT7-12AT7 into a BC-348. Later this year he hopes to go /P in Denbighshire, and is investigating possible sites. G6TA (London, S.W.12) goes up in the Tables, with G3CFK for Norfolk as an all-time new one, and now has 300S for his total of different stations.

After a long absence, it is good to hear again from G3BW (Whitehaven, Cumb.), who writes to say he is "still alive and kicking on two metres," with new claims for the Tables; G3BW says that he finds activity rather low, and puts this down to the malign influence of TV; often, during TV hours, the band sounds good, but there are no stations to be heard; he is just completing a big rebuild, in the course of which all parts of the two-metre equipment have had attention—his Tx sequence is now 12AT7-5763-832-829B, with a new CC converter; the beam is a

4/4 Yagi, which he is also thinking of replacing.

G2BRR (London, E.18) reports for himself and for G3BRX, the station of the Wanstead & Woodford Radio Society, also active on two metres, every Tuesday from 7.30 p.m., from a good site with a 4/4, a cascade into an R.1155 and a modified Type 50 transmitter. Calls h/w lists appear in the appropriate space.

Down in Worthing, G3JHM moves in the Tables, with G5RZ for Beds. and GC2FZC for Guernsey; F8GH and F8OB have been worked most evenings around 2200 BST, and for those who would like to know, F8OB (Gournay, Seine-Inf.) is on 145.070 mc.

GM3DIQ (Stevenson, Ayr) finds that he and G6NB have been hearing and calling one another at different times—each feeling that the other's Rx was the trouble; this seems to be another manifestation of the "one-way conditions" phenomenon, often noted in this space, and as strenuously denied by some as it is supported by others. Clarke thinks that, by reason of his location, he may be getting the DX a few hours before the rest of GM—and losing it a bit sooner—owing to the break-up of the layer formation over the Galloway Hills by the time an inversion has developed across the border suitable for G-GM working. For the field day on May 9, he reports GM3FGJ/P in West Lothian and GM6WL/P in Renfrewshire as having been active, and interesting possibilities in the Counties chase. The only G heard by GM3DIQ on this occasion was G3BW. With the GM's, May 11 was a good evening for GDY, but with everybody looking for Continentals, the only contact Clarke had was with G3CCH (Scunthorpe), who was RST-589 steady.

G3FYF (London, N.W.2) worked ten /P's on May 9, his best being G3ABA/P near Coventry; he makes an amusing comment about a certain G who was much in demand one evening during the period, when conditions were good, but said he was going QRT "because it was so cold in the shack." Says G3FYF: "That just shows how blasé operators in

**TWO METRES**

ALL-TIME COUNTIES WORKED LIST  
Starting Figure, 14  
From Fixed QTH Only

Worked	Station
65	G5YV
64	G3BW, G6NB
61	EI2W (209), G3BLP (630)
59	G3EHY
57	G2OI (349), G8OU
56	G8SB
55	GW5MQ
54	G2HIF (200)
53	G2AJ (519), G2HDZ (416), G3GHO, G3WW, G4CI, G4SA
52	G2NH
51	G5BD, G5BM, G5DS (531)
50	G3ABA, G3FAN, G3IOO, G6XX (238)
49	G3CCH (208), G5MA
47	G5WP
46	G2FJR, G4HT (476), G5BY, G5ML (280), G6YU (205)
45	G2XC, G6XM (356)
44	G3BK, G3HAZ (262)
43	G2AHP (456), G3BA, G3COJ, G4RO, G5DF
42	G3GSE (424)
41	G2FQP, G3DMU, G6CI (184)
40	G3BNC, G3CGQ, G5JU, G8KL
39	G2IQ, G3GBO (434), G3HBW, G3VM, G8DA, G8LL (325)
38	G2FCL (234), G3APY
37	G2DDD, G2FNW, G2FZU (180), G6TA (300)
36	G2HOP, G3CXD, G6CB (312), G8IP
35	G2DVD, G3FZL, G3HCU (224), G3HWJ
34	G3BKQ, G3DO (220), G3WS (153), G8IC
33	G3IUD (120)
32	G2FVD, G5MR (208), G8VR, G8QY
31	G3HXO, G5RP
30	G3FRY, G3GOP (208), G3GVF (129), G3IRA, G5NF, GW8UH
29	G3AGS, G3AKU, G3BJQ, G3FU (194)
28	G3DLU, G3FIH, G3IER, G8DL, G8VN (111), GM3BDA
27	G3DAH, G3ISA (160), G6GR, GM3EGW
26	G2CZS (100), G2DCI, G3AEP, G3CFR (125), G3FYF (124), G3SM (211), G4MR (189)
25	G5SK
24	G3FD, G3FXG, G3FXR
23	G3CWW (260), G4LX, G5PY, G6PJ, GM3DIQ
22	G3AGR (135), G3ASG (150), G3BPM, G3HIL
21	G2AOL (110), G3IWJ, G6XY
20	G3EYV, G3HSD, G3YH, GW3GWA
19	G3FEX (118), G3GCX, G5LQ (176)
17	G3JMA, GC2CNC
16	G3FRE
15	G2BRR, G3IWA
14	G2DHY, G3CYY

*Note: Figures in brackets after call are number of different stations worked on Two Metres. Starting figure for this classification, 100 stations worked. QSL cards are not required to verify for entry into this Table. On working 14C or more, a list showing stations and counties should be sent, and thereafter added to as more counties are worked.*

good locations can become! If ever I heard GDX stations calling me, I would hang on working until I froze to death rather than go QRT!" He also draws attention to the fact that there happen to be no VHF stations in some of the highest parts of London, e.g. Hampstead and Mill Hill at about 450 ft. a.s.l., whereas his own district is at sea level.

## TWO METRES

COUNTRIES WORKED SINCE  
SEPTEMBER 1, 1953

Starting Figure, 14

Worked	Station
51	G5YV
44	G3GHO
43	G3IOO, G4SA
42	G6XX
41	G3WW, G5MA
35	G3EPW, G5DS
34	G2DVD, G2FJR, G2XV
33	G3DO
32	G2AHP, G5BM
31	G3CCH
30	G5ML
29	G3GVF, G3IRA
28	G2DDD, G3IUD
27	G3CUZ
26	G2FCL, G3BW
25	G3WS, G6TA
24	G2CZS, G3FYY
23	G2HDZ
21	G3JFR, G4RO
20	G5MR, G8VN
19	G3FUW, G3IER
18	G3FIH
17	GW3GWA
16	G3JHM
15	G2AOL, GM3DIQ
14	G3FIJ

*Note: This Annual Counties Worked Table opened on September 1st, 1953 and will run for the twelve months to August 31, 1954. All operators who work 14 or more Counties on Two Metres are eligible for entry in the Table. The first list sent should give stations worked for the counties claimed; thereafter, additions claimed need show only stations worked for each county as they accrue. QSL cards are not required for entry in this table.*

Our mystery man of last month turns out to be G3GVF (Hartley Wintney)—so he is duly entered in the Tables. G3CGE writes from Southampton with details of recent activity, and we also have an interesting report from GC2FZC (St. Peter Port, Guernsey), who is apparently hearing more than he can raise in the way of G stations, but has now worked his Island neighbour, GC2CNC; with three GC's now active on two metres, it is well worth heading their way when G5TZ/A is a loud signal and Devon stations can be heard.

One of the Club stations out for the two-metre field day on May 9 was GW3ATZ/P, nr. Mold (Flints.), operated by four members of the Chester and District A.R.S.; they worked 20 stations, but "not much in the way of DX."

### Eire and Finland

We now have, from EI2W, fuller details of the OH situation. The Finns actually available are: OH2OP, 144.00 mc, running 200w. input with a 4/4 fixed on the U.K., a 6AK5-6J6 Cascode/NC100X as receiver, calling and listening at intervals during 1930-2130 GMT. Then there are OH2NM, with 50w. into a 3/3 Yagi, also on 144.00 mc, Cascode/HQ129X receiver, on with OH2OP; OH2NY, on 144.12 mc with 100w. into a 5-ele beam, and a push-pull triode receiver, operating any time 1000-2000 GMT; OH2SF, with 50w. and a 3-ele beam, with a Collins converter; and OH5PN, also on 144.00 mc dead. OH2NM is at Imatra in S. Finland, and OH5PN in Kotka; the other three are in Helsinki. OH2OK (Helsinki) is licensed for 500w. on two metres, and will be on shortly; in the meantime, he is QRX only with a Cascode and 4/3 Yagi.

This is a most impressive showing—all these stations are well equipped, evidently know what's what on two metres, and are on regularly, determined to work DX. Starting from May 20, EI2W/OH2OP have been on regular schedule when conditions seemed favourable, and will continue till something happens; times are

## TWO METRES

### COUNTRIES WORKED

Starting Figure, 8

- 15 G4MW (DL, EI, F, G, GC, GD, GI, GM, GW, HB, LA, ON, OZ, PA, SM).
- G6NB (DL, EI, F, G, GC, GD, GI, GM, GW, HB, LA, ON, OZ, PA, SM).
- 14 G3GHO, G5YV, ON4BZ
- 13 G3BLP, G3CCH, G5BD, G6XX
- 12 G2HDZ, G2HIF, G2XV, G3WW, G6LI, G6RH.
- 11 G2AJ, G3ABA, G3IOO, G4RO, G5UD.
- 10 EI2W, G2FOP, G3BK, G3EHY, G3GHI, G3HAZ, G4SA, G5DS, G5MA, G8IC, GW5MQ.
- 9 G2AHP, G3BNC, G3FAN, G3FIJ, G6XM, PA0FB.
- 8 G2XC, G3GBO, G3GSE, G3HCU, G3VM, G3WS, G5BM, G5BY, G5ML, G5MR, G8SB, GM3EGW

1930-2130 GMT, with EI2W transmitting at five minutes past each half-hour.

As Henry of EI2W puts it, this is not a private party; anybody can come along, and he says "I'm sure many G's would like to join in the hunt for this choice DX!" Yes, surely, and our thanks are due to him for the hard work and enthusiasm with which he has organised what will be a very interesting EDX attempt.

Also in the realm of interesting DX is a note we have that GM3ANG, GM3HGA and GM3HTH, all of Shetland, are either on two metres or coming on shortly. Remotely located as they are, they will be able to get organised on the band by working one another before settling down to look for the DX. It is difficult to assess the possibilities, but obviously there should be opportunities with the GM's and very good chances across to LA. Lerwick in the Shetlands is 125 miles from the nearest point on the mainland of Scotland, and 225 miles from Bergen, which is just about the nearest place in Norway, over an all-sea path; so good luck to these three GM's.

### On 70 Centimetres

G3BKQ (Blaby, Leics.) goes up to 23C in the Seventycems Table, having worked G5YV for Lancs.,

who was S7-8 on phone. G2FNW (Melton Mowbray) and G3IOO (Oswestry) are very good signals with him on 430 mc, the latter at 86 miles being workable at any time under any conditions; and the same applies to GW2ADZ/G3BKQ at near-enough the same distance. This can be put down to much improved gear at both ends.

### Frequency Shifting

Anent the "Warning—Aircraft" note in our last, G3IOO reports that he has been told officially to clear his usual frequency and is now on 144.260 mc, tripled to 432.78 mc. His old frequency of 144.18 mc is claimed as an aircraft channel!

The experience of G3IOO noted here, and the only case

reported so far, may conceivably lead to other operators being similarly involved, and this could cause considerable disruption of the Zone Plan, with consequent irritation all round.

For the moment, movements *within the Zone* area will probably meet requirements, and for most people a change of crystal frequency is no particular worry. But it may mean so much changing as to make VFO-working desirable, if not necessary; a few stations are already VFO-controlled in their Zones, notably G6XH (Chorleywood, Herts.), who has been VFO in Zone G for some time now—with, it may be added, entirely satisfactory results and a very stable signal. He uses the crystal oscillator-mixer arrangement;

other operators are beginning to think along the same lines, and we shall probably have more to say on this topic in future issues.

In the meantime, whatever you may have to do, please keep within your Zone area.

### In Conclusion

Well, friends, that seems to be about it for this time—many thanks for a large batch of interesting and useful reports, and your A.J.D. will sign now with his usual request for more next time, the dead-line being **Monday, June 21 certain**—address it all to: A. J. Devon, "VHF Bands," *Short Wave Magazine*, 55 Victoria Street, London, S.W.1. With you again on July 9—which seems a long way off at the moment of writing this!

## VHF WEATHER REPORT

PERIOD APRIL 17 TO MAY 14

A. H. HOOPER (G3EGB)

**N**OTHING spectacular to report, although there have been a few openings, mainly to western Germany and towards Bavaria.

The promising situation which developed just before Easter was short-lived, and by the Bank Holiday the anticyclone, still without propagation anomalies, was collapsing. Then followed a week of cold easterly winds with a cloud layer barring all sunshine from eastern and south-eastern districts. The cloud was thin—the sun nearly breaking through each afternoon—and observing the stratified appearance, the lone operator could expect a temperature inversion and a humidity deficit immediately above its upper surface, thereby yielding a "reflecting" layer over an appreciable area. Although the cloud was fairly high, and any layer above it not of the strongest, enhanced propagation was a distinct possibility. In the later stages the controlling anticyclone drifted south over Scotland, and the cloud broke up, leaving the invisible reflecting layer at between 4000 and 6000 feet over most of the British Isles. The poor conditions from April 29 were associated with a number of depressions, which, apart from a snap spell of one evening to the South on May 5, continued to May 7. For the last week an anticyclone over Scandinavia controlled the situation, with our first spell of hot, humid conditions and occasional thunderstorms. Unfortunately, the highly desirable reflection layer often associated with high-pressure systems failed to develop, and, by the time of writing, the system had weakened into a large

erratic area of nearly uniform pressure.

Temperature inversions which develop on clear, calm nights at ground level are of considerable value in refracting energy to points well beyond the normal horizon. The first line of Table I is devoted to this effect, and gives the time on each occasion when refraction is thought to have reached a maximum. Evenings of this type are easily observed by the lone operator, who should then look for extended range over inland paths.

What of the inhomogeneities in the atmosphere which lead to abrupt changes in the vertical gradient of radio-refractive index? As we have seen, when these form layers over appreciable areas, VHF propagation can be greatly extended. The remaining lines of Table I give the usual estimate of this effect over routes in selected directions from South-East England. It is based upon the results of radio-sounding reported in *The Daily Aerological Record* of the Meteorological Office, London. A period of extension as far as Western Germany is given from April 22, for example, and was associated at first with the cloud sheet discussed earlier. The layer was mainly over 5000 feet during the spell and, with relatively weak reflection, may not have been effective with our lower power.

With the Table referring only to certain directions from one area, the charts of Fig. 1 have been included. They represent, as far as can be judged, the whole situation for selected occasions, and any path within the limits of the map can be examined with their aid. The first one shows a layer extending over a considerable area. Unhappily, it was weak and relatively high, and it is thought that, over the favoured eastern path, the following evening was much better although still quite high, as the second chart shows.

*over*

Date	APRIL											MAY																
	17	18	19	20	21	22	23	24	25	26	27	28	29	30	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Radiation over Bedfordshire, GMT	05	05	04	04	04	03	—	—	21	05	00	03	05	06	01	—	—	—	—	04	05	—	—	—	—	—	—	—
NE	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
E	PA	—	—	—	—	WD	WD	WD	PA	WD	WD	—	—	—	—	—	—	—	—	—	PA	—	—	—	—	—	—	
SE	—	—	—	—	—	ON	—	—	—	ON	DL	ON	—	—	—	—	—	—	—	—	ON	—	—	—	—	—	—	
S	—	—	—	—	—	—	—	—	—	48	48	—	48	—	—	—	—	—	45	—	48	—	—	—	—	—	—	
SW	—	—	—	—	—	—	—	—	—	GC	—	GC	—	—	—	—	—	—	GC	—	GC	GC	—	—	—	—	—	
NW	—	—	L	—	—	—	I	L	L	L	I	—	—	—	—	—	—	—	—	—	—	I	M	—	—	—	—	

Discontinuities aloft, from S.E. England to countries indicated.

The possibilities for EDX and GDX from April 17 to May 14. Especially good dates are shown in bold type and are underlined. Country prefixes show approximate direction and distances from S.E. England to which good conditions are thought to have extended.

Table 1

- Notes:—(1) Conditions listed are for the evenings of the dates shown.  
 (2) Figures in the first line are the times when inland super-refraction had reached its peak.  
 (3) Country prefixes indicate the approximate limit of good conditions.  
 (4) Sub-divisions of distance have been necessary, thus:  
 ED = eastern DL, WD = western DL, L = Lancashire, I = GI, and M = GM. (Sometimes paths to I and M are open together).  
 (5) For the southern path degrees of latitude are given.  
 (6) Paris is about 49° and Marseilles about 43°N. Particularly marked discontinuities are in heavy type and have been underlined.

Evening, May 12/13

An effect we have not met since last year set in for the two days May 12/13. This is the formation of an *advection* temperature inversion in the surface layers of a well-heated airstream flowing from land out over a cooler sea surface. It is independent of day or night-time and accounts for much refraction of coastal radars. In this instance, air in the seventies came sweeping from the Low Countries over the southern North Sea (about 50°F) to East Anglia, setting up the right conditions. Working across to PA and ON was greatly aided, and formation of radiation each evening will have extended the path well inland at both ends.

In Fig. 2 we have the usual MSL barometric pressure graph for mid-Beds. This is given to test further the idea that pressure readings (of less than 1018 mb) can be used by isolated observers to discard the possibility of EDX. It can be seen that the one period of the month below this value does, in fact, coincide with one of the blank portions of Table I. Although last year's results did not support the method, those who wish to observe the rise and fall of pressure in addition to its absolute value can do so from the figure. The weakish spell centred April 26, for example, occurred with a rising barometer.

The Mediterranean

Last month A.J.D. remarked upon extended VHF working in the Mediterranean area. Being fully taken up with our own experiences, no day-to-day attention was given to the question last year. It is hoped to draw up one or two charts at a later date so that we can look at things in detail. The writer is in full agreement with A.J.D.'s remarks of last month. Good propagation conditions not only occur more frequently, but are even more pronounced than those developing north of the Alps. For us it is a simplified picture of night-time cooling for the benefit of inland paths and of a "reflection" process from discontinuity layers aloft for sea paths and the

Fig. 1. Of the two reflecting layers which developed during the period and shown here, the first (on April 27) was high and weak, although widespread. The second development, on April 28, could have been helpful in extending the VHF horizon, but only in certain directions.

longer DX. Further south the emphasis may well be different, with other factors, mentioned in a general account by the writer (*Short Wave Magazine*, February 1953, p.741), becoming prominent.

Since in the Mediterranean summer it is dark for much longer than with us, inversions formed by surface cooling are likely to be more intense and—of especial significance—of greater vertical extent. This suggests the formation of ducts of sufficient width to trap 2-metre energy. Hot air streams sweeping out across the cooler sea from North Africa will develop surface ducts. This effect, but limited in magnitude—and extent occasionally—occurs with us, as remarked above. With opportunities like these developing, it seems well worth while for ZB2, ZB1 and ZC4 to try some schedules. Certainly QSO's with the other Mediterranean countries should be possible. It is a question only of activity. No doubt we shall later see whether "reflecting" layers aloft have as much importance as for us. Perhaps, with contributions from these other effects, their value is less outstanding. One possible drawback not noticed by us here is that, with enhanced surface effects, the field at a distant point may comprise both "reflected" and surface-refracted energy, with rapid fading due to interferences as a result. In the British Isles this tends to happen only over relatively short paths.

**Middle East**

Further away to the South-East, in the Persian Gulf, summer-time propagation conditions are superb. Hot desert air sweeps out over the waters of the Gulf from Arabia exactly as discussed for the Mediterranean, and the combined effect of surface temperature inversion and moisture lapse is so intense that even the longer wavelength of ten metres is affected. In the summer of 1947 the ground wave from HZ1AB, forty miles away, was S5 in MB4 (it was known as VU7 then). During the following winter the signal was down to S1 and, in fact, the writer had then to work him via VS7PS. As is well known, of course, centimetric radar in that part of the world often produces echoes from objects many hundreds of miles away. At such wavelengths, duct

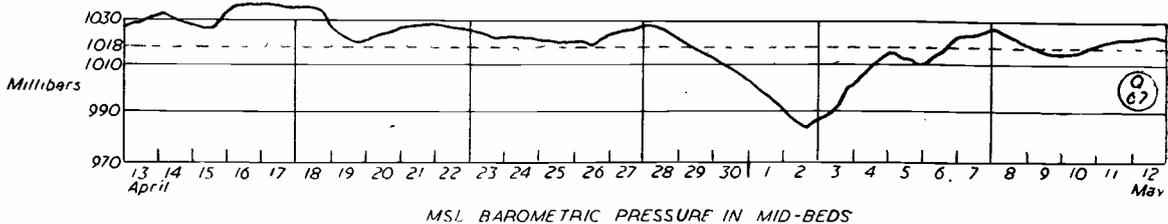
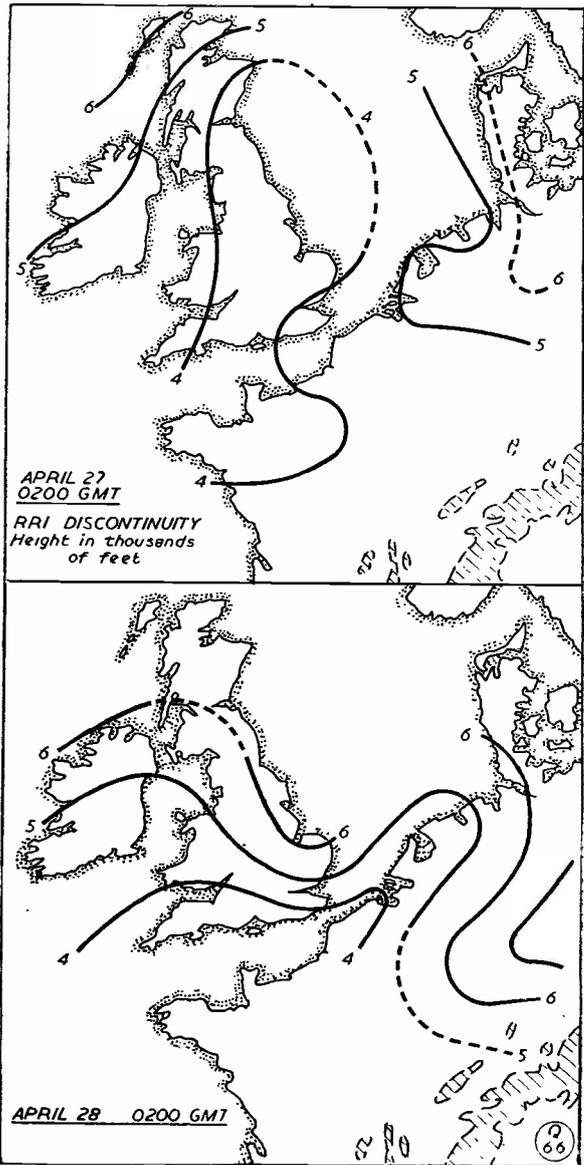


Fig. 2. The pressure graph for the period under review, during which the barometer stood relatively high. There was only one big dip below the 1018 mb "critical value." But in spite of this, conditions have not been good for EDX.

conditions are easily developed. It is this marked extension of the effect to the relatively long wavelength of ten metres that is worthy of particular note.

Another propagation anomaly during 1947 was the fully authenticated, although chance, reception on two occasions of 11-metre signals from an airborne radiosonde transmitter 1660 miles away. The S5 signals were capable of complete interpretation and therefore justified an R5 report! It will be remembered that these little balloon transmitters are but grid-modulated Hartley oscillators with an input of only 400 milliwatts and normal range of 120

miles. The successful telemetering of information in such circumstances seems worthy of record. This is *not* offered as an instance of tropospheric propagation, but rather as something to brood upon at the bottom of the sunspot cycle! At 4150 miles per watt it also provides a yardstick for amplitude modulated QRP and transistor signals. (As to the connection of this paragraph with VHF weather, it is, of course, upon the signals from these radiosonde devices that this monthly report depends!).

Acknowledgment is due to the Director, Meteorological Office, for permission to use information gained from the official publications mentioned.

### GREAT CIRCLE MAP AT THREE-AND-NINE

Those interested in any phase of world-wide DX, or the erection of aerials for coverage of particular areas, are reminded that we can still supply, at 3s. 9d. post free, our Map of the World, drawn to a great circle projection centred on London. This is the paper-backed six-colour production, suitable for wall-mounting, which gives the following information: The Zone areas, with call-sign allocations on a Zonal basis; true bearing and rough distances of all parts of the world relative to the U.K. (with London as centre); a world time scale based on GMT; and important place-names in all countries. This map is a handsome production, size 21 ins. by 35 ins., and was specially drawn for Short Wave Magazine, Ltd. It already adorns the walls of many an amateur station. The only difference between the 3s. 9d. and 6s. 0d. versions is that the latter is linen-backed and therefore more durable. Either can be supplied from stock, properly packed for safe transit. Orders, with remittance 3s. 9d. (paper) or 6s. 0d. (linen backed) to: Publications Dept., Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

### THE AMATEUR'S CONTRIBUTION

In a series of articles on "The Amateur Scientist in Britain," contributed to *Nature*, the well-known philosophical review, R. Brightman mentions (in the issue dated April 3 last) the part played by radio amateurs in having inspired the activities of the original broadcasting station in this country—Writtle, 2MT, which made its first authorised broadcast on February 14, 1922. Also mentioned is the valuable work done in the late 1930's by radio amateurs, and acknowledged by Sir Edward Appleton, on the study of solar-radio noise; Denis Heightman, G6DH, will be particularly remembered in this connection. There are, of course, a great many other pioneering explorations in radio for which amateurs can claim the credit—the discussion in *Nature*, which surveys broadly the amateur's contribution over the whole field of science (of which radio is only a part), is curiously inadequate and incomplete in the selection of radio subjects. For instance, the relatively quite unimportant concept of the R.A.E.N. (the "Radio Amateur Emergency Network") is mentioned, whereas the discovery of the short waves is not!

### BC/TV/CR LICENCE TOTALS

The Post Office announces that, as at the end of March, there were 13,436,793 licences in issue in the U.K. in respect of sound, TV and car radio receivers. Of this total, 3,248,892 were for TV and 226,667 for car radios. During the month of March, ten times as many licences were issued for TV receivers as for new sound sets—but only just over 3,000 licences for radio receivers in cars.

### A NEW MEDIUM-POWER TRANSMITTING VALVE FOR TELEVISION FREQUENCIES

A high-frequency tetrode valve with an anode dissipation of 3 kW and a maximum frequency rating of 220 mc has recently been introduced by the Communications and Industrial Valve Department of Mullard, Ltd. The new valve, designated type QY5-3000A, will deliver approximately 2.5 kW of RF power when operated as a grid modulated Class-C amplifier for television at its maximum frequency of 220 mc. It is therefore ideal for medium power television stations in Band Three (174-216 mc).

Type QY5-3000A is a ring-seal tetrode of glass-and-metal construction. It has an external finned anode designed for forced-air cooling. An anode dissipation of 3 kW is achieved in a comparatively small valve, the overall height and diameter being only 6.75 in. and 3.6 in. respectively. In common with other tetrode valves, type QY5-3000A has the advantages of high power gain and low output capacity. These features are particularly valuable at very high frequencies and video bandwidths.

While its power and frequency ratings make this new valve an obvious choice for medium powered VHF transmitters, it has other applications as a driver, frequency multiplier, or modulator in commercial VHF equipment.

### PHOTOGRAPHS

We are always glad to see photographs suitable for publication in *Short Wave Magazine*. Prints should be clear and sharp, with a note describing the subject, and are paid for immediately upon appearance.

YOUR ancient scribe remembers being confronted, throughout his childhood, with a water-jug inscribed "If we cannot have what we like, we must learn to like what we have." This rather smug motto never impressed him greatly—in fact, it put him off water for the rest of his life. No, we don't always "like" what we have—but we might as well make the best use of it, when we realise that nothing more is available. And this lesson might well be rubbed into the members of our amateur fraternity of today. We are dissatisfied with our bands, many of them shared with unwanted neighbours—but do we make the best use of them? We complain about the QRM, but what do we really do to reduce it? If the amateurs of the world really tackled this problem jointly, they could cause a vast improvement in their own working conditions, and we propose to point out a few very simple ways in which some such improvement could be achieved. No equipment is needed—beyond a certain amount of common sense.

### TIME AND MOTION STUDY

Unnecessary QRM is caused on the bands by two chief factors—the use of too much power and the use of a frequency for *too long*. The power question has always been a thorny one. Many of us maintain that a world-wide power limit of 100 watts would be a good thing, and would have nothing but beneficial results all round. Then, again, so many local QSO's (chiefly nets) operate with far too much power. In this connection, we are glad to note that there is a move afoot for a power limit of 5 watts for local nets, and it would be a good thing to spread a certain amount of propaganda on this subject. Too many stations working semi-locally (typical 80-metre contacts, for example) seem to regard signals of S9-plus as the bare minimum necessary for results. If they can achieve a report of S9 plus 40 dB with their 150 watts, they could reduce to less than 20 watts and still main-



tain S9 signals; with real QRP they could still be S7 or even better. But they have never tried it for themselves and can't be bothered.

### EXCESSIVE POWER

The whole business is relative—there are occasions when the use of 10 watts for local Top-Band contacts is a shocking waste of power. Local nets (the *really* local ones that take place within a town boundary) could comfortably be carried out with transistors and wouldn't even bother the net-next-door, perhaps twenty miles away. Go up the scale and you can condemn the use of 150 watts on Eighty for working anyone in your own country; and finally you reach the I's, W's, LU's and others who habitually keep to a kilowatt, whoever they may be working. The whole business is rather like using a photo-flood as a reading light, or a 100-ton press to bend an aluminium chassis. We should like to see a state of affairs in which all amateurs took pride in using as *little* power as possible for each contact made, even to the extent of modifying their gear to make the necessary adjustments feasible. A few tappings on the power supply to the final are really all the requirements; some ex-Government power supplies already have this facility.

### WASTING TIME

The waste of *time* on the air is even easier to cure. Both CW

and Phone users are offenders in this way, although we regret to say that the Phone men show up even worse than the brothers of the key. Long preambles, lots of "er's" and unnecessary repetitions, the use of phonetics when the other man is receiving you solidly in any case—they all waste valuable chunks of the band. We once heard a phone, coming in at S9 plus, saying "QTH here is Paramaribo" (which we got in one). Then he horrified us by adding "I spell . . . P for Portugal, A for America, R for Radio . . ." and so on—right through, *three times*. If that isn't criminal waste of the time-space continuum, what is? Phonetic spelling out of "handles" (*brrr!*), painstaking descriptions of a rig using a "Six Victoria Six, Six London Six, two Six London Sixes in Push-Pull." (P for push, U for uncle, S for sugar, H for Heaven Knows Why!) What a waste it all is!

### SPECTACULAR IMPROVEMENT

Imagine the flourish of trumpets with which we should greet any technical invention or improvement which would cut the QRM by half. And yet this could be done *tomorrow*, with no expense, no apparatus and no trouble, if everyone would cut his talking time by fifty per cent. And we guarantee that most amateurs could do just that without imparting one whit less information than they do now. Surely the after-dinner speakers' rule of "Stand up, speak up and shut up" ought to apply to our crowded bands, above all places. What conceivable justification is there for the types that say "I can't really think of anything else to say"—but then go on saying something (or nothing) at great length afterwards? Habitual users of (and payers-for) long distance telephones should make ideal amateur amateurs; they would get their ideas together, utter them concisely, and disappear. And with their disappearance would go half of our QRM. Think this over seriously and give it a try some time!

## The Other Man's Station

# G13IEO



ILLUSTRATED this time is G13IEO—owned and operated by B. Johnston, 17 Carleton Street, Portadown, N. Ireland—first licensed in March 1952. Activity is mainly CW on Twenty, with phone available, and the 40- and 80-metre bands also worked as the spirit moves.

Receivers at G13IEO are two R.1155A's, with a Class-D wavemeter, field strength meter, phone monitor, Q5'er and 20-watt quality audio amplifier as auxiliaries. At lower left on the table is the VFO, giving output over the whole range 1.8 - 28 mc, and comprising 6J5-EF50-807 with its own enclosed power supply. On the right is the main transmitter, running 6L6-807, and in the bottom rack is the modulator; this is arranged 6SJ7-6J5-p/p 6J5-p/p 6L6 in Class-AB2, plate-and-screen modulating the

807 PA; the microphone is a (crystal) D.104.

The whole station is relay-controlled, this being achieved by adapting the relay from a T.1154 ex-RAF transmitter. Aerials at G13IEO consist of a 132-ft. wire end-fed through an aerial coupling unit, coax-linked to the PA tank, and a 20-metre dipole made up of ribbon feeder.

DX is not a particular interest at this station, contacts on the various bands being made as they happen to come along. Apart from his own radio activities, G13IEO also runs the local school-Club station G13IJD, and through the latter organisation was instrumental in bringing 15-year-old G13JGZ on the air, as reported on p.569 of the November 1953 issue of *Short Wave Magazine*.

# THE MONTH WITH THE CLUBS

By "Club Secretary"

(Dead-line for Next Issue : JUNE 18)

A VERY keen Club member, and one with years of experience as committee member, treasurer and secretary, once remarked to us that you could always tell a healthy Club by the extent of its activities *outside* the Club-Room. He was probably quite right, and we know from experience that those Clubs who withdraw, snail-like, into their shells, lacking the essential contacts with the outside world, are usually short-lived.

Whether the extra-mural activities consist of Field Days, D-F Contests, participation in local exhibitions, visits to places of interest, or simply tours round the shacks of transmitting members, such goings-on always stimulate extra interest. Furthermore, any outside work that brings the Club in contact with the public invariably brings with it an increase in membership. One excellent method of doing this is to run a Club stand (preferably with gear in operation) at any local exhibition, trade fair or similar venture intended to attract members of the general public.

Many readers will remember the week's operation of "G Six Happy Hastings" last summer; and the *Hastings* Club is repeating its effort this year, the dates being July 3 to July 10 inclusive. All transmission is to be on 80 metres, and G6HH/A will be manned from 1000 to 2200 BST every day except Sunday, July 4. Schedules may be made from now onwards with the secretary (by post) but the Club would much prefer to see you there in person. Regular fortnightly meetings continue, with G3HCK as Chairman.

*Southgate* will be on the air from an exhibition in Broomfield House between June 26 and July 3, and at another later in the year — October 30 to November 13.

*Salisbury* is staging a similar effort at the local Model Engineers' Exhibition, held at the Egg Market during the Whitsun break — June 5 to June 7. Their exhibit will include a station on the air, a tape recorder for the use of the public, and the projection of suitable amateur films.

## Tackling TVI

The report from *Torbay* mentions the formation of their 5-member TVI committee, a new venture which will become operational on June 19. The main function of this committee will be to liaise with the GPO in the case of TVI complaints affecting members; the local GPO authorities have been asked to nominate a responsible Post Office official to attend committee meetings. This is obviously a most important "step in the right

direction," as it not only puts TVI on a negotiable basis as between local amateurs and the GPO, but will enable problems that do arise to be dealt with in a rational atmosphere by a responsible local organisation. We commend the *Torbay* move — which bears upon a recent Editorial in *SHORT WAVE MAGAZINE* on this subject — to the attention of all Club committees. We would also suggest that one of the most fruitful fields for the operations of any Club TVI committee is in the indoctrination of local dealers and the public on amateur transmission with respect to TVI.

## Transistor Activity

The *Leicester* club was instrumental, on May 4 and 5, in assisting G3CCA to make the first all-transistor contacts, first with G6FO (Maids Moreton, Bucks.) and then with a Kentish station at more than 100 miles. These contacts were made without any valves whatever, transistors being used for both transmission and reception, and they brought the Club much publicity in the local press and elsewhere. Several members have become very interested and a hive of transistor activity is buzzing.

The *Acton, Brentford and Chiswick* Club (G3IU) is now affiliated to the *QRP Society*, and meets each Tuesday at the AEU Rooms, 66 High Road, Chiswick, W.4. Recent talks have covered Parasitics and The History of Amateur Radio.

*Bradford* held its AGM on March 30, and elected G3GFD President, G2BYC Vice-President, and Mr. F. J. Davies Secretary. The 1954-55 programme is now being organised.

On June 18 at the "Jolly Waterman," Chesterton Road, the *Cambridge* Club meets to hear a talk by G2FJD on Ionosphere Research at the Cavendish Laboratory. The next meeting after this will be on July 16, when VHF Converters will be discussed by G4MW.

*Chester* have had a VHF Field Day, a talk on TV Converters, a discussion on Electronic Organs and another on NFD. G2YS has left them, having moved to Filey, Yorks. Meetings are on Tuesdays at the Tarron Hut, YMCA Chester.

Also meeting every Tuesday, *Liverpool* has acquired several more call-signs and keeps its transmitter G3AHD on the air from 2100 to 2200 during each meeting. All amateurs or SWL's finding themselves in Liverpool on a Tuesday are invited to make their way to the St. Barnabas Hall, Penny Lane, Liverpool 15.

Those "across the way" on the first and third Wednesdays will find the *Wirral* Club meeting at the YMCA, Whetstone Lane, Birkenhead, where SWL's and novices will be particularly welcome.

*Nottingham University* has held an AGM and elected G3JII President, G3JKO Vice-President, and Mr. P. Smith Secretary. They will be inactive during the summer vacation, but have plans for next season, including the acquisition of a BCI-proof phone and CW transmitter. In conjunction with the Nottingham Radio Society, they are taking part in NFD.

#### Field Day — Grafton

On p. 186 of our last, it was not made clear that the *Grafton* Field Day event takes place during the weekend June 19-20, the week following NFD, "with which there is no connection" as far as Grafton are concerned. Actually, the purely Club affair organised each year by Grafton is an interesting and ambitious undertaking, the aim being to operate on all bands; the site is Tumulus Hill, Hampstead Heath — and we hope the weather will be kind to them. Incidentally, their own home station G3AFT is on the 160-metre band every Monday evening, looking for Club contacts.

Talking of Club field days brings us to *Birmingham*, the annual outdoor event of the Birmingham & District Short Wave Society taking place at Oak Farm, Catherine De-Barnes, Solihull, on June 27 (again no connection with NFD), signing G2BON/P and G3DSM/P on Twenty, Forty, Eighty and the Top Band, and on 70 centimetres. We shall be interested to hear in due course how they got on.

With so many Clubs able, and keen, to lay on /P events purely as Club undertakings, it looks as if a Club Field Day might be a good engagement to add to the Contest Calendar.

Deadline for next month's reports is :

First post on Friday, June 18,  
addressed "Club Secretary,"

Short Wave Magazine,  
55 Victoria Street, London, S.W.1.

#### New Premises

*Portsmouth* have now transferred to their new home at the British Legion Club, where all future meetings will be held. Re-decoration is nearly finished, and the official opening will be announced shortly, meetings being held every Tuesday.

In this connection we would like to ask those Clubs who do change their meeting-place to let us know, as cases have arisen of visitors being misled by failure to locate Club meetings!

*South Manchester* ask us to state that they meet at Ladybarn House, Mauldeth Road, Fallowfield. They have a lecture on Transistors on June 18, and a Junk Sale and Discussion on July 2.

Discussion on the TVI Problem provided a lively May meeting for *Surrey (Croydon)*, and a repeat will be called for. On June 8 there will be a talk on the Principles of Television, followed later in the year by practical demonstrations. Meeting-place: The Blacksmith's Arms, South End, Croydon.

#### An Old-Timer Passes

*Southend* mourn the loss of Mr. J. E. Nickless, G2KT, a Vice-President and internationally-known Old-Timer. "Nick" was 75 years old and had been an amateur since 1911. He will be sadly missed. The Club has recently heard talks on Echo-Sounding, Electronic Computing and the work of the Fire Brigade. There will be no meeting on June 11.

*Sutton and Cheam* had a very successful Annual Dinner, and all the officers were re-elected at the AGM. For the next few months the Club will be competing with the rival TVARTS (*Thames Valley*) for the Cullen Cup, presented by G5KH. The next meeting, on June 15, takes the form of a Junk Sale.

*Walsall* report once more after a long absence. They meet at the Technical College, Bradford Place, Walsall, on the second and fourth Wednesdays and have a very small membership. Main interests are Portable work, QRP gear and Radio Control of Models.

The *Radio Amateurs' Invalid and Bedfast Club* continues its good work of providing reading matter and gear of all kinds for bedfast amateurs; anyone with amateur

#### NAMES AND ADDRESSES OF SECRETARIES REPORTING IN THIS ISSUE

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BRADFORD : F. J. Davies, 39 Pullan Avenue, Bradford, 2.  
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CHESTER : N. Richardson, 23 St. Mary's Road, Doodleston, Chester.  
GRAFTON (London, N.): A. W. H. Wennell, G2CJN, 145 Uxendon Hill, Wembley Park, Middlesex.  
HASTINGS : W. E. Thompson, 8 Coventry Road, St. Leonards-on-sea.  
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During his three years stay in this country, W7OFU has been a popular and active member of the Warrington & District Radio Society. On his return to Ephrata, Washington, recently, he and his wife were presented by the Club membership with a farewell gift of a pewter tankard and table centre; the presentation was made by chairman G3FGI.

interest who is confined to bed or an invalid is invited to join, and there is no subscription.

#### Next Meetings

The June programme for *Stoke-on-Trent* will cover such subjects as Preselectors, Signal Generators, Transmitting Aerials and Receiver Aerial Matching, Oscilloscopes and Audio Amplifiers. A Field Day will be held at Whitsun.

*Spen Valley* will visit Thornhill Power Station (C.E.A.) on June 16 and will hold an "Any Questions?" meeting on June 30.

On June 14 at 7.45 p.m. at The Colmore Inn, Church Street, Birmingham, 1, Basic Theory talks for the

beginner and LF Amplifiers will be the topics for the *Birmingham & District Short Wave Society* meeting.

At the Y.M.C.A., Torquay, on June 19 at 7.30 p.m., *Torbay Amateur Radio Society* have a talk billed as "Mobile VHF Operation" — this should be interesting, as /M working is now permitted.

*Reading Radio Society's* next lecture is on June 22, and will be on Flouro-Chemistry in Radio Manufacture. The *West Lancs Radio Society*—operating in the same area as the Liverpool and Wirral clubs — meets every Tuesday evening and has G3JQA as the Club call. At present it is not very active as they have very little aerial space; an R.1155 receiver has been donated by G3JND, ex-VQ3DM, so when they can get that aerial up, they will be away.

#### COLOUR TELEVISION — AMBROSE FLEMING MEMORIAL LECTURE

Speaking on the problems of colour television to the Television Society at the Royal Institution, Mr. G. G. Gouriet, of the B.B.C. Research Department, said that research during the past few years had given fresh impetus to the precise measurement of colour and its expression by means of accurate mathematical formulæ, both of which were necessary in the design of colour TV systems.

In transmitting colour scenes it had been found that the colour sensation could be separated from the sensation of brightness, and the modern colour television signal consisted of two separate components: one representing the brightness of the scene and the other conveying the colour informa-

tion, or "chrominance." It has also been found that a satisfactory colour television picture can be reproduced with a minimum of colour added, provided that the sharpness of detail is retained in the bright component of the signal.

Another term used in comparing television systems is "compatibility," which means that any colour TV picture should be capable of being reproduced on a receiver designed for monochrome pictures.

This condition has been laid down by the American Television Committee as essential to any practical system, as it would mean that a colour television system of the future would still be of entertainment value to owners of non-colour receivers.

### CRYSTAL PALACE TV TRANSMITTING STATION

As already announced, the BBC is to build a new London television transmitting station on the Crystal Palace site in South London. Contracts have been placed with Marconi's for two vision transmitters of 15 kW each and two sound transmitters of 4.5 kW. The two vision transmitters will be operated together, thus ensuring greater reliability, because if a fault should develop on one the service can be maintained on the other without interruption. By the use of a high-gain aerial system, the station will be capable of producing an effective radiated power (E.R.P.) of approximately 250 kW. This compares with an E.R.P. of 100 kW for each of the four post-war high-power stations and 34 kW only for Alexandra Palace. The Crystal Palace station is being designed so as to make it possible to raise the power still further should this be required at a later stage.

The aerial system will be erected at the top of a self-supporting steel mast 640 ft. high, which will raise the aerial to a height of approximately 1,000 ft. above sea level. The higher power of this station will not greatly increase the area already served by Alexandra Palace, but it will give a much stronger and therefore more interference-free signal in those parts of London and the suburbs where the level of interference is high. In particular, it will greatly improve the service along the South Coast, at present a fringe area where reception, generally speaking, is unreliable.

### SWITCH CLEANER

Many of the switch cleaners used for radio purposes appear to dry off quickly, making operation feel "rough," and soon losing effect. By mixing soldering paste ("Fluxite") with lighter fuel until it is of the consistency of light machine oil and carefully applying to the wafers with a small paint brush, it has been found that smooth operation results and, probably due to the continuous cleaning action, attention is not required for long periods. A rather complicated switch which had given considerable trouble was completely cured and no ill effects were experienced over a period of years. It should be noted that clean paste should be used for the purpose, in order to avoid any possibility of minute particles of solder or dirt being introduced. (A. E. Jefferies, Stroud, Glos.).

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If you have anything to sell, or need some particular item, try our Small Advertisement section. Rates are low and the coverage is the widest in the Amateur Radio field. Write out your notice, clearly, in as few words as possible and using the customary abbreviations, and send it, with remittance, to the Advertisement Manager, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1. If you are in any doubt as to how it is charged, send it in just the same, and the cost will be notified to you by return.

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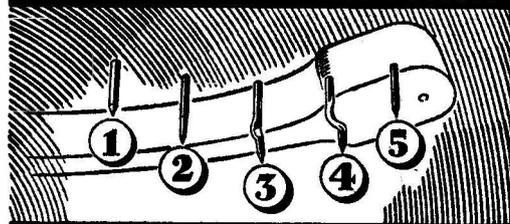
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1R5 ... 8/-	6K8GT ... 9/-	25A6 ... 8/6		DI ... 2/-
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1S5 ... 8/-	6L7 ... 7/6	50L6GT ... 8/6		AC5/PENDD ... 12/6
1T4 ... 8/-	6N7GT ... 7/6	42 ... 8/6	DK40 ... 9/-	PEN25 ... 6/6
1A7GT ... 10/-	6Q7GT ... 8/6	43 ... 8/6	UL41 ... 9/-	TP25 ... 8/-
1C5 ... 8/-	6S17GT ... 8/6	75 ... 8/6	UY41 ... 9/-	PEN46 ... 7/6
1LN5 ... 8/-	6R7 ... 8/6	78 ... 8/6	4Y1 ... 9/-	QP25 ... 6/6
2X2 ... 5/-	6X5G ... 8/6	80 ... 8/6	8D2 ... 4/-	SP61 ... 4/-
3V4 ... 8/-	6SA7GT ... 8/6	866A ... 15/-	9D2 ... 4/-	SP41 ... 4/-
354 ... 5/-	6SQ7GT ... 8/6	9001 ... 6/-	15D2 ... 10/-	HL23/DD ... 6/6
5Z3 ... 8/6	6S7G ... 7/6	9002 ... 6/-	R3 ... 8/6	VP23 ... 6/6
5U4 ... 8/-	6SH7M ... 7/6	9003 ... 6/-	D41 ... 5/-	VP41 ... 7/6
5Z4 ... 8/6	6SK7GT ... 7/6	9004 ... 6/-	D42 ... 5/-	U22 ... 8/6
6A7G ... 8/6	6SL7GT ... 9/-	9006 ... 6/-	D63 ... 5/-	ATP4 ... 4/-
6AC7 ... 6/6	6SN7GT ... 9/-	954 ... 6/-	KTW63 ... 7/6	TP22 ... 8/6
6AG5 ... 7/6	6SC7 ... 10/-	955 ... 6/-	U19 ... 10/-	TH233 ... 10/-
6A8G ... 8/6	6SS7 ... 7/6	956 ... 6/-	Y63 ... 8/6	41HP ... 7/6
6AM6 ... 9/-	6V6GT ... 7/6	1299A ... 7/6	P2 ... 4/-	21SSG ... 4/-
6B8 ... 7/6	7C5 ... 8/6	7C5 ... 10/-	MU14 ... 8/6	6U5 ... 7/6
6C4 ... 8/6	7S7 ... 10/-	931A ... 50/-	FX25 ... 12/6	6U5G ... 7/6
6C5GT ... 5/-	12A6 ... 7/6	EF54 ... 2/-	KT33C ... 10/-	FD13C ... 10/-
6C6 ... 6/6	12C8 ... 7/6	(VR136) ... 6/6	KT66 ... 12/6	ID5 ... 8/6
6D6 ... 6/6	12H6 ... 8/6	EB34 ... 3/6	GU50 ... 12/6	PENDD4020 ... 12/6
6F6G ... 8/6	12K7GT ... 8/6	EB34 ... 3/6	XP(2v) ... 4/-	MS/PEN(7) ... 7/6
6G6G ... 6/6	12K8GT ... 8/6	EB34 ... 3/6	XH(1.5) ... 4/-	MS/PENB(7) ... 7/6
6H6GT ... 8/6	12Q7GT ... 8/6	EB34 ... 3/6	XU111 ... 4/-	VP4(5 or 7) ... 7/6
6H6M ... 8/6	12SA7GT ... 8/6	EB34 ... 3/6	VU120A ... 4/-	PENAVA ... 8/6
6J5GT ... 5/-	12SQ7GT ... 8/6	EB34 ... 3/6	CV54 ... 5/-	(S or 7) ... 10/-
6J5M ... 8/6	12SG7 ... 7/6	EB34 ... 3/6	S130 ... 7/6	AC/PEN ... 10/-
6J6 ... 9/-	12SH7 ... 7/6	EB34 ... 3/6	7475 ... 7/6	(S or 7) ... 10/-
6KA5 ... 9/-	12SJ7 ... 8/6	EB34 ... 3/6	CV66 ... 6/-	
6J7G ... 6/6	12SR7 ... 8/6	EB34 ... 3/6		
6J7M ... 8/6	12SR7 ... 8/6	EB34 ... 3/6		
6K6 ... 9/-	14A7 ... 8/6	EB34 ... 3/6		
6K7G ... 6/6	25Z6GT ... 8/6	EB34 ... 3/6		

## CRYSTAL MICROPHONE INSERTS

Ideal for Tape Recording, Amplifiers, Baby Alarms, etc. No matching Trans. required. 8/6, post free.

## ROTARY POWER UNIT TYPE 104

Input 12 volts. Output 230 volts 65 mA. and 6.3 volts 2.5 amps. Fully filtered and smoothed and noise suppressed. Ideal for car radio, etc. BRAND NEW. ONLY 15/- (postage, etc. 2/6). Also 24 volt type. 15/-.

## 500 KC/S CRYSTALS

Standard 2-pin. Ex new units, guaranteed, 15/- each.

## VOLTMETERS

6v. M.C.	2 1/2 in.	Projection	10/-
15v. (50 c.) M.I.	2 1/2 in.	Flush	10/-
20v. M.C.	2 in.	Square	7/6
150v. M.C.	2 1/2 in.	Flush	10/-
300v. M.C.	2 in.	Square	12/6
300v. (50 c.) A.C.	Projection 5 1/2 in.	Dial	50/-

## AMP-METERS

250 mA T.C.	2 in.	Square	6/-
500 mA T.C.	2 in.	Square	6/-
1 A. M.C.	2 1/2 in.	Projection	10/-
3 A. T/C	2 in.	Square	6/-
6 A. T/C	2 1/2 in.	Flush	7/6
15 A. M.I. (50 c/s)	Projection	21/-	
20 A. M.I. (50 c/s) 2 1/2 in.	Flush Mtg.	10/-	
30 A. M.C.	2 in.	Square	7/6

## MILLIAMMETERS

500 M.A.	M.C.	2 in.	Round	15/-
1 mA.	M.C.	2 in.	Square	17/6
1 mA.	M.C.	2 1/2 in.	Flush	22/6
1 mA.	M.C.	2 1/2 in.	Desk Type	25/-
5 mA.	M.C.	2 in.	Square	7/6
10 mA.	M.C.	2 1/2 in.	Flush	10/-
30 mA.	M.C.	2 in.	Round	7/6
30 mA.	M.C.	2 1/2 in.	Flush	10/-
50 mA.	M.C.	2 in.	Square	7/6
150 mA.	M.C.	2 in.	Square	7/6
200 mA.	M.C.	2 1/2 in.	Flush	10/-
500 mA.	M.C.	2 1/2 in.	Flush	10/-
G.E.C.	1 mA.	Meter	Rect.	10/-
M.C.	Moving Coil	M.I.	Moving Iron.	
			Thermo-Coupled.	

All Meters are brand new and in original cartons

## CATHODE RAY TUBES

VR139A. 2 1/2 in. C/R Tube. Brand new, in original cartons (carr. free). £1 15/- VCR97. Guaranteed full T/V picture (carr. 2/-) £2

VCR517C. Guaranteed full T/V picture £1 15/- Mu-Metal Screens for VCR97 or 517. P.P. 1/6 6 in. Enlarger for VCR97 or 517. P. P. 1/6. 17/6

## RECORD CHANGERS

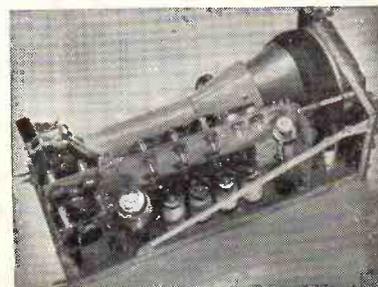
COLLARO RC3/531. Latest model 3-speed. Brand new maker's carton, cream finish. £10 10/-, carr. free. Latest model 3-speed B.S.R., plays mixed records. £50 10/-, carr. free.

## "426" CONTROL UNIT

Containing 4-EF50, 2-SP61, 2-EA50, 1-EB34, 2-single-gang. 0005 tuning condensers. W/VV. volume/controls, switches, condensers and resistors. Size 1 1/2 in. x 9 in. x 5 in. New condition, 35/-, carr. 3/-.

## SOLDER

1 lb. Reels Du-Bois 60/40, 7/6.



## INDICATOR UNIT TYPE SLC5

This unit is ideal for conversion for a 'Scope Unit or basis for Midget Television. It contains C/R Tube type ACRI0 (VCR193A) complete with holder and cradle, also earthing clip. 1-VR66, 2-VR65, 24 mfd. 550v. wkg. condenser, potentiometers and a varied assortment of resistors and condensers. These units are in good condition and packed in wooden transit cases. The C/R Tube will be tested before despatch. Dimensions: 8 1/2 in. x 6 1/2 in. x 1 1/2 in. 45/-.

## WANTED

723 A/B 931A, 9003, 813. Top Prices Paid.

## 62A INDICATOR UNIT

Complete with VCR97 or 517C, 12—EF50, 4—SP61, 3—EA50, 2—EB34. Built on double-deck chassis. Absolute new condition. 99/6, Carr. 7/6. Or less Tube, 69/6. Carr. 7/6.

## PYE 45 MC/S. STRIP. TYPE 3583 UNITS

Size 15 in. x 8 in. x 2 in. Complete with 45 Mc/s. Pye Strip, 12 valves, 10 EF50, EB34 and EA50, volume controls and hosts of Resistors and Condensers. Sound and vision can be incorporated on this chassis with minimum space. New condition. Modification data supplied. Price £5. Carriage paid.

## No. 38 "WALKIE-TALKIE" TRANS-RECEIVER

Complete with Throat Mike, 'Phones, Junction Box and aerial rods in canvas bag. Freq. range 7.4 to 9 Mc/s. All units are as new and tested before despatch. As supplied to Overseas Police Forces. £4/10/0.

## R.F. UNITS (Brand New)

Type 24. Switched Tuning 20-30 Mc/s with valves, etc. 15/-, post paid.  
Type 25. Switched Tuning 40-50 Mc/s with valves, etc. 19/6, post paid.  
Type 26. Variable Tuning 50-65 Mc/s with valves, etc. 45/-, post paid.

T.C.C. .1 5/7000 volts, wkg. Type CP58QO. Bakelite Case. 7/6 each

## EF50 (VR91A)

The selected EF50, Red Sylvanian, original boxes, 10/- each, 90/- for ten.

## BIB WIRE STRIPPER AND CUTTER

Strips insulation without "nicking" wire. Cuts wire without leaving rough edges. Splits extruded flex. A product of "Multicore." 3/6 each, p.p. 9d.

## R.F. OSCILLATOR UNIT

6-18 kV., including rectifier winding, 25/-.

## AMERICAN 12v. DYNAMOTOR

Output 250 volts, 60 mA. Weight 5 lbs. Suitable for Car Radio or Electric Razors 22/6.

## G.E.C. RECORDING TAPE

600ft. Reels. 10/-  
1,200ft. Reels. 17/6  
BUY NOW—UNREPEATABLE BARGAIN

## MORSE PRACTICE KIT

Complete with buzzer, morse tapper and battery compartment on baseboard. 6/-, p.p.

## INDICATOR UNIT TYPE 182A

This unit contains VCR517 or 517C Cathode Ray 6 in. 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. Suitable either for basis of television (full picture guaranteed) or Oscilloscope. 'Scope constructional circuit included. Offered BRAND NEW (less relay) in original packing case at 67/6 (plus 7/6 carr.). (See "Radio Constructor" for full 'Scope circuit).