The SHORT WAVE Magazine

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VOL. XI NOVEMBER, 1953 NUMBER 9

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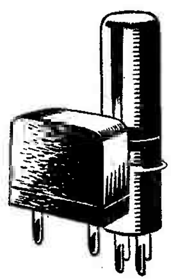

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FOR THE EXPERIMENTER AND THE RADIO ENGINEER

The SHORT-WAVE Magazine

EDITORIAL

Safety

Familiarity with electrical apparatus, and the relatively high voltages used in our work, tends to make some of us a good deal less careful than we should be in handling our equipment.

It is true that provided you know what you are doing, you can seem to go on getting away with a good deal. But the snag here is that you always have to remember what you are doing — there is no margin for error. Some people can stand, without serious discomfort, shocks which would kill others. At one end of the scale, there are people taking kicks from a 1,500-volt supply ; at the other, there is a well-authenticated case of a man being killed, indirectly, through contact with a circuit at a potential of only 60 volts.

Fortunately, it is quite easy to take the proper precautions in and around our stations. The first thing is to provide a really good earth, and to arrange for earthing down aerials when necessary ; the next is to see that all apparatus needing to be earthed is connected to a main earthing lead by heavy rubber-covered wire ; thirdly, all AC wiring should be three pin, with N, L and E correctly connected throughout. Fourthly, all power packs should be permanently bled, and in HV packs the heater and high-voltage transformers should be interlocked in the switching. Fifthly, power packs should be stowed in such a way as to be inaccessible in operation, with all connections to them carefully insulated and fused. Sixthly, all power used in the station should be taken off one main double-pole on-off switch, so that in an emergency everything can be shut down (and all members of your household should know where this switch is). And finally, that golden rule — To make transmitter adjustments with one hand in your pocket when power is on — should be observed as a matter of habit.

Recently, it has been said that only one in about six of all motor-cyclists wear crash helmets, and that one reason why some of the other five do not is because they are afraid of being thought unmanly if they take precautions against being thrown off on their heads. Much the same sort of idea seems to prevail at too many amateur stations, with hair-raising risks being taken without thought of the consequences — for family and friends.

Austin Forsyth
G6FO.

Noise Reduction in Receiver Design

PRACTICAL CONSIDERATIONS FOR THE IDEAL LAYOUT

J. C. BELCHER (G3FCS)

This article suggests how the home-built receiver can be considerably improved by close attention to the detail of noise elimination, and shows how the electrical and mechanical design should be approached to obtain a really good signal-to-noise ratio. Though a complete receiver is not described in detail, enough practical information is given for the guidance of anyone embarking on the construction of an HF receiver, or the rebuilding of an existing one.—Editor.

AS a general rule, the more complicated the design of a receiver, the more susceptible it becomes to noise. This is due, not only to the increased sensitivity which might result, but also to the increased circuitry which is prone to noise pick-up and generation. On the other hand, of course, the simple TRF receiver is not entirely immune from this complaint.

For the purpose of this article, noise is defined as any form of interference which can adversely affect an incoming signal, whether it be from an internal source — inside the receiver itself—or from an external source. In its characteristic, it may vary from anything between a hiss and a hum, to a crackle or a high-pitched whistle, and be either continuous or irregular in nature.

Until the post-war years, the question of TVI suppression did not arise in the design of the amateur transmitter—or in any other type of transmitter for that matter. In like manner, the requirements of noise reduction in receiving equipment have apparently also been overlooked. This does not seem unusual when it is realised that the engineering principles involved are similar, and in effect follow some kind of law of reciprocity. Several cases have been known where an apparently well-screened communication receiver, employing up to two stages of preselection, has caused television interference due to radiation of the third harmonic of its local oscillator. Application of Rayleigh's Theorem will show that, if the television receiver concerned is replaced by a noise source generating a noise field-strength comparable with that of the local oscillator, then the output of the communications receiver will show a noise level comparable with that of the output of the television receiver.

Later in this series, details will be given of simple tests which can be carried out in order to ascertain the degree of susceptibility of a receiver to noise. For the moment it is sufficient to say that very few receivers, running at full gain and with the minimum of selectivity, will show *no* trace of noise in the output when the aerial input is short-circuited. Unless, of course, this test takes place in a screened room with filtered mains supplies. Possibly this is the cause of the existing state of affairs today when receivers are, more often than not, the product of a noise-free laboratory instead of the typical receiving site with its high level of local noise.

An indication of the lack of appreciation of noise-free receiver design is given by the individual who proudly demonstrates the sensitivity of his receiver by showing what it will pick up in the shape of DX signals with no aerial or earth connected. A moment's reflection will confirm that the demonstration shows, not so much the sensitivity, as the inefficient screening of the receiver.

A Paradox

First of all, let us consider the basic principles governing noise in a receiver. It is an accepted fact that the noise-level of a receiver is a function of its overall bandwidth, and, where thermal agitation noise and valve shot noise are concerned, this is undoubtedly true. Unfortunately, this does not conjure up the complete picture where external noise is concerned. To quote a typical case, where IF breakthrough is experienced, an increase of selectivity might effectively decrease the signal level without materially affecting the level of the breakthrough, resulting in a decrease in signal-to-noise ratio instead of an increase as might at first be expected. To take this a stage further—increase in selectivity will not reduce mains-hum ; unless of course an audio filter is employed, and even this will not be effective if the mains-hum is picked up directly by the headphone leads.

Internal Noise

With these thoughts in mind, let us now consider each stage of a typical receiver and its relation to noise, working from the power

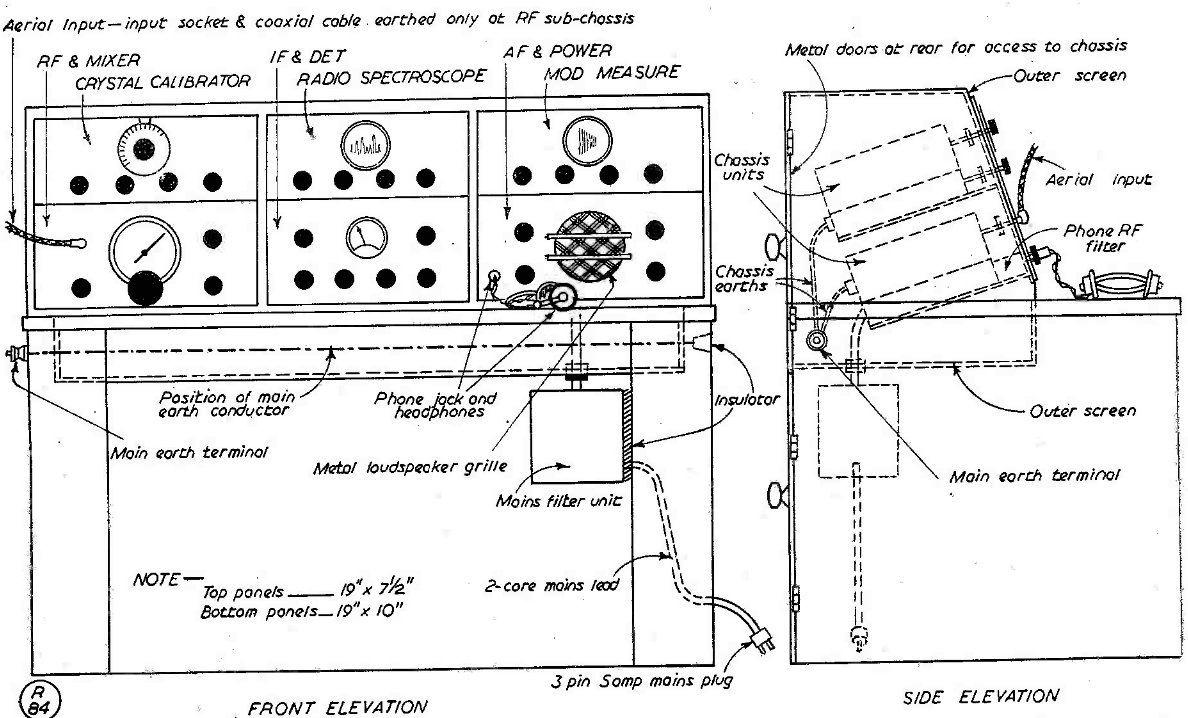


Fig. 1. Recommended layout plan for console-type receiver designed for noise-free operation. This is to show general arrangement only.

supply back to the aerial circuit. It will be convenient to deal first of all with internal sources of noise inherent in the receiver itself.

First of all—mains-hum. This can be caused in two ways, by ripple present in rectified HT supplies, and by induction from such as mains leads and heater wiring carrying alternating current. The latter effect can be reduced by mounting AF stages on steel chassis, screening all heater leads, magnetically isolating mains transformers and chokes, keeping inductive loops in circuit wiring to a minimum, and finally, by shielding all points at low signal potential, such as AF amplifiers, detectors and AGC leads—not forgetting mixer stages and the beat-frequency oscillator. Ripple present on HT supplies can, in some cases, cause modulation of RF and IF amplifiers particularly, resulting in modulation hum being superimposed not only on all signal carriers—being most noticeable on low-level signals—but also on the noise components derived from thermal agitation and shot effect. Hence in the latter case, a slight but continuous hum is always noticeable in the audio output. The answer to this, of course, lies in careful filtering of all DC supplies.

Feedback in amplifier stages also results in high internal noise level, due to the fact that valve noise is amplified out of all proportion. This in itself may not affect signal-to-noise ratio but in cases where non-linearity results—where sharp cut-off pentodes are employed, for example—the resulting components of intermodulation may cause an appreciable increase in the noise factor of the receiver. In order to overcome this, care must be taken to screen each stage and reduce unwanted coupling to a minimum.

Another form of instability which may cause trouble is a variety of Barkhausen - Kurz oscillation, this often taking place unnoticed in output pentodes employing a top-cap grid connection. This oscillation usually predominates at some frequency in the band 25-30 mc and in addition shows considerable second harmonic output. Hence interference can be caused to adjacent RF or IF amplifiers tuned to this frequency, especially in the case of 10-metre receivers and VHF intermediate frequency strips. The oscillation is far from stable, drifting several megacycles about its average frequency. In addition it is usually modulated by the audio component being amplified at the time. The cure is simply the insertion of a stopper resistor of the order of 1,000 ohms in the grid lead.

Incorrect application of voltage stabilizer tubes of the gas-filled type can also produce an annoying form of noise. This occurs when the load is such as to cause the tube to reach its extinction potential due to the increased voltage-drop across the dropper resistor. The result is a form of low frequency relaxation oscillation which will modulate the supply to the load. If this load happens to be the local oscillator stage or beat-frequency oscillator, the result will be a form of modulation hum. Hence care should be taken, in the initial stages of design, that the voltage stabilizer is operating well within its recommended capacity for a given value of dropper resistor, and that in addition, the possibility of mains voltage fluctuations are taken into account.

Excessive injection to the detector stage from the beat frequency oscillator will often result in a high level of hiss, hence minimum coupling between the two should be employed compatible with adequate AF output from CW signals. In general, all oscillators employed in the receiver should be very lightly loaded and should operate with a low anode voltage. This is to ensure that harmonics, parasitic oscillations and any forms of "squegging" are at a minimum. Not only does such mis-operation result in "mush," but, in addition, any spurious oscillations may be the means of entry of external interference to the receiver by way of the IF or front-end stages.

The only further source of internal noise is that from faulty components, with valves, composition resistors, and high-resistance soldered connections as common offenders. Such faults usually result in an intermittent form of noise, the level of which may be dependent on any local heating involved, load currents and mechanical stability. Hence attention should be paid to adequate ventilation, correct power and voltage ratings of components, and sound, robust construction.

If all the points, so far dealt with, on the subject of internal noise have been carefully attended to, then the preliminary stage is complete. It should be possible to test out our hypothetical receiver in a perfectly screened room and hear nothing but thermal agitation and shot noise, this being the ideal state of affairs from a practical point of view.

External Noise

Now let us consider external noise, and its effect on receiver design. Broadly speaking, external noise exists in two forms as follows:

(a) First, that caused by switches, thermostats, motors, and so forth connected to the supply mains and which cause an interruption in the electrical circuit involved. The resulting current waveform is rich in harmonics, its

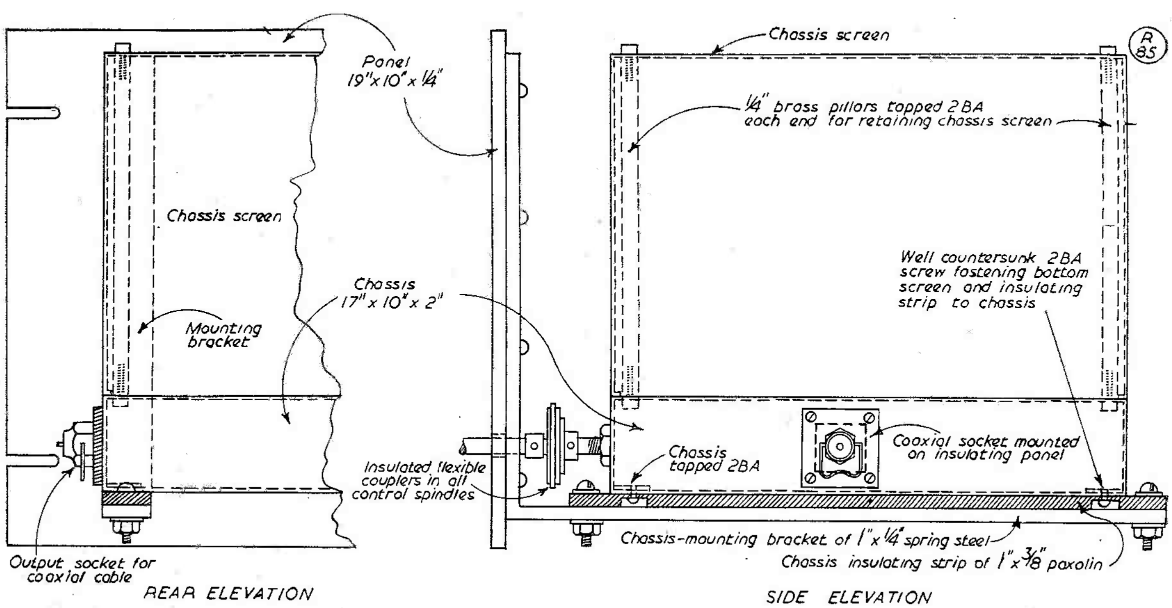


Fig. 2. Sketches showing detail for panel and chassis mountings for the type of receiver discussed in the text.

frequency spectrum theoretically stretching from zero frequency to infinity. Thus, any particular source is likely to cause interference on both IF and RF channels of a receiver. In general, the components below 10 mc are mainly conducted to the receiver *via* the supply cables and wiring, and those components above 10 mc are mainly radiated from the source.

(b) Secondly, that produced by RF generators such as radio transmitters, oscillators of all types, including those in the receiver itself, and industrial and medical RF heating equipment. This type of interference is usually radiated, but, if the source is very near to the receiver, a certain amount of the interference may be conducted *via* the mains supply.

Of the two forms of interference, the first can be most troublesome owing to the many channels by which it can reach the receiver.

Considering the pre-mixer stages, the normally available channels are those on frequencies $(f_1 \pm f_2)$, where f_1 is the local oscillator frequency and f_2 is the intermediate frequency ; in other words, the signal frequency and image frequency. Harmonics of the local oscillator afford other channels such as $(2f_1 \pm f_2)$, $(3f_1 \pm f_2)$, and so on.

Image rejection of the order of 40 dB or so is not sufficient when the local field strength of the interference is of the order of 10-100 mV/metre, as it may well be under very adverse conditions. Hence a double-superheterodyne receiver is essential, in order to make the image rejection, due to the overall Q-factor of the pre-mixer stages, high enough to give adequate rejection on the highest level of second channel interference which may be experienced. Then, in order to ensure that *only* the channel at the signal frequency is open to the first mixer stage, sufficient screening must be employed so as to prevent the pre-mixer stages being by-passed by a strong signal. If care has been taken to reduce the local oscillator harmonic content to a minimum, trouble from other spurious responses at this point will be negligible. One thing which should not be overlooked where VHF receivers are concerned, and where neutralized triode RF stages are employed, is that a low frequency signal—at the first intermediate frequency, for example—can sometimes pass straight through the RF stages with little attenuation *via* the grid-anode capacitances of the valves. This is due to the *shunt* circuit capacitances having very little by-pass effect at frequencies far below the signal frequency.

Directing our attention to the IF amplifier we find other channels available to the interference components. In the case of the double superheterodyne receiver the two intermediate frequencies come into this category. In addition, spurious responses are possible at the second mixer stage similar to those which we discovered at the first mixer stage. In the latter case the " second IF channel " effect can be considerably reduced by fitting a tuned rejector in the mixer grid circuit. At the same time screening of these circuits and all associated wiring is of vital importance.

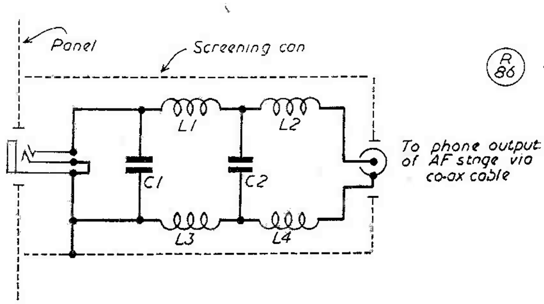


Fig. 3. Circuit of RF filter for phone output leads. L1-L4 are " all-wave " RF chokes, and C1, C2 are .001 μF.

Considering now the final detector and AF stages. The latter—even if nominally class-A amplifiers—should be treated as signal rectifiers. It is possible that, even with a very slight non-linearity of a valve characteristic, for rectification to take place in the presence of a strong RF carrier, resulting in the modulation appearing in the output of the AF amplifier. Hence all control grids should have either stopper resistors or chokes in circuit, and if necessary RF by-pass condensers of the order of 100-500 $\mu\mu$F.

It has been seen that screening of the receiver is of prime importance and this aspect will be dealt with in further detail.

Shielding

First of all, a single screen will not provide sufficient shielding for our purpose. Those who have studied the design of signal generators will appreciate that, with an RF oscillator delivering an output of 1-volt, in order to keep the maximum permissible stray radiation to less than 1·0 μV—an attentuation of 120 dB—triple screening must be employed. In our particular case, where, with an external noise field-strength of 100 mV/metre it is necessary that the effective field-strength at the receiver proper shall not be greater than 0·1 μV/metre, similar screening is required.

The outer screen will take the form of a metal cabinet or enclosed rack, housing the whole of the receiver, and should be earthed at one point only. The receiver will be composed of at least three chassis, *i.e.*, RF and mixer stages, the IF stages and final detector, and the AF amplifier and power supply. The only external leads will be the aerial input, the low-level audio output, the mains supply lead, and the earth lead. *It is of prime importance to keep the aerial input and mains supply lead as far apart as possible.* This immediately presents a problem which is only solved by considering local conditions. If the receiver is to be installed on the operating table it will be necessary to have the RF panel at the bottom of the rack, likewise the aerial input. In such a case the power supply will be at the top of the rack and the mains lead will undoubtedly hang downwards in the general direction of the power point and aerial. If the receiver rack is to be a floor-mounted affair then the panel order will be reversed, a suitable proposition from the point of view of this article, but hardly affording a convenient operating position. The ideal layout, of course would be a metal console desk with the aerial input coming in at one end and the mains lead at the other. This also conforms with modern amateur practice and therefore will be in keeping with an up-to-date station. Hence for the purpose of this article a console desk will be assumed.

Practical Layout

An admirable arrangement is shown in Fig. 1. The RF panel is at the bottom left hand corner. This results in ease of tuning the receiver to a drifting signal with the left hand, whilst copying it with the right. Just above the RF panel is the crystal calibrator which is fed from the same power supply, its output being injected to the RF stage by means of an internal screened cable. The centre bottom panel is the IF amplifier with the oscilloscope above that, again, both being fed from a common power supply. The AF stages, power supplies and loudspeaker are associated with the bottom right hand panel, with the modulation measuring equipment above that. The two-core mains-supply lead is near floor level at a suitable height for the power socket.

This layout caters for most of the requirements of the amateur receiving station. The only possible modification may be that of providing VHF converters before the RF stages

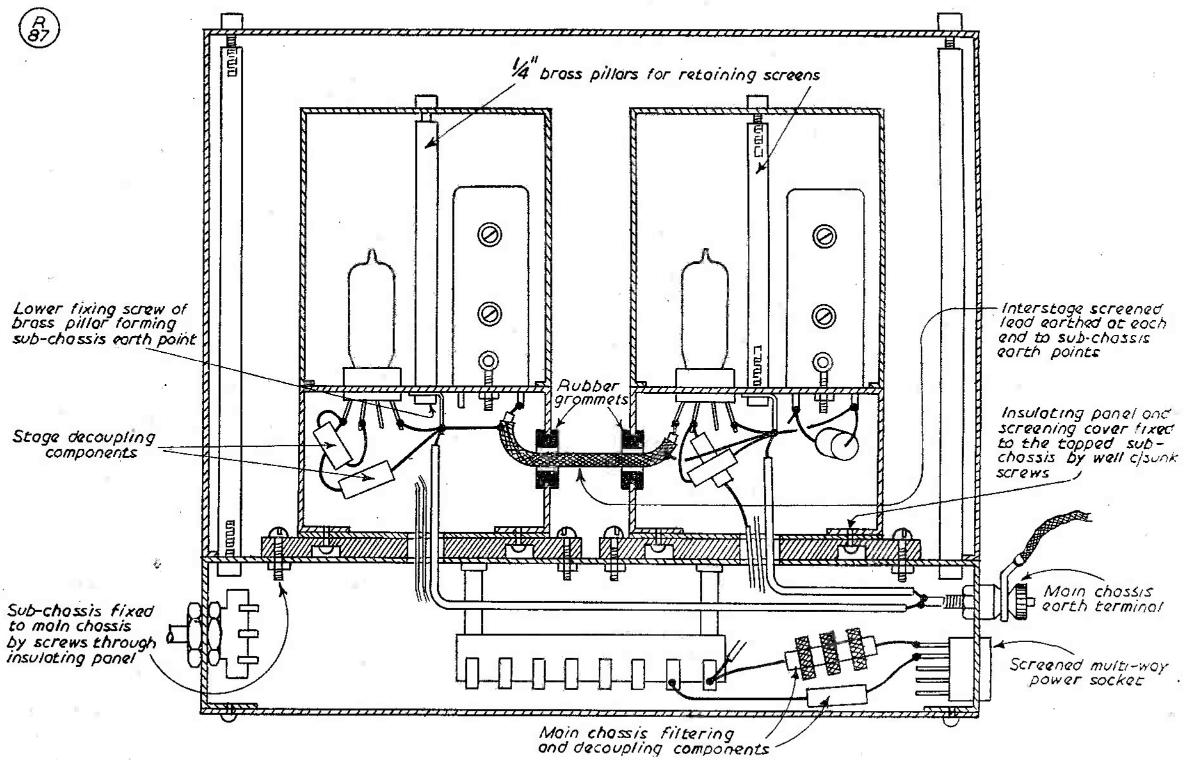


Fig. 4. Cross-sectional view of sub-chassis, showing methods of fixing to main chassis, and general wiring scheme.

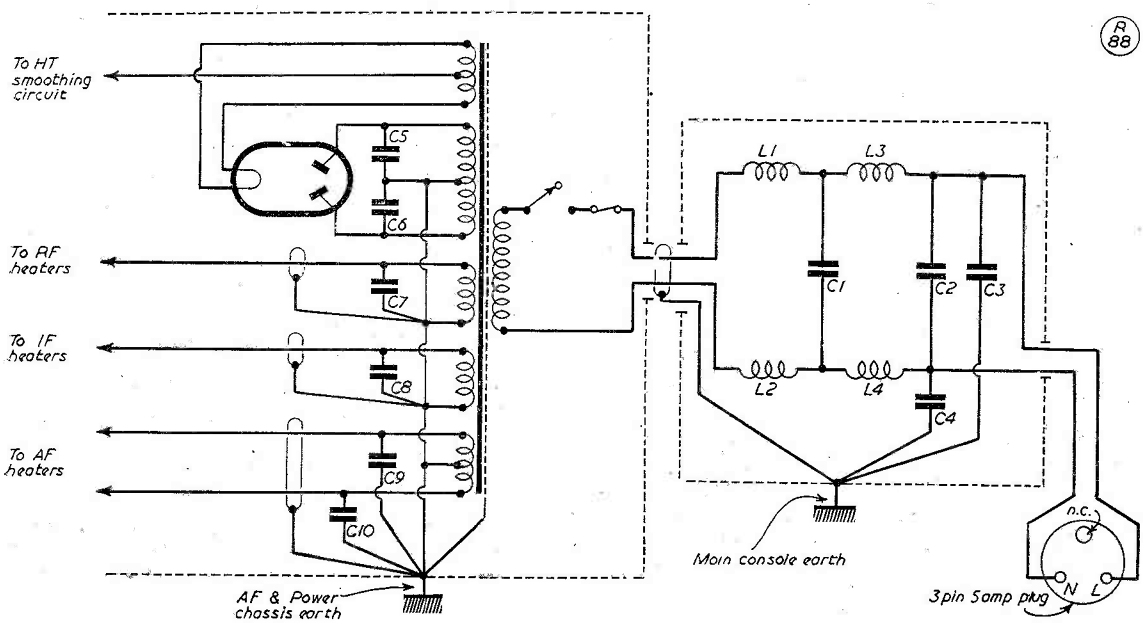


Fig. 5. Circuit of power pack and suitable mains supply filter for use with the idealised noise-free receiver.

—these should be mounted on additional panels to the left of the receiver.

The installation of a typical chassis is shown in Fig. 2. It will be seen that support is provided by strip iron brackets screwed to the panel, the chassis being attached to the brackets by means of strips of insulating material. Hence *the chassis is kept insulated from the panel and the outside shield.* In order to maintain this insulation, each control spindle is broken by an insulated coupler. For ease of fault finding, inter-connecting cables are removed, the panel securing bolts unscrewed, and the whole unit and panel removed at the front. The chassis is earthed at one point only, by means of a flexible copper braid to a copper earthing bar which passes along the back of the console. This copper earthing bar is again only in contact with the outer shield at one point, *i.e.*, the main earth terminal.

The input and output connections are of low impedance and made *via* coaxial cable. The sockets are insulated from the chassis, the internal lengths of cable having their sheaths earthed at the input or output transformers only. Similar technique is used for the screened multi-core supply leads, AVC leads, etc. In this case the outer braiding is earthed *via* the insulated multi-way socket to the chassis earth terminal only.

Table of Values

Fig. 5. Circuit of Receiver power pack and Mains filter.

C1, C2 = 0.1 μF, 1500v. wkng.	C7, C8,
C3, C4 = .005 μF, 1500v. wkng.	C9, C10 = .01 μF.
	L1, L2 = *See* text.
C5, C6,	L3, L4 = 2.0 mH RF chokes.

The S-meter should be a metal cased movement in order to retain the shielding properties of the outer screen.

The phone jack on the AF panel should be fitted in a screening can screwed to the rear of the panel. In order to prevent unwanted noise being picked up by the unscreened phone leads a double section RF filter should be installed in this can. This filter can consist of two "all-wave" RF chokes in each lead together with by-pass condensers 0.001 μF in value. The appropriate circuit is shown in Fig. 3. The effect of chokes L2 and L4 in series with the "earthy" lead is to isolate the panel, jack and can from the outer braiding of the coaxial cable leading to the AF unit, hence preserving single point earthing.

Where cathode-ray tubes are used in the oscilloscope and modulation measuring equipment, mu-metal shields should be fitted. These should be connected to the panel concerned but not to the chassis. The leads to the CRT bases should be screened in a similar manner

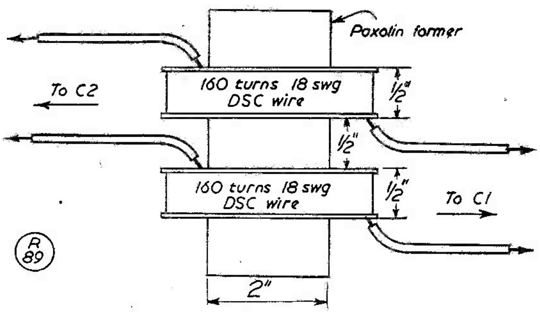


Fig. 6. Detail of the construction of 2.0 mH RF chokes for mains filtering.

to power supply leads, coaxial cables being used where RF is applied to the tubes. The main function of the mu-metal shields in this application is to make up for any loss in the effective shielding of the panels, brought about by the circular apertures and the glass tubes.

Turning our attention to the inside of a typical chassis unit, we arrive at the third and innermost screen. This encloses each stage concerned, and takes the form of a metal screening box complete with sub-chassis, all of which is mounted on the main chassis but insulated from it. Single point earthing of each stage is carried out, this termination being connected *via* an insulated conductor to the single earthing terminal of the main chassis.

Ordinary decoupling of anode and screen supplies is carried out between stages. Where the supplies enter the chassis, however, they should be well filtered and decoupled at the frequency or frequencies at which the amplifier operates. In the case of the IF unit, for example, parallel-tuned trap circuits should be inserted in series with HT leads and AVC leads, with 0.1 μF condensers by-passing the heater supplies. It will be seen in Fig. 4 that the *unit* decoupling and filtering components are installed in a screened box under the main chassis, whereas the individual stage decoupling components are mounted under the associated sub-chassis.

Where control spindles are required to be extended from inside an innermost screen (as in the case of crystal phasing controls) the spindle should be made of some insulating material such as ebonite rod, and a slot cut in the outer *chassis* screen in order to facilitate removal of the latter. Naturally, toggle type switches are not suitable in an application of this nature, and all switches should be of the rotary type.

Power Supply and Mains Filter

So far we have effectively screened the receiver and filtered one external circuit — the headphones. There now remains the final, and possibly the most important circuit of all, to attend to—the power supply and mains lead.

Here we may consider just how much interference is reaching the receiver *via* the power pack. Quite often it may be of the order of *millivolts.* DC supply mains normally have a greater noise level than AC by virtue of the fact that all electric motors connected to the system are of the commutator type. Induction motors, used on AC mains supplies, on the other hand, cause practically no interference at all. Hence, a receiver connected to DC mains is at a disadvantage to start with. Moreover, the effect of a mains transformer—where it is employed between the receiver and the AC mains supply—is similar to that of a filter, *especially when an electrostatic shield is used between the primary and secondary windings.* At the same time, where a mains transformer is so constructed that the heater windings are interposed between the primary and HT secondary to form such a shield, then the heater windings are most likely to be at a high potential with respect to interference and hence the heater wiring should be treated with respect.

From the above it can be seen that the use of a mains transformer is essential, where of course, its use is appropriate. In order to give maximum shielding it should be a fully-shrouded type instead of the usual half-shrouded drop-through-chassis type, and should of course, have an electrostatic shield betwen the primary and secondary windings.

The design of a typical mains filter is given in Fig. 5. It is totally enclosed by a screened-box which is mounted on the outside of the console but insulated from it, being grounded to the main console earth *via* an insulated conductor. The leads from the filter to the primary

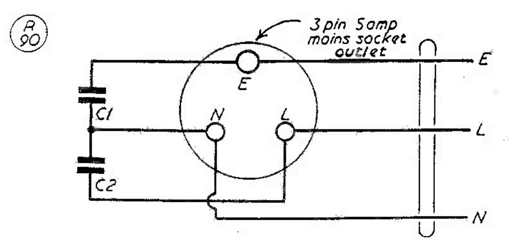


Fig. 7. Additional mains filter to be fitted at plug point. C1, C2 are 2.0μF, not less than 1000v. wkng. The lettering N, E, L, stands for "neutral, earth, live," and should appear on all plugs and sockets in properly-wired installations.

circuit of the mains transformer are shielded, passing through rubber grommets in the outer and middle screens, being earthed at the filter screening box only. It will be noticed that the mains on/off switch is on the receiver side of the filter in order to permit the switch to be mounted on the AF-cum-power panel.

L1 and L2 are quarter-wave chokes suitable for the highest frequency band used and are wound on a ¼-inch dia. former. The number of turns will depend on the wire gauge used, and is best determined with the aid of a grid-dip oscillator when the chokes are wired in circuit.

L3 and L4 are multi-layer wound on a 2-inch former as shown in Fig. 6. *It is important to wind the coils in the same sense and to connect up each one as shown in the sketch.*

The voltage rating of the condensers is important, and lower ratings are not permissible. Care should be taken to keep all wiring as short and direct as possible, in order to prevent any inductive coupling between the input and output of the filter from by-passing it.

It will be noticed that no connection is made to the "Earth" pin of the 5-amp 3-pin mains plug. This is because it is absolutely essential for the receiver to be connected to a noise-free earth, which the average mains-earth very seldom is. A further discussion on this point will be given later.

In Fig. 7 are given details of an additional filter which may be fitted to the 3-pin socket-outlet. The effect of fitting this is to restrict any interference currents which may be circulating between the line, neutral and earth. Where it is not possible to get at the socket-outlet wiring the filter can be wired to a 3-pin plug and connected to the supply by means of a multi-way adaptor.

Reference to Fig. 5 shows that separate heater supplies are provided for the AF stages, the IF and final detector stages, and the RF and mixer stages. This is done to prevent interference being picked up by the heater leads of one stage and passed on to the heaters of another. As an example, using a common heater supply, an interfering signal at the intermediate frequency could be picked up by the RF heater wiring and conducted straight to the IF stages and thus cause breakthrough. This, however, is avoided with the arrangement given.

In the preceding paragraphs the author has been concerned with the general design of the noise-free receiver. On the whole, specific details have not been given as in most cases the final design will be a matter of personal choice. In Part II of this series the general design of the aerial and earth system will be dealt with. Finally, in Part III, the station layout and overall adjustments will be considered.

XTAL XCHANGE

Offerings for this month are as below. We give free space for those wishing to exchange crystals—buy-or-sell notices can *not* be accepted here. In the six years or so since this feature was instituted, well over 200 exchanges have been effected. Set out your notice in the form shown below, on a separate slip headed "Xtal Xchange —Free Insertion." All negotiations should be conducted direct.

G2FXK, 82 Walsall Road, Aldridge, Staffs.

Has 3503.5, 3526.6, 3533, 3550.5, 3588, 3592 kc crystals. Wants frequencies 6600-6800 kc and 8000-8050 kc, ½-in. mounting.

G3IOZ, 1 Hillington Road, Edgeley, Stockport, Cheshire.

Has 3510 kc crystal, FT-171B, ¾-in. pins ; 7015, 7017, 7025, 7050, 7075, 7100, 7150, 7175 kc, FT-243, ½-in. pins ; 6497.9, 6522.9 kc, CR, ½-in. pins. Wants 6 mc crystals for multiplying to Zone E (144.4-144.65 mc), any mounting.

G3WR, 6 Green Ridge, Brighton, 5.

Has 3960, 4610, 7010, 7153, 7184 kc crystals, also various frequencies 5190-6720 kc, ½-in. and ¾-in. mountings. Wants frequencies 6027, 8039, 9040, also 6035.4-6054 or 8047-8069 kc for Zone J.

HB9KH, Pierre Weber, Herrliberg, Switzerland.

Has crystals 7150, 7175, 7200, 7225, 7250 and 14135 kc, FT-243 mounting. Wants frequencies 3500-3600 kc, 12900 and 13100 kc.

DIARY FOR 1954

Our respected contemporary, *Wireless World*, again offers, for the 36th year of publication, the well-known Diary, in its usual handy pocket size. The 1954 edition, now on sale, contains no less than 80 pages of reference matter, diversity of information being the feature. In addition to formulae, miscellaneous circuits and design data, base connections for about 500 current valve-types are included ; in all, the reference matter falls under nearly 40 different main headings. The format is a week at an opening, and the price in leather 5s. 10d. (rexine 4s. 1d.). Iliffe & Sons, Ltd., Books Dept., Dorset House, Stamford Street, London, S.E.1.

POSTAGE — PLEASE NOTE !

Due to heavy postage charges, we must ask that in future all correspondence to which a reply is expected should be accompanied by a stamped addressed envelope. This need not, of course, apply to correspondents' reports for our various activity features, to which in the ordinary way no individual reply is necessary.

Designing a Ground Plane

AND DESCRIBING A 14 MC SYSTEM

F. HAGUE (ZB1AH)

On any band for which it can be installed, the Ground Plane is an excellent radiating system for DX work. Practical considerations of construction tend to confine the use of a Ground Plane to the higher frequency communication bands; here, it has the advantage that the radiation characteristic is such as to weaken transmission (and reception) at the shorter ranges in comparison with the more usual types, while improving signal strengths at greater distances—a very useful feature for the DX-seeker on the 14, 21 and 28 mc bands. From the data given by our contributor, a Ground Plane system can be designed for any one of these bands.—Editor.

UNTIL the introduction of the 21 mc band the writer had a dual rotating beam for the 14 and 28 mc bands, the former being a two-element and the latter at three-element; a photograph of this structure appeared in *Short Wave Magazine* for March, 1951, page 27. With the introduction of 21 mc, the 14 mc beam was converted to this band with the hope that an ordinary dipole would suffice for 14 mc. However, this proved a poor substitute, and a search was made for a more omni-directional type of system; the Ground Plane was eventually decided upon.

Unfortunately little information was available, although a good start was made with the article by G2PL in the March, 1952, *Short Wave Magazine*. Further search was undertaken, since if nothing else there is no shortage of technical literature at ZB1AH. All the information it has been possible to find has been collated and the radiating system designed and built from it, and now in use, has proved so very successful that it is hoped the data given here will save much head-scratching by other amateurs interested in trying out the Ground Plane.

Since the construction is, to say the least, unorthodox no details are given in this article, the mechanical design being left to the ingenuity of the individual. But the figures and description should permit of such a system being easily duplicated in performance if not in physical construction.

Basic Design

This consists of a vertical rod or whip and four radials (*see* Fig. 1.) and it is upon the radials that so much depends, since to a large extent, their length determines the efficiency, and the angle relative to the pole supporting the whip the impedance matching of the radiator and feeder; this latter, as with any aerial system, is most important. Normally four of these radials are provided, spaced equally through 360 degrees, *i.e.*, 90 degrees apart (*see* Fig. 2). Three radials can be used with success (as may also five or six), but the optimum number appears to be four. Should it prove impossible to space these at 90 degrees they may be grouped in a semi-circle with only a slight alteration of directivity, this being so slight as not to be worthy of note.

The length of the whip or radiator should be 0.235 of a wavelength, and that of the radials 0.28 w/l. It will be noticed that the whip is slightly less than a quarter of a wavelength whilst the radials are a little greater; it has been found that this definitely makes for greater efficiency. The whip must of course be mounted on insulators and the radials insulated from ground at the bottom ends, but where they are joined together at the apex, insulation is desirable but not important, since this point is effectively at ground potential. To aid the easy working out of these lengths the following formulæ have been obtained to give direct lengths in feet.

$$\text{Length of } \textit{WHIP} \quad 0.235 \text{ w/l equals } \frac{231.24}{\text{f mc}} \text{ ft.} \quad \text{(i)}$$

$$\text{Length of } \textit{RADIALS} \quad 0.28 \text{ w/l equals } \frac{275.52}{\text{f mc}} \text{ ft.} \quad \text{(ii)}$$

Impedance Matching

It has already been said that the matching impedance is dependent upon the angle of the radials (Fig. 3 shows one radial for clarity). At 90 degrees the impedance is in the region of 25 ohms, at 45 degrees 40 ohms, at 30 degrees 50 ohms, whilst at 0 degrees the impedance is in the order of 72 ohms and the aerial in effect becomes a vertical half wave dipole, and although easy to match with standard coaxial cable exhibits *none* of the properties of the Ground Plane system proper. From the above it will be seen that at 45 and at 30 degrees a match can be obtained by using standard coaxial cable of 45 ohms, *i.e.*, Service Uniradio 4, or 52 ohms ; both these can be obtained, but should it be desired to match with other types, by judicious use of coaxial available nearly a perfect match can be obtained. The principle is the use of a Q-section, which is an *electrical* quarter-wave matching section connected between the aerial and the feeder. The impedance necessary for this Q-section is worked out as follows :

$$Zq \text{ equals } \sqrt{Za.\ Zf} \qquad \text{(iii)}$$

where:—Zq is the matching section impedance required.
Za the aerial impedance.
Zf the characteristnc impedance of the coaxial to be used.

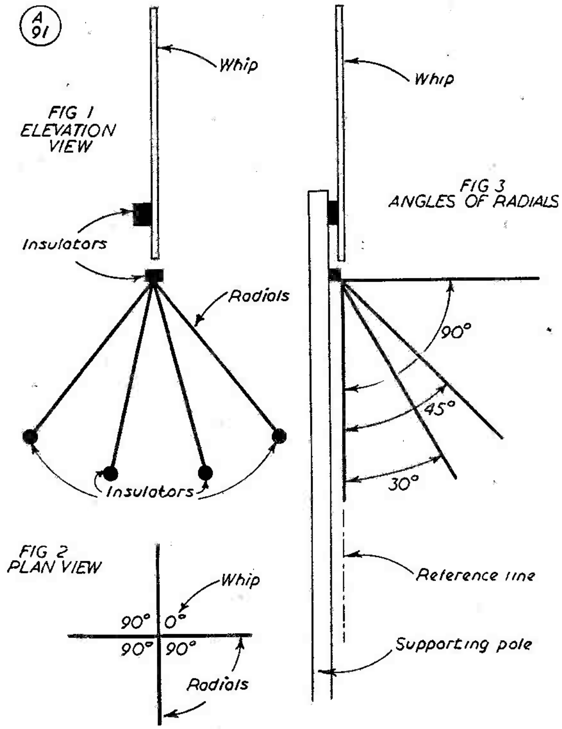
The matching stub or Q-section may then be a length of coaxial cable of such impedance, or two or more lengths in parallel, but whichever method is used it is important that the standing-wave ratio be kept as low as possible. The *electrical* quarter wavelength in this case bears little or no relation to the linear length since it depends upon the velocity factor of the cable in use ; this factor for nearly all types of coaxial cables can be taken as 0.65 and to simplify matters the formula for a quarter wave line is given which can be worked out directly in feet.

Length of a quarter wave matching section—

$$\text{equals } \frac{246}{f\ mc} \times VF \ldots \text{(iv)}$$

VF being the Velocity Factor

Using this method it becomes easy to match the ground plane or for that matter almost any other type of aerial. If coaxial cable of the correct value is available then all that is necessary is to connect the centre conductor to the whip and the braid to the radials, which should of course all be connected together at the apex. Should a Q-section be necessary and a piece of coaxial of the correct impedance be available then it is just joined in between aerial and feed line. If, however, two lengths have to be used in parallel as a matching section then the two inners are joined together and connected to the whip and the two braids to the radials ; similarly, at the feed point end the inners are joined and connected to the inner of the feed line, and the outer braids to the braid of the feed line. It should be noted for those who find it difficult to obtain coaxial cable or who already have a different type of feed in use (such as 150- or 300-ohm twin) that this aerial can be fed with any type of line so long as the Q-section is used ; in



Sketches showing general arrangement of the Ground Plane system discussed by ZB1AH.

the case of either open wire or balanced twin the inner/s of the Q-section are joined to one leg and the braid/s to the other leg of the feed line.

Practical Lengths

As already mentioned, the author was endeavouring to make up for the loss of a 14 mc beam so the figures given are for a ground plane resonant at 14.2 mc since the original two-element beam was cut for this frequency.

(1) Length of WHIP *from Formula (i)*

$$\frac{231.24}{14.2} \text{ equals 16.28 feet}$$

(2) Length of RADIALS *from Formula (ii)*

$$\frac{275.52}{14.2} \text{ equals 19.4 feet}$$

(3) It was originally decided to fit the radials at 90 degrees to the vertical, giving an impedance of 25 ohms approximately.

(4) The only coaxial available was of 80 ohm characteristic impedance.

(5) 'Q' Section required *from Formula (iii)*
$\sqrt{25 \times 80}$ equals $\sqrt{2000}$ equals 45 ohms.

(6) Thus two pieces of 80 ohm coaxial were to be paralleled as a 'Q' Section, making 40 ohms, which was the nearest available. Luckily, a long length of 45 ohm impedance coaxial was obtained, which permitted the use of radials at 45 degrees and an exact match.

(7) Length of quarter wave matching section *from Formula (iv)*

$$\frac{246}{14.2} \times 0.65 \text{ equals } 11.26 \text{ feet}$$

Results

Using this information the system was erected, the results being almost as good as the lost two-element beam. Tests carried out using the original dipole as a standard showed a gain of 6 dB in favour of the Ground Plane to stations in the direction of the dipole's main lobes and almost 12 dB in other directions. It should be realised that any good ground plane system has a low angle of radiation and results at distances under about 1,200 miles are little better than with a dipole—in fact, in some cases not as good—but for DX work this is actually an advantage.

★ ★ ★

Following on this account of the ZB1AH Ground Plane design, we have a description of the G.P. system in use at G4OT, Maldon, Essex.

In this, the point of particular interest is the arrangement of the radials. (It happens that G4OT's whip section is also cut for 14·2 mc). The mast itself is supported or stayed independently, *i.e.*, other than by the radials themselves. This is because, for directional purposes, the radials can be slightly bunched and made to "rotate" about the vertical axis of the mast and whip section.

By bunching all four radials in one direction, an almost vertically polarised field is apparently produced, mainly in the direction in which the radials are headed. By being able to swing all four together round the mast, what is virtually a beam effect can be achieved, in any direction desired. In fact, by judicious spacing of the radials, some very interesting (and quite surprising) results are obtained.

Moreover, it has been found by G4OT that this directional effect can be procured to some degree on any band on which the ground-plane can be made to resonate.

The system as set up by G4OT has been made to behave very well on *all* bands from 160 to 10 metres! This eccentric effect is procured by the simple expedient of introducing a tuning network at the transmitter end of the coax feeder line. With a suitable coil/condenser combination, the system as a whole can be made to resonate over several bands. For 21 and 28 mc working, the variable condenser is put in series with the "live" side of the feeder; on 14 mc (for which the system is actually designed) it is of course shorted out; and for the other bands a suitably proportioned tapped, or variable, inductance is used across the condenser. It is easy to see that what the feeder tuning process actually does is to produce the two arms of a centre-loaded dipole, with the whip section and radials getting electrically shorter as the frequency is lowered; thus, while the system as a whole can be loaded up on any band, it ceases to perform as a ground plane on the lower frequencies, and the radiation efficiency falls off rapidly owing to the electrical shortening.

Nevertheless, the directional feature at the fundamental described by G4OT is an interesting new possibility of the Ground Plane system, and well worth experimental investigation.

AUTUMN CALL BOOK

This is available in two versions, of the latest and most up-to-date issue. The *Radio Amateur Call Book* complete covers the whole world, giving the call-sign, name and address of every licensed amateur transmitter known, the listings being alphabetically by country prefix and call-sign. The other edition of the *Call Book* is exactly the same, less only the American section (which amounts to about two-thirds of the whole). The 21-page British Isles section of the autumn issue carries 61 columns of the call-sign/addresses of some 7,500 licensed operators in the U.K., and includes all QTH's and changes of address as published in "New QTH's" in *Short Wave Magazine* up to and including our issue for July, 1953. The price of the autumn *Radio Amateur Call Book,* for which we are sole agents in the U.K. and Europe, is 25s. for the full edition, and 10s. for the edition less the American section, covering all amateur stations outside the United States. Order on: Publications Dept., Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

AMATEUR RADIO EXHIBITION

The seventh annual Amateur Radio Exhibition, sponsored by the Radio Society of Great Britain, will again be held at the Royal Hotel, Woburn Place, W.C.1, during the period November 25-28 next. There will be a wide range of home-constructed equipment on show, and several firms have reserved stand space. As in previous years, Short Wave Magazine, Ltd., will be among those supporting the Exhibition by taking a stand, at which we hope, as usual, to meet many readers.

Why not Phase Modulation ?

RESULTS ON EIGHTY METRES

J. D. CAMERON, Assoc.Brit.I.R.E. (GM3BEA)

Our contributor discusses ideas for the practical application of phase modulation, with the objectives of reducing BCI and TVI while obtaining good phone working without the relative expense of high level amplitude modulation. An article on NBFM circuitry and methods appeared in the November, 1951, issue of SHORT WAVE MAGAZINE.—*Editor.*

HAVING experienced the effect of interference, phone and CW, amateur and commercial, on the 80-metre band, many amateurs will, no doubt, have wished for a QRO final to get through it all. But on consideration, the increased TVI and BCI, to say nothing of cost, may have prevented the use of higher power. The modulation system to be described here is another approach to these three stumbling blocks for the average amateur.

Some years ago the writer used the 10-metre band exclusively, and a reactance - valve modulator for NBFM was operated with such results that the AM equipment was never subsequently used on that band.

When the facilities were granted in this country for NBFM on the lower frequency bands, the writer was operating SSB on 80 metres. It was found that though the system has everything claimed for it by its advocates, for general use under present conditions a method of modulation *with a carrier,* easily tuned with an ordinary receiver, is really more desirable from the practical point of view. Frequency modulation seemed to be the answer on the LF bands as on the 10-metre band.

Having experimented with the reactance-valve modulator, the writer has come to the conclusion that on the 80-metre band it is practically impossible to obtain the centre-frequency stability which is so necessary for correct NBFM operation. It was decided to use phase modulation where the deviation is proportional to the frequency rather than the amplitude of the audio input voltage to the modulator. However, true NBFM is obtained by "cutting the highs" by means of a condenser between anode and earth of the first audio stage, and the essential centre-frequency stability obtained is due to the fact that the oscillator itself is not varied, as in the reactance-valve method of control.

PA Considerations

In many cases, TVI is caused by harmonic generation in the PA itself, which for amplitude control properly set up must be in Class-C with considerable drive power ; thus, harmonic suppression has to be included in the output circuit with varying degrees of success.

Some amateurs have used a Class-B linear PA to amplify the AM from a previous stage and the harmonic output has considerably decreased due to the low driving power required, with consequently less TVI. The drawback with this method is that the carrier efficiency is approximately 33%, which means low output from the normal PA, with the usual QRM reports. But the *peak* efficiency of a Class-B PA is twice this value, and a CW transmitter in Class-B is very little different as regards output from the normal Class-C arrangement—so that NBFM in conjunction with a Class-B PA means high carrier efficiency with low harmonic output. Fairly high efficiency can be obtained from a tetrode in Class-AB1 with no grid current at all, and still less harmonic output !

BCI troubles can be much reduced by using NBFM as very often it is shock excitation which is the real cause of trouble. However, the tunable BCI, due to oscillator harmonics beating with the transmitter fundamental, though much less with NBFM, can only be

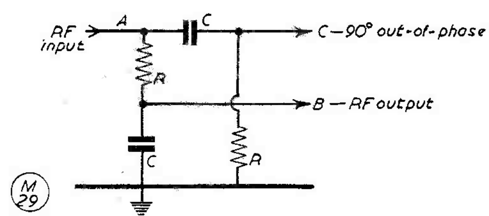


Fig. 1. Basic phasing network, the action of which is discussed in the text.

Table of Values

Fig. 1. Basic RF Phasing Network.

At 900 kc	At 1800 kc
R = 1,500 ohms.	R = 750 ohms.
C = 100 μμF.	C = 100 μμF.

Table of Values

Fig. 2. Practical Phase Modulation Unit.

C1, C2	= 100 $\mu\mu$F.	R1, R2	= 1,500 ohms.
C3, C4, C5	= 500 $\mu\mu$F.	R3, R4	= 15,000 ohms.

L1, C6 tuned to 900 kc.

completely cured by fitting wavetraps at the receiver and/or altering the aerial system.

The cost of an NBFM transmitter is very much less than with the same power on AM because often the PA can be built of surplus components easily obtained, and the peak modulation voltage is only half that of the amplitude modulated PA so closer spaced tank condensers can be used. High level modulation equipment is expensive and often difficult to adjust for good speech quality. And for the thrifty, the saving in running costs is no small matter !

The writer has been using frequency modulation on the 80-metre band in competition with high powered AM stations with success for some time and the details following will show the simple phase modulator giving such results. It is interesting to note that many operators worked did not realise that NBFM was being used until told so.

Circuits

Fig. 1 shows an RF phasing network which at B and C will give outputs 90° out of phase when RF is applied at A, and the reactance of C at the applied frequency equals the resistance R. If the output is fed through a twin-channel amplifier and each amplifier controlled by another voltage then the phase of the output will vary dependent on the controlling voltage. The double-triode modulator has the RF 90° out-of-phase fed to the two cathodes, and audio voltage 180° out-of-phase fed to the two grids, the anodes being strapped and tuned to the NBFM output frequency. The output from this stage has both frequency and amplitude modulation but the latter can be eliminated by a following Class-C stage. The variation in frequency of the output is, in this circuit, almost equal to the audio frequency applied and would sound very " toppy." To make the speech sound more balanced the speech amplifier has a .001 μF condenser between anode and earth in the first audio stage.

Results

The deviation on the operating frequency is not sufficient for the average AM receiver, so this modulator operates on 900 kc and the deviation is increased by four times on the

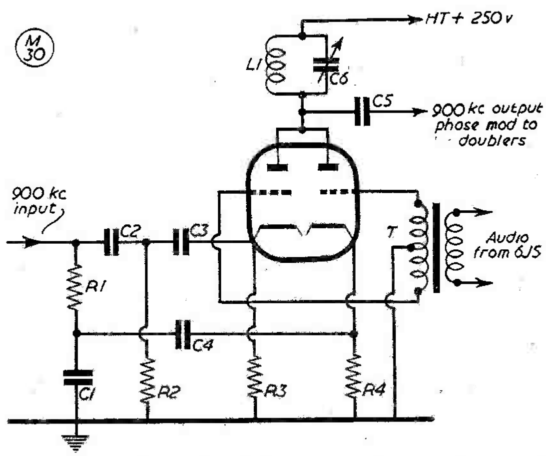


Fig. 2. Practical circuit for phase modulation, with all necessary values in table. The author of the article operates successfully on the 80-metre phone band, using this method of control.

80-metre band ; this is perfectly adequate, with good speech quality.

For the higher frequencies the audio gain control is adjusted for 2.5 kc deviation, and an excellent check is to listen to the exciter on an AR88 (selectivity position 3) advancing the gain till the speech quality deteriorates and then reduce below that point.

The modulator shown may be followed by any all-band CW transmitter, with results comparable to amplitude modulated operation.

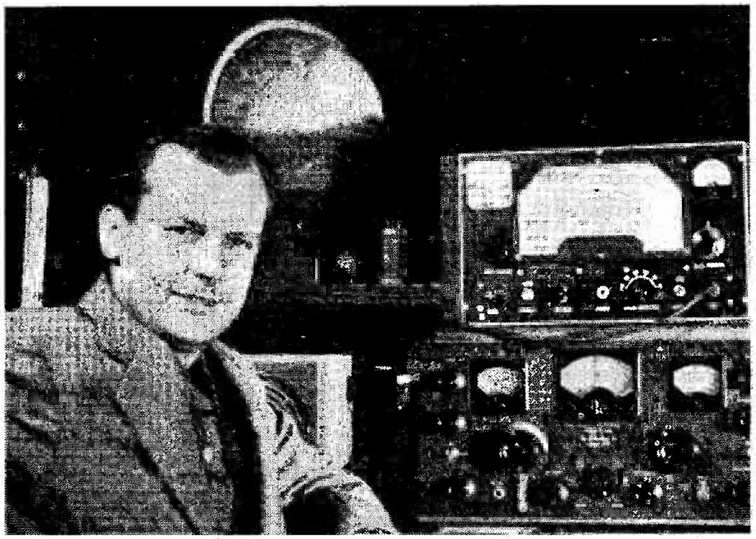
ARTICLES FOR PUBLICATION

We always want to see articles on subjects of Amateur Radio interest, and we pay high rates for published material. A general note on how to submit articles appears every month on the Contents page. But there is a bit more to it than that. Contributors can best help themselves, and us, by preparing their material in the form in which they expect to see it in print in *Short Wave Magazine*. This calls for a close study of *Magazine* presentation, and careful attention to such points as permitted abbreviations, the use of sub-headings, the drawing convention, the setting out of tables of values, and sequence in the treatment of the subject. Particular care should be taken with drawings and diagrams, which *must* be accurate in every detail and conform as nearly as possible to the *Magazine* convention ; but they need not be copper-plate, as all diagrams are re-drawn for block-making. On the average, we use in each year the work of some 60 outside contributors, most of whom have seen themselves in print for the first time in *Short Wave Magazine.*

FREQUENCY METER TYPE LM-10

G2ZP, of 180 Maidstone Road, Chatham, Kent, would be very glad to hear from anyone who can give him the base connections of the octal holder for the 1000 kc bar in this instrument. The LM-10 is the U.S. Navy version of the BC-221.

DX COMMENTARY



WØNWX

CALLS HEARD, WORKED AND QSL'd

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

AT the time of writing this preamble we are still enjoying the longest spell of good conditions that we have had for months (or even, possibly, years). Starting at the end of September, the bands really livened up in a big way, and, to everyone's surprise and joy, they did not immediately flop again! This has acted like a tonic; several of the old hibernators have emerged from their nests, the voices of VK and ZL have been heard in the land once more, California has showered its kilowatts over us, and all has been relatively bright and beautiful.

Of course, we are quite prepared to believe that you will be reading this on a day when the DX bands yield nothing but OH, SM, DL and CN8—but who can tell? Let's use the bands while they *are* open. (Incidentally, the big stick at G6QB had to choose this particular time to collapse under the weight of its three long wires, leaving the despondent owner with one single wire 18 ft. high at the home end, but it doesn't seem to have made much difference—except to the wounded pride of the said D.O.)

The Come-Back

Last month's opening remarks were intended to stir up some controversy, but they failed lamentably — all the comments thereon have been most decisively on our side. To summarise them, the opinion is "Keep on with the theme of the Poor Man's DX, however humble, and never mind the stray expeditions unless you happen to know all about them in good time." In particular, the Top-Banders have rallied round in the hope that the space allotted to their territory will not be cut down.

To quote just one remark: "Never mind the het-up brigade. If you ever get to the stage when you can foretell just who is going to be where, and why, and at what time, just slip me the winner of the next Derby instead." This month our tame tipster has *no* news of the future, and can only tell you that once again some nice ones have been let loose without any prior notice at all. Those who have walked off with VQ1NZK and FL8UU will know what we mean!

Top-Band DX, G/ZL

The series of tests between ZL and G on the Top Band is now concluded, and, so far as we know, no actual QSO resulted. But ZL1AH did receive signals from G6CJ and G6GM most mornings of the first week in October; conversely, the two G's concerned received ZL1AH on several occasions. G6GM (Holsworthy) tells us that ZL1AH was heard on September 29 at 0720 BST, calling G6CJ/G6GM and reporting them RST 229. And on October 12 G6GM heard G6CJ giving ZL1AH a report of 349, but then silence.

Personally, we should describe these tests as a triumph of perseverance and organisation—not by any means as a failure. The actual formality of a QSO means very little (except on paper), when it has once been established that each end is hearing the other. So several large bouquets to ZL1AH, G6CJ and G6GM.

Another very interesting note for Top-Band DX-ers. G3EIZ, temporarily billeted in London, has been listening on the medium waves with his R.1155. On October 7 he heard KNX, Los Angeles (50 kW) on 1070 kc, peaking S6 at 0500; and also KOMO, Seattle (50 kW) on 1000 kc, peaking at S8 at 0600. 'EIZ remarks that the medium band in the late evening gives a good idea of conditions; CBA, Sackville, can be heard by 2300 GMT on 1070 kc, if conditions for North America are good. If LR1, Buenos Aires, shows up instead, then conditions are no good for North America but excellent for South. Top-Band conditions are closely related to these medium-wave effects.

Flash: G3PU (Weymouth) worked W3RGQ at 0505 GMT on October 4—the earliest contact of the kind that we can remember for any season. 'PU was on 1840 kc and found conditions fair, in spite of static Are there any prior claims for the first contact of the 1953-54 season?

DX Openings on 21 mc

A fortnight of really good conditions on this band has proved to be quite an eye-opener (for those who normally keep them shut!). DX from all parts, especially on phone, has been fairly romping in. We all know it's too good to last, but let's enjoy it while we can.

G2BJY (West Bromwich) says that some of the openings to U.S.A. between 1330 and 1430 have been quite like the old 10-metre days. New ones for him were VU, SV, ET, IS, YO and VQ1NZK, all on phone, as well as OA4C on CW.

G2YS (Chester) put his score up to 65 with ZD4AB (1730), OA4ED (1250), CP5EK (1850) and VP8AJ (1700)—the latter for his second G contact. G3CMH, the Yeovil Club, collected some nice ones on Phone, such as VK9GW (0915), VP6FR and 6PV, ZE2JK and a crowd of KP4, KV4, KZ5 and ZS stations. But his list of "Got-aways" just shows you what goes on around the band; here it is: CP5EK, CR4AP, ET2MK and 2VD, FB8SR, HK4FV, HP's, TI's, VQ1NZK and 3KIF, YK1AA, ZD9AA and ZS3E—all on phone.

G2BW (Walton-on-Thames) thinks October 11 was the best day we have yet had on 21 mc—and a reminder that during the next few years a more selective receiver will be wanted! New ones recently worked have been PJ, YN, CE, VS1, YV, VP6, KP4, KG6, AP and HK. Another nice list of Gotaways includes JA1CO, XE2W, VK9WK, DU7SV, FB8SR, VP8AJ and ZP9AY. 'BW passes on the news that W8BHW has already passed his Century mark on this band; he it keeps on like this the real race will be for the 200 mark!

G5BZ (Croydon) bagged YN1AA, SVØWE and ZD4AB, and heard most of the Gotaways already mentioned, as well as 4S7LB. G3DO (Sutton Coldfield) added TI2EV, ET2MK, HC1FS, ZD2S, FB8SR and ZS3E—all on phone.

G3GUM (Formby) raised VK4HR for his first VK this year, as well as YV5DE for a new one. He passes on a message from VP8AJ, who says he is very active on 21 mc and wants to work G—but, as you have already read, he has done it by now.

G3HCU (Chiddingfold) is getting going on phone in a big way, and worked 20 new ones during the month. The best of them were HK4FV, KZ5CP, TI2EV, VK6BS and 9GW, VP5SC and 6FR, VQ1NZK, VU2JP and ZD4AE. The total is made up by strings of VQ's, W's, ZS's and 4X's, plus a few Europeans.

G2WW (Penzance) passes on VQ4RF's score of 94, and his own of 80, which now includes TF5TP, YO3RF, FB8SR, VP5SC, VQ1NZK and HC1FS (all on phone). Other nice phone contacts, though not new for the band, were TI, KZ5, HP, VP6, ZD2, 9S and GD. But 'WW still isn't satisfied and says there were many that got away—such as VK9GW and CP5EK.

High scorers on 21 mc who do not report their scores to us for the Table are DL3RM (92), DL7AP and G6ZO (84), DL7BA (82), PAØJJ (79) and TI2TG (76).

The DX on 14 mc

Although Twenty has naturally been wide open at the same times as Fourteen, the DX has not been so exciting because of the lack of novelty about it. All the same, it has been gratefully lapped up by the DX-starved customers, and your Commentator, for one, has derived a lot of pleasure from some really good contacts with W6, VE7, KL7, KH6, ZL and the like.

G3CMH found a few openings for VK's at 0800, and some good early-evening sessions. On CW he worked KV4AA, PI1LS, VE8YC/2, VP6GT, VS9WI and W6YRA; phone raised SVØWK and VK5RN, but missed on I5RM, MP4K, VS1BA and ZS8D. Also DI9AA/MM, the Hugo Haas

"What I like about . . . SSB is that . . . it is so nice to tune in . . . an A3 signal afterwards."

expedition in the North Atlantic.

Several readers report hearing the latter station, but not many QSO's have been claimed. One of the exceptions was G2DVD (Slinfold), who ran a sked and had many interesting contacts. One of these was a four-way with DI9AA, KV4BB and KV4BD; the latter is controller of a Caribbean 80-metre net which is acting as a communication system for DI9AA when he reaches St. Lucia. On another contact KP4TO broke in with a hurricane warning which was successfully passed to the *Xarifa*.

Other nice contacts for G2DVD were with KG6AEX and VS6CL, both on phone, making his first visit to 14 mc for some months a very profitable affair.

G2YS visited the band and collected W7HYW in Wyoming (1623) and EA6BC (1715). G8OJ (Manchester) worked KF3AA, who will be remembered as the station on Fletcher's Ice Island that formerly signed W5AGB/FM. KF3AA gave the temperature as 33 below and said QSL *via* W2LXP.

G5BZ raised MP4ABW (Qatar) on phone, as well as VP8AJ, JA1BZ, VP4LZ and ZS8D on CW. A nice trio of Gotaways were KAØIJ, FK8AC and KX6BC. House-painting has taken up more time than DX-chasing (with conditions so good, too!)

G3GUM found an all-time new one with HR1AT, and others raised were ZD2DCP, FP8AP, VS1FN, VS9AD and KH6LG. He tells us that VP7NM, who has been off for months, is now back, and will be on 21 mc shortly. (We also hear rumours that he will be on the Top Band during the winter tests). 'GUM received his "heart-gladdeners" from VS9UU and VQ9UU, but has heard no sound yet of ZD3UU—only a quick "pop-up" from FF8. Finally, 'GUM is going up Snowdon with G2JT and G6DC, but for a 70-cm. epic; he has been inoculated with anti-VHF serum, so we may expect him back on the DX bands.

News from Overseas

XZ2OM (Rangoon) is a newcomer to the "trade," but, being a Signals Officer, is picking it up quite easily. He is on CW with 50 watts and has worked 59 countries up to date on 14 mc. Working times are normally 1130-1700 GMT, extended to 1030-1800 on holidays. XZ2OM tells us that the amateurs in Burma are licensed for 160 metres, but *not* for 80; and that their allocation on 40 is 7100-7150 kc only.

ZS2AT (East London) is very active on 21 mc, where his score is now up to 62. He is looking for G's most afternoons.

CE3AG, who operated CEØAA on Easter Island, managed to work 68 G's during his session there, as well as raising a few more as CEØAA/MM while on the return trip to Chile.

VK2NO (Sydney), whose amateur career started in 1911, drops a line in which he says that Amateur Radio is still "the permeating atmosphere in the household"; he has lost little of his interest, but a lot of his available time. He might, however, appear on the bands at any time.

Top-Band Topics

GC3EML (Jersey) asks whether GC counts as one county, or each island, or neither! The answer is that each island counts as a separate one, for the purposes of our little game. (Of course, it is not politically correct, but then neither is the inclusion of the Isle of Man as a "county"). 'EML reports hearing W1EFN, 1LYV and 1VDB on the morning of October 11.

G3GZJ (London, S.E.8) put his score to 64 by finding GW3GMN/P in Brecknock. He hopes to sport a new aerial soon and rush off towards the 80 mark . . . .

G2HKU (Sheerness) says the OK's have been coming in at S8, and has heard rumours that an Italian station is on the band.

G5LH (Horbury) appeals for more activity, and says that the alteration in frequencies does not really warrant any falling off in activity. He adds that QRM from Service and commercial stations is very little worse, and that there are still plenty of open spaces that want using.

Most interesting QSO for GM3IGW (Alloa) was one with GM3DTV in his own county of Clackmannanshire—his first! This was No. 85 for 'IGW—the highest number of counties yet worked by anyone. Other news from 'IGW is that the OK's and DL2PA have been worked; that GM3IXE/P is a fine sig. from the Shetlands; and that two contacts with GW3ZV and GI3IOS were made between 1030 and 1200 on October 11. Best daylight DX on CW was from G3EBO and G3IEF (both Bucks.), and some S9 phone was heard from Yorks. and Lancs.

G3IVH/A (Norwich) claims his WABC, which is, as he suggests,

FIVE BAND DX TABLE

POST WAR

Station	Points	3.5 mc	7 mc	14 mc	21 mc	28 mc	Countries	Station	Points	3.5 mc	7 mc	14 mc	21 mc	28 mc	Countries
DL7AA	630	83	145	214	84	104	220	G2BW	346	24	57	144	78	43	155
G6QB	577	52	103	215	72	135	231	G2YS	330	42	56	127	65	40	151
G5BZ	525	57	102	223	78	65	228	G3ABG	326	36	81	147	32	30	155
G2VD	478	46	84	175	65	108	184	G3GUM	319	31	38	168	81	1	177
G2WW	469	23	70	189	80	107	196	GM2DBX*	279	11	31	154	2	81	163
G2BJY	458	48	77	141	76	116	179	G8VG	277	35	76	123	17	26	140
G3DO	430	24	45	192	62	107	219	G3FPQ	254	47	40	120	35	12	127
G3FXB	403	54	102	168	40	39	174	G4QK	217	21	45	137	11	3	132
G5FA	398	33	116	150	26	73	165	G2DHV	173	20	21	107	10	15	111
G4ZU	388	11	9	185	63	120	199	4S7XG	121	1	17	93	7	3	93
G6QX	387	50	91	143	46	57	166								

* (Phone)

the first awarded to a "stroke A" station. He runs a TT11 with a 264-ft. end-fed aerial, and best DX so far has been a 579 report from a Polish SWL, while he was working HB9T.

G2YS has been stuck at 59 QSL's for months now, in spite of having worked 71. He did *his* part in writing out 62 Merioneth QSL's, so is entitled to criticise those who are too slack to QSL to others. He suggests that some of the rarer counties "have got browned off with QSL-ing," and that this may seriously curtail WABC activity in future.

Mystery Man

We are told by G5MP (Hythe) that, for participation in the RSGB Top-Band Contest (November 7, 2100 GMT, to November 8, 0800 GMT), a "station with a very rare prefix" has been granted special permission to operate on the Top Band. His signals may be weak, and to keep his frequency clear it is asked that replies should be made 10 kc above his CQ frequency, unless indication is given to the contrary. The operator is known personally to G5MP, but does not want his call divulged until he actually appears on the band. We are not at all sure that this is the sort of "advance information" that is worth passing on, but you have it as it reached us.

The Counties Ladder

We originally applied to all the various ladders the rule that the absence of a report for three consecutive months would imply lack of interest; the entry was therefore removed. We find that the "Counties Ladder" has become largely static, and have therefore cleaned it up by cutting away the dead wood. Only those who have made no sound since July 15 (for the August list) have been removed. They may reinstate themselves in the table at any time by sending along their current scores.

Short Wave Magazine

DX CERTIFICATES

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

WFE

No. 13 HB9EU (Cham.)
14 G3DO (Sutton Coldfield)

WNACA

No. 56 G6VC (Northfleet)
57 G3AAE (Barnet)
58 OH2NQ (Helsinki)
59 G3LP (Cheltenham)
60 PAØLR (Santpoort)
61 SM7QY (Karlskrona)

WABC

No. 41 G3BRL (London, W.5)
42 G3AID (Farnborough)
43 GM6RI (Forfar)
44 G3IVH/A (Norwich)

FBA

No. 21 I1AMU (Rome)
22 SM7QY (Karlskrona))

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

Don't be fright! When ST2UU goes on tour in the southern areas of the Sudan these are the DX boys he meets.

Other Bands

Yes—*Eighty* and *Forty* are so neglected these days that they can be tucked away in a corner and labelled "other bands." A tragic situation, isn't it? But a casual look over the two bands concerned, at most times of day or night, is sufficient to explain it. *Forty* consists of a few very small cracks in between broadcasting stations and "jingle-bells" of all types; *Eighty* is a mass of those highly excitable, peremptory, imperious and usually chirpy signals, very badly keyed, whose origin and intention remain for ever shrouded in mystery. Doubtless they all serve some useful purpose in the Universe, along with wasps, 'flu germs and poison ivy.

We know that some DX is being worked on Eighty—W's and VE's late at night, and ZL's in the morning; and we have a report that VK6KX has been worked on the band, quite early in the evening. W2QHH (Hamilton, N.Y.) told us over the air that he had raised PZ1WX for his 104th country on Eighty, and we also know that 4S7XG has been worked up there.

We would be glad to have some authentic news from a few of the regular DX-ers on Eighty, because only a one-band specialist can really know just what does go on nowadays.

Forty is more or less its normal self, apart from the QRM, and PY's are invariably there late at night, with ZL's in the early (and not-so-early) mornings. The latter have been heard at 0900 GMT.

General Patter

G2HKU reminds us of the power failure on the Isle of Sheppey and tells us that they are running on a cable supported by oil drums across the River Swale! They had neither power nor sewerage for two days, and a temporary cable half-a-mile long was laid on the pavements of the main road to supply the hospital with power from the Dockyard.

A well-known amateur who does not normally figure in the DX notes tells us that he is probably going to be forced to keep on the DX bands, for a new reason: It constitutes a novel geography lesson for his young daughter! She looks up the day's QSO's in the *Call Book* and then sticks pins in the map . . . . and if the OM doesn't produce a nice list of contacts every day there is going to be trouble. (Maybe he'll start cheating by making a lit of Got-aways as well as contacts?)

G2DPY (Shoreham) has had his "house mast" down, and is running a temporary 80-ft. aerial from an apple tree at an average height of 15 feet. With 35 watts into this on Eighty, he is working W's and ZL's with ease, getting S6 from the latter. (There's nothing for it, we shall have to put up an apple tree . . . .)

GW3IEM (Swansea) has not been active since November, 1952, and has been in Germany most of the time. But he has been receiving cards for G3IEM and G3IEM/A, apparently manned by a type named Eric. As the genuine station is about to open again shortly, he would like to warn off this character—and we suggest that the said character might take steps towards acquiring a call-sign of his own.

DX Gossip

The fabulous W6UXX is still due to appear on Cocos Island as a TI9, and the latest "probable date" was around November 1. But TI2TG advises us that *two* treasure expeditions to the island may materialise before February. And, thirdly, the West Gulf DX Club has plans for a DX-pedition to the same place, probably during December. So QRM from Cocos should be coming thick and fast.

It is rumoured that a UA will be active from a weather station on Rudolph Island (red-nosed reindeers are believed to be the local fauna) and has been seeking permission to work W's. The QTH is near Nova Zemlya, but no one knows whether it is a "country" as yet.

Activity from Jan Mayen seems to be confined to the occasional appearances of LB8YB, who has been reported on Forty as well as Twenty.

The long-promised expedition to Rio de Oro by EA4BH (probably signing EA9DD) had not shown up at the time of writing, but was

TOP BAND COUNTIES LADDER

(Starting Jan. 1, 1952)

Station	Confirmed	Worked
GM3JDR	82	82
GM3IGW	81	85
GM3EFS	81	83
GI3HFT	79	80
GI6YW	79	79
GM3OM	79	79
G6VC	77	79
G8KP	77	77
G5LH	76	78
G2NJ	76	76
G3ELZ	73	76
G3HIS	70	73
G4XC	69	72
G3HDQ	69	70
G3GZJ	64	64
G3HTI	63	65
G2AOL	61	72
G3IVH/A	60	63
G3BRL	60	61
G2YS	59	71
G5JM	54	77
G3AKY	53	62
G3ABG	46	60
G3ITY	41	52
G3FTV	38	53
G3CFG	29	51
G8VG	29	36
G3FZS	23	39
G5FA	20	38

21 mc MARATHON

(Starting July 1, 1952)

STATION	COUNTRIES
VQ4RF	94
DL7AA	84
G3GUM	81
G2WW	80
G2BW	78
G5BZ	78
G2BJY	76
DL2RO	75
G6QB	72
G2VD	65
G2YS	65
G4ZU (Phone)	63
G3DO	62
ZS2AT	62
G3TR (Phone)	57
G3CMH	57
G3HCU (Phone)	54
G8KP	50
VK2AWU	47
G6QX	46
G3FXB	40
G8OJ	40
G2DPY	32
G3ABG	32
G3WP	26
G5FA	26
GW3CKB	19
G8VG	17
G2DHV	10
GM2DBX (Phone)	2

expected during the latter part of October.

CR8AB is actually in Goa (Portuguese India) but without any gear, his rig still being in Portugal. Nevertheless, QSL's for CR8AB are being bandied about, and the call has actually been heard on the bands.

The Worldwide DX Contest (formerly the *CQ* Contest) will be all over by the time you read these notes. We hope that conditions favoured it.

Tail-Piece

Two days after having written that optimistic opening on the subject of conditions, we have fallen right down the hole again. At the time of writing *this* paragraph one can only switch on, look at the bands, shudder slightly and switch off again. But it may be only a temporary lapse, and WWV is sending "U 5," which seems to indicate possibilities of something better.

So, for another month, we take our leave. Next month's deadline is **first post on November 11,** so you only have a few days after reading this to send your news along. Address it, as usual, to "DX Commentary," *Short Wave Magazine,* 55 Victoria Street, London, S.W.1. 73 and BCNU next month.

DL1MC is in Regensburg and is well-equipped for operation on the HF communication bands.

FROM BEHIND THE CURTAIN

NOTES ON RUSSIAN AMATEUR ACTIVITY

Here our contributors discuss the latest Russian operator-ability award, and describe the process of indoctrination for a young Russian YL aspiring to come on the air on her own.—EDITOR.

IN the June 1953 issue of *Short Wave Magazine* we referred briefly to a new yardstick laid down by the DOSAAF organisation for the classification of operating ability; among other things, this included working all 16 Union Republics within 3 hours, to qualify for the title "Master of Radio-amateur Sport," and within 6, 12, or 24 hours to merit the distinction "Radio-amateur 1st, 2nd or 3rd Class" respectively. To ensure sufficient activity from each of the Republics, a special test was arranged, commencing at 18.00 GMT on October 24 and finishing at the same time on the following day. This event is officially termed the "2nd All-Union Classification Contest for Short-wave Operators of DOSAAF" and took place on all amateur bands, operation being confined to CW. Unfortunately, this test will have occurred before these notes are published, but at least readers will know what all the QRM was on the week-end in question!

We have previously described how Russian amateurs are officially encouraged to cultivate efficient operating ability rather than to win fame by DX achievement, and we feel that an article in the June issue of *Radio* (Russian edition), describing the progress of a YL operator, illustrates the Russian approach quite well. We have therefore thought it worth while to include here a free translation of: "The Way to Achievement."

The story opens when Maria Tokareva, idly tuning round the dial, suddenly heard, "Attention! Here is the collective station of the Krimski (Crimean) Radio Club, UA6KSA. We are beginning a special transmission devoted to the radio-operators' contest in this oblast." Very surprised and not a little interested to see what it was all about, she listened to a description by the announcer of the work of Soviet radio amateurs. After this came a CW transmission, and Maria was very impressed when the operator gave the speed as 30 words per minute.

While still at her secondary school, Maria had been curious to know how, without conducting wires, speech and music were transmitted over hundreds of miles. Now, listening to this transmission from UA6KSA, her desire to understand the principles of radio was re-awakened, so at the earliest opportunity she joined the club. There she met young men and women with the same interests and took a course in radio theory. The account goes on:

"Maria Tokareva studied at the Teachers' Institute during the day, and now in the evenings she spent her spare time learning the fundamentals of radio and also learning Morse, in due course successfully finishing her course. While still learning she became interested in the club transmitter and in the other club stations in distant parts of the Soviet

Union which she had heard. Then, on March 8, 1951, she became an operator of the club transmitter —her dreams were coming true!"

"The number of Maria's QSO's grew, and so did her operating ability. The QSL's came rolling in. Then one day the president of the club mentioned to her the possibility of her representing the club in the All-Union Contest for Radio-operators of DOSAAF, and, following his advice, she practised passing messages. Day by day the number of words per minute she could read increased. Finally, at the 4th All-Union Contest, the Krimski Club was placed 1st of all the radio clubs in the Soviet Union and Maria Tokareva was in the winning team."

"As a member of the Krimski club and a young Communist, she knows the importance of popularising the technique of radio among working people. At the Simferopol Institute, where this need is catered for in a number of ways, Maria started to give lectures on the history of the development of radio, explaining to her class about the work of the great and learned A. S. Popov. Then, at the end of last year, she organised a radio society at the Teachers' Institute, in which student members of DOSAAF could learn Morse and operating procedure."

"For her active work in the short-wave section of the radio club, and for her efforts in spreading the science of radio among the people, Maria Tokareva was rewarded with Certificates and Diplomas of the Krimski committee of DOSAAF. Her ambition for the future is to build an amateur radio station of her own and, in view of her perseverance, there is no doubt that her wish will come true."

This, then, is typical of the type of propaganda article which appears in profusion in every issue of *Radio*, which claims a monthly circulation of 90,000 copies—in a country of about 200 million peoples it is not difficult to understand the reason why the circulation is not higher!

Galaxy of T2FD

DESCRIBING SOME UNORTHODOX INSTALLATIONS

N. P. SPOONER (G2NS)

The method of operation of the T2FD is apparently still widely misunderstood. What it amounts to is an aperiodic system, inherently broad band, which can be made to load up over a wide range of frequencies by virtue of its method of matching. The fact that, if cut to the design data given in our January, 1953, issue, it does not show resonance at any particular frequency in a band does not necessarily mean that the design is wrong, or that the system will not work, but simply that it is exhibiting the required flat-band characteristic. Those who feel inclined to argue about the T2FD on purely theoretical grounds should try one—and then see if they can produce a theory to account for its effectiveness.—Editor.

At least one dictionary tells us that the word galaxy can mean "an assemblage of splendid things" and the purpose of this article is to show that by erecting and operating a T2FD in ways other than the orthodox its varying characteristics can be chosen to suit different circumstances.

The four main features of a basic Terminated Tilted Folded Dipole are all-round reception and radiation (Table A), multi-band operation (Table B), space-saving (Table C) and the possibility of beaming made apparent by Fig. 2. A strong signal appears off the low end of the system and where at any given location there are two available points of high suspension—

Table of Values

Fig. 1. Circuit of the Field Strength Meter.

C1, C2	= 30 $\mu\mu$F, silvered mica.		7t. 26g. close wound on 3/8-in. slug tuned former, tightly coupled to earthy end L2.
C3, C6	= 0.1 μF.	L2	= Grid coil, for band in use. 14 mc, 21 turns as L1.
C4, C5	= 150 $\mu\mu$F, silvered mica.	L3	= For band in use, 14 mc, 15 turns.
C7	= .002 μF.	V1, V2	= 1L4 (CV1578), or 1T4.
R1	= 2 megohms.	LT	= 1½v. dry cell.
S1	= HT switch.		
S2	= LT switch.		
J	= Phone jack.		
M	= 0-500 μA meter.		
HT	= 22½v. Deaf Aid.		
L1	= Aerial coil, for band in use. 14 mc,		

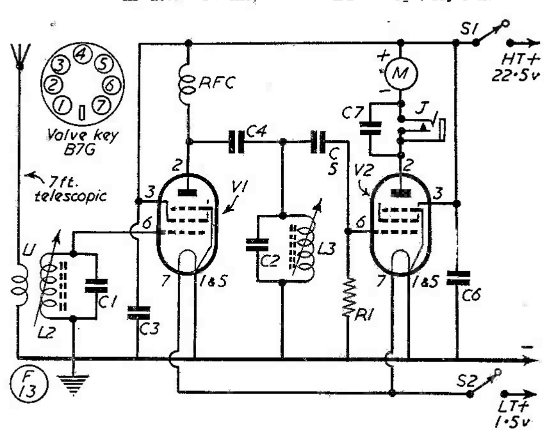


Fig. 1. Circuitry for a modern type of Field Strength Meter, sensitive enough for measurements to be made at some distance from the radiating system. Coils are for the band(s) required and values are given in the table. The built-up version of this circuit is shown in the photograph.

TABLE A

APPROX. AZIMUTH IN DEGREES	PREFIX	RST	OFF T2FD HIGH end = H LOW end = L SIDE = S
15	OH	589	S
40	KG6	469	S
60	DU	579	S
85	VS2	569	S
110	YU	579	H
135	SV	559	H
175	VQ2	559	H
200	CT1	579	S
250	KP4	579	S
280	VE2	569	L
300	W9	569	L
320	W6	359	L
350	TF	579	L

Coverage obtained with a 300-ohm fed "40-metre" T2FD when operated on 14 mc with the low end to the North-West.

such as a couple of poles or convenient chimney-stacks—the low ends of two separate aerials could be aimed at DX sought from two particular directions.

A further disclosure concerns the aerial currents of Figs. 2 and 3. Because of doubtful calibration only the actual dial readings themselves are quoted for comparison, the surplus hot-wire ammeter in question being scaled from zero to nine and originally reading up to 4 amps. The difference in currents seems to imply that even after allowing for the power unavoidably lost in the terminating resistor, with its stipulated wattage rating equal to 35% of the input to the PA, there is still more active energy left in the T2FD for useful radiating purposes than there is in a half-wave dipole excited under similar conditions.

Obtaining the Data

In preparation for the tests an Ordnance Survey sheet of the immediate neighbourhood scaled at 50 inches to the mile was obtained. Circles drawn at distances of 150 and 250 feet from the aerial site showed that private property would everywhere deny access for taking field strength meter readings. At 500 feet, however, the eight main points of the compass were, with the exception of a school chapel, seen to fall on or near public roads. It was decided therefore to risk the displeasure of the minister even though an obviously mad experimenter with a tin box and a telescopic aerial would appear about as self-effacing as a panther in his vestry.

When the old pre-war FSM was brought out and dusted its combined HT and LT supply of only 2 volts proved quite inadequate except when very close to the aerial. A more sensitive meter and a germanium crystal were no better and urgent necessity then evolved the modernised version reproduced in the photograph and shown in Fig. 1. The 5" x 3" shelf attached to the front panel comfortably held a $22\frac{1}{2}$ v. deaf-aid HT battery, a $1\frac{1}{2}$ v. LT dry cell and the HF and detector stages; the stripped Tuning Unit box housing them was purposely made large enough to accommodate an accumulator and several grid bias batteries in case of future need. Actually deaf-aid HT batteries will be found to give a longer shelf-life than the GB type if the FSM is only used infrequently. Whatever the chosen power supply and method of switching it the average $1\frac{1}{2}$ v. valve still prefers the HT in series with the LT accompanying it.

During wiring-up a grid-dip oscillator proclaimed when the correct number of coil-turns had been wound on and the same "useful piece of auxiliary equipment" made pre-tuning possible.

When the first outdoor trial was made only a slight re-adjustment of the iron cores was found necessary to peak the received signal. With the meter in series with the HT to the detector anode a standing-current reading

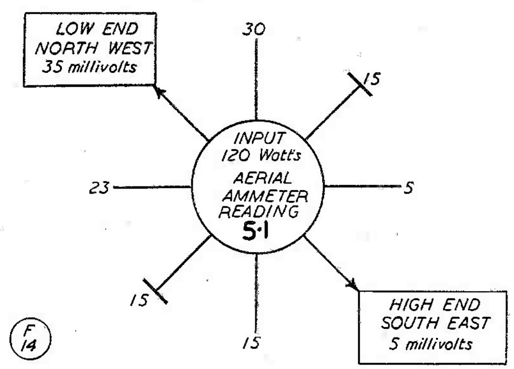
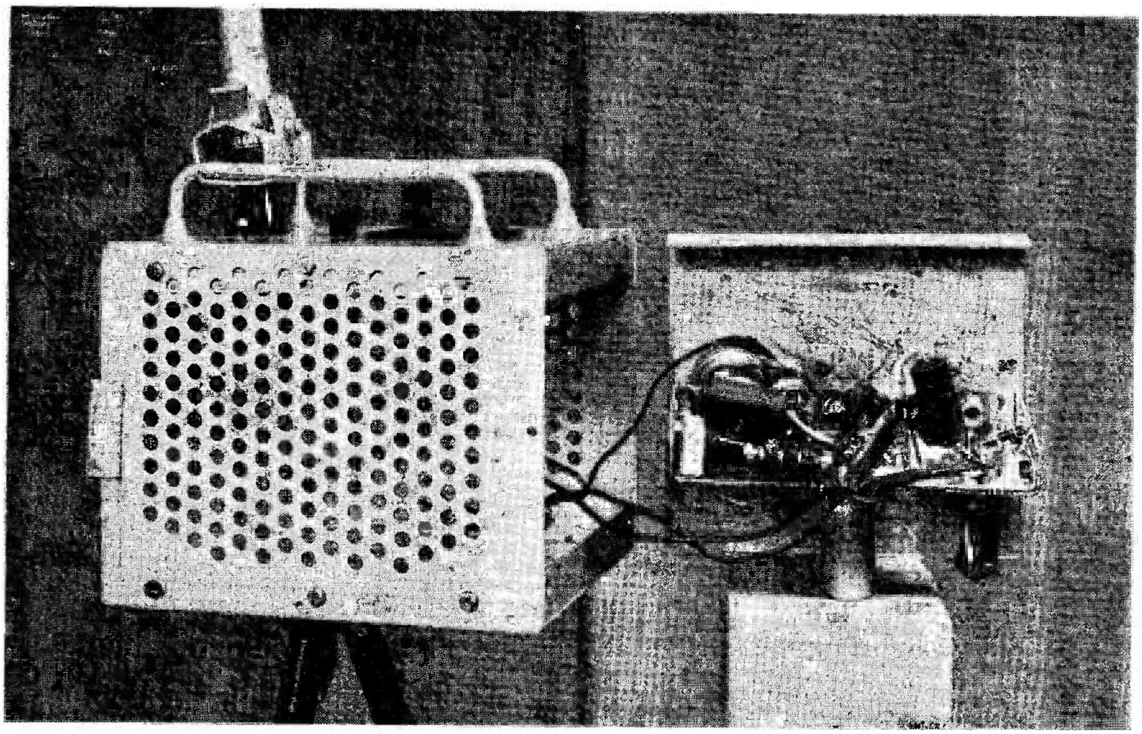


Fig. 2. Some relative field strength readings taken round a 40-metre T2FD operated on 14 mc, at a distance of 500 feet.



The field strength meter exposed, with its carrying case and tripod on the left. The telescopic mast extends to 7 feet; LT is from a 1½v. dry cell and HT from 22½v. deaf-aid batteries. A shelf-type chassis is used, with parts fitted above and below. It was with this instrument that G2NS obtained the readings given in his article.

appeared with the transmitter swtiched off, but this dropped in the manner of a GDO whenever the carrier came on, the dip becoming lower as the received signal increased in strength. The no-signal standing-current reading will be found worth memorising as a fair guide to the state of the batteries from time to time. A second operator should be induced to keep an eye on the transmitter for constancy of drive and output and if the meter is calibrated beforehand by means of a borrowed signal generator the dial figures can then be interpreted directly in millivolts by the operator who traverses the neighbourhood to take strength readings. But this is a refinement, and not necessary where relative readings are required.

TABLE B

BAND	PREFIX	RST	OFF T2FD HIGH end = H LOW end = L SIDE = S
3.5 mc	9S4	359	S
7 mc	YI	459	H
14 mc	KH6	569	L
21 mc	W4	569	L
28 mc	*Not*	*open at time*	*of tests*

Multi-band operation with a coax fed "40-metre" T2FD — that is, an assembly designed for the 7 mc band, but operable on other bands. In this case the low end is to the North West.

Indoor Possibilities

At this stage it is perhaps opportune to emphasise that the basic T2FD is intended as an outdoor, multi-band, space-saving, omni-directional system and as its originator, W3HH/4, himself states, its use "Is not indicated when operation is confined to one band or in lieu of a directional beam on the higher frequencies, regardless of the glowing reports received from enthusiastic users."

Unorthodox happenings, however, demand unorthodox solutions and this is particularly true of the numerous housing estates where the "No outside aerials allowed" edict shows that (solely from an Amateur Radio point of view, of course) the planners have been indus-

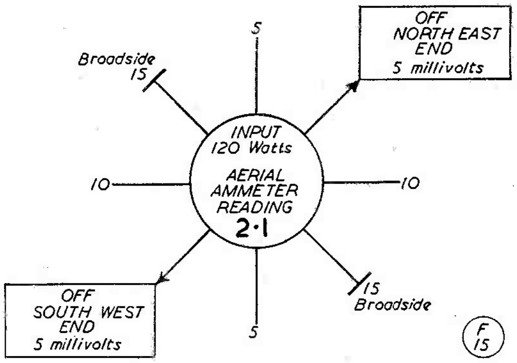


Fig. 3. Relative field strength readings, taken at 500 feet, round a coax-fed 14 mc dipole. Compare with Fig. 2, noting that the transmitter input is the same in both cases.

triously casting their blight. While the neighbours and the authorities may be standing-by immediately to sound the sirens should anything be raised above the garden wall and the house-roof line, the ostracised operator should not, as long as he has a roof over his head, be too perturbed by these murmurings and buffetings from the outside world. Beneath that very roof perhaps may be found space for an unorthodox aerial and it is suggested that those who live perched in a block of modern flats or in an old multi-storied conversion should hang up a TVFD (terminated vertical folded dipole). Available space will restrict the choice but the "20 metre" version of the T2FD merits consideration as it only requires a stretch of 24 feet and will radiate on four bands. To "practise what is preached" the writer suspended one in the stair-well of an old house and with an aerial current reading of 5.6 the first QSO on 14 mc during a short-skip period produced a 579 report from Finland. This was followed on 7 mc with a reading of 3.9 and a 559 report from the north of England.

For those who occupy a small house or bungalow a *horizontal* T2FD might be tried and to ascertain its possibilities the writer "untilted" his basic 40-metre version in the garden with the results given in Fig. 4. To see what could be done indoors the writer took his 40-metre version up to the first floor, and with both ends bent down to within a few inches of the boards it was hooked to a wardrobe, taken through the open door of a bedroom and suspended along a passage in close proximity to gas and radiator piping, power and lighting. In these strange surroundings and during poor conditions it collected a 449 report from a W3 in Washington D.C. on 14 mc with an aerial current reading of 5.4, this being followed by 449 from LA on 7 mc and 469 from a G3 on 3.5 mc. The current readings of the latter two bands were 3.9 and 3.7 respectively.

Feeder Considerations

With unorthodox versions there will at times arise the question of adequate insulation of the feeders at the point where they leave the roof. The use of coax throughout at once solves this problem, but with 300- and 600-ohm feeders different treatment is called for. In such a case perhaps a length of coax could be used to couple the PA to an aerial tuning unit placed within reach of the trap-door usually to be found in the ceiling of the bathroom, the hall or a passage. If then the XYL pretended not to notice, the feeders could be dropped down through the trap-door opening during an operating session and replaced in the roof when not in use. Provided that by experimenting with the number of turns at the PA end every effort is made to match the impedance of the feeder in use, coupling and loading should give no trouble whether the T2FD is in or out of doors, basic or unorthodox.

With 600-ohm line a link of about 6 turns on the feeder at the PA end for 3.5 and 7 mc, and about 3 turns for 14 mc should prove correct, while with coax and 300-ohm feeder one or two turns will suffice for 14 mc, the other bands being determined by trial and error. The whole point is that if the match is not fairly good the aerial will not load up properly. Low-pass filters and coax or change-over relays may of course be inserted. With TVI-proofed transmitters using coax feeder a Pi-filter network PA tank, band-switched if desired, is recommended and for still greater

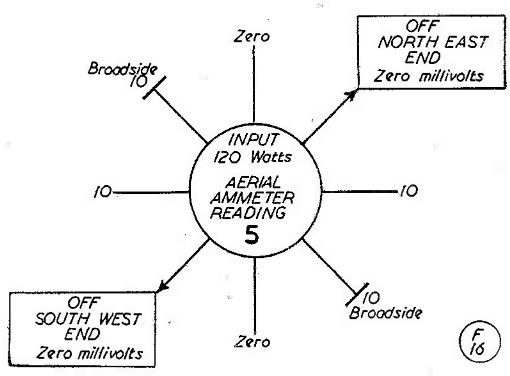


Fig. 4. Field strength readings at 500 feet round a coax-fed horizontally disposed 40-metre cut T2FD operated on 14 mc. This sketch should be compared with Fig 2, for which the aerial was correctly tilted.

flexibility, coax from such a tank through a low-pass filter and coax change-over relay to an aerial tuning unit is excellent. While of course an ATU is not necessary with coax feed its presence definitely helps from a TVI suppression point of view.

At the best of times the indoor aerial question is not easy to solve and the foregoing information and suggestions concerning unorthodox versions of the T2FD have been given with the hope that it may provide some measure of relief in extreme cases. Readers will of course understand that taking any aerial indoors usually deprives it of its virility.

To give, in conclusion, further food for thought and experiment there appears no reason why two outdoor horizontal versions of the T2FD erected in line but not touching should not be operated with identical lengths of 300- or 600-ohm feeder to give in or out of phase working at will. The result would be a multi-band sharply beamed pattern at right angles to the aerial when in phase and a four-lobe pattern when out of phase. By erecting the two aerials at right angles to each other instead of in line sharp beaming in two different directions at will becomes possible. With coax feeder the nature of its manufacture restricts radiation to the out-of-phase four-lobe pattern when the aerials are in line and to out-of-phase sharp fixed beaming in one chosen direction when the aerials are erected at right angles to each other. The writer will be pleased to give interested readers full information about a simple plug-and-socket method of accomplishing this.

TABLE C

VERSION	COVERAGE	APPROX. LENGTH LEG*	APPROX. SPACING*	GROUND REQUIRED FOR ERECTION
80 metre	6 BANDS 1.8 to 28 mc	47ft.	2ft. 10in.	87ft.
40 metre	5 BANDS 3.5 to 28 mc	23ft. 3in.	1ft. 5in.	40ft.
20 metre	4 BANDS 7 to 28mc	11ft. 9in.	8¼in.	17ft.

*See Design Data p.660, January, 1953.

Indication of the space overall required for a T2FD cut for different bands. It can be seen that much space is saved by folding and tilting. Design formulae appeared in the January and June issues, 1953.

"GP TEST INSTRUMENT" — CAUTION!

It has been suggested that the "GP Test Instrument" as described in the October issue of *Short Wave Magazine* is open to certain objections on the grounds of safe handling—that it could, in certain circumstances, be dangerous. In fact, the danger is no more than is commonly met with in handling AC/DC receivers, about which most readers are quite clear.

The precautions to be taken in handling this equipment are those usual with "live chassis" apparatus. When using the GP Test Instrument as described for lining-up an AC/DC receiver, damage could result if the mains plug of the Tester and that of the receiver were so connected as to be in anti-phase—if the "Common chassis" terminal of the instrument was taken to the receiver. *This should not arise,* because in lining up a receiver no direct connection need be made with the Tester. A short piece of wire on the RF output terminal (acting merely as an aerial) is normally all that is required, as explained in the article. No physical connection between instrument and receiver is necessary.

Again, when using the AF oscillator for checking amplifiers, no inter-chassis connection is needed—the only physical connection is the transient touching on of the insulated probe as normal testing is carried through.

Therefore, the risk of damage or shock should never arise under these conditions. But it is necessary to draw attention to the fact that, since the instrument uses what is known as "transformerless HT," the chassis itself could be at the high-potential (to earth) side of the mains; then, a body making contact simultaneously with chassis and some earthed object will get a severe shock—as in any AC/DC apparatus. In the normal operation of the instrument, however, this contingency should not arise, since all tests are made with a single insulated probe.

The risk of mains shock can be eliminated by using a transformer for HT supply. To obviate any danger from a mains plug reversal, a three-pin power plug should be used (not only with this, but with all apparatus) with the chassis side of the Tester (in the circuit on p.463) connected to the N-pin on the plug to correspond with the N-socket in the mains outlet. It would, in fact, be a good thing for all amateur stations to be wired throughout using three-pin plug/sockets correctly connected; there could then be no danger from a plug reversal. These precautions are the usual, and elementary, ones called for in handling AC mains equipment of any kind.

Provided that the user appreciates the points brought out here, and handles the GP Test Instrument with the respect due to all electrical apparatus, there need be no danger. As a final precaution, the instrument could, of course, be built into a wooden box with an insulated panel and the chassis fitted in such a way that it cannot be touched.

807 Modulation Unit

60 WATTS AUDIO WITH SPEECH CLIPPING

W. SCHREUER (VK2AWU)

It has been shown that effective modulation can be considerably increased by the use of circuits limiting or clipping the speech peaks. The broad argument is that if peaks are kept within the 100% modulation mark, then the average depth of control cannot be more than about 30%—and it is the average depth that we are interested in. But if the peaks are cut off, then the average level of modulation can be raised, thus producing a much louder signal, still within the 100% limit. Cutting off peaks amounts to distortion, to some extent, of the speech as originally imposed on the microphone. But this is tolerable within quite limits if we can be satisfied with what has come to be known as "good communication quality." Hence, it follows that if the modulating capability is available in the modulator itself, more modulation—in the sense of depth of control—can be applied with speech clipping (or limiting) than without it. And that is the whole case for the principle of speech clipping. There are several approaches to the problem of how the peaks can be suppressed. This article discusses an 807 modulator capable of giving about 60 watts of audio power output, to which controllable speech clipping has been applied.
—Editor.

SOME three years ago the writer started experiments with speech clipping using pairs of 807 valves in the modulator and PA stage. Early set-ups employing high level negative peak clipping produced rather disappointing results for reasons given in an earlier article. ("Speech Clippers and Their Operation," *Short Wave Magazine*, October, 1953). However, the final version of the modulator, using a self-limiting power stage, performed well up to expectations.

Voltage Amplifier

The complete circuit of the modulator is shown in Fig. 1, which is largely self-explanatory. The frequency response is restricted between 300 and 3,000 c/s, and the three-pole switch S provides variable bass cut; for local work, position 1 (maximum bass) is used with the gain adjusted so that little or no clipping occurs. For DX working position 2 is selected, with the gain control appreciably advanced. Position 3 is used only when requested; this generally occurs when conditions are extremely poor and a high degree of clipping is employed of the order of 12 dB. The author's microphone, a Ronette Crystal, has a rising bass response; for this reason the inter-stage coupling condensers are perhaps rather smaller than would normally be used.

Output and Driver Stages

The heart of the modulator, the self-limiting output stage, consists of a pair of 807 valves in Class-AB1. Initially this stage was driven directly from a phase splitter valve, clipping taking place at the grids of the 807's. This performed reasonably well, but the modulation transformer "talked back" whenever appreciable clipping was used. In the final arrangement, a low impedance driver stage is employed with a separate 6X5 valve as clipper, so as to permit the use of a two-section RC filter in front of the 807 grids. As common bias is employed for the clipper and the 807's, clipping takes place at grid current level.

The measured power output with a 2 kc sine wave signal just below clipping level is 58 watts into a resistive load, with all filters in circuit. For this measurement an effective anode-to-anode load of 12,000 ohms was used, though the writer normally employs a value of 10,500 as the maximum output available is higher than required. The modulation transformer is a Woden type UM2 which, when connected for maximum inductance, has sufficient bass response to avoid excessive tilting of the tops of the clipped waves. The load on the output valves must be so selected that no more than barely sufficient power is produced for 100% modulation. Details of this are given in the Notes on the operation of 807's.

LC Filters

A two-section low-pass filter is used on the secondary side of the modulation transformer. The values are easily worked out from the simple formulæ given in the components list. The condensers may be mica or good quality paper types and C21, C23 and C25 should have a working voltage rating equal to at least twice the PA HT voltage, while C22 and C24 should be rated for the PA HT voltage. It may be necessary to employ condensers in series to satisfy this requirement.

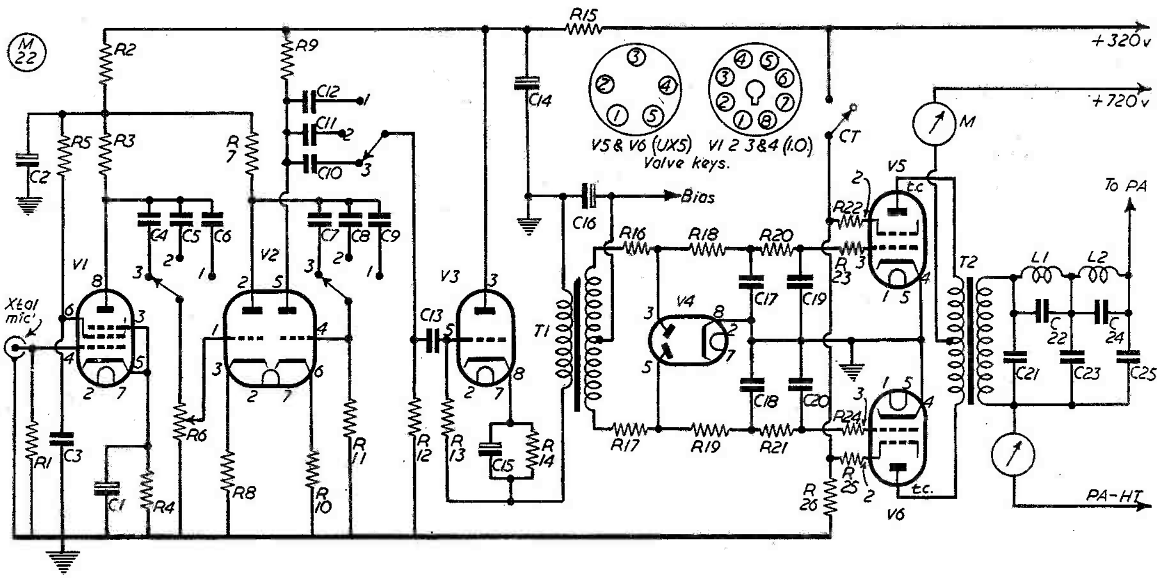


Fig. 1. Circuit of the 807 modulator designed by VK2AWU and discussed in his article. It incorporates speech limiting.

The inductances L1 and L2 may be iron or air cored. With iron cores (laminations), a large air-gap must be used, and the components must be set up with the help of an AF bridge suitable for inductance measurements with adjustable direct current through the coil under test. This DC, when varied from zero to twice the normal PA HT current, should not cause an inductance change of more than 2%. This latter requirement must be specified when obtaining the inductances.

Air cored coils are very much more bulky than iron cored units and must be kept away from metal surfaces parallel to the circular cross-section. On the other hand, air cored coils can be calculated and constructed with sufficient accuracy without the need of elaborate test gear. Suitable methods for these calculations can be found in the *Radio Engineer's Handbook* (1st edition), by F. E. Terman, Sec. 2, par. 11, or other text books.

Conclusion

During the six months of operation of this modulator not one adverse comment has been received. Tests with local stations using selective receivers have indicated almost complete absence of excessive side-band splatter, even for very high degrees of clipping. Distant stations invariably report considerable increase in readability when the gain control is advanced from the position corresponding to 100% modulation on the occasional voice peak.

The quality of the transmission, despite the severely restricted frequency response, is quite good for low degrees of clipping, up to 6 dB, but does deteriorate with larger amounts, though not to too objectionable an extent. In any case, we cannot have it all ways !

Table of Values

Fig. 1. 60-Watt Modulator with Speech Clipping.

C1, C15	= 25 μF, 25v. electrolytic.
C2, C14	= 8 μF, 450v. electrolytic.
C3	= .005 μF, mica.
C4, C7, C10	= 680 μμF, mica.
C5, C8, C11	= 820 μμF, mica.
C6, C9, C12, C13	= .001 μF, mica.
C16	= 25 μF, 50v. electrolytic.
C17, C18	= .0033 μF, mica.
C19, C20	= 470 μμF, mica.
T1	= Driver xformer.
T2	= Modulation xformer, (Woden UM2)
M	= 0-200 mA meter.
CT	= "Make" contact on relay, operated by bias supply.
L1, L2	= .06 R/mH, where R is equivalent resistance of PA stage.
V1	= 6SJ7.
V2	= 6SL7.
V3	= 6J5.
V4	= 6X5.
V5, V6	= 807.
R1, R5, R11, R12	= 1 megohm.
R2	= 27,000 ohms.
R3	= 270,000 ohms.
R4, R14, R23, R24	= 1,000 ohms.
R6	= 1 megohm, pot'meter.
R7	= 100,000 ohms.
R8	= 2,200 ohms.
R9	= 180,000 ohms.
R10	= 3,300 ohms.
R13	= 470,000 ohms.
R15, R18, R19	= 10,000 ohms.
R16, R17	= 2,700 ohms.
R20, R21	= 82,000 ohms.
R22, R25	= 10 ohms.
R26	= 330,000 ohms.
C21	= $\frac{30}{R}$ μF.
C22	= $\frac{27}{R}$ μF.
C23	= $\frac{15}{R}$ μF.
C24	= $\frac{20}{R}$ μF.
C25	= $\frac{30}{R}$ μF minus any RF by-pass on PA stage.

(*Note :* For C21-C25 inclusive, R is the equivalent resistance of the PA stage. All resistors R1-R26 inclusive rated ½-watt).

Fig. 2. Operating Conditions for 807's in Class ABI.

ANODE VOLTS	500	600	700	750
SCREEN VOLTS	300	300	300	300
GRID BIAS (approx.) volts	-28	-30	-32	-34
ANODE CURRENT, ZERO SIG. mA	2 x 40	2 x 35	2 x 30	2 x 26
ANODE CURRENT, MAX. SIG. mA	2 x 85	2 x 80	2 x 77	2 x 75
LOAD RESISTANCE (A to A), ohms.	9,000	10,000	12,000	12,500
POWER OUTPUT (undistorted), watts	38	50	60	65

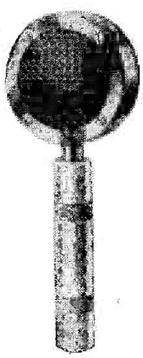
Notes on 807 Valves (in Class-AB1)

This method of operating 807's is extremely convenient for use in self-clipping modulators. Typical operating conditions are given in Fig. 2. Grid bias voltages are approximate and, in practice, the value should be adjusted to give the stated zero-signal anode current. Owing to the large change of anode current with signal, cathode bias cannot be used, but the smallest of bias supplies will suffice since no grid current flows. The screen voltage must be obtained from a separate supply. Voltages below 300 should not be employed as excessive distortion would result, but higher values, up to 360 v., may be used with some advantage. Whatever the value of screen voltage, the bias voltage should be adjusted to produce the zero-signal anode current given in the table. A screen voltage of 360 will increase the power output approximately 10% above the values given for 300 volts.

Should the power output be too large for a particular application, after allowing for transformer losses, it may be lowered by decreasing the effective load resistance. Very approximately, the maximum power output, just below clipping level, is directly proportional to the value of the load resistance employed.

ROTHERMEL'S NEW D.104 MICROPHONE

For many years now, the Rothermel D.104 crystal microphone—either mounted on a pedestal, hand held, or fitted on a grip—has been in regular use at a large number of phone stations, as well as having other applications in recording, public address and studio work.



The new D.104 as illustrated here looks the same as before, but is actually a much-improved version electrically. It has a substantially uniform response range of 50-7000 c.p.s., with an adequate output level, and the recommended load impedance is 5 megohms; this can be 2 megohms for a slightly reduced bass response. The overall size of the model illustrated is 8 inches, the head being 3 inches in diameter and one inch deep. The white ivorine grip gives the instrument a nice balance for hand work.

For a long time, we have used an original D.104 for various purposes, both on and off the air, feeling quite satisfied with its performance into two or three different types of speech amplifier. A comparative test against the improved D.104 showed the latter to be less peaky, giving a more even response and what can only be described as better tonal quality to the speech. It can therefore be confidently recommended to all who want a really good, robust general-purpose crystal microphone, handy to use and neat to look at. It is available either mounted as shown, with 6 feet of good quality shielded cable, or for stand mounting without cable, or (in the cheapest version) as the head only, with suspension rings and connecting cable. Rothermel, Ltd., 9, Stratford Place, London, W.1.

COLOUR TV IN AMERICA

The London *Daily Telegraph* for October 16 carried a very interesting report, by Mr. L. Marsland Gander, of the Colour TV demonstration arranged in New York for the Federal Communications Commission and other interested authorities, including the BBC. The first transmission was by the NBC from the Empire State building, to which some 13 different receivers, each made by a different manufacturer, were tuned. Most of these sets were using a new tube developed by R.C.A. The results were astoundingly good, colour being reproduced almost perfectly on most receivers, which could also meet the requirement of "compatability," meaning that they could reproduce either colour or ordinary black-and-white TV. Difficult outdoor colour and indoor dance-girl scenes, to test response to rapid movement, were successfully shown, and it seems that all who saw the demonstration, including the representatives of the BBC, were deeply impressed. October 15, 1953, will be an important date in the history of TV development, as it marks a significant advance in television technique.

★ ★

"NEW QTH's"

We much regret that it has not been possible to include "New QTH's" in this issue. It will be there as usual next month. All readers are reminded that as agents for the *Call Book,* call-sign/addresses appearing in our "New QTH" feature are automatically re-published in the *Radio Amateur Call Book,* which is the only directory to the amateur stations of the world. Call-signs as issued, and changes of address, should be notified to us immediately they arise, so that the G sections of the *Call Book* can be kept up-to-date.

VHF BANDS

A. J. DEVON

Wide Openings, October 7-11—Many EDX Contacts Obtained—Suggested "Conditions" Code—Individual Station Reports—Calls Heard and The Tables—

THE past month has again been very interesting and productive on the two-metre band. In spite of being a "short" one with a tight dead-line (which we abominate but cannot avoid on occasions, because of a fixed publishing day) there has been a goodly incoming of reports and claims; the latest positions and results are shown in the tables scattered through this text.

During the month, conditions were fairly consistent for comfortable GDX working at the 200-250 mile ranges. The big break came over the period October 7-11—which ties up nicely with the "VHF Weather Report," incidentally—during which good EDX conditions were stabilised over the greater part of Northern Europe and Scandinavia, with a marked extension westwards, taking in EI, on the 10th.

To be more specific: For EI2W, things began to happen on October 7, when the whole of England became workable, culminating in the night 10/11th, when he was able to raise DL, ON and PA between 2100 and 0200 GMT; his contacts included PAØFC for the EI/PA "First," and at about the same time ON4BZ's phone signal was blocking the receiver at EI2W. His QSO's with DL3VJ and DL6EP (Linz) represent distances up to 620 miles or so—and the band was well enough open to give EI2W three separate QSO's with DL3VJ (Herford) between 2145 and 0200 GMT.

Over this period October 7-11, G5YV (Leeds) worked no less than 24 different EDX stations in 6 countries outside the British Isles—*see* Activity Report. A fine performance, indeed. Another noteworthy QSO was between ON4BZ and G3EPW (Bury, Lancs.), on the "wrong" side of the Pennines, on October 11.

Nevertheless, it seems clear that the extent of the opening was not fully appreciated by many EDX stations — on the evening of October 10, particularly, quite a number of them apparently closed down early without realising that there was a very good chance of working into the U.K., and even further west to EI2W.

As it happened, Bob took G5MA/P into Rutland for the week-end October 10-11 and, as he puts it, "Experienced good conditions and had a very successful spell of portable work." His log shows a total of 71 different stations worked, with DL, OZ and EI2W. Operation was over 17½ hours of the period 1750 October 10 to 1515 on Sunday 11th—so he did not waste much time in sleeping or eating! Bob says it was like a super field day all to himself. (He well deserves that cup from Ireland).

So much, then, for the general survey of conditions and some of the outstanding results mentioned in the correspondence. Many G operators were among those present when the going was good, and got a full share of the EDX that was available.

The "Conditions" Code

On the subject of conditions, Guy of ON4BZ (Brussels) makes what we consider—and we hope all VHF operators will agree—to be an extremely practical and original suggestion. It is simply this: When calling CQ, or working a station, the level of conditions to be indicated thus: C1, Very bad; C2, Poor; C3, Fair; C4, Good; C5, Exceptionally good. This could be further qualified by giving a directional indication, *e.g.* "CQ de G6NB C4 NW," meaning that at Brill the north-westerly stuff was coming in quite well, *i.e.* the EI/GI stations.

There seems to be no reason at all why the C-code—due entirely to ON4BZ, one of our most experienced and reliable EDX operators—should not be brought into general use forthwith. Of course, there will be differing individual standards as to what constitutes C4 or C5. (For some of us, to hear G5YV must mean C4, though to others he is always there even under C1 conditions). But this is no more a difficulty than interpreting the RST code; the point is that, provided the C-code is used with discretion to indicate an individual's own opinion for his particular location and receiving conditions, then we get a very fair picture, in the simplest and most convenient way, as to how things are.

So, unless there is any violent disagreement or objection, it is suggested that, with the appearance of these lines, we all start using the C-code right away. (Of course, applying it to the 430 mc band as well when operating on that frequency).

In Guy's own words, "It will, perhaps, help fellows just breaking in and hoping to make a little DX without spending too much time smelling the band"! Jolly good.

The Tabular Matter

G6NB (Brill, Bucks.) takes the lead in All-Time Counties, he having worked GW3ENY/P, near Beaumaris in Anglesey, for a new county. And if you heard GW3ENY/P on the evening of September 26, and did not realise that Anglesey is one of the 13 counties of the Principality of Wales—well, it is not GW3ENY's fault! He worked seven G's (we have the list) and heard two more (both of whom could have done with Anglesey).

In Annual Counties, which

shows a very good list of operators who have worked 14C or more in less than two months, Harold of G5YV keeps the lead.

We are also showing "Two-Metre Firsts" again this month, with a number of new entries extracted from the recent EDX results. But there are some notable omissions. We have no record of the G/GI "First" (which would have been about 1949-'50, probably with either GI2FHN or GI3GQB at the GI end), nor have we the date of the ON/LA "First" made by ON4BZ with (probably) LA8RB.

A new Table is "70-Centimetre Firsts," and here also there are some gaps, particularly in respect of the G/ON and G/PA first contacts on 430 mc. These would probably have been made during the March openings this year, but could have been much earlier. Claims are requested to fill these gaps, please, as well as a note of any other unintentional omissions.

As there has been no further distance-advance since the G5UF-SM6ANR contact over 750 miles on March 22 last, the Table of Two-Metre Progress (British Records) is being held until somebody does better than this. As to Countries Worked, there have been a few further movements, and these are notified herewith.

Quick Contest No. 3

We got a break—well, half a break—with No. 3 during September 26/27, in that conditions were not too bad for GDX working on the Saturday. Though only a few actual entries were received, a good many stations were on during that evening. Those who put in scores express themselves as having thoroughly enjoyed the affair. So it is a great pity that we did not get some more entries.

Results are: G3FAN, Ryde, I. of W., 7521 points, gained from 57 contacts in 23 counties, with G5YV and G6XX (Goole, Yorks.) as best DX for 20 pts. each. G2DSW, Southampton, had 47 QSO's, worth 190 points, with G6XX again as best DX; his counties multiplier was 20, giving him a total of 3800 pts. G2DSW's 10-pointers were G2CNT, G3AUS, G3BA/A, G3IIT, G3WW, G5ML, G5MR and G6CW. G3IRA, Swindon, Wilts., made a total of 1034 points from 15 contacts in 11 counties, having three very nice 15-pt. QSO's with G5BD, G5GX and G6XX. For G5MR, Hythe, Kent, G2DSW was best DX, his total being 9 stations worked in five counties, for 170 points.

TWO-METRE ACTIVITY REPORT

(Lists of stations heard and worked are particularly requested for this section, set out in the form shown below.)

G5YV, Leeds, Yorks.

WORKED: DL1LB, 3FM, 3VJ, 6SV, F3CA, 3LQ, 9MX, ON4BZ, 4HN, OZ2FR, 5AA, 8JB, 9NH, PAØFB, ØFC, ØNL, PE1PL, SM6ANR, 7AEB, 7AED, 7AEU, 7BE, 7BNX, 7XU. *(All DX—October 7 to 11 only).*

G3WS, Chelmsford, Essex.

WORKED: DL3VJ, F3LQ, 9CQ, G2XV, 3BKQ, 3IIT, 3NL, 3WP, 4PV, 5MA/P, 6NB. *(September 14 to October 11).*

G2DVD, Slinfold, Sussex.

WORKED: G2AIW, 2BRR, 2CNT, 2DSP, 2DSW, 2DUV, 2FVD, 2TP, 2UN, 2YB, 3AUS, 3BNC, 3EGV, 3FAN, 3FEX, 3FQS, 3GBO, 3GHS, 3GVF, 3HCU, 3HXS, 3HZJ, 3IAM, 3IEX, 3WW, 4RO, 5BC, 5DS, 5FF, 5MA, 5MA/P, 5NF, 5TZ/A, 5UF, 6AG, 6TA. *(September 14 to October 11).*

G8VN, Rugby, Warks.

HEARD: G2ACV, 2FWW, 2WA, 3BLP, 3CJY, 3CUZ, 3EPW, 3FMI, 3GVF, 3HAZ, 3HDY, 3IOB, 3WW, 4AU, 4SA, 5MA, 5UD, 8QY, 8SC, GW2ADZ. *(September 27 to October 9).*

G4OU, Sheerness, Kent. NGR 917737.

WORKED: G2JF, 3AEX, 3ANB, 5DS, 6AG, 6CH, 6NU, 6RH.
HEARD: F3LQ, G2BYF, 2CZS, 3FIJ, 4OT, 4SA, 4YB, 6NB, ON4BZ, 4HC, PE1PL.

G3IRA, Swindon, Wilts.

WORKED: G2AHP, 2CNT, 2FZU, 2HCG, 3APY, 3BA/P, 3BVU, 3CUZ, 3EGV, 3EUP, 3FAN, 3FKO, 3FRY, 3GHO, 3GHU, 3HZF, 3ION, 3IOO, 3JKZ, 3WW, 4AP, 4SA, 5BD, 5GX, 5HB, 5MA, 5YV, 6NB, 6VX, 6XA, 6XX, 8DM, 8SC, GW3EJM/A, 8UH.
HEARD: EI2W, G2BVW, 2FWW, 3AUS, 3BKQ, 3BXK, 3GZM, 3HAZ, 5MA/P, 5ML, 6AG, 6YU, 8AO/MM, GW2ADZ. *(September 12 to October 12).*

EI2W, Dublin, Eire.

WORKED: DL3VJ, 6EP, EI2A, 6A, G2AJ, 2FZN, 2HOP, 3CCH, 3CHY, 3CUZ, 3DMU, 3EPW, 3FFD, 3FQP, 3FRY, 3FZU, 3GHO, 3GNC, 3GOP, 3GZM, 3WW, 4RO, 4SA, 5BM, 5MA/P, 5TZ/A, 5VN/A, 5YV, 6MI, GI3FZQ, 5AJ, GM3DIQ, 6WL, GW2ADZ, 3ENY/P, ON4BZ, PAØFC.
HEARD: G2AIW, 3GHI, 6XX, GM3FVX, ON4HC. *(September 14 to October 11).*

G6NB, Brill, Bucks.

WORKED: DL1FF, 1LB, 6SV, 9MZ, EI2W, G2FCL, 2FO, 3AUS, 3EPW, 3FKO, 3FMO, 3HVO, 3YH, 4JJ, 5VN/A, 5YV, 6XX, 8AO/MM, GM3IBV, GW2ACW, 2ADZ, 3CKB, 3EJM/A, 3ENY/P, 8UH, ON4HN, 4YB, OZ7FB, PAØFB, ØFC, ØNL, PE1PL.

GM6WL/P, Mull of Galloway, Wigtownshire.

WORKED: EI2W, G2FZU, 3BLP, 3CCH, 3GHO, 5BM, 5YV, 6LI, 6NB, 6XX, GI3FJX, 3FZQ, 3GQB, 5AJ, GM3DIQ.
HEARD: G2HCG, 3CGQ, 4SA, 6RH, 6VX. *(On September 12 only).*

SWL, Bridgend, Glam.

HEARD: EI2W, G2AHP, 2BMZ, 3AUS, 3BKQ, 3BLP, 3CGE/A, 3CMT, 3EGV, 3FAN, 3FIH, 3FMO, 3FRY, 3FWW, 3GNJ, 3GOP, 3GVF, 3HZF, 3ION, 3WW, 4GR, 4RO, 4SA, 5BM, 5MA, 6NB, 8DL, 8FC/A, 8OU, 8VX, GW2ACW, 2ATK/P, 3CKB, 3EJM/A, 8SU, 8UH. *(September 17 to October 10).*

G2HDZ, Pinner, Middlesex.

WORKED: EI2W, G2ATK, 2DD, 2DDD, 3BKQ, 3BNC, 3BVG, 3FMO, 3FYY, 3HVO, 3MI, 4RO, 5DS, 5MA/P, 5TP, 5UF, 8CK, 8DV/A, 8SC, GW8UH.
HEARD: DL6EP, G2BAT, 2CPT, 3AGA, 3FCL, 3FZU, 3IVU/A, 3LQ, 3YH, 5GX, 5JO, ON4BZ, 4HC. *(September 1 to October 13).*

G2CZS, Chelmsford, Essex.

WORKED: G2CNT, 2FQP, 2FWW, 2XV, 2YB, 3AEX, 3BA/A, 3CFK, 3CZY/A, 3GDR, 3GHI, 3GHO, 3GJZ, 3IIT, 3IUK, 5AM, 5SK, 5YV, 6CW, 6NU, 6XX, 6YU, 8SY, PE1PL.
HEARD: G2AHP, 2AVR, 2DVD, 2FZU, 2HCG, 3HSC, 3NL, 4RO, 4SA, 5GX, 5ML, 5TP, 5UM, 6LI, 8LN, 8SC, GW2ADZ, HB1IV. *(September 11 to October 12).*

G5MA/P, Near Oakham, Rutland.

WORKED: DL3VJ, 6EP, 9MZ, EI2W, G2AHP, 2AIW, 2ATK, 2DDD, 2DVD, 2FCL, 2FJR, 2FZU, 2HDZ, 2HOP, 2MR, 2MV, 2RD, 2TP, 2XV, 2YB, 3AEX, 3ANB, 3EPW, 3EYV, 3FAN, 3FD, 3FQS, 3FSD, 3FXG, 3FZL, 3GDR, 3GHO, 3GNJ, 3GOP, 3GWB, 3HZF, 3IER, 3IOO, 3ISA, 3JFR, 3JMA, 3SM, 3WP, 3WS, 3WW, 4AU, 4CI, 4FB, 4KD, 4RO, 4SA, 5BM, 5DS, 5JO, 5LK, 5MR, 5TZ/A, 5UD, 5YK, 5YV, 6AG, 6CW, 6NF, 6OU, 6TA, 8KL, 8SB, 8SC, GW3ENY, 5MQ, OZ2FR.
HEARD: F8GH, G3BKQ, 3FOU, 8DL, GW2ADZ, ON4BZ. *(October 10 and 11).*

G3YH, Bristol.

WORKED: G3FIH, 3FKO, 3GHO, 3GVF, 3HBW, 3HSD, 4GR, 4SA, 6NB, GW8UH.
HEARD: G2AHP, 2HCJ/P, 3BLP, 3HWF, 3ION, 3WW, 4RO, 5MA, 5TZ/A, 6AG, 8DL, 8FC, 8OU. *(September 17 to October 14).*

G3FYY, London, N.W.2.

WORKED: G2AHP, 2DUV, 2FWW, 2HDZ, 3AEX, 3BKQ, 3CGQ, 3CVO, 3ENI, 3FQS, 3FSD, 3FUL, 3FXG, 3GHI, 3GHO, 3GHS, 3GSE, 3HSC, 3HXS, 3IIT, 3ISA, 4AU, 5TZ/A, 5YV, 6LR, 6TA, 8UQ, GW2ADZ. *(All September 5-17 and September 26 to October 7).*

G3CUZ, Leek, Staffs.

WORKED: EI2W, G2AIW, 2ATK/P, 2BFT, 2BNZ, 2COP, 2CVD, 2DCI, 2DDD, 2FWW, 2HCJ/P, 2HGR, 2MV, 2YB, 3BA/A, 3DMU, 3EPW, 3EQR, 3FAN, 3FKY, 3FMI, 3FRY, 3FXR, 3GBS, 3GZM, 3HAZ, 3IOO, 3IRA, 3IUD, 3NL, 3WW, 4RO, 4SA, 5BM, 5MA, 5UN/A, 6AS, 6MI, 6NB, 6OU, 6WF, 6XA, 6XX, 8MZ, 8SB, 8SC. *(September 1 to October 13).*

G3EPW, Bury, Lancs.

WORKED: EI2W, 6A, G2AIW, 2BNZ, 2DCI, 2FCV, 2FJR, 2FZN, 2HGR, 2HOP, 2IT, 2MV, 2XV, 2YB, 3AGS, 3AOO, 3AUC, 3CCH, 3CHY, 3CUZ, 3DMU, 3EJZ, 3EYV, 3FMI, 3FRY, 3GHI, 3GMX, 3GNC, 3GNJ, 3GXI, 3GZM, 3HWF, 3HYH, 3HZK/A, 3IAI, 3IIT, 3JFR, 3WW, 4SA, 5BM, 5DS, 5MA, 5MA/P, 5TH, 5VN, 5VN/A, 6LC, 6NB, 6WF, 6XX, 8SB, GW3ENY, 3ENY/P, ON4BZ. *(September 16 to October 12).*

70-Centimetre Band Only

G2HDZ, Pinner, Middlesex.

WORKED: G2DD, 2FKZ, 2QY, 2RD, 3BKQ, 3FP, 3GDR, 3HBW, 3MI, 4RO, 5CD, 5DF, 5DS, 5DT, 5TP, 6NF, 6YP, 8KZ, 8VR.
HEARD: G2DDD. *(September 1 to October 13).*

Several other operators sent in scores without any QSO details, saying they had come on merely to see what sort of score could be made under the rules. For the benefit of those who also tried this, but did not even send in the result, these "non-entry" scores ranged from 2140 to 375 points.

Some Individual Reports

G3DLU (Compton Bassett) spent most of the period on constructional work—to such effect that his 8-element stack is now suspended from a wire between two 80-foot masts, and the converter has been re-modified to have a tunable SEO tripler. So he is all set to try out the effects.

G3FXR (Northfield, Birmingham) runs 25 watts to an 832, has a four-stage converter using Z77-Z77 GGT - 12AT7 mixer - Z77 oscillator, with a 5-ele. close-spaced Yagi, and during this year has worked ON4BZ and OZ2FR. Since last writing, G3CUZ (Leek, Staffs.) has had a major rebuild; he is now running an 829B at 64 watts, plate-screen modulated by a pair of 807's, with the 832 push-push doubler to drive the 829B. On the receiving side, the converter has become EC91-EC91-12AT7 in GGT, with the other side of the 12AT7 as mixer (all-same ON4BZ) and a 12AT7 oscillator-multiplier, using a BC-455 as IF/AF strip. Though this is giving very satisfactory results, G3CUZ says that he is still getting better reports than he is able to give—so he is now considering a CC G2IQ job into an S.640, which should be a very sound proposition; the beam is a 12-ele. stack, to the *Magazine* design of November last.

In Leek, G3CNS and G3FKY are also active on Two; the former has two 6J6 converters, either working into an R.107 as IF/AF strip, and 15w. to a pair of 7193's, with a 4-ele flat top. G3FKY has a modified G6VX-type converter into a BC-455, and much the same sort of PA and aerial arrangements as at G3CNS—except that G3FKY is one of those unfortunates with unlimited milliamps but very few volts; he is on DC mains, that archaic system of power transmission which the British Electricity Authority still allows to exist in some parts of the country. G3EPW (Bury, Lancs.) felt himself fortunate to raise ON4BZ—it has given him a new slant on EDX possibilities—and is also happy with his contact with G5MA/P when in Rutland.

GM6WL (Glasgow) is enthusiastic about his /P experiences on 144 and 430 mc during his September trip to the Mull of Galloway, Wigtownshire; apart from the interesting 70-centimetre contacts with GI3FWF/P and GI3GQB, he was very pleased to work (and to hear) a number of G stations quite new to him—*see* Activity Report.

Some of the results obtained by EI2W (Dublin) have already been mentioned, and glad indeed we were to know that conditions had taken in EI for a Continental opening. At the shorter ranges, GM3DIQ (Stevenston, Ayr) is an S9 with EI2W signal any night,

Quite a number of readers will recognise G5TZ, the well-known Old Timer now operating /A from St. Catherine's Point, at the southern extremity of the Isle of Wight, from where he is putting out such a fine two-metre signal.

TWO METRES

COUNTIES WORKED SINCE SEPTEMBER 1, 1953

Starting Figure, 14

Worked	Station
43	G5YV
38	G4SA
34	G5MA
32	G2AHP
29	G3EPW
28	G3GHO
27	G2DDD, G6XX
25	G2DVD
21	G3WS, G4RO
20	G3CUZ, G2FCL
19	G2CZS, G5ML, G6TA
18	G5BM
17	G5MR
16	G2HDZ
15	G2AOL, G5DS
14	G3FIJ, G8VN

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.

with GM6WL of Glasgow also well heard. While EI6A (Wicklow) is gradually building up a nice total of counties—he has worked into London, and as far to the North as Belfast and Glasgow — EI2W knocked off G3IOO (Shropshire) for his 58th, he having been stalking G3IOO all through the season. For those who may wish to make distance calculations at any time, EI2W gives his pin-point as 6° 15′ W, 53° 15′ N, disregarding the seconds. What a pity it is that the whole of Northern Europe has not been tied to the excellent grid reference system of our own Ordnance Survey, enabling distances to be calculated to any required degree of accuracy merely by solving a right-angled triangle. As a digression on this theme, it might be mentioned that during the last war your A.J.D. was indirectly concerned with a ground controlled bombing operation calling for accuracies in terms of yards over distances in terms of hundreds of miles. This meant checking our own survey against that of the enemy's location in the area of the Ruhr. It was found that, by our standards, Northern Europe was wildly out (by at least 600 yards) and a corresponding correction had to be applied before the bombs could be accurately delivered. In fact, the accuracy of the bomb release was within the accuracy of any practicable survey! Which shows how far you can go if you feel like splitting hairs about distances. In truth, for our VHF communication purposes, a ruler across a map is near enough—provided it is the same ruler on the same map, used by the same person. Then, any error is constant and applies to all measurements.

G8VN (Rugby, Warks.) started on Two last April, and has now got to 25C—and what will make this of particular interest is the fact that G8VN uses an *indoor* 4-element Yagi exclusively, with but 16 watts to an 832! This beam is in the roof space, and can be rotated from the operating position; his receiver is 6J6-6J6, into a Skyrider at 10 mc.

G3IRA (Swindon, Wilts.) remains pleased with his 4/4/4, and agrees with G6LI (*see* last month's "Sayings") about the possibility of finding good conditions in the early mornings—he actually says "dawn," which is *very* early; anyway, G5YV has been coming in extremely well at this sort of time, being S9 in Swindon some mornings.

G4OU (Sheerness, Kent) has gone seriously into the business of beam assembly and support. He has a 3-ele flat top for 430 mc surmounting a 4-ele job for 144 mc, both being supported by a one-inch water-pipe run up the side of the main mast (holding up the

SEVENTY - CENTIMETRE STATIONS — Seventh List

CALL	LOCATION	FREQ. (mc)	EQUIPMENT
DL3FM	Mulheim-Ruhr	434.2	Tripler, 32-ele stack, SEO Rx
EI2W	Dublin	432.54	Tripler, 16-ele stack, (? Rx)
G2BFT	Solihull	433.17	Tripler, 16-ele stack, (? Rx)
G2BVW	Leicester	432.60	Straight PA, 5-ele Yagi, Special Rx
G2CNT	Cambridge Airport	435.2	Tripler, CC Rx, 12-ele stack
G2DDD	Littlehampton	435.6	Tripler, 16-ele stack, CC Rx
G2DHV	Lewisham	434.97	Tripler, CC Rx, 16-ele stack
G2FCL	Shipley, Yorks.	433.134	Tripler 15E, G2DD C'vrtr., 6-ele Yagi
G2FKZ	London	435.95	*no details*
G2FNW	Melton Mowbray	?	Tripler, 5-ele Yagi (? Rx)
G2HCG	Northampton	434.00	*no details*
G2HDZ	Pinner, Middx.	435.17	Straight PA, SEO Rx, 20-ele stack
G2MV	Kenley, Surrey	435.22	*no details*
G2RD	Wallington, Surrey	435.57	*no details*
G2WJ	Great Canfield, Essex	436.00	Straight PA, CC Rx, 16-ele stack
G2XV	Cambridge	435.10	Tripler, CC Rx, 12-ele stack
G3ABA	Coventry	?	Tripler, 16-ele stack (? Rx)
G3AOO	Denton, M'cr.	433.13	Tripler, 4/4/4, CC Rx
G3AYT	Hyde, Ches.	433.13	Tripler, City Slicker, CC Rx
G3BKQ	Blaby, Leics.	434.05	Tripler, 48-ele stack, CC Rx
G3CGQ	Luton, Beds.	434.10	*no details*
G3DA	Liverpool	432.6	Tripler, 6-ele Yagi, CC Rx
G3EOH	Enfield, Middx.	436.03	Tripler, G2DD C'vtr., 12-ele stack
G3EUP	Swindon, Wilts.	433.9	Tripler, 3 stk'd dipoles, CC Rx
G3FAN	Isle of Wight	435.80	*no details*
G3FFC	Leicester	?	Tripler, 16-ele stack (? Rx)
G3FIJ	Colchester	435.18	Tripler, SEO Rx, 5-ele Yagi
G3FP	Sidcup, Kent	436.04	*no details*
G3FZL	Dulwich, S.E.22	435.24	Doubler, CC Rx, 12-ele stack
G3GDR	Watford, Herts.	435.39	*no details*
G3GOP	Southampton	435.00	*no details*
G3GZM	Tenbury Wells, Worcs.	?	Tripler, 16-ele stack (? Rx)
G3HAZ	Northfield, Birmingham	435.00	Tripler, SEO Rx, 4/4 Yagi
G3HBW	Wembley, Middx.	434.61	Tripler, 12-ele stack, CC Rx
G3HHY	Solihull, Warks.	433.93	Straight PA, 21-valve Rx, 4-ele Yagi
G3HTY	Kidderminster, Worcs.	?	Tripler (? beam array and Rx)
G3IAI	Northampton	433.80	*no details*
G3ILI	London, S.E.22	434.97	Tripler, 6-turn Helix, R.1294 mod.
G3IOO	Oswestry, Salop.	432.54	Tripler, 16-ele stack, SEO Rx
G3IOR	Hellesdon, Norwich	?	Tripler, SEO Rx, 4-ele Yagi
G3IRA	Swindon, Wilts.	436.05	Tripler, SEO Rx, 8 d'ples stk'd
G3IUD	Wilmslow, Ches.	432.41	Tripler, CC C'vrtr., 6-ele Yagi
G4AP	Swindon, Wilts.	436.50	Tripler, CC Rx, 3 stk'd D'ples
G4OT	Maldon, Essex	435.240	Tripler, G2DD C'vtr., 4/4 Yagi
G4OU	Sheerness, Kent	432.414	Tripler, Superhet, 3-ele Yagi
G4RO	St. Albans, Herts.	434.16	Tripler, 16-ele stack, CC Rx
G5CD	Hendon	435.66	*no details*
G5DS	Surbiton, Surrey	435.61	Tripler, G2DD C'vtr., 16-ele stack
G5DT	Purley, Surrey	436.02	*no details*
G5YV	Leeds	432.72	Tripler, 8-ele stack, G2DD C'vtr.
G6CW	Nottingham	?	*no details*
G6NF	Shirley, Surrey	435.47	Straight PA, 5-ele Yagi, SEO Rx, ASB8 cavities
G6RH	Bexley, Kent	434.7	Tripler, 16-ele stack, ASB8 C'vtr.
G6YP	London, S.E.5	435.75	*no details*
G6YU	Coventry	434.10	Tripler, CC Rx, 16-ele stack
G8QY	Birmingham	?	Tripler, 24-ele stack (? Rx)
G8SK	Enfield, Middx.	433.15	Tripler, G2DD C'vtr., 8 ½-waves stk'd
G8VR	London, S.E.22	435.0	Tripler, SEO Rx, 12-ele stack
GM6WL	Glasgow, W.1.	?	P/P CV53 PA, CC Rx, 20-ele stack
GW2ADZ	Llanymynech, Mont.	432.84	Doubler SEO Rx, 32-ele stack
GW5MQ	Mold, Flints.	432.58	Tripler, 3-ele Yagi (? Rx)
ON4UV	Fayt-lez-Mange, Nr. Charleroi	434.7	Straight PA, CC Rx, 32-ele beam

This list is incomplete as regards some stations known to be equipped for the 70-centimetre band. All 430 mc operators are asked to forward details for inclusion in this Table, under the headings given.

LF/HF band aerials independently). The VHF beam assembly is thus adequately stayed—the water-piping is eyeletted to the main mast—and can be rotated from the bottom without disturbing the main LF/HF band aerials in any way, since the feeders for the 144/430 mc beams are brought down the centre of the piping. This strikes us a sound engineering approach to the mechanical problem; anyway, it results in a beam assembly for both VHF bands which still stand against any weather. And G4OU is now able to fire on 70 centimetres.

He is probably able to work the next on the list, who is G4OT (Maldon, Essex), also active on 70 cm, with an 832 tripler, a G2DD converter, and a 4/4 at 40 feet. Interesting 430 mc contacts for Old Timer G4OT (who started in Amateur Radio in 1908) have been PE1PL and G2WJ, on phone recently.

G4SA (Drayton, Berks.) enjoyed himself during the October 9-10 opening, working DL6EP, EI2W, F3LQ, ON4HC and PAØHAK with S9+ signals both ways—but nothing was heard of either GI or GM. G2HDZ (Pinner, Middx.) has been somewhat inactive, but having managed 16C for Annual Counties, is starting up that ladder; on 70 cm, he has a QQVO3-20 running as a straight PA, and comes in on the Station List.

In spite of a state of QRL, G6NB found conditions quite good whenever he could get on—at any rate, he shows a nice DX-worked list.

TWO-METRE FIRSTS

G/DL	G3DIV/A-DL4XS/3KE	5/6/50
G/EI	G8SB-EI8G	23/4/51
G/F	G6DH-F8OL	10/11/48
G/GC	G8IL-GC2CNC	24/5/51
G/GD	G3GMX-GD3DA/P	29/7/51
G/GM	G3BW-GM3OL	13/2/49
G/GW	G5MQ-GW5UO	22/10/48
G/HB	G6OU-HB1IV	12/9/53
G/LA	G6NB-LA8RB	29/6/53
G/ON	G6DH-ON4FG	25/9/48
G/OZ	G3WW-OZ2FR	1/6/51
G/PA	G6DH-PAØPN	14/9/48
G/SM	G5YV-SM7BE	1/6/51
GC/DL	GC3EBK-DL3VJ/P	22/3/53
GC/EI	GC2CNC-EI2W	8/10/51
GC/ON	GC3EBK-ON4BZ	4/3/53
GC/OZ	GC3EBK-OZ2FR	2/3/53
GD/EI	GD3DA/P-EI2W	30/7/51
GD/GM	GD3DA/P-GM3DAP	29/7/51
GD/GW	GD3DA/P-GW5MQ	28/7/51
GI/EI	GI3GQB-EI2W	13/6/51
GI/GD	GI2FHN-GD3DA/P	29/7/51
GI/GM	GI2FHN-GM3OL	1/7/49
GI/GW	GI2FHN-GW3ELM	8/7/49
GM/EI	GM3BDA-EI2W	12/6/51
GW/DL	GW5MQ-DL4XS	22/9/51
GW/EI	GW2ADZ-EI8G	19/4/51
GW/F	GW2ADZ-F3LQ	14/5/50
GW/ON	GW2ADZ-ON4YV	13/5/50
GW/PA	GW2ADZ-PAØHA	13/5/50
GW/SM	GW2ADZ-SM6QP	1/7/53
DL/OZ	DL6SW-OZ2FR	4/3/51
DL/SM	DL2DV-SM7BE	10/3/51
EI/DL	EI2W-DL3VJ/P	29/8/52
EI/ON	EI2W-ON4BZ	21/9/51
EI/PA	EI2W-PAØFC	10/10/53
ON/OZ	ON4BZ-OZ2FR	3/6/51
ON/SM	ON4BZ-SM7BE	2/3/53

Home Counties, and South

G3FYY (London, N.W.2), while agreeing about height not being a factor of any great importance, considers that "local attenuation" reduces signal strength both ways far more than screening; by this he means that town-dwellers lose a lot by signals having to pass through, or over, areas with a heavy concentration of metal piping and electric wiring. He cites G3EHY and GW2ADZ as stations well in the clear, even if low-lying, compared with those in the London area which, though they may have more height, must suffer from severe attenuation due to this factor.

G3SM (Harrow, Middx.) goes up five counties, and asks to be remembered to G2BMZ and G3AGA, both of whom he hears and calls quite frequently — and badly wants for two more counties. G2DVD (Slinfold, Sx.) makes progress in the Tables, and likewise G3WS (Chelmsford, Essex). G2AHP (Perivale, Middx.) is obliged to G5MA/P for Rutland, and says that counties for the new Annual Table have been "coming in thick and fast"; he finds that in many counties there are always several stations to work.

G3WP (Brightlingsea, Essex) has been in a rebuild, and now has 20w. into a TT15 PA; the valve sequence is EF91 18 mc CO into ECC91 36-72 mc, into 6F17 as 144 mc doubler. G3WP remarks that the 6F17 seems to be a very effective valve for the purpose. Next for attention here is the aerial, which is going to be something better than the present rotary dipole. G2CZS (Chelmsford) missed the Continental opening; he has overcome his ignition-QRM trouble to some extent by fitting a noise-limiter of the AR88 type to his NC80X—this must have been quite a job. With an 829B PA as well, he will now be chasing the boys up the ladder.

Vernon of G5MR (Hythe, Kent) raises a point about scoring off /P stations—the answer is that a /P contact scores for the county, irrespective of the call-sign being the same in several different counties; in other words, Bob is worth about six counties to some lucky people. G5MR remarks upon the phenomenon noted in our last about HB1IV's signals "passing over" certain areas; HB1IV was very strong in Hythe in the early evening of September

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.
13	G3BLP, G3CCH, G6XX
12	G2HIF, G3WW, G5BD, G6LI, ON4BZ.
11	G2AJ, G2HDZ, G2XV, G3ABA, G3IOO, G5UD.
10	EI2W, G2FQP, G3BK, G3EHY, G3GHI, G4RO, G4SA, G5DS, G5MA, G6RH, G8IC, GW5MQ.
9	G2AHP, G3BNC, G3FAN, G3FIJ, G6XM.
8	G2XC, G3GSE, G3HCU, G3VM, G3WS, G5BM, G5BY, G5ML, G5MR, G8SB.

70-CENTIMETRE FIRSTS

G/DL	G2WJ-DL3FM	10/8/53
G/GD	G2JT-GD3DA/P	26/8/51
G/GW	G4LU-GW2ADZ	5/7/50
GD/GW	GD3DA/P-GW5MQ	29/7/51
GI/GD	GI3GQB-GD3DA/P	14/6/53
GM/GI	GM6WL/P-GI3FWF/P	9/9/53
GW/ON	GW2ADZ-ON4UV	3/3/53
GW/PA	GW2ADZ-PAØNL	1/7/53

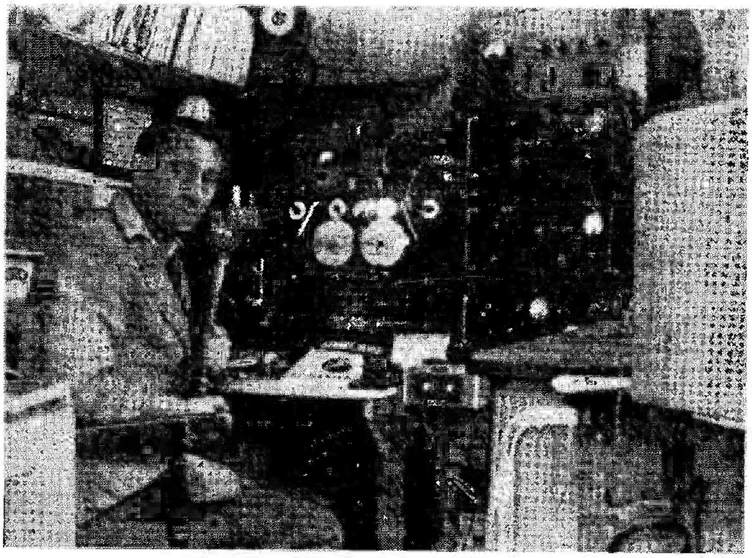
TWO METRES

ALL-TIME COUNTIES WORKED LIST

Starting Figure, 14
From Fixed QTH Only

Worked	Station
64	G6NB
63	G5YV
61	G3BLP (630), G3BW
59	G3EHY
58	EI2W (192)
57	G2OI (349)
56	G8SB
55	GW5MQ
54	G2HIF (200)
53	G2AJ (519) G4CI
52	G2HDZ (398), G2NH, G3WW, G4SA
51	G5BM
50	G3ABA, G3FAN, G3GHO, G5DS (503)
48	G5BD, G5MA
47	G5WP, G6XX (210)
46	G4HT (476), G5BY, G6YU (205)
45	G2XC, G3IOO, G5ML (264), G6XM (356)
44	G3BK, G3CCH, G3HAZ (194)
43	G3BA, G3COJ, G4RO, G5DF
42	G2AHP (428), G2FJR, G3GSE (424)
41	G2FQP, G3DMU, G6CI (167)
40	G3CGQ, G5JU, G8KL, G8OU
39	G2IQ, G3VM, G8DA, G8IL (325)
38	G2FCL (222), G3APY, G3HBW
37	G2DDD, G2FNW, G2FZU (180), G3BNC, G3GBO (414), G6TA (277)
36	G3CXD, G6CB (312), G8IP
35	G3FZL, G3HCU (224), G3HWJ
34	G3BKQ, G3WS (153), G8IC
32	G2FVD, G5MR (180), G8VR, G8QY
31	G3HXO, G5RP
30	G2DVD, G2HOP, G3GOP (208), G3FRY, G5NF, GW8UH
29	G3AGS, G3AKU, G3BJQ, G3FIJ (194)
28	G8DL, GM3BDA
27	G3DAH, G3FIH, G3ISA (160), G6GR
26	G3AEP, G3CFR (125), G3DO, G3SM (211), G4MR (189)
25	G5SK, G8VN
24	G2CZS, G3FD, G3FXG, G3FXR, GM3EGW
23	G3CWW (260), G3DLU, G3IUD, G4LX, G5PY, G6PJ, GM3DIQ
22	G3AGR (135), G3ASG (150), G3BPM, G3HIL
21	G2AOL (110), G3IWJ, G6XY
20	G3EYV, G3IRA, G3YH
19	G3FEX (118), G3GCX, G5LQ (176)
17	G3JMA
16	G3FRE, G3HSD, GC2CNC
15	G3IWA
14	G2DHV, G3GYY

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.



G3ARL, Lake, I. of Wight, is not well situated for VHF working, but gets his share of the DX nevertheless. His two-metre equipment is a modified SCR-522 driving an 829B to about 80 watts, a 6AK5 converter and a 4-element beam.

12, but later on could not be heard at all, though G's further north were working him.

G3BNC (Southsea), in sending in his claims for the Tables, reports that nothing further has been heard about that I1XV signal—so it will have to be marked off as No-Go, ascribable only to some peculiar and particularly nit-witted form of piracy.

Besides moving in the Tables, G2DDD (Littlehampton, Sx.) has been active on 430 mc, and on that band can work G2DD (Stanmore, Middx.) over the 55 miles or so of the Downs; he has also been heard on 70 cm by G2HDZ (Pinner) and G3GDR (Watford)—all of which is very nice going. G2DDD keeps a regular operating schedule on 435.6 mc; this is 1930-35 on Wednesday and Saturday evenings, 7.30-35 on Sunday mornings, listening until 20.00 and 7.50, and during these particular periods his beam is directed on the London area. This gives us another useful GDX point in the 70-centimetre network.

Some European Notes

It was expected that HB1IV might have been on again, from his erie on Mt. Pilatus, for the week-end October 17-18; this was to have been only if conditions looked good enough to make it worth while organising the transport. At the moment of writing, we have no news.

We have a complete list of OZ two-metre stations, with their equipment and frequencies; as there are more than 20 of them, it is too long to reproduce in detail here, but it may be said that they operate on various frequencies between 144.14 (OZ7G) and 145.48 mc (OZ2IZ), run inputs up to 100 watts (OZ9R), and have beam assemblies varying from a 4/4/4 (OZ9R) to a 16-ele stack (OZ2IZ); all are

BRITISH ISLES SEVENTY-CENTIMETRE ZONE PLAN

FULL BAND, 420-460 MC

Area (mc)	Service
420-425	SEO Transmission (MCW and Phone).
425-432	Amateur Television.
432-438	CC Communication Band, Station Frequencies tripled from Two-Metre Zone.
438-445	Amateur Television.
445-455	Future Amateur Development.
455-460	SEO Transmission (MCW and Phone).

using converter-type receivers, mainly the G2IQ 6J6 design.

The first European group to feature the "British Isles Two-Metre Zone Plan" is the Swedish S.S.A. The Plan is reproduced in full, with explanatory notes, in the October issue of their *QTC*.

From Khartoum, ST2UU writes that he now has a two-metre transmitter running 80 watts, and would like to fix schedules for Saturdays and Sundays at 1200 and 2200 GMT. Though he suggests G's, we feel that for a start there would be a much better chance of success with ZB1 or CN2, and possibly with Italy or the F's in Southern France.

Apologies Due To

GW2ADZ for crediting the GW/F two-metre "First" to GW8UH last month. To GI3FWF/P for mis-quoting his call-sign in reporting the GM6WL 70-centimetre QSO. To G2DDD for having inadvertently dropped him from Annual Counties—and to ON4BZ for having lost the bit of paper on which we noted the date of his ON/LA "First."

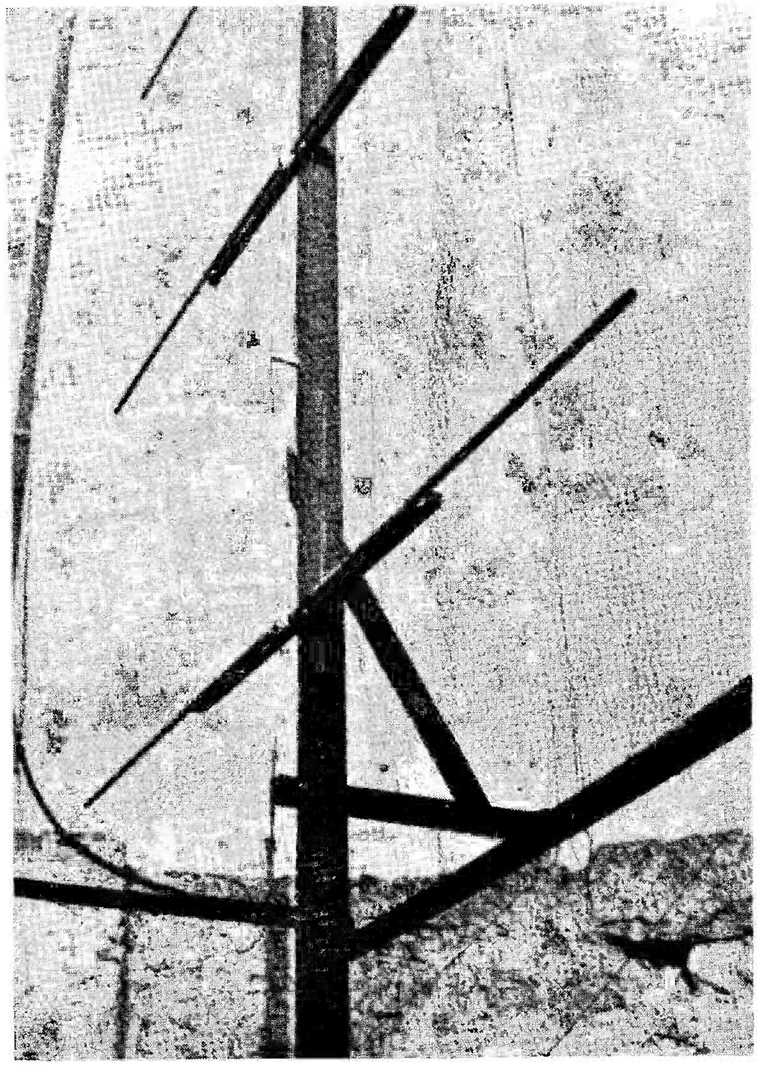
A Few Crax

"I am now on phone, so hope to work some of those chaps who never use the key" (G3WP). . . . "It makes me terribly discontented with my QTH when I hear G6NB handing out S9 reports to DL and OZ when I cannot even hear their carriers with the BFO on!" (G3FYY). . . . "May G5MA's motor car never break down" (G2AHP). . . . "I can claim the distinction of being one of the very few who neither heard nor worked HB1IV; I was on 70 cm all that week-end and did not even know he was on" (G2HDZ). . . "I have 15 cards outstanding, and those concerned have all had one direct QSL and two reminders—they must be a thick-skinned lot" (G3DLU). . . ."Please would you press for more CW working, especially under poor conditions; I have found that with CW the band is never as dead as it seems" (G2CZS).

VHFCC Elections

The following, having shown cards for 100 or more stations worked, are elected to the VHF Century Club: G3IOO, Oswestry, No. 152; G6XX, Goole. No. 153; GW8UH, Cardiff, No. 154.

All operators who hold the

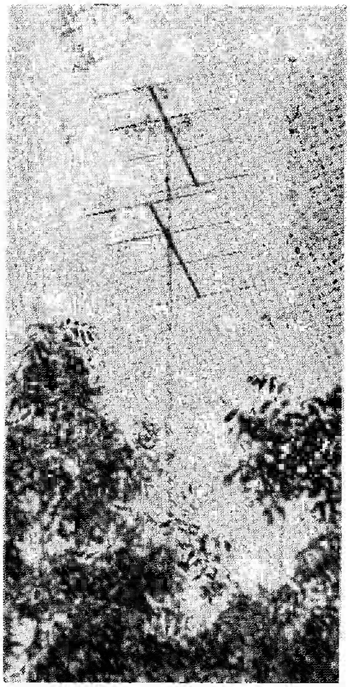


Construction of the 16-element stack at G5TZ/A, with its wire-mesh reflector. The Old Light House, long since abandoned, on St. Catherine's Point — from where G5TZ/A operates on two metres — is a very lonely spot 780 feet a.s.l. An important item in his equipment is a rifle — to keep the wild life under control and possible intruders at bay!

BRITISH ISLES TWO-METRE ZONE PLAN

(This is reproduced here for the benefit of newcomers to the band).

Zone A & B: **144.0 to 144.2 mc.**	All Scotland.
Zone C: **144.2 to 144.4 m.c.**	All England from Lancs. Yorks., northward.
Zone D: **145.8 to 146 mc.**	All Ireland.
Zone E: **144.4 to 144.65 mc.**	Cheshire, Derby, Notts., Lincs., Rutland, Leics., Warwick and Staffs.
Zone F: **145.65 to 145.8 mc.**	Flint, Denbigh, Shrops., Worcs., Hereford, Monmouth and West.
Zone G: **144.65 to 144.85 mc.**	Northants., Bucks., Herts., Beds., Hunts., Cambs., Norfolk, Suffolk.
Zone H: **145.25 to 145.5 mc.**	Dorset, Wilts., Glos., Oxon., Berks. and Hants
Zone I: **145.5 to 145.65 mc.**	Cornwall, Devon, Somerset.
Zone J: **144.85 to 145.25 mc.**	London, Essex, Middlesex, Surrey, Kent, Sussex.



The efficient looking 4-over-4 installed at G3FAN, Ryde, I. of W. This beam is gamma-matched, and puts a fine signal out to GDX.

necessary cards from 100 different stations worked two-way on the VHF bands are eligible for membership of the VHF Century Club, for which we issue a numbered certificate. Claims can be accepted for any such post-war QSO, and can be made for any band from 50 mc up — this specifically includes the old five-metre band, and the six-metre band for the short time that we had it. Cards to support the claim, with a check list, should be sent to A. J. Devon at the office. The certificate is issued and the cards returned within a few days. So far this year 18 VHFCC elections have been notified.

In Conclusion

So we come to the end of another interesting month — and perhaps at this point your A.J.D. might be permitted to thank, collectively, all those who when sending in their reports are good enough to add some words of praise for "VHF Bands"; naturally enough, such comments are greatly appreciated, and for his part A.J.D. would say that were it not for the encouraging support and the large volume of mail which this feature has always enjoyed, it would be extremely difficult to present "VHF Bands" at all. Correspondents' letters give us the news, and it is the news that makes the story.

For the next dead-line, we are again caught by the calendar—it must be **Monday, November 16, certain,** and even at that we are stretching it very tight. Address all your VHF news to: A. J. Devon, "VHF Bands," *Short Wave Magazine,* 55 Victoria Street, London, S.W.1. CUAGN on December 4, all being well.

". . . . And if this doesn't get us a new record, Fwed, I'll eat my ticket . . . ."

THE BBC THIRTY YEARS AGO

In 1923, the British Broadcasting Co., Ltd. (as it then was) had six medium-wave transmitters in operation, always identified by call-sign: Birmingham, 5IT; Cardiff, 5WA; Glasgow, 5SC; London, 2LO; Manchester, 2ZY; and Newcastle, 5NO. The daily transmitting schedule was 11.30-12.30 a.m. and 5.30-11.0 p.m. only, with Sundays restricted to 8.30-10.30 p.m. In addition, each week-day evening every station observed a half-hour silent period! These arrangements were naturally very popular with the amateur transmitters of the day, as BCI was a curse and almost unavoidable in populated areas, since BC receivers were mainly of the 1-V-1 variety. Except for the broadcasting of sporting events, and similar actuality broadcasts of national interest and significance, there are those who would say that there was no need for the BBC's original schedules ever to have been extended! Under present conditions, enormous sums of money could be saved for programme material of real talent on both sound and TV, and we would be spared the eternal gramophone-grinding of the disc jockeys—which now comprises the bulk of the day-to-day routine programmes.

PHOTOGRAPHS

Readers are reminded that we are always in the market for photographs of radio interest—either equipment, personalities, or stations. Prints only should be sent, and can be almost any size so long as they are clear and sharp. Photographs should be identified on the back, lightly in pencil, and accompanied by descriptive notes. Payment is made for all photographs used in *Short Wave Magazine* or *Radio Quarterly*.

* *

POSTAGE — PLEASE NOTE!

Due to heavy postage charges, we must ask that in future all correspondence to which a reply is expected should be accompanied by a stamped addressed envelope. This need not, of course, apply to correspondents' reports for our various activity features, to which in the ordinary way no individual reply is necessary.

VHF WEATHER REPORT

PERIOD SEPTEMBER 17 TO OCTOBER 14

A. H. HOOPER (G3EGB)

This month's Report brings out several points of great interest arising from recent results and discussions in "VHF Bands." It is once again emphasised that though the VHF Weather Report here is for the period as covered by the current "VHF Bands" in the same issue, neither G3EGB nor A.J.D. can have any knowledge of operating results as generally experienced until all individual reports are received. Thus, the VHF Weather Report for any given period shows conditions as they were, indicating the EDX and GDX possibilities, while "VHF Bands" in the same issue shows what results were actually achieved under those particular conditions. Hence, individual VHF operators can back-check on their own results—and can see what they may have missed! The correlation, which is the point of greatest interest, depends entirely upon correspondents' reports; these should be as detailed as possible, in terms of dates, times and EDX/GDX worked.
—EDITOR.

POOR for the first fortnight, then a good spell of twelve days, and finally three poor days.

The collapse of high-pressure conditions at the end of the last period introduced a succession of depressions which followed one another over our part of Europe until late in September. One of them, originally a tropical cyclone near Bermuda, was one of the deepest yet experienced at this time of year, and although the full effect was not felt in the South, its passage during September 21 is well marked in the pressure graph of Fig. 1. After a preliminary advance North-eastwards from the Azores anticyclone on the 26th, a high-pressure belt became established over Biscay, France and Germany during September 29 and affected Southern districts of the U.K. on October 1. Later moving to the East, we were then left in a col between one anticyclone lying to our West and the other over Eastern Europe. The former drifted Eastwards over us late on October 3, where it remained with good effect for five days before moving on over Germany. It was not until October 12 that conditions finally collapsed. A slow clearance from the North-west set in during October 14 and 15, bringing our first cold autumn spell.

Interpretation

The coarse MRI structure over East Anglia has been deduced from the results of radio-soundings reported in *The Daily Aerological Record* of the Meteorological Office, London. Changes in the gradient of MRI with height were found which, if extending over appreciable areas, would be of value in returning two-metre energy to ground level far beyond the horizon. The heights above mean sea level (MSL) at which these discontinuities were observed are given in Fig. 1, from which the poor conditions occurring in the latter half of September, with only isolated discontinuities, are at once evident. The sequence of good conditions starting with a very strong layer (the double circles) in the early hours of September 30 is shown, and the fact that the height of the layer underwent considerable fluctuation is well brought out. The double circles are used on those occasions when the discontinuity was so marked as to act as a duct for the shorter wavelengths. It is unusual for there to be a duct at a wavelength of two metres, and for us these layers represented no more than especially strong reflection. On September 26 the low-level discontinuity normally associated with night-time cooling appeared to continue during the day.

The other soundings over the British Isles have been studied in the same way, so as to ascertain the extent of the reflecting layers of Fig. 1. Apart from a single spell for the South and South-east on September 20, it was not until September 26, when these two areas, together with the South-west, Midlands and Lancashire were affected, that the first good opening developed. All areas with the exception of GM opened up on September 30, but by the following evening GI was shut off. Their turn came next on October 3, when an anticyclone to the West brought a layer over all districts, but sloping upwards over the South-east, where conditions are thought to have been inferior. This was remedied twenty-four hours later, when all areas enjoyed a layer at about 5000 feet, which settled to 3500 feet on October 5 with the continued Eastward drift over us of the parent anticyclone. Then came a temporary weakening over all but the South, South-west and Midlands until October 8, when a general level over most areas of 4500 feet was observed, peaking thereafter at about 1000 feet on October 10. The layer was rising by the following evening prior to a complete collapse. Throughout these days the layer was tilted upwards over the North and North-west, where levels of 3500 feet were not achieved until the last two evenings. With a clearance of bad weather, the GM/GI path benefited from a high-level layer on October 13 and 14. It remains to be seen whether this layer will extend South-eastwards.

The EDX Possibilities

Table 1 is partly derived from the weather charts in the *Daily Weather Report* of the Meteorological Office. The entries are in respect of the evenings of the dates quoted. The first line shows the type of pressure system over Southern England, while the second—devoted to evenings of radiation cooling—shows the time, on each occasion, when saturation at the surface heralded a lifting of the layer of super-refraction. (Where the time is after midnight, it is still placed under the pre-midnight date.) On the night of October 3/4, for example, it is thought that super-refraction increased steadily during the evening until about 0100 on October 4, and then deteriorated slowly, until dawn brought the inevitable return to

Date	Sep 17	18	19	20	21	22	23	24	25	26	27	28	29	30	Oct 1	2	3	4	5	6	7	8	9	10	11	12	13	14
Pressure system over Southern England	D	D	D	D	D	D	D	C	C	C	D	A	D	D	A	C	A	A	A	A	A	A	A	A	A	C	C	C
Radiation over Bedfordshire, GMT	—	01	—	—	—	—	05	**03**	**06**	**04**	01	02	—	—	22	03	01	**04**	**03**	06	—	01	04	23	—	—	—	—
Discontinuities aloft, from East Anglia to the countries indicated: NE	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	LA	—	—	—
NE	—	—	—	—	—	—	—	—	—	OZ	—	—	—	—	—	—	—	—	OZ	—	—	—	OZ	**OZ**	SM	—	—	—
E	—	—	—	—	—	—	—	—	—	**DL**	PA	—	PA	PA	DL	—	PA	PA	DL	PA	PA	**DL**	DL	DL	PA	—	—	—
SE	—	—	—	—	—	—	—	—	—	—	ON	ON	ON	ON	**OE**	—	—	DL	DL	ON	ON	DL	**OE**	**OE**	DL	—	—	—
S	—	—	—	45°	—	—	—	—	45°	—	—	47°	—	45°	43°	—	—	47°	47°	43°	43°	43°	45°	47°	47°	—	—	—

Table 1. The possibilities for EDX working at VHF from September 17 to October 14. Especially good dates are shown in bold type and underlined. Country prefixes show approximate directions and distances from South-East 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) *D = Depression. A = Anticyclone. C = Col, slack pressure gradient.*

(3) *Times in the second line mark the fading of inland super-refraction.*

(4) *Country prefixes indicate the approximate limit of conditions.*

(5) *For the southern path, which is wholly over France, it has been necessary to indicate limits in two-degree steps of latitude. The latitude of Paris is about 49°N, and that of Marseilles 43°N.*

(6) *Occasions of particularly marked discontinuities are printed in heavy type and are underlined.*

normal conditions. On the following evening, in the same good spell, the effect was more marked and continued to improve until 0400.

The remaining lines of the Table are given to the possibilities of EDX. They show, for certain directions from Southern England, the occasions when reflecting layers aloft are thought to have yielded communication with the countries designated by prefix. For example, Belgium was a good possibility during the period September 27-30, while on the following evening the same path, opening very much further, extended as far as Austria. Along the eastern path the symbol DL covers a considerable range of distances, and the Table fails to reveal that a layer extended Eastwards right across PA to Eastern Germany on September 26, whereas the similar entry for October 5 is only as far as the Western Zone.

Certain entries are stressed with heavy type and by underlining. These represent the really good occasions, and in the case of dates give a cross-reference to Fig. 1.

The writer is curious to know why little seems to result from openings to the South. The conditions leading to the QSO about two years ago over a 630-mile path to near Bordeaux are duplicated from time to time, while reflecting layers as good as those along other paths are a frequent occurrence. In the past, Tables have shown more frequent openings southwards than to the north-east; results should bear this out. It must be that there is not much activity of the right sort in this general direction.

The Controllable Factors

As a change from the vagaries of anomalous propagation, some time has been spent in examining the more controllable factors: Operating site and beam angles. The data accumulated over the last few months have been combined with a detailed report[1], with interesting implications for the two-metre enthusiast. The reference will be found of great value to those seeking a full treatment of anomalous propagation.

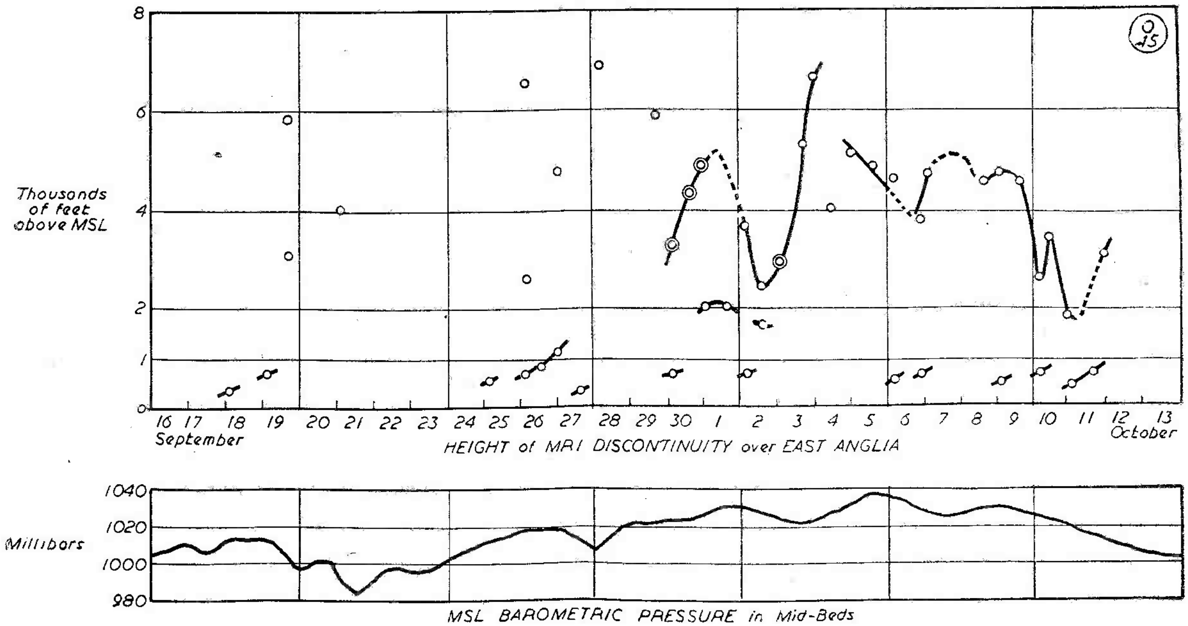


Fig. 1. Showing the reflecting layers that formed over East Anglia during the period September 16 to October 13. The occasions when they are thought to have started EDX paths can be found by reference to Table 1.

For best reflection we need our radiation to strike any reflecting layer aloft as shallowly as possible. It will be apparent that the shallowest angles occur with the lowest layers. From the factors involved it appears that the signal strength at a given point will improve by something in the order of 12 dB with the sinking of a reflecting layer from 4000 feet to 2000 feet. The layer height, therefore, is of considerable importance.

Table 2 shows the incidence, upon a layer at 4000 feet, of a single ray emitted at various angles from the horizontal.

Table 2

Tx Beam Angle, degrees (from horizontal)		0·00	0·10	0·50	1·00	2·00	4·00
4000 feet	Angle, degrees	0·95	0·95	1·05	1·37	2·21	4·10
	Distance, miles	92	83	56	37	—	—
Relative Reflection, dB		+1	—	—	0	-6	-11

From the angles at 4000 feet it might appear that there is little point in striving to lower a beam angle below 0.5 degrees, in so far as shallowness of arrival at the layer is concerned. However, the third line shows that failure to do so greatly reduces the distance at which reflection of the single ray would occur. The figures are computed using an average lapse of 135 M-units to 4000 feet. Variations of less than 8% occur for most atmospheric fluctuations. The distance figures, but not the angles, will be short by about 14% when, the overall M-lapse being the same, the lapse over the first 1000 feet is 22 M-units. This value is the smallest the writer has found over these last few months. With a layer at 4000 feet and a horizontal radiation angle, the round figure of 100 miles applies, with subsequent reflection downward to a total distance in the order of 200 miles. It should be emphasised that these figures are only a rough guide, as actual processes are vastly more complicated.

A layer occurring at a lower level will be reached in a shorter distance, and at 1000 feet, with favourable conditions, the *total* surface distance is about 75 miles. For a layer at 6000 feet, the corresponding distance is about 250 miles, but here we have a considerably inferior degree of reflection. It has been pointed out[1] that even at best the amount of reflection is very small and that double-hop paths are highly unlikely.

The degree of reflection varies with changes in angle, and the fourth line of Table 2 gives an idea of the variation with beam angle for a layer of constant height (in this case 4000 feet). It can be seen that the penalty for an upward tilt increases rapidly!

Aerial Height

The much-discussed question of aerial height has also been examined. If we imagine the results of Table 2 as applying to an aerial array at sea level, then an aerial at a higher level can radiate downwards.

The ray emitted at a downward angle so as to skim the sea some distance away will then bend upwards in the normal way, following the path corresponding to a beam emitted at an angle of 0 degrees from that point. Again using the most

References :

1. J. A. Saxton. " The Propagation of Metre Radio Waves Beyond the Normal Horizon." *Proceedings* : The Institution of Electrical Engineers, Vol. 98, Part III, No. 55.

favourable conditions observed by the writer and a layer at 4000 feet, raising the array to 1000 feet will increase the total *distance* achieved by such a ray by about 40 miles, and, by being nearer the layer, will improve the signal *strength* by about 6 dB. Thus it would appear that, for the normal increase in height possible to the amateur, little improvement in reflected fields can be expected. However, this result is for an initial site with a clear, horizontal "take-off." When, as is often the case, this happy condition is not met and minimum take-off angles are substantially greater because of surrounding obstructions, then considerable improvement can result. It is worth noting that no matter what the height of the array or of the layer, the beam angle for greatest amount of reflection is the *horizontal,* and other angles, whether up or down, are inferior in this respect.

Although the figures can be no more than a rough guide, they do give an idea of the magnitudes involved, and from them it appears that, for the person confined to an average site with DX as the primary interest, lowering the beam angle is more likely to be rewarding than striving for a few more feet of height.

In the paper already referred to, signal strengths due to horizontal reflecting layers are computed for varying distances using a more elaborate treatment than is here possible. It is noteworthy that there is little change in strength between 125 and 250 miles owing to improved angles of incidence at the greater (single-hop) distances.

Since amateur VHF communication to over 600 miles is occasionally achieved, it is obvious that simple reflection is only a partial explanation. It is almost certain that the bending downwards is a process taking place *over a considerable horizontal distance,* and in such circumstances the figures quoted earlier apply only to the "take-off" to, and the "let-down" from, the layer. All this fails to take into account the effect of tilted and curved layers. In Fig. 2 is given, as far as can be ascertained, the contours—in the same way as for a valley on a map—of the layer which developed early in September.

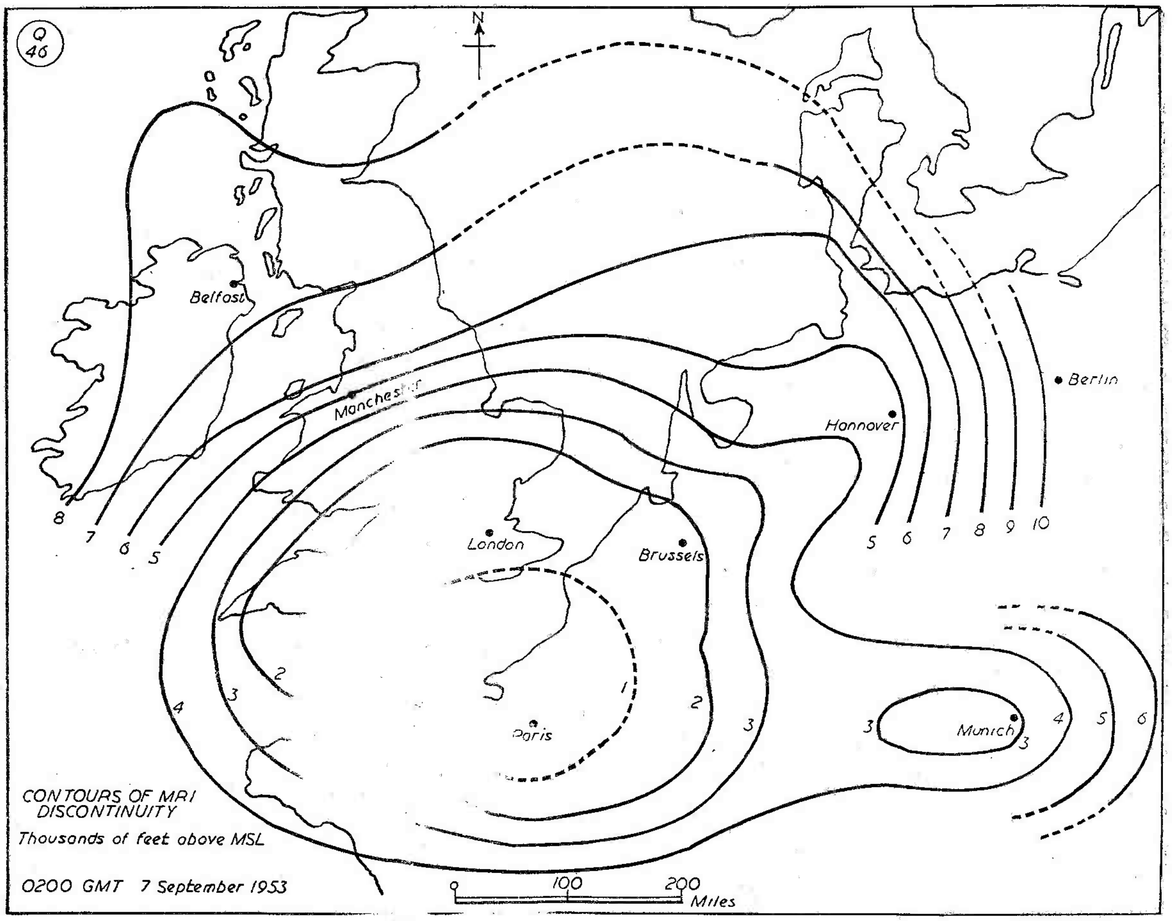


Fig. 2. Showing the contours (heights) of the MRI discontinuity (reflecting layer) that formed over part of Northern Europe early in September. From the heights given, it can be visualised rather as an irregular bowl, with the lip sloping upwards from the earth from a small, low-level central area. With the level central area well spread out, conditions are very much better.

It is a picture of an area near the Channel of gentle slopes (0.1°), about 200 miles by 300 miles in extent, bounded by a "steep" rise of 0.9° over Cheshire. There is a long, helpful extension south-eastwards to Bavaria and a shorter one eastwards to the vicinity of Hanover. Coverage within the limits of about 65 miles (the 2000 foot value) beyond the limits of the 2000-foot contour, with extension to the east and south-east, could have been expected for a flat layer. In this more representative case the coverage is likely to be considerably modified by the slopes existing. It is interesting to note that the presence and extent of the layer could *not* have been deduced from the surface weather chart.

In Retrospect

The extensive selection of reports for last month's fine spells have been very welcome. Their agreement with the VHF Weather analysis is excellent and most encouraging. Detailed reports of the kind received are very helpful; a number of points have arisen.

The opening to HB is first to receive attention. It developed with the approach of an anticyclone from the west, first being confined to the Continent and then, on September 12, opening northwards to the UK as the high-pressure system arrived. Over East Anglia a duct of about 300 feet appeared for the whole of the 12th and 13th. It was not wide enough for two-metre energy, even for people high enough (5000 feet) to be within it, but acted as a very well marked discontinuity, shown as a double ring in the figure. The opening of this south-east path was shown in the Table, but, with the layer weaker and well over 5000 feet up over the Continent, the opening was not shown as extending as far as HB. From a study of a map of the area, HB1IV was in the happy position, on top of his mountain, of radiating useful energy over an arc extending down to about 1° below the horizontal. The importance of a good take-off has been brought out already, and in this case was good for an 80-mile start. From the intensity of the reflecting layer over the UK, there appears no meteorological reason for the northward limit of propagation observed, and an alternative explanation should be sought.

G6LI mentions the arrival on September 6 of Continental signals, and suggests that the good conditions affected the East Coast area only. This is in excellent support of the detailed account given on page 495 last month, when a vast reflecting layer was described as extending from the Continent over the UK on this day. The levels given elsewhere in that report were 2000-3000 feet in the South-east, rising to 6000-7000 feet in the north-west. The layer is depicted in Fig. 2 herewith, which shows approximate contours of its height above MSL at 1000-feet intervals. From the lowest values over the Channel, the discontinuity layer curves upwards almost as a step over the north-west. The difficulty of obtaining reflection down to areas beneath the pronounced tilting is self-evident. At this time there was, in fact, little or no horizontal portion, even in the central area, but by the following evening the layer was below 2500 feet over all areas and giving extensive propagation. EI2W was then working all over Southern England and hearing PA. In this connection, it is interesting to note that the lower surface was at about 2300 feet, while for the opening at the beginning of March it was at about 1000 feet, and EI and Lancashire stations then heard nothing. The present instance corroborates the theory then evolved that in March interruption of the 1000-foot discontinuity by high ground accounted for the rerstricted results then experienced. Undoubtedly, conditions that are very good for us in G can be too good for EI and GM stations, in that they can be cut off by high ground. It is observed, too, that EI2W, who heard PA stations on September 7 but failed to achieve a QSO, heard nothing of them the following evening, when GW8UH heard ON. Obviously, conditions were marginal for EI/ON on September 7, and the slow deterioration of conditions over the Continent on September 8 had the inevitable result at EI2W while still producing signals as far West as Cardiff. One wonders why nothing was heard in Cardiff on the previous evening. (*See* Fig. 2). Not in such excellent agreement are the several QSO's of G5YV with GI stations at times when no discontinuities have been observed aloft. It is quite evident that an alternative mechanism operates over this path, and details of the G5YV site would be of great interest. The path to ON is also intriguing, as G5YV's consistent results for the fortnight from August 13 are *not* in accordance with the overall result suggested last month. The writer hopes for the opportunity of a detailed analysis, and is anxious to hear from any operators running a schedule over paths sufficiently long to bring out day-to-day signal fluctuations reliably. (The opportunity is here taken of correcting last month's report—it is the *exclusion* of one case which brings up the improvement from 11 to 16 per cent.)

G6LI also mentions that at 0730 GMT on September 7 (*see* Fig. 2 again!) he appeared to be the only soul on a wide-open band. This assessment of the band is undoubtedly correct. While the improvements arising from radiation cooling are, in essence, solely a night-time effect—*see* the times in Table 1—the major DX is achieved from discontinuities aloft. These come about from large-scale atmospheric processes and, apart from the rare occasions of sinking to near-surface levels, are independent of day/night effects. Undoubtedly, G6LI could have had DX company.

Some reports mention directional efforts on September 1. On this occasion a belt of high pressure over France and Germany produced a discontinuity over these countries and over Southern England. During the evening a cold front was approaching from the north-west and can be imagined as causing the layer to move away eastwards, until by 0600 next morning there remained only a poor chance of DX to the east and north-east.

The writer is indebted for permission of the Director, Meteorological Office, London, to quote information derived from the official publications mentioned.

Keying for BK

SIMPLIFIED SYSTEM USING RELAYS

M. C. WATSON (ZB1AR)

DESIRING some effective yet simple system of keying, the writer searched contemporary literature for suitable circuits. He was appalled by the complexity of most systems, one of which, described as "de-luxe break-in," involved no less than four valves and a separate power pack.

Attention was then turned to the use of lagged relays, and the ideal relay was found in the BC-625 assembly, now readily obtainable. It can be recognised by its rather long, golden coloured body, mounted on two metal stand-offs. Any similar relay would of course do as well.

Action of the Circuit

The main circuit is shown at Fig. 1, and the action is as follows: When the key is closed Relay 1 closes which results in the 18-volt DC appearing across the output terminals. The lagged relays (Ry1, Ry2, Ry3) also close and open, one by one, when the key is released. The output voltage is maintained until the last relay has opened. A selector switch (S1) controls the amount of delay. Spare contacts on Relay 1 are used to break the cathode circuit of one of the driver stages. The output terminals are connected to the following:

(1) Aerial change-over relay (Ry5). This is a coaxial relay changing the aerial from the Rx to Tx and shorting the Rx aerial terminal to earth when in the "Tx" position.

(2) Receiver break-in relay (Ry6). This circuit may consist of a relay in the HT lead to the Rx, or in any of the usual cathode muting circuits.

(3) VFO relay (Ry7) and crystal oscillator relay (Ry8). Fig. 2 is self-explanatory. S2 is a push-button switch for tuning the VFO to the Rx. The ECO works on 160 metres and T9 results are apparent at 10 metres.

All this may sound much more complicated than it really is! Although some 8 relays are used, these are all left-overs from surplus equipment. An incidental advantage is the ease with which remote Tx control may be effected.

The operating voltage is derived from a rectified 18-volt mains supply, but it may be conveniently obtained from batteries.

The system is quiet in operation as only relays 1 and 2 move on actual keying. At a pause between words the system swings over to receive, with the selector switch in the fourth position and keying speed of about 12 w.p.m. At the second position the system goes over between each letter, while the first position provides "no-delay" keying and should be used on phone.

The author, who likes relays, is now building a four band, four PA rig with instantaneous relay band switching—but more of that later!

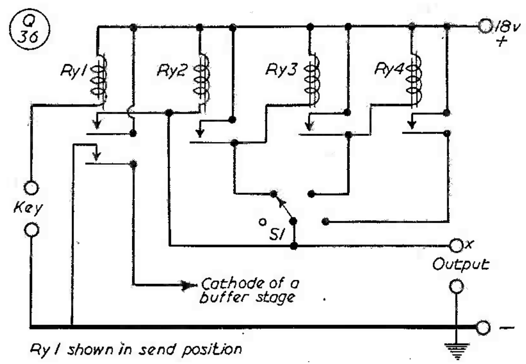


Fig. 1. Electrical layout of the key controlled circuit.

Relays Required

RY1 =	Any small, fast relay, 2 pole, make and break.
RY2 =	Lagged relays from Tx BC-625 equipment, or similar.
RY3, RY4, RY5 =	High speed aerial relay, as previously described. If this is not of the fast type, it is probable that the first dot of the signal will not be transmitted.
RY6 =	Any normal make and break relay.
RY7 =	Small single-pole 2-way relay located in VFO.
RY8 =	Single-pole relay in the cathode of the crystal oscillator when the crystal is used.
S1 =	Four-way single-pole.
S2 =	Two-way single-pole press-button type.

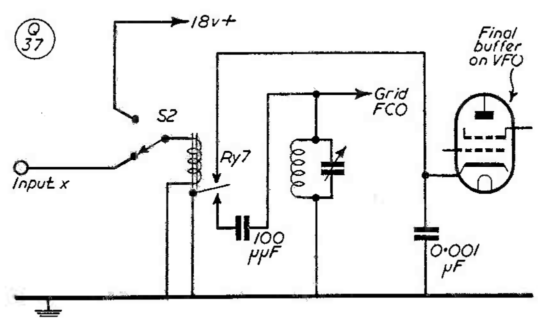


Fig. 2. Control applied to the early stages of a transmitter.

Random Jottings by the Old Timer

HOW true is that old saying, "the onlooker sees most of the game." It may be obvious, but it is often forgotten. It is mentioned here because we all lose our sense of proportion when regarding our hobby from the inside, and an outside opinion comes as a shower of clear (and sometimes pretty cold) water. This month we had a session with an old friend; he has been mentioned before. He is not, and never has been, an amateur, but he follows our doings with some keenness, sitting behind the controls of an aged Sky Champion. In his present state of mind he is inclined to wonder how we manage to carry on at all—not because conditions are so bad, but because he can't see what driving force we have behind us. (He doesn't listen on VHF, of course, so he does miss that much of the picture). But his observations on the HF bands lead him to suppose that we have all run out of subjects of conversation, and now do nothing but natter about nothing in particular.

ROUND IN CIRCLES

This fellow, who is a keen listener and really very well-informed on amateur and short-wave matters, has picked up every scrap of his knowledge by simply *listening* on the amateur bands for over twenty years. He started as an absolute tyro, knowing nothing of Morse or the comic abbreviations that we use; now he knows the lot. But he says most definitely that he never learns anything now—and, moreover, that he knows a good deal more than most of the chaps he listens to! He hears an interminable argument round a six-way net about why one particular aerial doesn't get out, or why an 807 squirts parasitics. And he finds himself just dying to chip in and give the very short and simple answer; meanwhile, the whole gathering seem to regard it as something very mysterious and intriguing. The important point is to find out why this lack of "know-how" seems to be so much on the increase. Is it because of the lack of real experimental work these days? Do we spend too much time talking and too little finding out?

THE WISE OLD OWL

There was a famous Belgian QSL, back in the 1920's, with an illustrated version of the parable of the Wise Old Owl. Probably this could teach us a lot. For it is obvious (just listen on the phone bands any day) that some people talk so much that they never have *time* to learn anything. Those who listen are learning something or other all the time, if it's only an object lesson in how not to expose their lack of knowledge! It is a remarkable fact that the amateurs who really know their stuff are those who keep in the background. When they do chip in, their remarks are snappy and very much to the point. (The trouble is that they have such a job to break in and get a word to themselves.) So let us refresh your memory with the wording of that Belgian QSL—"There was an owl lived in an oak; the more he thought, the less he spoke. The less he spoke, the more he heard; Hams please copy that wise old bird!" And remember that a little less aimless natter would also reduce the QRM on our bands.

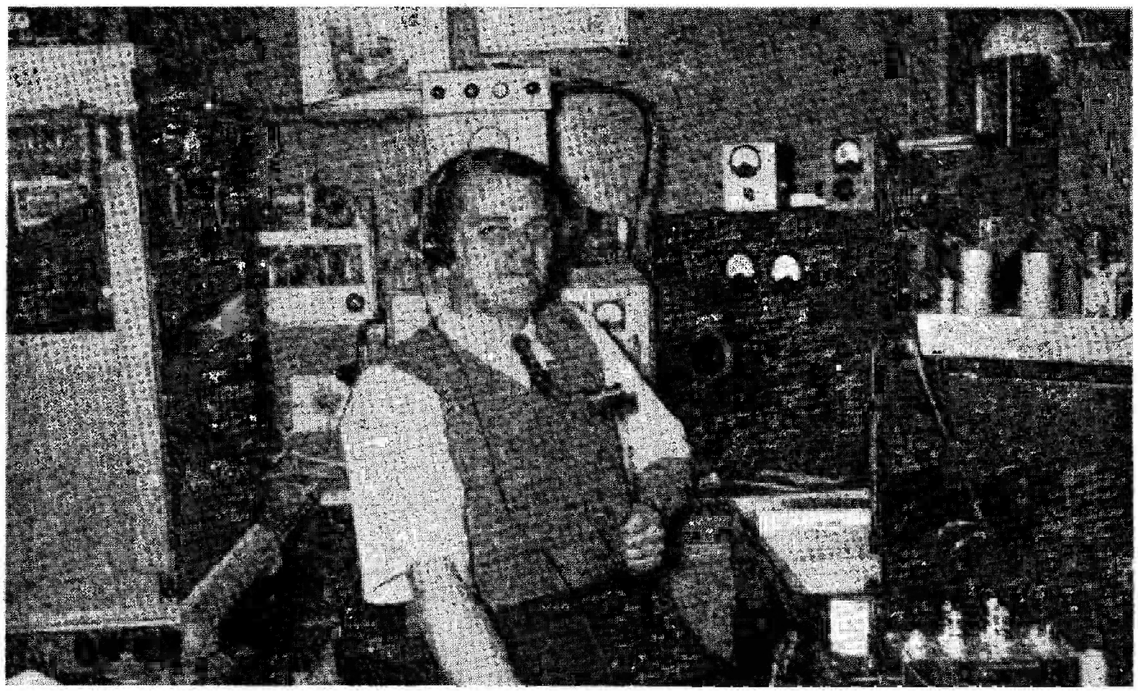
MINIATURES

One of the joys of home construction is that of producing something unusually small, compact and simple. One of our friends makes a hobby of building Top-Band transmitters, all QRP and each one smaller than the last. But progress in this direction is limited by the sizes of coils and condensers, so he has switched his attention to the VHF bands, where such obstacles do not exist. There is certainly some strange fascination about making the minute transmitters that he does—probably keen modellers would understand it. And when the thing really works as well . . . There must be a most satisfying creative sense about it. This leads us to remark that it is a pity that receivers present such a terrifying problem compared with transmitters! A complete two-metre transmitter *could* be built in a 2-oz. tobacco tin, but what size would the receiver be, if it were to match the transmitter's performance? Perhaps some of our clever readers will remark that if the transmitter were a hundred times bigger, the receiver *could* be quite small!

COME INSIDE!

We are, alas, arriving at the time of year when heated shacks and tobacco "smogs" are the order of the day. Those who have not done their stuff in the way of renewing guys, halyards and aerial wire will be the sad ones this winter, for if it hasn't been done by now, there are few chances. Aerial fatigue-parties are all very well in the summer months, with long hours of daylight and dry ground to work on, but when the days of damp mists and gum-boots are upon us, we concentrate more on the inside working of our stations. Just how annoying it can be to lose an aerial in the middle of a contest we know from personal experience; an unexpected February gale once removed aerial, mast and all. After the summer, though, it is surprising how many jobs inside the shack need doing; they have been neglected because of the call of the open air. So out with that soldering-iron, on with the electric stove, seal up the cracks in the windows and under the door. The season of Fug has begun!

The Other Man's Station G3HFW



THE station owned by E. F. Brooks, 29 Falsgrave Road, Scarborough, Yorks., first came on the air as G3HFW during 1950—the operator having previously signed VS1BF. The photograph herewith shows part of the present layout, in the outdoor shack.

There are many points of interest about the design of this station. All equipment is built on the table-top principle, and the main transmitter is a fully band-switched job running an 813 in the PA, at 150 watts input on 80, 40, 20 and 14 metres. As operation is phone-only, considerable care has been given to the speech-amplifier and modulator units; the 813 is plate-and-screen controlled by a pair of TZ40's in Class-B, and the speech amplifier has been designed to do full justice to a crystal microphone.

Receiver at G3HFW is a CR-100, and the auxiliary equipment includes a BC-221 for frequency checking and an oscilloscope for watching the modulation. The radiating system consists of an "extended Zepp" for the 80- and 40-metre bands, with dipoles for 14 and 21 mc. Station control is by relay throughout, and the entire change-over motion is brought out to one send/receive switch.

G3HFW is also fully operational on the 144 mc band, with an 829B in the PA running 80 watts, a 4-element Yagi flat top, and a converter into the CR-100.

In view of the fact that full-power phone is an operational requirement on the DX bands, particular attention has been given to TVI; using the well-known methods of screening and filtering, this has been almost completely cleared on all bands, the only neighbouring receivers affected—and that only slightly—being those with awkward (we might have said "impossible") IF channels. Some of the TVI measures incorporated are evident from the photograph. Much wire-mesh screening is used, and all inter-connection of units is carried out by screened cable. The inter-connecting plug-board can be seen at lower right.

Altogether, G3HFW is another interesting example of an amateur station designed and laid out on modern lines, equipped for operation over a wide frequency range—all with the determination to overcome the oppressive influence of TVI. In that respect alone, the notes appearing here will encourage others faced with the same problems.

The Month With the Clubs

THE TIME: 1430 to 1830 GMT
THE PLACE: "Top Band" — 1800-2000 kc.
THE DATES: November 14, 15, 21 and 22

Club members will realise that the above details apply to "MCC," the Eighth MAGAZINE CLUB CONTEST, in which they are all invited to join.

Should there be any active Club which has not yet received a copy of the Rules, they may be obtained by sending a post-card to the address given below.

It is hoped that this, the Eighth of the series, will produce a memorable and enjoyable battle between those Clubs who place the accent on practical work and operating. The hours are shorter than before, and are so chosen as not to lead to any complications over meal-times or returning home late in the evenings. Thus it is hoped that many Clubs who have not previously entered this event will, this year, find themselves able to do so.

This month we acknowledge the following Club publications: Journal of the QRP RESEARCH SOCIETY; *News-Letter* (PURLEY & DISTRICT); QRZ (MERSEYSIDE); *and the Calendar of Winter Events* (DERBY).

Next month's deadline is **first post on November 11,** *and Club notes should be forwarded to "Club Secretary,"* SHORT WAVE MAGAZINE, *55 Victoria Street, London, S.W.1.*

And now follow this month's reports, from 19 Clubs.

Bradford Grammar School Amateur Radio Club

For the next three terms the following officers have been elected: President, Mr. R. B. Graham (Headmaster); Vice-President, Mr. R. V. Cox; Secretary, D. M. Pratt; Treasurer, B. A. Wady. Meetings are held every Wednesday at 4.30 p.m., and visitors are welcome.

Clifton Amateur Radio Society

At the recent AGM, G3FNZ was elected Chairman and G3DIC Secretary. Meetings continue every Friday, 7.30 p.m., at the Clubrooms, 225 New Cross Road, London, S.E.14, and new members and visitors are always welcome. Recent events have included a D-F Field Day (won by D. Bennett), a talk on VHF by G3JRC, a Quiz devised by G3FNZ, and a Junk Sale.

Edinburgh Amateur Radio Club

Forthcoming events: November 18, RSGB Lecture on Tape; December 2, Audio Amplifiers (T. Telford); December 16, TV Construction (C. Patrick). The Club Station GM3HAM will operate every alternate week. The Clubrooms are at 16 Bothwell Street, Easter Road, where new members and visitors will be welcomed.

Midland Amateur Radio Society

At the recently-held AGM the officers and committee for the coming year were elected, G6DL becoming President in succession to G2AK. A full programme of lectures and events has been arranged, and all local amateurs are cordially invited to attend the meetings, on the third Tuesday, at the Imperial Hotel, Birmingham.

Scarborough Amateur Radio Society

This Club reports itself as being 100 per cent. active all the year round, and among its interests are all the various Field Days, including the VHF events. Newcomers and old-timers alike are welcomed to the meetings on Thursday evenings at 7.30 p.m.

Spen Valley & District Radio & Television Society

Forthcoming events: November 18, Talk on GPO Micro-Link, by Mr. E. A. Smith; December 2, Cinema Show; December 16, "Poor Man's BC221," this by G2BMC. Fortnightly meetings have been planned right through to the end of next July, with what appears to be a very interesting programme.

Torbay Amateur Radio Society

Two members have passed the RAE and hope for their licences shortly. A welcome was extended to G3EFY (Devon C.R.) and to G3IEA and G3JDZ, temporarily resident in the area. During October the principal events were the South-Western Hamfest on the 11th, and the regular meeting on the 17th.

Birmingham & District Short Wave Society

Activities are continuing at a satisfactory level, and for the general meeting in November (on the 9th) a talk will be given entitled "Closed Circuit TV." This subject promises to be entertaining, and visitors will be very welcome.

Hastings & District Amateur Radio Club

As a result of the Exhibition held during July, membership has increased by ten, and attendances at meetings are very encouraging. QSL's for contacts with G6HH/A during the Exhibition will be forthcoming eventually, when cards arrive! A very enjoyable trip was made to the BBC station at Tatsfield, where the Engineer-in-Charge personally conducted two parties round and explained everything in detail.

The South Shields & District Amateur Radio Club's participation in a local exhibition was reported in our October issue. Here are those who did the work. Among the callsigns are: G8AO, seated, 2nd from left; G6VG, centre; G3ELP, 2nd from right; and G3ATA, hon. secretary, right. Standing left are G3GBF and G3HIF.

Southend & District Radio Society

Fortnightly meetings have re-opened after the summer season, and at the first of them Mr. K. F. Crispin gave a talk on the Mixer Valve, and Mr. G. O. Thacker, B.Sc., explained the functions of a double-diode. Both speakers translated their subject into practical language, with blackboard illustrations.

Stoke-on-Trent Amateur Radio Society

The Club premises are situated at the rear of the Cottage Inn, at Oakhill. The main objective at present is to re-equip the workshop with tools and accessories so that any type of constructional work can be undertaken by members. The HQ is open on Tuesday nights for constructors, and it is also hoped that large quantities of tea will be on tap. Normal meetings are on Thursday nights, and all interested persons are cordially invited.

Cambridge & District Amateur Radio Club

Next meeting is on November 6, 8 p.m., at the Jolly Waterman, when Mr. McGee, of Pye, Ltd., will give a talk on Television Cameras.

Cannock Chase Amateur Radio Society

The October meeting had a record attendance, and several new members were enrolled. On November 12 G2AMG will give the first of three talks on Aerial Systems; note that this meeting has been deferred from the normal date (November 5) because of counter-attractions!

Derby & District Amateur Radio Society

Attendances at meetings have increased, and membership is now in the 60's. November meetings include a Film Show on the 4th and a talk and demonstration (Avo) on the 18th. Copies of the future programme are available from the Hon. Sec.

Grafton Radio Society

At the AGM the following officials were elected: President, J. H. Clarke (G2AAN); Vice-Presidents, G3AFC, G8PL, G2AHB, G3RX, GW3ALE and

NAMES AND ADDRESSES OF SECRETARIES REPORTING IN THIS ISSUE

BIRMINGHAM : F. C. Cook, 67 Regent Road, Handsworth, Birmingham, 21.
BRADFORD GRAMMAR SCHOOL : D. M. Pratt, 27 Woodlands Grove, Cottingley, Bingley.
CAMBRIDGE : T. A. T. Davies, G2ALL, Meadow Side, Comberton, Cambridge.
CANNOCK CHASE : C. J. Morris, G3ABG, 58 Union Street, Bridgtown, Cannock.
CLIFTON : C. H. Bullivant, G3DIC, 25 St. Fillans Road, Catford, London, S.E.6.
DARTMOUTH : B. Farleigh, G4RJ, Montpelier, Lower Contour Road, Kingswear.
DERBY : F. C. Ward, G2CVV, 5 Uplands Avenue, Littleover, Derby.
EDINBURGH : D. B. R. Black, 16 Edina Place, Edinburgh.
GRAFTON : A. W. H. Wennell, G2CJN, 145 Uxendon Hill, Wembley Park, Middx.
HASTINGS : W. E. Thompson, 8 Coventry Road, St. Leonards-on-Sea.
HOUNSLOW : R. J. Parsons, 16 Cypress Avenue, Whitton, Middx.
MIDLAND : D. Hall, 144 Hill Village Road, Sutton Coldfield.
NOTTINGHAM UNIVERSITY : J. Cragg, Radio Society, The Union Room, The University, Nottingham.
SCARBOROUGH : P. Briscombe, G8KU, 31 St. John's Avenue, Scarborough.
SOUTHEND : J. H. Barrance, M.B.E., G3BUJ, 49 Swanage Road, Southend-on-Sea.
SPEN VALLEY : N. Pride, 100 Raikes Lane, Birstall, near Leeds.
STOCKPORT : G. R. Phillips, G3FYE, 7 Germans Buildings, Buxton Road, Stockport.
STOKE-ON-TRENT : K. H. Parkes, G3EHM, 159 Belgrave Road, Longton.
TORBAY : L. D. Webber, G3GDW, 43 Lime Tree Walk, Newton Abbot.

A constructional session at the Clifton (London) Amateur Radio Society, who operate G3GHN ; they also run /P events with D/F as a strong feature.

C. T. Bird ; Chairman, G8PL ; Secretary, G2CJN. On November 6 there is a lecture by G5GQ, entitled "To Set You Talking," and on November 13 the title is "Any Questions ?" Meetings continue on Mondays and Fridays.

Hounslow & District Radio Society

Meetings continue at fortnightly intervals (not *every* Thursday, as stated last month), and the next is on November 12. The meeting place is the Grove Road Junior School, and the time 7.30 p.m.

Nottingham University Radio Society

The new session has begun with greatly renewed interest in the Club, and a 150-watt 2-metre Tx has been put on the air. Under the call of G3DBP, the Club is now on the air also on 80, 40 and 20. Visits have been arranged to the local power station, to Whiteley Bros., Mansfield, and to Pye Radio at Cambridge. Morse classes are held on Wednesday afternoons.

Stockport Radio Society

A wide variety of subjects is planned for the winter programme, and the RAE Classes continue every Thursday at 7.30 p.m. General meetings take place on November 11 and 25, and new members will be welcomed. The Club were runners-up in the Region 1 Field Day, for the second time.

Dartmouth & District Amateur Radio Society

Meetings continue every Monday evening, and lectures are to be given by G3ABU (Radiating Systems) and G3FHI (Radio Fundamentals). A Club Tx is now working, the licence having arrived with the call G3JEU, and is active on Club nights with 7 and 14 mc CW. The Club is a member of the QRP Research Society and has already taken part in a QRP Contest.

ANOTHER YOUNG OPERATOR

GI3IEO, of Portadown, Northern Ireland, runs a local club station signing GI3IJD. The club has recently produced young Eddie Wright, aged 15, who not only passed the last R.A.E., but has also taken his Morse test successfully. He now awaits his own licence, which will be issued to him as a minor in the name of a parent or guardian. We shall be very interested to hear further of Eddie's progress, and congratulate him on his success in qualifying at so early an age—an achievement in which GI3IEO has (we guess) played no small part.

TRANSMITTING VALVE MANUAL

From the General Electric Co., Ltd., we have Part II of their *Osram Valve Manual*. This gives engineering data and much useful and interesting information on the wide range of Osram transmitting and industrial valves, ranging from the small triodes like the DET-19, with a plate dissipation of 5 watts, up to the big water-cooled and forced-air cooled types dissipating kilowatts at the anode. For the smaller triodes, tetrodes and pentodes in which we are interested, up to about 50 watts plate dissipation, ample data are given. Part II of the *Osram Valve Manual* is a very well produced reference book of more than 200 pages, strongly bound. The price is 10s., of the General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.

EDISWAN-CLIX MASTER PLUGS

All Ediswan-Clix Master Plugs are now being packed in cartons in convenient quantities for the serviceman or home constructor, with equal numbers of red and black markings. In seven different types, prices for packs of 18 each vary from 10s. 6d. for MP1 to 21s. for the type MP4. The MP5 variety can be obtained in cartons containing 12 black and 12 red plugs for 18s. Edison Swan Electric Co., Ltd., 155 Charing Cross Road, London, W.C.2.

HALF-GUINEA IDEAS

If you have any technical wheezes or notions of your own — such as you sometimes see as a short item in an odd corner of the *Magazine* — send it in. We pay 10s. 6d. a time for those published. In general, they should be the sort of idea that can be described in 50-100 words without drawings or diagrams.

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ADMIRALTY INTEGRATORS TYPE A S91. With very fine Galvo movement coil 40 ohms. Centre Zero to F S D 1 microamp. Small mirror 1 metre radius, **65/-.** Carr. 2/6.

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20ft. AMERICAN SURPLUS TELESCOPIC STEEL AERIAL MASTS. Length about 6ft., dia. of first section $1\frac{1}{2}$in., dia. of top section, $\frac{3}{4}$in., complete with base guys, insulated assembly and metal pegs, **£4/10/-.** Carr. 5/-.

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NIFE BATTERIES. Crates of five cells giving 6 volts at 58 A.H. Size of wood crate 15 x $5\frac{3}{4}$ x $11\frac{1}{2}$. In perfect condition, **£6/19/6.** Carr. 7/6. Limited number only. Single Cells, 2.4 volts, 18/20 A.H. Size $4\frac{1}{2}$in. x 6in. x $3\frac{3}{4}$in., **17/6.** P.P. 1/6.

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AERIAL SWITCHES. Knife action on-off, base 5in. x 6in. Twin bakelite arm $6\frac{1}{2}$in. Overall length with fixing plate 11in. **10/-.** Post 2/-.

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RELAYS. High Speed, 2000 ohm twin coil type new, **14/-.** D.P.C.O. relays 24 volt D.C. coil break 0.25 amps, **3/6,** post 6d.

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KLYSTRONS 723 A/B few only cheap.

NIFE BATTERIES. 1.2 volt 45 a.h. uncharged, **25/-** each, post 2/-. 2.4 volts 125 a.h. in wood crate, **£4/10/-,** carr. 5/-.

MOTOR BLOWERS 230 volts A.C./D.C. 300 watts $3\frac{1}{4}$" inlet $1\frac{3}{4}$" outlet portable with carrying handle, on-off switch and flex **£5,** each carr. 5/-.

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TRADE

QSL'S and LOGS by MINERVA. The best there are.—Samples from Minerva Press, 46 Queen's Road, Brentwood, Essex.

WANTED: RCA 4331 Transmitters.—P.C.A. Radio, Cambridge Grove, Hammersmith, W.6. *(Telephone: RIVerside 3279).*

45/- EACH offered for 813-type valves.—Pype Hayes Radio, 606 Kingsbury Road, Erdington, Birmingham 24.

VALVES: Type 813, 832A, 833A, 250TH and 723 A/B in any quantity, urgently required; high prices paid.—Pype Hayes Radio, 606 Kingsbury Road, Birmingham 24.

WANTED: BC610 Hallicrafters, ET4336 Transmitters, SX28's, AR88's, receivers and spare parts for above; best prices.—P.C.A. Radio, The Arches, Cambridge Grove, W.6.

WANTED: RCA Speech Amplifiers, type MI-11220 J or K, and aerial tuning units BC939a.—Offers, stating quantity and price, to P.C.A. Radio, The Arches, Cambridge Grove, W.6.

WANTED: Power Supply Units for No. 33 transmitters (Z.A. 10729).—Call or ring P.C.A. Radio, The Arches, Cambridge Grove, W.6 *(Riv. 3279).*

QSL CARDS AND LOG BOOKS. APPROVED G.P.O. SAMPLES FREE. — ATKINSON BROS., PRINTERS, ELLAND, YORKS.

50/- PAID for new boxed 813's.—Box 1324, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

VALVES: Over 3,000 in stock. 12E1, 85A1, 85A2, 15/-; CV284, 2D21, VR150, 10/-; 12AU7, 12AT7, 6SN7, 807, EC91, 6V6, 6BW6, 6CH6, 9/-; 6J6, EF91, 6SJ7M, 12AX7, 6SL7, EL91, 6F33, EY91, 7/-; 6AL5, 6C4, EF92, EAC91, 6/-.—Skillman, Franchise Street, Weymouth.

READERS' ADVERTISEMENTS

3d. per word, min. charge 5/-, payable with order. Box Numbers 1/6 extra. Replies to Box Numbers should be addressed to The Short Wave Magazine, 55 Victoria Street, S.W.1.

FOR SALE: Eddystone 659 with baffle-mounted speaker; recently overhauled and aligned by makers; £45, or near offer.—Stones, 76 Swann Lane, Cheadle Hulme, Cheshire.

SURPLUS: RK20A, 829, 30/- each; T55, 30/- pair; PT15, 10/-; 12SK7, 12SR7, 12A6, 2/6 each. Add postage.—8 Denmark Villas, Widmore Road, Bromley, Kent.

BC348, built-in power/pack, LF band modified for 21 mc, £18. Excel Tape Recorder, 2-speed, £45.—J. Spivey, Healey Cottage, Batley, Yorks.

II

SMALL ADVERTISEMENTS, READERS—*continued*

PROFESSIONAL 150-watt Phone/CW, VFO controlled transmitter complete; 10—20—40—80 metres. Offers over £60.—G3ATL, The Limes, Hugglescote, Leicester.

£25–SALE: BC221M, complete with calibration book, spare valves and instruction manual; as new, hardly used.—M. Allen, 104 Vallance Road, Alexandra Park, London, N.22.

URGENTLY WANTED: MANUALS OR INSTRUCTION BOOKS, DATA, ETC., ON AMERICAN OR BRITISH ARMY, NAVY OR AIR FORCE RADIO AND ELECTRICAL EQUIPMENT.—HARRIS, 93 WARDOUR STREET, W.1.

BC348, built-in power/pack, speaker, etc., in polished wooden case; black crackle front panel; perfect. Offers?—3 Millhouse Avenue, Stockton Heath, Warrington, Lancs.

EXCHANGE set HRO bandspread coils for BC221 frequency meter. Also wanted: Wilcox-Gay Master Oscillator and S27 Receiver.—Box 1318, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

EQUIPMENT for sale: HRO coils; general coverage; all ranges, 35/- each. One complete set 4 bandspread coils, £10. Meissner Signal Shifter, 1953 model, bandswitched, as new, £30. Webster wire recorder, attaché case type, £30. AR77 receiver, box of spares for same, £27 10s. CNY1 transmitter, £10. Valves, all guaranteed: 807, 8/6; 6J6, 6AK5, 6/6; 5Z4, 5U4, EF91, 6/-; 6V6G, 5/6; 1T4, 1LN5, 3A4, 5/-. WANTED: ET4336 transmitter, AR88, BC221.—Box 1319, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

SALE: R1155A, brand-new; modified power/pack and output stage; 8in. speaker; perfect order; £14 or offer.—Coram, 6 Rock Avenue, Newport, Barnstaple.

APN/1, 465m. Tx/Rx, complete, £5; B.P.L. Signal Generator, model 600, £6; P15, 5/-; 829B, 30/-; 715B, 15/-; R1155, power/pack, speaker, covers top band, £8; BC625, Tx/Rx, £2; Evershed Ohmmeter, 50/-; DST-100, excellent condition, £20. Buyer must collect.—Barron, 20 Second Avenue, Halifax.

SALE: Q.C.C. P5 xtals 7050, 7091, 7118 and 7160 kc, with certificates; BC-453-B (less valves). Offers?—G2ART, 113 Waterloo Road, Southport, Lancs.

HALLICRAFTERS Sky Champion, 350 kc-42 mc, £12; Furzehill Type "L" 'Scope, £7 10s. 0d. Both excellent condition; o.n.o.—Newham, 13 Warkworth Avenue, Wallsend, Northumberland.

VALVES, new, unboxed; all guaranteed: PT15, 7/6; 807, 5/6; 6J5G, 4/6; 6B4G, 6/-; 6L6G, 6/-; 6SK7GT, 5/6; 2X2, 5/6; 6H6, 3/6; 6L6M, 7/-; 6K7M, 6/6; 6SH7M, 4/6; 12SG7M, 5/-; 6J5M, 5/-. German Seven-valve Receiver, 2.5 to 14.8 mc, BFO, LS, 110-230- volt, AC, 50 cycles, or 24-volt DC, in grey crackle case, £8 (c.f.). Spare set valves and vibrator in box, £1.—R. Low, Moulin, Balmoral Road, Blairgowrie.

SMALI ADVERTISEMENTS, READERS—*continued*

EDDYSTONE 680/2, good condition; best offer. Add carriage, please.—R. Grain, 15 Waverley Gardens, Grays, Essex.

BC221-D with spare valves and charts; good condition; first offer over £20 secures. All genuine offers answered. — Box 1316, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

670-0-670 AND FILAMENTS, 21/6; 813 transformer, 8/6; amplifier bit, 31/6; 12in. turntable and motor, 31/6; many transmitting items, valves; s.a.e.—F. Glynn, The Mount, 13 Station Road, East Grinstead.

WANTED for Field Day, BC348, preferably unmodified; if modified, dynamotor required. Good price for good condition receiver; would consider BC342. SALE: Type 18 Trans/Receiver, complete; serviceable microphone, webbing, no battery; £4.—G2ZV, 199 Uxbridge Road, W.7. *(Ealing 2749).*

FOR SALE: R.S.T. 100 Receiver (requires attention); built-in power/pack; £8 o.n.o.—Crisp, Claypole, Newark, Notts.

WANTED: Grid-type Meter by first-class American maker such as Millen, etc.; BC-455 Rx, unmodified, late model Rx HRO 50T or 60T, or equivalent Hallicrafters 2-metre gear. Am prepared to pay fair prices for any of the above items, which must be in first-class condition.—Offers to Beckett, Manor Farm, Brimington, Nr. Chesterfield.

8-VALVE Communication Receiver, 7 wave bands, xtal, handbook, 10 metres to medium wave, good condition, £14. Manchester area.—Box 1321, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

HAMMARLUND HQ120X Communications Receiver, 31 to 0.54 mc, 110-volt; spare valves; £35.—Pratt, Hoyland Vicarage, Barnsley *(Phone: HOYLAND 2279).*

SALE: Collins TCS Equipment; receiver, transmitter, 12-volt dynamotor pack, and harness; s.a.e. with enquiries.—Offers to: Box 1320, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

SALE: BC348-L, internal power supply, perfect working order, £16; or would exchange for BC221 frequency meter.—Wilson, 47 Victoria Road, Sydenham, Belfast, N. Ireland.

AR77, appearance new; all Amateur bands separately spread, plus medium wave, £25.—For inspection: 65 Hurst Street, Birmingham. *(MID. 1355).*

G2WZ requires "Command" Receiver, Transmitter and associated equipment; all gear must be in first-class condition. — Wedderspoon, 109 Jermyn Street, London, S.W.1.

MUST CLEAR: Valves—EL91, EF91, Z77, N.78, TT15, VR150/30, etc.; P/Packs, Xfmrs, EF92, VFO, BC221 Handbook; 500 kc Osc., Xtals, Coils, Condensers, Resistors. Lowest prices; s.a.e. list.—Box 1322, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

SMALL ADVERTISEMENTS. READERS—*continued*

HRO MX, as new; complete nine coils and power/pack; £30 or offer.—Cave, Kostrena, Sebastian Avenue, Shenfield, Essex. *(Phone: Brentwood 591).*

SX28 FOR SALE, £20; no outer case, rather shabby, but good working order; new valves, manual. Buyer collects.—G3FYY, 49 Melrose Avenue, London, N.W.2.

BURGOYNE Tape Recorder, brand-new, few hours' use only; complete with three rolls tape and microphone; £28. B2 Transmitter Receiver and Power/pack, in excellent condition, £12.—G2ACZ, G. Whitehead, c/o 27 Cross Street, Burnham-on-Sea, Somerset.

BC221N, £7 o.n.o.; Western Analyser, model 772, £7 o.n.o. Bargain-priced transformers, new valves, etc.; s.a.e. for list.—Simpson, 7 Tenby Close, Chadwell Heath, Essex.

SWL SELLING UP: DST 100, built-in 230 AC p/pack, £20; home-built VCR139 'scope, wobbulator, p/pack, working, £5. Buyer collects these. Following carriage paid: CR-100 coil-pack, IFT's, crystal, circuit, £2; 5ft. 6in. rack, 2 x 10 panels, 6in. panel, with covers, £3; RF24, 12/6.; RF27, £1; BC453, £2. S.a.e. with order, please.—Box 1326 (Herts.), Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

NATIONAL Receiver NC.183 for sale, as new; covering 0.5 to 31 mc, with bandspread on amateur bands; 14 valves, P/P output, noise limiter, crystal selectivity, CW oscillator, AF and RF gain controls; 110v. and 230v. AC; complete with speaker and booklet; £65 o.n.o.—A. Taylor, 23 Marley Way, Rochester, Kent.

SALE: AR88 and handbook; perfect condition; one owner; £50. Delivered free within London area.—Box 1323, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

WANTED: *Bulletin,* May and October 1934; *QST* before November 1923; most *CQ* 1945/6; *Radio, R/9,* and *Popular Wireless* from No. 27; 102 odd pre-war *Practical Wireless.* Early *Call Books,* amateur handbooks, etc.—G3IDG, 95 Ramsden Road, London, S.W.12.

XYL REQUIRES CASH! What offers for DST-100 Mk. III receiver, 230v. 50 cycles? Good condition.—Sykes, 41 Croydon Road, Westerham, Kent.

EDDYSTONE 740, very little used, complete speaker and phones.—Write T. P. Griffith, College House, St. Thomas's Hospital, S.E.1. £30 o.n.o.

AR88D Receiver, £50; Bendix Signal Generator type 1/96/A, freq. range 100-155 mc, AC/Batt, £25; 150w. all-band transmitter by Transmitter Equipment Manufacturing Co., U.S.A., Phone/CW, VFO/Xtal, built-in 'scope, £100; 200 ft. approx. 14g. copper aerial wire, 12/6. Various metal and glass valves, cheap; s.a.e.—Box 1325, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

AVO Oscillator, battery model, less batteries, in perfect condition; no reasonable offer refused.—10 Moor Park Road, Northwood, Middlesex.

SMALL ADVERTISEMENTS, TRADE—*continued*

BC348M converted 230v. AC; good condition; excellent conversion; £16, complete with earphones. Buyer collects.—J. Greenwood, 4 Ashley Court Road, Bristol 7.

EDDYSTONE 740, mint condition, about 50 hours' use, £29. Bristol M.Q.1 Tape Recorder with latest mods., 3 motors, 2 reels tape, £25, perfect.—G5FH, 17 Knottsall Lane, Oldbury, Birmingham.

AVO Model "H.R.," 20,000 ohm per volt, £6; RF27 unit, modified 28 mc; RF26, modified 144 mc; T1154, four-range job; pair 211's.—Offers to G3AAU, 30 Churchbury Road, Enfield, Middlesex.

BC1147A Rx S-meter, 1-30 mc, mint condition, £18; 1155N, external power supply, loudspeaker, mint condition, £10. Valves: 832 new, boxed, 15/-. Valves: 6V6, new, boxed, 6/-. Valves: 6AK5, new, boxed, 6/-; VR91, 2/-; 8 mc Xtals, U.S.A., var, freq., 6/-; 7 mc Xtals, U.S.A., 6/-; Top Band Xtals, 6/-. Lancs. district (postage extra).—Box 1327, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

AR88 SET for sale, £50; good condition.—Grafton, The Leys, Stone Lane, Kinver, Near Stourbridge.

FOR SALE: Hambander, built-in spkr., 25-watt CW xmtr., with p/pack, brand-new; G.E.C. Miniscope with felt-lined case; Webb's absorption wavemeter; RF24 unit; Pifco radiometer; £40 the lot. Buyer collects.—Pile, 34 Palace Mansions, London, W.14 *(opp. Olympia).*

FOR SALE: BC348 AC power/pack, perfect, £17; Battery Rx 1224A, £3 10s. 0d.; Battery-operated Transmitter, Phone/CW, built-in two-tier rack, offers? 100 kc Xtal, 12/6; 10,000 kc Xtal, 12/6. Valves: 803, 811, 10/- each. Model Boat, suitable radio control; nice job, with motor; R/C Rx parts and partly-built R/C Tx in case; £4 10s. 0d. Douglas Coilwinding Machine, with quantity of wire; perfect; cost over £30; offers, or exchange any Amateur gear.—G. Robbins, 2 Jamaica Street, Liverpool 1.

WANTED: SCR522 driver xformer; BC221 case.—Offers to: G3BPE, 35 Bladindon Drive, Bexley, Kent.

HALLICRAFTERS HT9 Table Top Tx, 75 watts Phone, 100 watts CW, complete with coils for 20, 40 and 80 metres. Also Hallicrafters HT18 VFO/NBFM unit to work with above Tx. A very nice outfit, and can be seen in operation; £100 or near offer; would separate. The following equipment is the property of an Amateur now QRT: Taylor 45A valve tester, £12 10s. 0d.; Taylor 65B signal generator, £8 10s. 0d.; G.E.C. Miniscope, £8 10s. 0d.; McElroy Auto-tape Morse code sender, complete with tape puller and audio oscillator, £12 0s. 0d. This equipment is all as new.—For further details, send s.a.e. to Beckett, Manor Farm, Brimington, Nr. Chesterfield.

HAMMERLUND SUPER PRO 210 LX FOR SALE. RACK MOUNTING. FIRST-CLASS CONDITION. £35 OR NEAR OFFER. — 55 MACLEAN ROAD, WEST HOWE, BOURNEMOUTH.

Q-MAX B4/40 Transmitter; mint condition; any reasonable offer for quick sale.—G2BNH, 366 Gillott Road, Birmingham 16 *(Tel. EDG. 3115).*

SMALL ADVERTISEMENTS, READERS—*continued*

NEW 832's, tested and boxed, 22/6.—Box 1328, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

PROFESSIONAL "Ferrograph" Tape Recorder; two speeds, twin tracks; two hours each reel. Offers over £65. Photograph supplied.—Wood, 90 Grestone Avenue, Handsworth, Birmingham 20.

WANTED Urgently, any Top-Band or Eighty-Metre CW Xtals; 2 pin holders only.—Box 1330, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

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for BC-312, brand new or nearly brand new, complete with dynamotor. — Box No. 1329, Short Wave Magazine Ltd., 55 Victoria Street, London, S.W.1.

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2C26	4/9		6K7	7/9		5654		10/0
6A8G		10/6	6K7G	6/9		7193	2/6	
5Z4G	9/6		6K7GT	6/3	5/9	EA50		2/0
6AK5		9/6	6Q7G		9/0	EB34		2/0
6AM6		8/9	6Q7GT	11/6	9/6	EC31		4/6
6F6G	8/9		6SH7	5/9		ECC31		8/6
6H6	4/6		6SK7		6/3	EB91		7/6
6J5	6/6		6V6GT	10/6		EF92		7/9
6J5GT	5/6		6V6G		9/6	EF50		6/6
6J6		10/6	9D6		7/9	KT263		6/6
6J7		7/0	12H6		2/9	RK34	2/3	1/9
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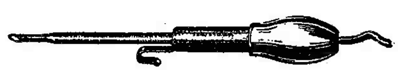

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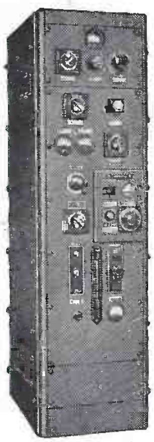

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