The SHORT WAVE Magazine

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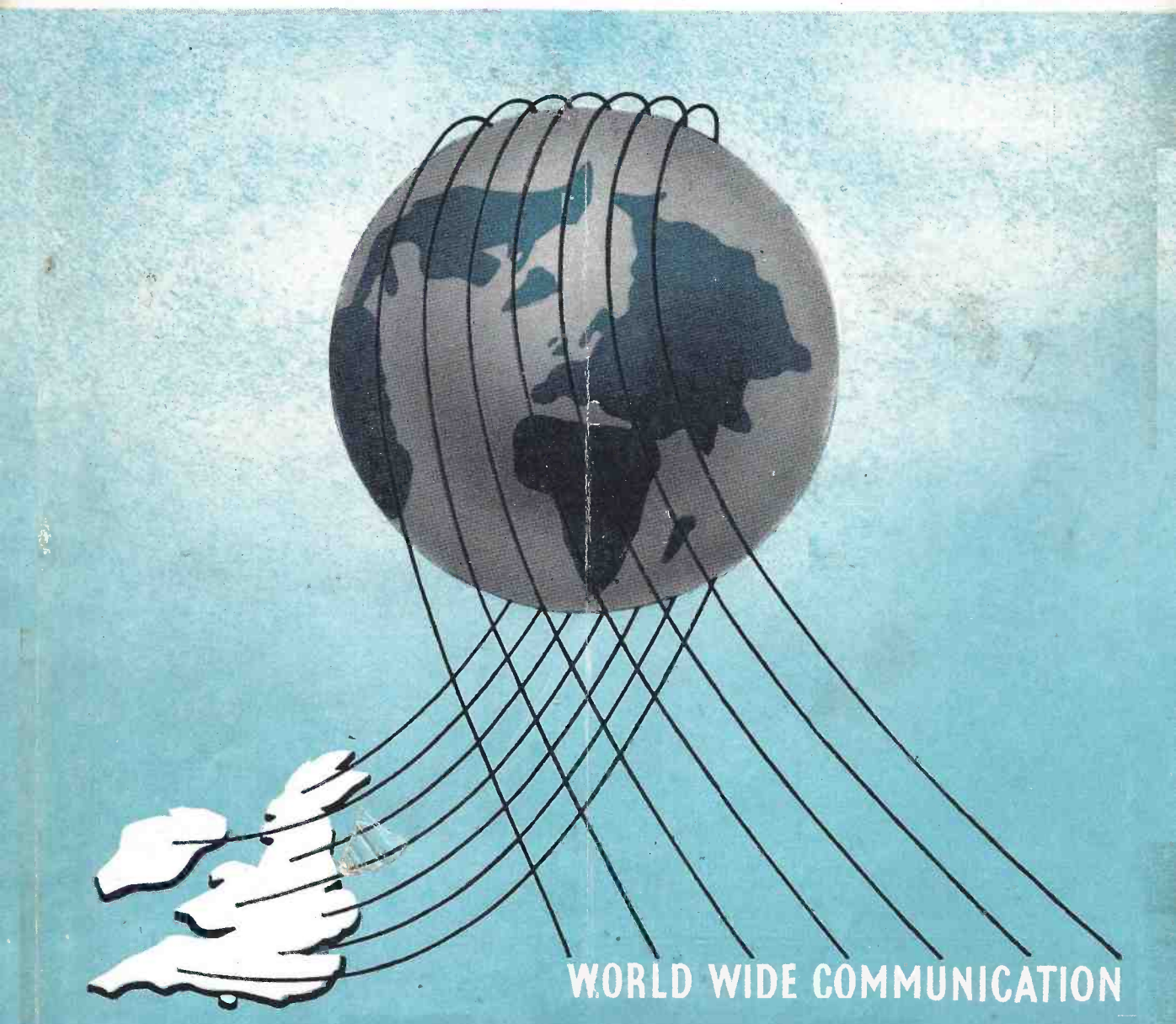
VOL. X MAY, 1952 NUMBER 3



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SHORT WAVE MAGAZINE

Vol. X MAY 1952 No. 106

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Managing Editor: AUSTIN FORSYTH, O.B.E. (G6FO)

Advertisement Manager: P. H. FALKNER

Assistant Editor: L. H. THOMAS, M.B.E. (G6QB)

Published the Friday following the first Wednesday each month at 55 Victoria Street, London, S.W.1. *Telephone: Abbey 2384*

Annual Subscription: Inland 30s. Abroad 30s. post paid.

AUTHORS' MSS

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THE *SHORT WAVE LISTENER* ASSOCIATED WITH THIS MAGAZINE IS SPECIALLY FOR THE RECEIVING ENTHUSIAST

FOR THE EXPERIMENTER AND THE RADIO ENGINEER

The SHORT WAVE Magazine

EDITORIAL

Certificates

In every field of human activity competition is the factor that gives spice to individual effort, helping to make it all worth while for its own sake.

This applies with just the same force in the sphere of Amateur Radio, where competition has always been recognised as the inspiration of progress. To encourage and sustain those who are interested in the competitive aspect of Amateur Radio operation, we have decided to offer a number of new achievement certificates. A preliminary announcement regarding some of them appears elsewhere in this issue.

These awards will interest operators at all stages of DX-ability, and though DX working is by no means the ultimate objective of every active amateur, the fact remains that the quest for DX is one of the more important factors in promoting station efficiency, on any band.

For this reason, we feel that these awards will not only give individual operators on the communication bands something at which to aim, but that in the long run they will help those who compete for them to attain a higher standard of operating ability. While it is not, and never has been, any part of our policy to encourage "pot hunting" as such, we do believe that the keen competitive spirit evident on all our bands is something which is worth encouraging. It may fairly be said that there are already enough DX certificates for which the keen amateur can work—but our contention is that there are very few within the grasp of the modest DX operator, who must graduate through successive stages before he is in the top flight of DX workers. It is for amateurs in this category that our awards are mainly intended.

Austin Forbes G6FO.

The Oscilloscope in Reception

INTERPRETATION OF THE TRACE ON CW AND PHONE SIGNALS

I. E. HILL (G6HL)

This is a useful practical article which will be of added interest to those who already possess—or plan to provide themselves with—an oscilloscope as part of the station equipment. For those who have not one, it gives a very good idea of the sort of report that should be forthcoming from a station using an oscilloscope with the receiver.—Editor.

A MULTI range Avometer or similar testmeter is accepted by every amateur as a "must" for the shack. Since the war, disposal CRT's have become readily available and the oscilloscope is rapidly assuming its proper position as a fellow to the testmeter. It is, therefore, surprising that although fairly numerous articles have been published on construction of oscilloscopes, only occasional reference is made to methods of using them.

The oscilloscope is a convenient means of drawing a graph from electronic data, the normal rules for plotting a graph on paper applying. In the simple case, one set of electronic data are plotted against another known factor, *e.g.*, the amplitude of a signal is plotted on the vertical, or Y, axis against time on the horizontal, or X, axis.

Elementary ? Yes, but the point to note is that an oscillograph is similar to a graph drawn on a piece of paper. It relates two variables, one of which is commonly time and as a convenience is plotted on the X-axis. But it does not have to be so ; time can be plotted on the Y-axis if desired, or any two other factors can be related provided they can be converted into variable voltages.

Some CRT's have the addition of a separate grid controlling the electron stream and thus the intensity of the trace on the face of the tube. By this means a third variable factor is introduced and three electronic variables can be related in a convenient instantaneous display.

Installing the Oscilloscope

For the purposes of this article it is assumed that an oscilloscope is available ; desirable details of its design will be referred to only as necessary relative to the various applications.

First, the 'scope should be conveniently positioned, the tube at eye level and the axis of the tube continuing the line of sight. The 'scope screening case should be in position before the AC supply is switched on.

The oscilloscope is a sensitive instrument and particularly when provided with Y-amplifiers the trace is easily distorted by stray AC. Design of the oscilloscope—provision of a mu-metal screen for the CRT, and so on—will have minimised this effect, but it may still be noticeable when the instrument is switched on. The cure is usually a good earth. It is not always sufficient to connect a wire to the transmitter chassis or other metal mass thought to be at earth potential ; the 'scope earthing lead must go, independently and directly, right back to the point of earth entry to the shack and from there to a good earth connection. Don't try to use the 'scope until the correct earth connection has been found and made.

Coupling to a Receiver

It is astounding how many people disbelieve a report if it is critical in detail and perhaps not entirely complimentary ; yet if reports are to be of any real value they *must* be critical. Listen to someone operating on an amateur band and if the signal is in any way not 100%, note the variety of reports given by different operators. The ear is easily deceived, but the eye takes more fooling.

An oscilloscope coupled to the IF of a receiver is a tremendous asset and adds weight to reports. Lots of amusement can be had from tuning in a signal by the 'scope with receiver audio gain at zero, assessing the received signal for quality, be it CW or Phone, then turning up the audio gain to see if the signal really does sound that way. With a little practice one can give surprisingly accurate reports by 'scope only. Combining with observations on the aural signal, the report really means something, even if it is not too well received !

To use the 'scope in this manner it is most

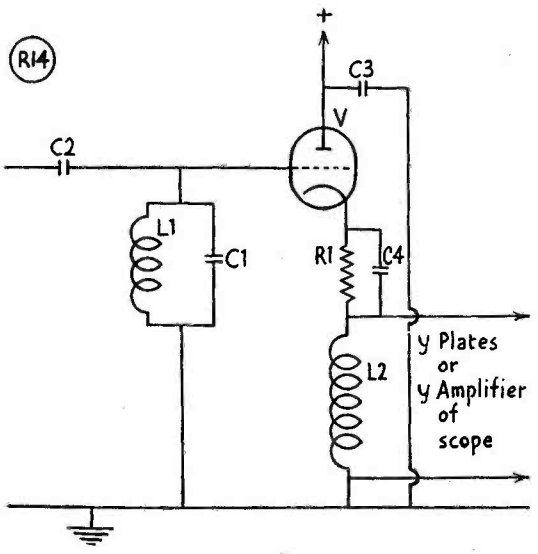


Fig. 1. Cathode follower connection for the 'scope. C2, 20]$\mu\mu$F, silver mica; C3, C4 .005 μF; R1, as required; L1/C1, to resonate at IF, or replaceable by 100,000 ohm resistor; L2, RF choke; V, 6J5 or similar.

convenient to feed the receiver IF output to the Y-plates of the 'scope and connect the X-plates to a time base. The IF can be picked up from either an early stage in the receiver or at the IF output to the detector. In deciding at which point to connect the 'scope several factors must be considered. If an early IF stage is utilised receiver aural selectivity will be greater than visual selectivity and signals will be seen but not heard. If the 'scope is connected at the detector end of the IF amplifier, visual and aural reception will be identical. On CW there will then be negligible possibility of mistaking the signal on the 'scope for an interfering one. On Phone the visual display will suffer the effects of limited audio frequency range similar to the aural one if the IF selectivity is made high in order to clear interference. Probably the most convenient connection for the 'scope is to the input of the last IF valve; selectivity is not then too high and isolation from the BFO is assured. If connection to an earlier IF stage is decided, allowance must be made for possible additional video amplification requirement and greater care must be taken to avoid any pick up of signals at IF by the 'scope interconnecting leads.

The best way to connect in the oscilloscope is by use of the cathode follower, a typical example of which is illustrated at Fig. 1. When installing the unit, care should be taken to ensure the cathode follower itself is so positioned that it cannot give RF feed back in the IF valve to which it is connected. Also care must be taken that interconnections to the 'scope are well screened to avoid IF pick up; coaxial cable is most convenient for this purpose.

Checking Phone

To check phone signals it is necessary first to set the 'scope with X-plates connected to a time base, preferably through an amplifier with gain control. The time base is set as slow as possible consistent with a reasonably steady trace on the tube; around 30 c.p.s. will be satisfactory. The X-plate amplifier should now be adjusted so that the trace fills the face of the tube. Tune in a good quality amplitude

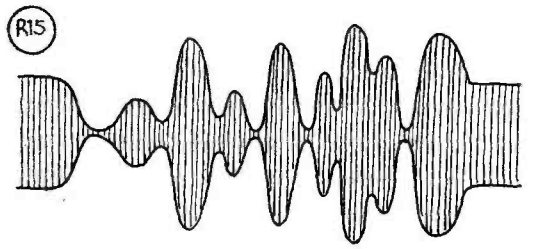


Fig. 2 100% modulation

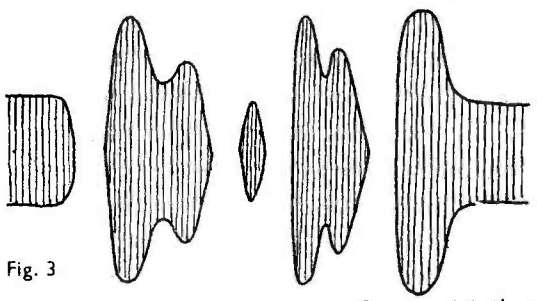


Fig. 3 Over modulation

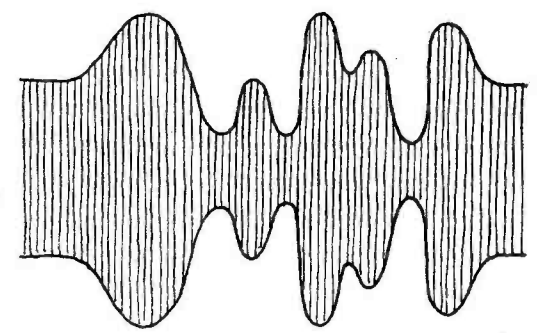


Fig. 4 B.B.C

modulated signal and adjust Y-plate gain so that modulation peaks do not saturate the tube. Now increase X-plate amplifier gain until the pattern on the tube opens out to show the waveform of the modulated signal. If no X-plate amplifier is used it becomes necessary to run the time base very slowly in order to obtain the audio modulation envelope. A very slow running time base means an unsteady trace, so use of the amplifier is a distinct advantage.

Interpreting phone signals is not difficult but needs some practice. Modulation percentage can be assessed by noting relative peak amplitude values of the RF, modulated and unmodulated. The modulation depth is continuously changing with normal speech and therefore any exact determination of modulation percentage is difficult. In general a good fully modulated signal should cause the amplitude of the RF signal to vary between double normal amplitude and zero on modulation peaks (Fig. 2). Should the modulation be in excess of 100% the effect on the 'scope will be to make the trace show a thick centre line during modulation peaks (Fig. 3).

Phone quality is not so easily judged, but again with practice one can go a long way. BBC speech shows a gently undulating audio envelope and peaks rarely approach the 100% modulation mark (Fig. 4). For amateur purposes a higher percentage of modulation is acceptable and in fact desirable. In the bad old days one could obtain amplitude modulation by connecting a carbon microphone in the aerial lead of a low power transmitter. The resultant scratchy spitch will show on the 'scope as a very spikey waveform not unlike continuous static, but of course as a modulation of the carrier (Fig. 5). There still are such signals about, and they sound and look the same ! Use of audio filters at the transmitter will affect the audio envelope and usually gives a waveform something between the rounded and the spikey shape. 'Tis on such signals that the 'scope report can be most misleading if one does not also take notice of the report suggested by one's ear.

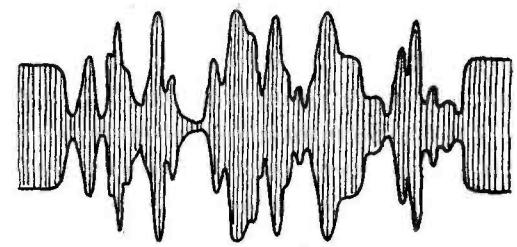


Fig. 5 "Scratchy" modulation

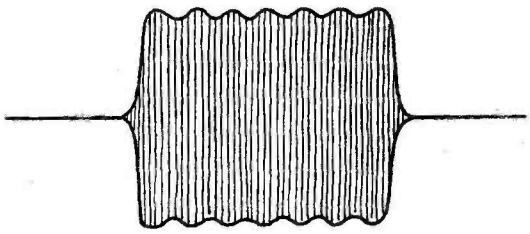


Fig. 6 T7 or T8 CW
Note: Audio modulation on signal amplitude

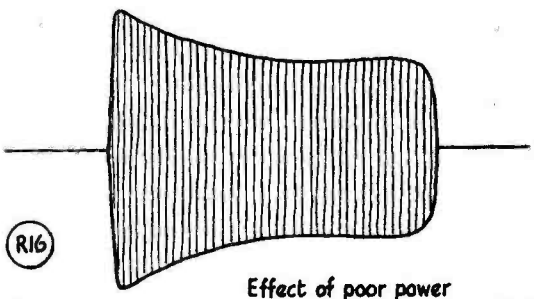


Fig. 7 Effect of poor power pack regulation (exaggerated)

Checking CW

To set the 'scope for CW checks, switch the time base to slow running and adjust the X-plate amplifier so that the trace fills the width of the tube. Tune in a CW signal and set the Y-plate amplifier to give a vertical deflection of about 50% on the tube face.

At this stage a useful check can be made on operation of the receiver BFO. Connect the 'scope at the IF output to audio detector, the point at which the BFO is also usually connected. With receiver RF gain in a normal position and BFO off, tune through the band and note the average amplitude of signals heard. Now tune to a dead spot, or disconnect aerial, and switch on BFO. Amplitude of the signal from the BFO should be approximately the same as the average of signals heard. If not adjust BFO injection until it is.

Except when checking the BFO as referred above it is better that the 'scope be isolated from the BFO by the last IF valve. The BFO signal does not then appear on the 'scope and only the incoming signal is displayed. This is accomplished by feeding the 'scope cathode follower from the input to the last IF valve.

With the 'scope adjusted as detailed above and the receiver tuned to CW signals it will

be noted that they run across the tube. If transmission keying speed is fairly steady, adjustment of the 'scope time base vernier speed control will enable one to hold or almost hold at least successive dots from the transmission.

If the signal can be so held, the X-plate amplifier gain can be increased until the dot nearly fills the 'scope face, thus permitting more detailed examination. Unfortunately this condition obtains very rarely except by prearrangement, so an alternative method of examining the keyed signal becomes necessary. The writer has found the most effective method is to synchronise time base with keying speed as nearly as possible, expand the time base by turning up the X-amplifier gain and then concentrate on each of the salient points in turn.

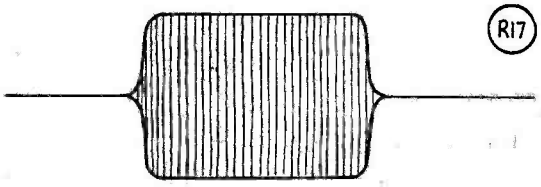


Fig. 8. Ideal keyed signal. No clicks on frequency unless receiver is overloaded

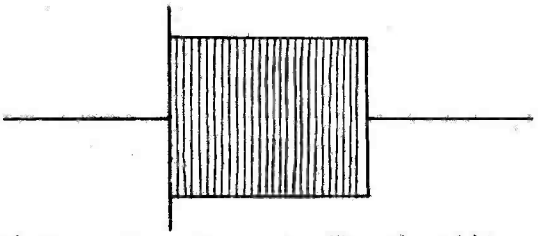


Fig. 9 Incorrect or no key filter. Signal fairly clean to read but bad click on make. Click persisting off resonance.

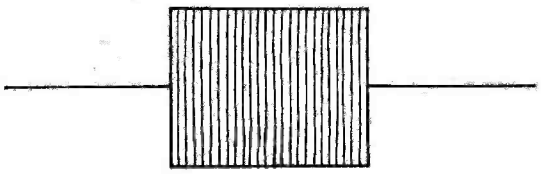


Fig. 10 Clean signal but insufficient key filter. Signal clean but keying "hard" and clicks at resonance.

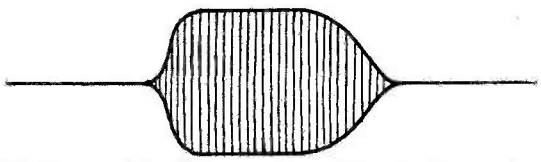


Fig. 11 Key filter overdone. Signal will sound woolly. No clicks. Primary keying with power pack filter too large gives same effect.

Analysing a CW signal, the following points can be assessed better from the 'scope than by the ear:

(i) *Tone.* A pure DC signal should show steady amplitude throughout, Fig. 10. A modulated (T8 and below) signal will show an AF ripple in the amplitude of the signal, Fig. 6.

(ii) *Transmitter Power Supply Regulation.* Providing a ground wave signal is being examined, but also in some other cases, poor power pack regulation is indicated if the amplitude at the start of the signal is appreciably different from that at finish, Fig. 7. This effect is difficult and often impossible to assess on DX signals.

(iii) *Keying Filter Adjustment.* On "make," the ideal signal should build up to maximum relatively gradually and similarly fall to zero gradually at "break," Fig. 8. Incorrect filter adjustments will give varying shapes at make and break ; Figs. 9, 10 and 11.

(iv) *Key Clicks.* The signal which makes and breaks suddenly without a click filter will give rise to keying clicks. These may be noticeable only on or adjacent to the transmitter frequency or they may spread over a wide frequency band. First tune in the signal to peak response, ensure that the receiver is not overloading (in fact turn the receiver gain as low as possible without losing the signal) and increase the Y-plate amplifier gain. Synchronise the time base speed as nearly as possible to keying speed in order to hold the dots and then watch the display for a few seconds to familiarise the eye with the relative position of the signal. Now mistune the receiver slowly off the signal frequency till the trace falls to zero on the 'scope. If clicks are present they will show on the tube as pulses of short duration in the position occupied by the start and/or finish of the keyed signals. In some cases the click can be identified as associated with a particular signal without such careful cross-check. In other cases it will be found that the click is noticeable only by tuning some kc off the transmitter frequency, but again the pulses can be identified with start and/or stop of the transmitted signal. Clicks shown in Fig. 13 are typical and were seen and heard on 14 mc recently.

(v) *Keying Relay "Bounce."* Keying relays are commonly used in most present day transmitters. It is surprising how many are incorrectly adjusted and "bounce" on make.

The effect of the bounce is not always noticeable to the ear or is lost in the key clicks, but on the 'scope the signal appears broken as at Fig. 12. If a properly adjusted keying filter is used this break disappears, probably because it was caused by sparking at the relay contact on make, the keying filter obviating this defect.

(vi) *Spacer wave.* Spacer waves (key-up signal) are not so common as in the old days of neutralised (?) triodes, but they do happen and show up as in Fig. 14. In reporting such a spacer it is of course necessary to do a careful check that the spacer does belong to the transmitter and is not another signal on the same frequency.

It is surprising how many amateur CW signals regularly reported T9x do not stand investigation by the all-critical oscilloscope. Those that do are pretty good signals !

Only one important aspect of the CW signal has not yet been covered, and that is frequency stability. If the receiver frequency stability is beyond reproach one can check transmitter frequency shift during keying or during transmission by first connecting the 'scope IF feed to the same point as the BFO injection. The BFO is set to beat with the incoming signal and the resultant AF signal modulation will show on the 'scope. Any frequency shift during keying or during the transmission will show as an alteration of the audio frequency modulation—again assuming the receiver frequency hasn't drifted. However, this is a fine point and frequency drift that requires comment is normally noticeable aurally.

It has been the writer's practice for some years past to keep an oscilloscope permanently available in the shack. The X and Y plates can be switched to the transmitter for keying and modulation checks or alternatively they can be switched to the Y amplifier and X time base. The Y amplifier is in turn permanently connected to the receiver IF. It is very rare that the receiver is used without the 'scope being switched on as well. The dividend in added interest and more detailed information is well worth while. The tube is a 5in. one, a factor dictated by availability and not choice. However, this size has proved extremely satisfactory and given a choice would probably be re-selected.

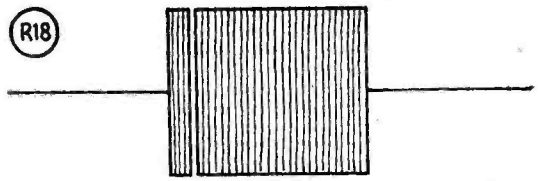


Fig. 12 Incorrect key filter and relay sparking/bouncing on make

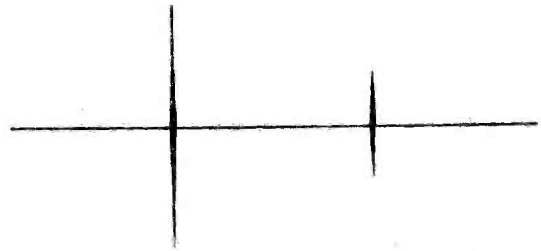


Fig. 13 Key flicks as seen off the resonant frequency

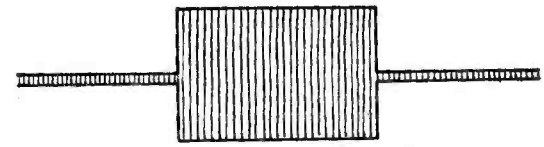


Fig. 14 Spacer wave

VOLUNTARY TRAINING OF R.A.F. CLASS "G" RESERVISTS

During the training of Royal Air Force Class "G" Reservists last year, a number expressed their willingness to come forward for a fortnight's additional training this year if allowed to do so. The Air Ministry are most anxious to encourage any volunteers from the Class "G" Reserve provided they are of the branches and trades which are being called this year and which are as follows:—

Officers: Fighter Controller, Radar Supervisor.
Airmen: Radar Operator, Wireless Fitter (G), Radar Fitter.

Applications, giving name, service number and address, should be sent, in the case of officers, to Under-Secretary of State for Air, Air Ministry D.P. 10, Adastral House, Kingsway, W.C.2; and in the case of airmen, to Air Officer Commanding R.A.F. Record Office (9 Division), Royal Air Force, Gloucester.

As the attendance of these volunteers will, in many cases, affect employers, it is imperative that they obtain the consent of their employers before applying.

DX Aerial for One-Sixty

INCREASING DIRECTIONAL EFFECT ON TOP BAND

J. N. WALKER (G5JU)

Our contributor was one of the most successful of the G stations taking part in last winter's 1.7 mc Transatlantic Tests. Here he describes how a simple directive system, not needing acres of ground space, made his results possible. It is clear from the experiments he discusses that the same methods could be used with short aerials in a restricted space.—Editor

PROPAGATION of signals over long distances—that is so say, *real* DX—on 160 metres is a matter very different from obtaining long range on the higher frequency bands. For one thing, the site of the station has much to do with the results. Amateurs living near the coast (and the western coast as regards America and Canada), having a good elevation above sea level and with a clay subsoil, start off at a definite advantage. Most important of all—as ever—is the aerial itself and it is already evident that the stations achieving success in this season's Top Band DX Tests are those with large aerial systems. The review of this year's tests ("Top Band Transatlantics, 1952," *Short Wave Magazine*, April) undoubtedly confirm further that those who did best are in the fortunate position of being able to combine a good aerial with an advantageous site.

A long aerial means that the effective wavefront occupies a substantial slice of space or, in other words, it enables the radiated signal to "get a grip on the ether" (or whatever one may call it). This article records the experiences of the writer with a not-so-long aerial and is intended to encourage others similarly placed and perhaps not doing so well as they could wish on the lower frequencies.

Requirements

The requirements for DX operation are rather different from normal amateur work on the Top Band, "normal" here meaning all-round propagation to cover a good range in *all* directions. When considering real DX and bearing in mind the low power of the transmitter, it is important—more, it is essential—*not* to allow the signal to radiate more or less equally in all directions. Somehow or other, *aerial gain* must be achieved and that in the required direction; without it, in the writer's experience, it is simply a waste of time to get up early and put out endless CQ calls — the hope of a reply can be but small.

Reception

Then there is the receiving side to consider —to repeat the old adage, unless you can hear a station you cannot work him. The Top Band can often be noisy—atmospheric noise, that is —even in mid-winter and, whilst a nondescript aerial will give reasonably good reception perhaps over a range of up to 1,000 miles at night, weak signals will be lost in the noise. So again *directional* aerial gain is of considerable assistance in raising a weak signal above the standing and unavoidable noise level.

Some Interesting Experiments

The standard aerial (hereafter termed the WLW, which is short for "west long wire") for 1.7 mc work at G5JU is about 135 feet in length, 110 feet of which is horizontal at a height of about 40 feet and running almost due N/S, the balance comprising the semi-vertical lead-in. This aerial is of course a quarter wavelength at 1,800 kc and the current-feed series tuned system used to make the aerial draw energy from the transmitter is shown in Fig. 1. As is to be expected, this aerial gives excellent all-round results but, at the beginning

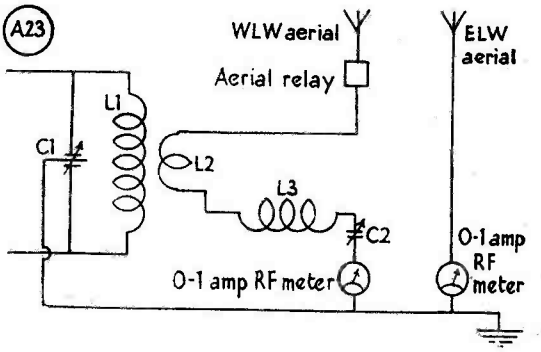


Fig. 1. Current-feed system used with 135ft. end-on wire operated as a Marconi aerial on 160 metres. C1/L1, balanced tank circuit; L2, coupling link; L3, loading coil, 24t. of 18g. enam. on 2 in. former; C2, .0005 μF receiving type condenser.

of the 1950-51 season, Transatlantic contacts could not be made.

A second aerial was then erected on the east side of the garden, again 135 feet in length but only twenty feet or so in height and separated from the WLW aerial by about 30 feet, which is one eighth wavelength (near enough), the general scheme being as shown in Fig. 2. With this second aerial (the ELW) isolated, performance and tuning of the WLW was unaffected. On earthing the ELW however, matters were very different—interaction with the WLW could only be termed violent. The terminating impedance of the WLW by itself was fairly low and it now become still lower and the reading of the RF thermocouple meter inserted in the earth lead (as shown in Fig. 1) increased considerably. Further, a second meter inserted in the lead to earth from the end of the ELW aerial showed a reading almost as great! Tuning the aerial — the WLW, that is—became a much more critical business and only a slight change of operating frequency necessitated fresh adjustment. This would be a drawback normally but for DX work it is well to stick to one selected frequency. It was not considered worthwhile inserting any tuning circuits in the ELW aerial as this would involve still greater care in tuning, because of the interactive effects and, anyway, the ELW appeared to act roughly as a quarter-wave over the restricted portion of the band in use—the meter reading was practically constant. If the second aerial had not been made a quarter-wave then tuning to resonance would have been advisable.

It was hoped that the ELW aerial would now act as a *reflector* and this evidently was the case—contacts were made with W1 and VE1 without difficulty. It would be interesting to ascertain the radiation pattern by taking field strength measurements but this, on 160 metres in a semi-built-up area, is a practical impossibility and one must work partly on the application of theory and partly on results.

Further Experiments

Came the approach of the 1951/52 season and with it more thought on possible improvements. Permission was obtained temporarily to extend the ELW to a tree, making its length up to a half-wave, but unfortunately only twenty feet high. Fig. 3 illustrates the revised arrangement. Expectations were great and, on the receiving side, the revamped aerial certainly gave good promise. With it, there was no mistaking the improvement in overall signal-to-noise ratio and signals could be copied on the ELW which were down in the noise on the WLW. But on the transmitting side, the new ELW was disappointing. The tuning arrangements had to be altered drastically to permit voltage feed and whilst results were good over medium distances in all directions, DX—meaning W stations—could not be raised, although clearly audible.

So back to the WLW and current feed. The ELW was at first left isolated and interaction was strong—voltage was present at the shack end of the aerial. Undoubtedly it was acting as a reflector but the probability was the wavefront was skewed round—at any rate, the DX did not come back as was hoped and anticipated.

The ELW was then again earthed. Now, there is nothing more "dead" where aerials are concerned than a half-wavelength earthed at one end—neither end can then develop a voltage antinode. This time there was no doubt that the ELW was acting as a *really* efficient *reflector*. Contacts were made not only along the eastern seaboard of the United States but also inland—W9CVQ gave a RST569 report and W9NH has heard G5JU at 579—which goes to prove that the somewhat unusual (considering the frequency) radiator-cum-close-spaced-reflector combination is pushing radiation in the right direction and assisting reception also.

About Earths

From a general safety point of view, any amateur station should possess a sound direct earth. From a purely radio angle, the actual effectiveness of the earth is not of much consequence when voltage-fed aerials are employed, but a really good earth becomes essential when a quarter-wave Marconi aerial is used, as in the present instance. Therefore, whilst aerial improvements were in hand, steps were also taken to improve the earth system. A large galvanised water tank, which had been discarded because of a leak, was acquired and was buried with the top rather more than a foot below the surface. Connection was made with 14 gauge wire at three points, the joints being well covered with three coats of bitumastic paint. The copper wires were brought together at a junction piece where connection was made to the outer and inner of a coaxial cable which formed the lead-in to the shack. This cable was used because

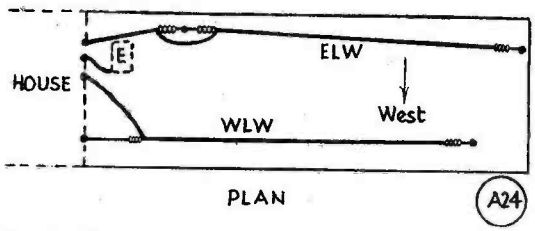


Fig. 2. General arrangement of the two 135ft. aerials at G5JU (roughly to scale). Point E indicates the position of the buried earth mentioned in the text.

it provides a large surface area of low inductance and is well protected from the elements —it is a pity to spoil a good earth by using thin wire for the lead-in.

On connecting up the new earth in parallel with the old one (itself good in its way), a definite increase in aerial current was registered. Separate meters were connected in each earth lead and it was found the new earth was carrying by far the greater proportion of the RF current.

An alternative to a good earth is a counterpoise. The latter can at times confer some advantage but to be effective on 160 metres it would need to be both long and use a number of wires. It then becomes a nuisance and tends to look unsightly in the garden. In the writer's experience, a really good earth is better than a mediocre counterpoise.

Summing Up

By the time these words appear in print it will be too late to do much in the way of making aerial improvements for the 1952 season, but at least the interested reader will have something to think over and be able to give consideration to what can be done for next winter. On 160 metres, the essentials are one wire running north/south and space to erect a similar wire 25 to 35 feet to the east of the first one. Height is generally fixed by the availability of supports, but some experiment in this direction may be useful if feasible, although it is then desirable to be able to take field strength measurements, preferably at some distance.

The point the writer would like to bring out is that the experiments described can be repeated and extended with smaller aerials and on other bands. For instance, it would be interesting to know how much propagation in a given direction can be improved by using a second tuned aerial as a reflector to a 66/70 foot wire, on 160 metres. Also, the same system could be tried on 80 metres, in which case tuning of the second aerial should not be necessary. The directional effect can of course be varied and need not necessarily be in a westward direction as described.

As a matter of interest, the two 135 feet wires at G5JU have been found to vary the directivity on 7 mc—if one aerial is energised and the other left isolated, the latter definitely tends to act as a reflector. To date the effect of earthing and perhaps tuning (or even detuning to swing the main lobe) has not been tried but obviously there is a fruitful field of experiment open here. Those who can perforce only erect a comparatively short wire but have the facilities for putting up a second wire, not necessarily very high, may like to see what can be done. It should be borne in mind that the spacing between the two aerials will vary according to the wavelength — between one-eighth and one-quarter wavelength, translated into feet, is recommended. When the same combination is employed on a different

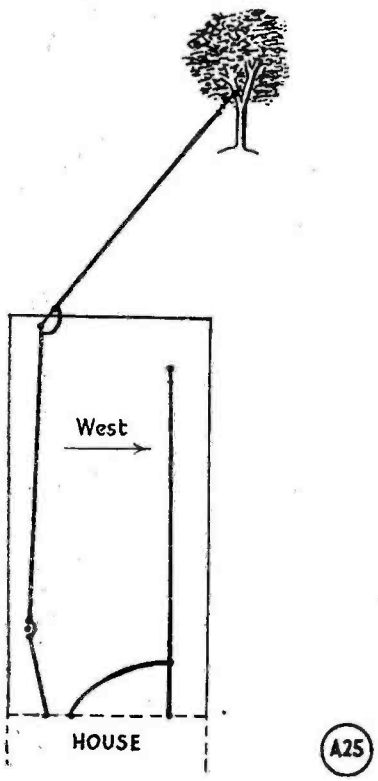


Fig. 3. A modification of the system as used during the 1951/52 Top Band DX Tests.

and higher frequency band, it may well be found that one wire acts as a director instead of a reflector. There are also possibilities in the way of *directly energising* the two wires, both in and out of phase, instead of allowing one to be energised parasitically. This has been in mind for some time, but as a lengthy series of tests would be necessary, nothing so far has been done about it. Now the suggestion is passed on to those who are looking for something to keep them busy for a long time to come!

Measuring Small Capacities

SIMPLE AND EFFECTIVE TESTER FOR VHF VALUES

R. C. HORSNELL (G2YI)

This article describes an ingenious condenser-testing unit particularly suitable for small condenser values. The variable reference capacity is a 100 μμF SLC condenser, working in an oscillatory circuit and using grid dip indication.—Editor.

THE test instrument described here was designed to meet the need for testing small condensers below the value of 100 μμF, which are often beyond the accurate range of a conventional bridge.

Apart from the usefulness of the tester, a strong point in favour of its construction is that it is entirely self-calibrating, which point will appeal to anyone not having access to a "master" calibration source.

Capacities within the range 10-100 μμF can be read directly from the dial to an accuracy of 1 μμF, and provision is also made, as described later, for accurate measurement of capacities within the range of 1-10 μμF. This is especially useful in these days of VHF and Television, where it is the smaller condensers that are used more frequently than those of about 500 μμF and greater. The tester enables suspected units to be checked for open-circuit and the values of unmarked ones to be determined; this is often necessary where waxed silvered mica condensers have been recovered from a piece of surplus equipment and the wax bearing the value has been scraped off or otherwise obliterated. Furthermore, variable trimmers can be adjusted to any desired capacity within the range of the instrument.

The circuit, Fig. 1, is self-explanatory and consists of an oscillator and absorption load. The heart of the oscillator is a variable condenser of the "straight line capacity" type with a maximum of 100 μμF. (In the tester constructed by the writer an ex-R.A.F. type 10C/3947 capacitor was used.)

Calibration

The method of calibration is as follows: A National type dial, scaled 0-100, is used, and as the 100 μμF variable condenser is straight line, it will be seen that the capacity value will follow the dial readings accurately once a small correction is made for the zero of the condenser, *i.e.*, a dial reading of 60 will represent 60 μμF, 70=70 μμF, and so on. The larger the dial used the more accurate will be the readings taken; if, for instance, a slow-motion dial with vernier scale and calibrated 0-1000 is employed, then exceptionally accurate readings can be taken, capacities to 0.1 μμF being determinable.

Operation

The operation of the tester is as follows: Normal use will cause oscillation at all frequencies covered by the range of the tuned circuit, L1-C1, grid current flowing whilst the circuit is oscillating. If a fixed condenser of 50 μμF is connected across terminals 1 and 2, a parallel tuned circuit is formed, *i.e.*, Cx-L2, which will give a resonant absorbtion circuit. This will become effective when the oscillating tuned circuit is adjusted to the same frequency as the tuned circuit Cx-L2. As the inductance of L1 is equal to that of L2, this condition will only exist *when C1 is equal to Cx*; it will be indicated on the tester by a dip in the grid current meter reading, the dial reading at the lowest point of the dip on the meter representing the value of Cx in μμF, which in this case will be 50 μμF.

It will be seen, then, that any unknown value condenser (provided that its value is within the range of the tester) can be connected across terminals 1 and 2 and by rotating the tuning knob for grid dip on the meter the

unknown value can be read direct from the dial.

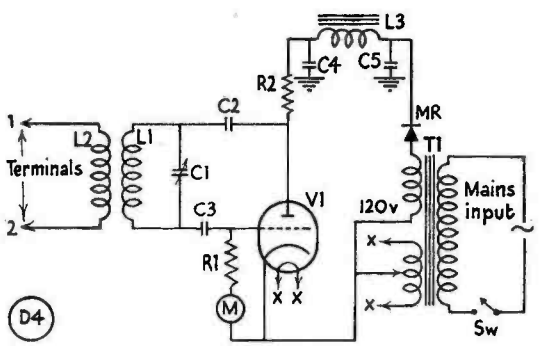
Larger condensers can be checked, if required, by putting them in series with a fixed capacity of 100 $\mu\mu$F, when the resultant capacity will be less than 100 $\mu\mu$F; the series condensers are then connected across terminals 1 and 2 and the series capacity determined as for a single condenser. The value of the larger condenser is then determined by the formula :

$$C \text{ (unknown) } \mu\mu F = \frac{100 \times \text{dial reading}}{100 - \text{dial reading}} \ \mu\mu F$$

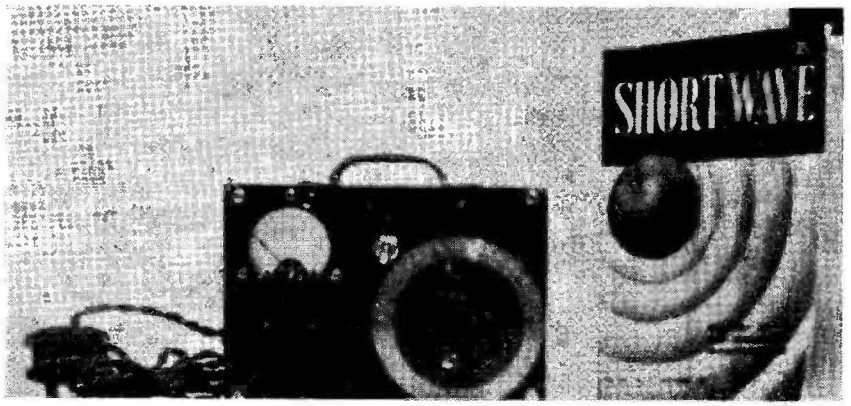
e.g. C (unknown) for a dial reading of 80 will be:—

$$\frac{100 \times 80}{100 - 80} \quad \frac{8000}{20} = 400 \ \mu\mu F$$

As all condensers within the range 100-1000 $\mu\mu$F will give a reading on the dial between 50 and 100, there is no reason why a calibration chart could not be made out giving the equivalent capacities for dial readings between 50 and 100 (where the unknown capacity is in series with a condenser of 100 $\mu\mu$F). As the dial reading will be the series capacity of the two condensers, the unknown could just as easily be determined from ABAC charts, but the formula above should be just as quick.



Circuit of the Test Unit described by G2YI, and incorporating its own power supply. Test capacities are connected across terminals 1, 2, and resonance readings taken off the scale of C1, which is an SLC condenser of known characteristics.



The Tester Unit for VHF capacities, as described by G2YI, with a size comparison

Smaller Values

To determine the accurate value of a condenser within the range 1-10 $\mu\mu$F, connect a fixed capacity of about 50 $\mu\mu$F across terminals 1 and 2, and by means of the tester determine its accurate value. Then, leaving the 50 $\mu\mu$F across 1 and 2, place the smaller condenser in parallel with the 50 $\mu\mu$F and retune the tester to obtain the new total capacity; the value of the smaller condenser will then be (Reading 2 – Reading 1) $\mu\mu$F. As 50 $\mu\mu$F is about mid-scale reading the results obtained will have a high degree of accuracy.

Construction

If no micro-ammeter is available for the construction of the Tester a milliammeter can be fitted in the oscillator anode circuit and resonance will then be shown by an anode peak current at the point of absorbtion resonance.

In the Tester constructed by the writer, the dial scale was removed from the skirt and fitted direct to the case, and the skirt knob used as the indicator. Due to the fixed

Table of Values

The Variable Oscillator Capacity Tester

C1 = 100$\mu\mu$F, SLC
C2, C3 = 20$\mu\mu$F, silver mica
C4, C5 = 8 μF, 250v. DC
L1, L2 = 5-10 turns, close wound on ½-inch former. Both coils must be identical and closely spaced
L3 = Smoothing choke, small
R1, R2 = 10,000 ohms.
M = 0-500 μA meter (5-10 mA if used in anode *see text*)
MR = Metal rectifier.
TI = Suitable transformer
VI = 6C4 or any 6.3v. B7G valve strapped as troide.

minimum capacity of C1 the knob is actually off-set by approx. 4 divisions on the particular condenser employed. The valve used is a 9003 strapped as a triode, but any small mains type is suitable—or, for reasons shown later, a triode of the 1.4 v. series.

The mains transformer for the Tester was taken from an old eliminator which employed a valve rectifier, the rectifier heating winding being used for the 9003 filament supply; the HT is obtained *via* a small metal rectifier. Thus, the writer was able to build the Tester and its power supply into a single small case without any difficulty.

The instrument as described has already paid for itself by the number of unknown or badly marked condensers, re-tested and used up, which otherwise would have been scrapped, or "chanced," with the possibility of large errors resulting. These would soon have been in evidence if, for example, a condenser of 75 $\mu\mu$F had been used in a circuit requiring only 25 $\mu\mu$F.

The actual cabinet shown can, of course, be larger, or, if desired, the Tester could be wired to operate from any external power supply which may be available, *i.e.*, a communication receiver power unit.

Alternatively, there is no reason why the Tester should not be built around a 1.4v. ty triode and the unit made entirely portat being a proposition for any constructor whc confined to the use of batteries. The miniat type LT/HT battery packs should have alm shelf life on such equipment due to the sm drain.

Sound Recording

METHODS AND SYSTEMS

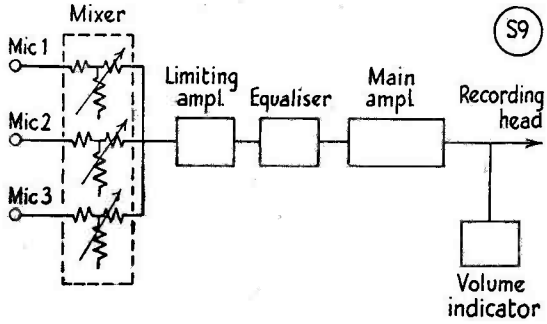
R. E. B. HICKMAN

(R.C.A. Photophone, Ltd.)

In this series of articles, our contributor will discuss in general terms the techniques associated with the various methods of Sound Recording. The reader interested in the subject —and perhaps in the building of his own equipment—will gain a good understanding of the principles involved in this particular field of design and construction.—Editor.

THE history of sound recording may be said to date from about 1864 when the Phonautograph was invented. Some thirteen years later came Edison's use of the waxed cylinder. From these early efforts and crude apparatus have developed the many excellent recorders and reproducers of sound which we know today. The real progress made in the technique of sound recording is largely due to the application of electrical principles to the art, which had its beginnings about 1929. With the introduction of the microphone and the electrical recorder the sound recording technician was set free from the crippling limitation inherent in acoustic recording and the way was open for the rapid development of several excellent systems of recording which are now in common use.

There are two fundamental requirements which are common to all systems of sound recording. First, it is desirable to be able to reproduce sounds which are an exact and faithful copy of the original sounds. Secondly, it is desirable that the recorded sound should be capable of being reproduced at an intensity approximating to that of the original sounds. In other words, the reproduced sound should be a secondary source equivalent, as far as is practicable, to the primary source. It will readily be appreciated that such a state is an ideal one and presents considerable technical obstacles to full realisation. Conversion of one form of energy (*e.g.*, the mechanical energy of sound waves) into another form (*e.g.*, the electrical energy of an amplifier) must involve distortion due to lack of perfection in the transducer employed. Only the simple harmonic or pure sine wave form can be translated without serious distortion. Unhappily, however, for the sound recordist, speech and music is almost invariably concerned with complex wave-forms. On the other hand, the human ear is in some respects a very accommodating instrument and will ignore considerable departures from the perfect in sound recording. For example, a large error in accuracy of intensity of reproduction will pass un-noticed. Towards the accuracy of frequency reproduction, however, the ear is much more exacting and slight errors in the relatives pitches of sounds are readily detected. Fortunately, however, from the point of view of the recording technician, the practical difficulties involved in securing a



Block diagram of a typical recording system.

good frequency response are less serious than those involved in securing a sound intensity equal to the original.

Recording Technique

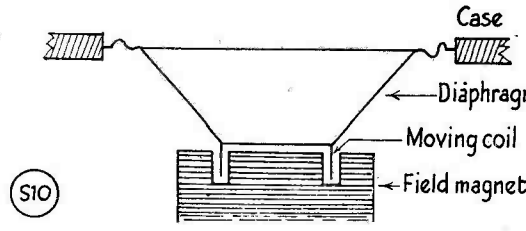
It is the purpose of this and succeeding articles to describe in some detail the technique and practice of the three main methods of sound recording now in use. These are *(a)* Mechanical embossing on disc, tape or film, *(b)* Photographing on film, and *(c)* Magnetic recording on wire, tape or disc.

Method *(a)* includes the ordinary gramophone record and is probably the most generally familiar of the methods of recording to be discussed. Under this general heading there are several different forms which the recording can take, but in all cases the recorded sound is a function of the physical arrangement of the recording material. This method of recording has the great advantage, from a commercial angle, of affording an easy method of producing large numbers of copies from a master record. The method is capable of very high quality results and modern slow speed, fine groove recordings made under ideal studio conditions and using high quality microphones and amplifiers can give results closely approaching the quality of the original sound when played back through high fidelity reproducing equipment.

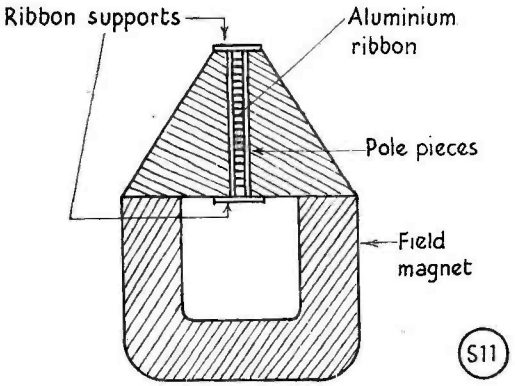
Method *(b)* is almost entirely confined to the cinema industry. Some few years ago an attempt was made to introduce optically recorded music into the domestic market, but the movement did not find favour and was abandoned. Although the end product is so familiar to the ordinary cinema-goer it is a method of sound recording which is still very indifferently understood. In this method the recorded sound is a function of either the density or area of a photograph image printed on to the edge of the picture film. Again, with high quality modern equipment it is possible to obtain a very high standard of reproduction, and it is probably true to say that many of the notable advances in sound recording techniques have stemmed from the continual search for ever more perfect methods of making sound motion pictures.

Method *(c)*, magnetic recording, is of comparatively recent introduction, although the principle has been recognised and used for over 50 years. Magnetic recording, which will later be discussed at length, has two important advantages over the other two systems mentioned above, in that (i) the recorded sound may be reproduced almost immediately after it has been recorded, and (ii) the recording may be removed entirely from the recording material which may then be used again for subsequent recordings. A further interesting feature of magnetic recording technique is the number of mediums which can be used for the recording; wire, discs, paper, and tape, all have their uses. Intensive research and development work is at present being carried out in this method of recording, and it may well be that magnetic recording will eventually displace all other types of recording even in fields where at present these older systems seem to offer unchallenged advantages.

Before going on to consider any one of these systems more fully, it should be remarked that common to them all is the use of a microphone and an amplifier system. In commercial recording of ambitious projects, as for example, an opera or a symphony, several microphones may be in use simultaneously coupled to the recording amplifier through a microphone mixer enabling the balance of recording to be adjusted as desired. The recording amplifier will almost certainly include equalising circuits so that its frequency response may be adjusted for optimum results depending upon the particular method of recording in use. The equalising circuits can also be used to compensate for known deficiencies in frequency response



Outline sketch showing arrangement of a typical moving-coil microphone.



Diagrammatic representation of a ribbon microphone.

or any other departure from linearity of the microphones employed.

Microphones

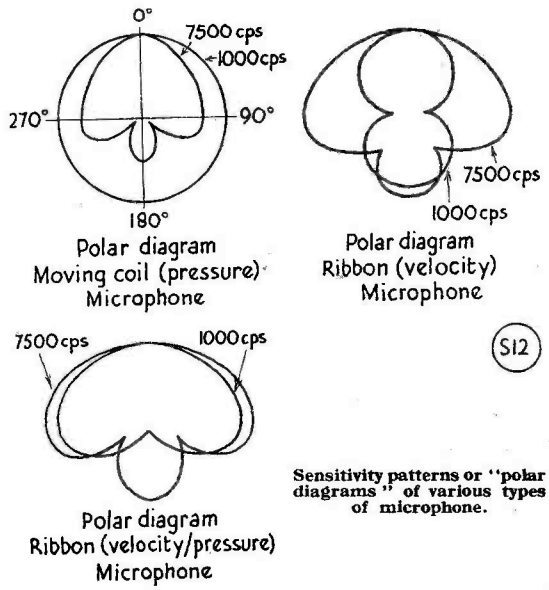
It has been truthfully said that no chain is stronger than its weakest link, and similarly it may be asserted that no recording channel can be better than the microphone it uses. It may therefore be profitable, at this stage, to consider the various types of microphones which may be used with recording equipment. The student of the literature of sound recording will probably soon meet references to a whole host of microphones, including such descriptions as electromagnetic, electrodynamic, moving coil, inductor, piezo-electric, velocity, pressure, pressure-gradient, condenser, carbon, ribbon. Some of these classes are themselves sub-divided into related types; for example, electro-dynamic microphones may be either mass-controlled or resistance-controlled. It will thus be appreciated that to study all types of microphones in these articles would be impracticable and we shall confine our review to the three types most generally used with present-day sound recording equipment. These are the moving-coil, the crystal, and the ribbon microphones.

Moving Coil Microphone

Moving coil and ribbon microphones are both of the general type known as electrodynamic. If a conductive element is vibrated in a strong magnetic field a corresponding alternating e.m.f. will be generated in the conductor. In the moving coil instrument a coil having a large number of turns is wound on a thin cylindrical former attached to a vibrating diaphragm or cone. The coil lies in the strong radial field in a corresponding cylindrical gap of a permanent magnet. (An interesting aspect of the moving coil microphone is that its action is reversible and by supplying an alternating e.m.f. to the coil it may be used as a reproducer of sound—it becomes in fact, the well-known moving coil loudspeaker.) The impedance of a moving coil microphone is generally low—of the order 10-100 ohms—and consequently it can be used at some distance from its associated amplifier. A great advantage of all types of electrodynamic microphones is the facility with which the mechanical and electrical quantities involved in their design can be adjusted. The diaphragm and the magnet system can hence be adjusted to give a high order of sensitivity. For general-purpose work in sound recording the moving-coil microphone offers a high sensitivity combined with a good frequency response, and, due to its design simplicity, models can be obtained at comparatively low cost. Hence it is very widely used for all but the most exacting work.

Ribbon Microphone

The ribbon microphone operates on the same principles as the moving coil type, but its conductive element consists of an aluminium ribbon approximately one ten thousandth of an inch thick. It may be about two inches long and corrugated to increase its flexibility. The ribbon is held under very slight tension in a gap between the poles of the field magnet. The ribbon is so thin and of such negligible weight that the air set in vibration by the action of sound waves can more easily move the ribbon



Sensitivity patterns or "polar diagrams" of various types of microphone.

than flow round it. To assist this action the pole pieces of the magnet are specially shaped to present minimum obstruction to air movement. Thus the amplitude of the movement of the ribbon is for all practical purposes equal to that of the air itself. No damping is needed for such a light object and no tendency to resonate appears. A typical well-designed and carefully manufactured ribbon microphone will have a uniform response from approximately 50 c.p.s. to 3,000 c.p.s. Above this frequency the output drops slightly and the response of the microphone may be down some 2 or 3 dB at about 12 kc. This falling off at the upper audio frequencies is generally quite smooth and can readily be compensated in the amplifier system. It will be appreciated that the output from such a single conductor will be very small, and hence a step up transformer is always provided, normally built into the microphone case. A microphone of this type is known as a velocity microphone since it responds to the velocity of air movements rather than to air wave pressure. An important feature of the ribbon microphone is its directional properties. The movement of the ribbon depends upon the direction of travel of the sound wave. If the speaker or musician is directly in front of or behind the microphone (*i.e.*, along a line perpendicular to the plane of the ribbon) maximum movement results. If the sound comes from the side, no movement results. The resultant sensitivity curve of a freely suspended ribbon microphone is a figure-of-eight. With sound coming from all directions the average response of a ribbon microphone will be about one-third of that of a non-directional unit having equal sensitivity for sound coming directly from in front.

By suitable shielding of one face of the ribbon, microphones of this pattern can be made into pressure operated devices. A chamber or tube is placed behind the ribbon sealing off the air space at the back. The dimensions and form of this acoustic labyrinth, as it is called, result in all sounds from the back of the ribbon being suppressed and such an instrument becomes a uni-directional microphone.

By combining a unit of each type in a single case, as for example, by clamping a single ribbon at its mid point and providing a labyrinth behind one half, it is possible to produce a microphone with omni-directional properties. If the opening to the labyrinth is made adjustable a microphone with a variable acoustic response can be obtained.

To summarize : The ribbon microphone is capable of reproducing sound with a very high degree of accuracy ; it has a naturally smooth frequency response without any resonance effects ; it is of low impedance ; it can be constructed to have a variable directivity characteristic. The ribbon microphone is used in all high fidelity recording work.

The Crystal Microphone

If alternating mechanical pressure is applied to one face of a crystal of quartz, tourmaline or Rochelle salt corresponding alternating e.m.f.'s will be set up in the crystal. The effect is very small, but various methods can be used to increase the efficiency of such a microphone. The best effects are obtained when the applied forces due to the incident sound waves tend to twist the crystal about its principal axis. Modern crystal microphones are of the Rochelle salt crystal type and feature comparatively high output, high impedance and a frequency response with a drooping characteristic at the lower frequencies.

Mixers

For simple recording of single artistes the signal output from the microphone in use may be fed directly into the recording amplifier, but when using more than one microphone it is usual practice to employ a mixer. Generally this will be a low level mixer ; in other words, the microphones will be connected straight into the mixer without any pre-amplification, but for some purposes it is desirable to add an amplifying stage between microphone and mixer. An ideal mixer is one in which any adjustment of the sound level from any one source does not affect the level of any other source, and in which the input and output impedances are constant at all settings of the mixer controls. All mixers introduce a loss of gain into the amplifying chain.

Equalisers

Since most types of recording head—mechanical, optical or magnetic—and all types of microphones introduce some frequency distortion it is usual to provide an equaliser in the recording channel, by which low frequency or high frequency attentuation or any other modification can be introduced according to the material being recorded and the results desired.

Limiting Amplifier

In many recording applications a special amplifier is used to limit the audio peaks to a pre-determined level. For example, in disc

The Emicorda, by E.M.I. Sales and Service, Ltd. is a good example of a typical magnetic-type commercial recording instrument.

recording the use of a limiting amplifier will prevent over-cutting of the disc on heavy passages of music or speech and will permit a marked improvement in the signal-to-noise ratio. In a small recording system the limiter may take the form of a separate stage in the main recording amplifier.

Main Amplifier

The main recording amplifier usually consists of a three or four stage amplifier giving high gain with a very wide frequency response and providing sufficient output power to drive the recording device. A push-pull output stage is almost always employed and resistance-capacitance coupling is generally preferred to transformer coupling. Considerable negative feed-back is generally used to ensure very low harmonic distortion and freedom from cross-modulation effects. The power supply for such an amplifier often provides a regulated HT voltage and is designed for extremely low AC ripple. The output from this high quality amplifier is then fed to the recording head and so transferred to the recording material. In subsequent articles we shall examine some of the problems involved in the actual transfer of the sound to a permanent (or semi-permanent) record by the methods already outlined.

(The series by G3GFN on Tape Recorder Construction will be resumed in the next issue).

SPRING 1952 CALL BOOK

The Spring 1952 edition of the *Radio Amateur Call Book*—which lists all known amateurs throughout the world by country, call-sign, name and address, and runs to more than 400 closely-printed pages—includes a 19-page section of U.K. call-signs. The 56 columns of G listings, covering G, GC, GD, GI, GM and GW stations, give more than 6,500 British amateurs and include all QTH's and changes of address as published in *Short Wave Magazine* up to and including our March 1952 issue. The price of the Spring 1952 *Call Book* is 21s. post free, of the sole agents for the U.K. and Europe: Gage & Pollard, 55 Victoria Street, London, S.W.1.

NINTH ANNUAL RADIO COMPONENT SHOW

Sir Robert Renwick, President of the Radio and Electronic Component Manufacturers' Federation, opened the Ninth Annual Radio Component Show at Grosvenor House, London, on Monday, April 7. There were 108 exhibitors, and visitors came from 25 countries.

Great Britain, whose imports of radio components before the war were greater than her exports, is now the world's largest *exporter*, the value of loose radio components exported approaching an annual rate of £10,000,000, of which no less than 10 per cent. goes to Canada and the U.S.A.

The exhibition demonstrated the dependence of radio, television, radar and electronic equipment generally upon the reliability of components measuring fractions of an inch and wires and foils measured in tens of thousandths of an inch.

CARDS IN THE BOX

Our QSL Bureau holds card(s) for the stations listed below—which we are unable to deliver as we have no mailing address. Please send a large stamped addressed envelope, with name and call-sign, to: BCM/QSL, London, W.C.1. The cards will be forwarded on the next G clearance, which occurs fortnightly. If desired, the call-sign/address can also be accepted for "New QTH's" and appearance in the *Radio Amateur Call Book*, the world-wide directory of amateur stations, for which we are U.K. and European agents.

G2ASP, 3FVE, 3GBI, 3GNF, 3HUI, 3HWF, 3HXD, 3HYU, 3IAH, 8AG, GD3FBC, GM3HMQ, 3HWN, 3HZX, GW3IDJ.

WE frequently have an unkind word to say about over-modulated phones and the interference that they cause on the bands. Equally pernicious, however, is some of the bad keying that can be heard down at the CW end. True, bad key-clicks are not quite as devastating as sideband splatter and whiskers, but in short-skip conditions they can be extremely annoying to a very large number of stations, and there is no excuse for them. After all, *anyone* can tell whether his own transmission has bad key-clicks or not, without having to go on the air and ask fifteen other stations about it. The normal type of keying filter, which has been well-known and well-publicised since about 1924 (see *QST*!) still works—but apparently it hasn't penetrated the consciousness of many whose sole concern is key-bashing, and "who cares whether it clicks?"

THE KITCHEN TABLE

Why the widespread assumption that rack-and-panel, or at least chassis-and-panel, construction is the only way of building transmitting equipment these days? How many would-be beginners have been disheartened, or put off completely, by visions of metal-work stretching into the future for ever? And yet extremely efficient stations have been put together and put on the air without anything of the sort. The remedy seems to be this: for the equipment where metalwork is essential, use surplus gear. (The TU5B springs to mind at once—it can be converted into almost *anything*!) For the rest, use wood, whether on the old "breadboard" lines, or whether on wood-panel-and-baseboard lines, designed to fit into a rack and to look like *pukka* chassis-and-panel stuff. In the pre-war days, of course, more equipment was built for experimenting with than for DX-chasing, and you couldn't beat the breadboard for out-and-out experimental work. Nowadays it seems that too many people build their equipment with the idea of putting it

straight on the air—and *staying* there for ever and ever. The urge to experiment seems to have died.

A STABLE OSCILLATOR

Here's an amusing scheme for those whose delight is to play with super-VFO's. It is well-known that there is some difficulty in keying an oscillator while still maintaining complete stability of tone. Even a crystal oscillator doesn't like it. So why not key an oscillator whose frequency simply *cannot* be shifted? The enthusiast who propounded this system has built a VFO using an oscillator with a range of 3700-4000 kc. With this he mixes a component of 200 kc, derived from Droitwich, amplified by three stages. His resultant frequency range (after the mixer and a buffer stage) is, of course, the desired 3500-3800 kc—but the oscillator which is keyed is Droitwich. (Let me hasten to add that this is really a cheat, because of course it is a buffer amplifier that is being keyed.) The effect, however, is that of keying an immovable frequency in that it gives the cleanest, most chirp-free results I have yet heard; and, of course, full break-in is possible because, when the 200-kc component is removed, the combined output and the operating frequency disappears completely. All the advantages of oscillator keying while actually keying a buffer!

AERIAL TUNING

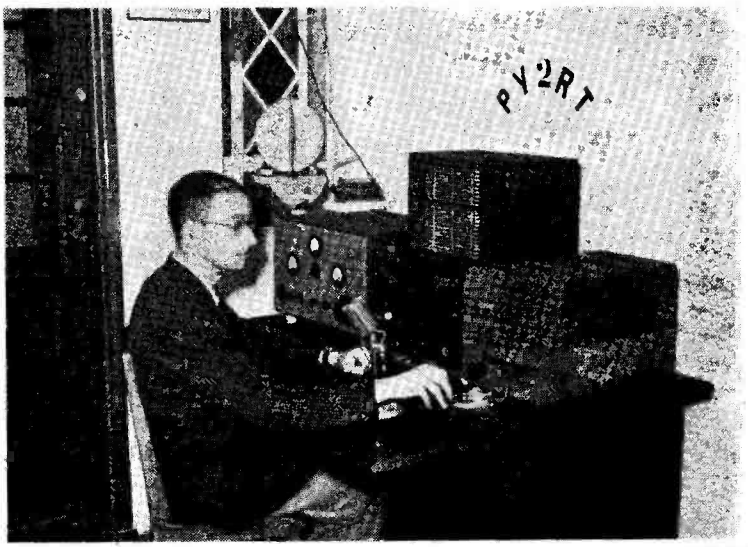
Strange how many people use a nice aerial tuning unit for their transmitter, and then couple the receiver all anyhow on to any old piece of wire. If only they would just try the effect of going through the same tuning unit for the receiver *and* the transmitter, it is pretty certain that some drastic rewiring would take place. After all, it's quite easy—the tuning panel is presumably coupled to the transmitter through either 80-ohm or 300-ohm line; the change-over switch is installed in this line and the receiver is offered the result. Most receivers take kindly to an input impedance of 300 ohms; even the receivers designed for that figure will, it is said, give a *better* sig/noise ratio if they are coupled into something that looks like 80 ohms. The only disadvantage (and a very slight one at that) is that you have to change coils in the aerial tuner if you want to do the odd rush off the band to see what conditions on the others are like.

THE JUNK PILE

Those whose shack has also to serve as a workshop (and their number must be legion) are well advised to have a "demolition purge" every now and then. Nothing causes such chaos in a small space as those odd chassis, partly stripped, which present sharp edges and lethal corners to the unsuspecting wrist or shin. Something occupying about twelve by nine by six lies around simply because of a Yaxley switch and a 5-watt resistor which have yet to be removed; something else takes up as much room as an AR88, although there is probably nothing left except "sentimental value" and a moving-coil meter that doesn't work; and those funny-shaped bits that we used on Field Day .... There is no better way of spending a week-end when conditions are bad than in clearing up all this detritus; quite a lot of useful bits can be salvaged from it, there's always a dustbin outside, and the shack is an awful lot tidier and roomier after the clearance.

DX COMMENTARY

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



PY2RT

THE news of the month is, of course, the opening of the 21 mc band to the U.S.A. and other countries in the Western Hemisphere (and also to all the "WSEM" countries!) As this did not take place until May 1, we cannot yet report on the actual event. Neither, to our sorrow, can we give any gen. whatever on when it is likely to be made available to us. For the moment, all we can hope for is cross-band contacts with W's. We are doing all we can to initiate the technique of VFO'ing on to two-thirds of their frequency, so that they will know where to listen for replies. More of this in a month or two.

Those who remember what good conditions were like (and there are legions who don't!) continue to say that this winter and spring have been the worst ever. Others are of the opinion that the season has not been quite so bad as the previous one, but we can't back them up on that. In terms of Countries Worked, it is true, many of the 'chasers have scored more in the first four months of this year than in the corresponding period last year, but that has been due to the occasional (*very* occasional) excellence of conditions over patches of two or three days. In general, the earlier part of this year has been quite the most dismal DX-chasing period we can remember since 'way back before the war—and that's now a matter of 14 years, don't forget.

Twenty

GW3FSP (Skewen) had a reasonably good month with EA9BD, KG6ABI, VK9XK, ZK2AA and ZS3K on CW, and AP2N, 3A2AH, VQ5BVF and VQ5CK on phone. He reports a big improvement in reception conditions since the Electricity Board did something about a leak on their 33 kV line; the noise, which used to give a meter reading of S9 on occasions, has disappeared. Dewi is now going to start working DX . . . .

G8FC (Locking, Somerset) sends a list of nice DX worked in the afternoons and early evenings. FF8, VQ2 and 4, VS6, ZD2, ZD9AA and 4U-AJ are among the best, lashed together with hordes of LU, PY, VK, ZS and the like! G2BJN (Loughborough) sends his Marathon Score, for which additions include HV1AD (?) and 3A3JA. They both sound pretty queer.

G2DPY (Shoreham) says he doesn't remember worse conditions in 25 years' operating, and he doesn't care what anyone says about it! On Twenty he raised EA6, VS2 and 7, KG6, VU and a 3V8. Nice ones heard were VK9DB, YS1O and 4U-AJ. G3ABG (Cannock) has returned to the chase, and pretty successfully, judging by VP6AA, VQ4's, ZD2, ZS3K, VS7, FQ8AF and hordes of lesser lights. Nice Gotaways were ZP3NB, YS1O, VP7NT, FD8AA, CR5JB, HH3L, VU4AC and KR6IG, to mention a few.

G6QX (Hornchurch) reports a dud month, but mentions VP6AA, KG6AAY, VQ4BZ and W7NIN. G3FPQ (Bordon), still with 25 watts, has passed his Century and mentions CO, CR7, CX, FF, FQ, VP9GX, VS2, 6 and 7, YV5AB, ZS3U and ZS8MK. Gotaways were CR6PI and ZD9AA.

G8KP (Wakefield) cashed in with EAØAC for a new one, plus FF, MI, ST and FQ. Cards turned up from ZD6DU and VQ8CB. G3GUM (Formby) reports conditions terrible on the whole, but quite brilliant for BERU week-end. He worked CP1BK for a new all-time country

CALLS HEARD, WORKED AND QSL'd

and says he is getting a kick out of the WAZ Marathon. Others were worked, such as VP6AA and 7NM, VU2CK and ZD2HAH. Gotaways were KR6GI, VP3TY, HH3L, MP4BBD and a highly suspect ZM6AK (S7 at 1500). 'GUM mentions rumours that there is to be a ZD7 expedition in the early summer, and that HB9AW is going to Clipperton.

G5BZ (Croydon) maintains his handsome lead in the Marathon with his score of 33Z, 109C—but even *he* admits that conditions are shocking. Best of the month were CR4 on phone, CR9, DU, FB8, KG6, ZD9 and ZS2MI on CW. He says that on April 12 there were more Central and South American signals on Twenty than he has ever heard before, but no one seemed able to raise them. In two hours he heard VP2, 3 4 and 7, KG4, KP4, HK, HH. HR, YS, CP, ZP and all the rest.

G2BW (Walton) found VS6, ZS3, VK9 and VQ5 as new ones on CW, and also winkled out MI, MP4, YI, XZ and ZC6 on phone. G3BDS (Worcester) reports for the first time with CR7CK, EL2R, FQ8's, ZD6DU, EQ3UU and IT1AGA. Gotaways were ZP3NB, HI6EC, FR7ZA, KR6IG, ZD9AA and CR5JB. He asks whether 9S4 counts—he certainly does.

G3FXB (Hove) did nice work with EQ, KG4, KG6, KR6, FI8YB, VK9XK, VP9GX, YV5AO, ZD4BI and lots more. Gotaways were FN8AD, MP4KAF, DU1MB, XE1N, ZS7C, 4U-AJ and some of the others already quoted. G3WP (Brightlingsea) reports for the first time, having graduated from a 1-watt CO in 1938 to a 150-watt phone and CW rig today (and he has been a reader all the time.) His present score is 110. During the past month he heard VQ9AA, YA3UU, CR9AE, YK1AH, FI8YB, FB8BB, HI6EC, FR7ZA and a few others. He worked VK2AWU, who turns out to be ex-G3DCU.

G2DHV (London, S.E.13) has had cards in from DU1AL, HZ1TA, VE8PM and ZK1BC. G2NS (Bournemouth), on his usual afternoon watches, has worked KG6DEA, DU1MB, KP4JE, VS1EJ, IS1FIC and ZB2I, and would very much have liked FI8YB, FB8BB, FR7ZA . . . but why go on? Everybody's Gotaways seem the same this month! QSL's rolled in from PX1AA, PJ1UF, HS1UN and a few more. G3DOG (Brentford) is practically a 100 per cent. twenty-metre station now, and has put his score up to 16Z and 34C this year.

G3FXA (Bexhill) jumps to second place in the Marathon table with his score of 32Z and 81C. New ones include CR9AE, FI8YB, JA8OT, KG6ACJ, VK9XK and KG4AF, but the pick of the month must be his two Russians—UA1KAC and UAØAA. 'FXA finds that by this time last year he had only worked 40 countries, so he thinks conditions must have been even worse then. On the other hand, G5FA (London, N.11), who has only worked 57 countries this year, remarks that by this time last year he had worked over 100—so draw your own conclusions!

G6QB's own contributions on the band were CR9AH (old CR9AG), FI8YB, DU1VVS, KG6AAY, 6ABW, 6DEA and 6GX, KR6DT and 6HB, VP6AA, VK9XK, VR2CG, XE1N (1630) and ZD9AA. Most of these came in one or two good patches between 1400 and 1600—otherwise the month has been pretty shocking.

G3TR (Southampton) raised CR5, VQ5, CR4, CO, KL7, YV and ZE—all on phone. GM2DBX (Methilhill), also on phone, worked LZ1KSR, CR9AG, EA8AW (with G6WX on the mike). 'DBX is now off the air during TV hours!

Forty

G5FA worked 5A2TT for a new one, as well as W's, VE's, SU's and the like. 9S4BE on phone was another new one, and during the *REF Contest* 'FA raised enough French Provinces for a

Station of G3ASC, Oswestry, who has had what he describes as "A clean-up to something more pleasing to the eye (the eye of the XYL!)." The table-top Tx was designed to match the AR88, and consists of Collins 70E8 VFO-6AG7 broad band doublers-807-829, with all switching for these circuits ganged to one panel control and giving output on all bands 28-3.5 mc. The modulator is 6SL7-6SN7-829B, and the station is relay operated throughout with electrical interlocks on the power supplies. Input runs 140 watts CW and 110 watts on Phone. What with everything, G3ASC may reasonably claim to have got a full quart into his pint pot!

DPF Certificate.

GW3FSP extracted some good stuff from the band, and mentions VK2DI and 2ANN (1900), ZS3K (1930), MD5GO (1930), VS6CJ (2000), and VK6LJ and a bunch of ZS's (all between 2100 and 2300). VQ2GW, ZE3JP, VQ4HJP. 4AQ and 4CM were also polished off during the evenings. Dewi adds: "In spite of the above list, I think conditions have been rather poor."

G8FC worked MP4BAE at 1445; incidentally the operator at G8FC was G3IDC, who was VS9GT and MP4BAB in 1948. G2DPY — one-time forty-metre stalwart—was diverted to such an extent by Twenty that he only collected ZL, VK, YV and TI on Forty this month.

G3ABG raised ZB1, SU, LZ1KAB, SM1AHN (Gottland) and heard YS1O, YV5AQ and some LU's. G6QX worked KP4UW, LU, PY and W, but OX3EL got away. G2BW collected PY, VQ4, VU, ZE and ZS.

G3FXB's log shows KV4AA, MD5GO, PY, VP6AA and 7NM, VQ4CM and 4HJP, YV5FH, ZE3JP and ZL's—mostly worked during BERU. 'FXB says the band is in a sorry state now, with Radio Pakistan on 7010 and Moscow Radio putting out T5 parasitics all over the band. (There was a time when we didn't think it could get worse, but now it's just about a dead loss, and *still* the pirate broadcasters arrive.)

WAZ MARATHON, 1952

Station	Zones	Countries
G5BZ	33	109
G3FXA	32	81
G2VD	31	102
G6QB	30	90
G3FXB	28	81
G6QX	27	70
G2DPY	24	65
G3BDQ	23	66
G3GUM	23	62
G3FPQ	23	52
G2BW	22	65
G3ABG	21	61
G5FA	20	57
G3TR (Phone)	19	52
GM2DBX (Phone)	19	51
G5GK	17	24
G2AJ	16	45
G3DOG	16	34
G2BAM	13	35
G6TC	12	31
G6YR	12	24
G2BJN	10	37
G2VJ (Phone)	8	12
G4QK	4	7
G3GVY	2	7

NOTE: New entries in this table must not include QSO's dating back more than two months from the time of entry. Regular reporters should send in their score month by month — three months' failure to do so will be taken to indicate loss of interest and the score will be deleted.

The Ham Spirit

Just to cheer us up after the preceding paragraph, here is a story from G8KP. He was wondering how to get 700 francs out of the country to get his *DUF 4* award, and shortly after publication of the issue in which that was mentioned (March "DX Commentary") he received a letter from F8TH. This amateur (although he had never worked G8KP) offered to pay the 700 francs and to get the Certificate for 'KP. By then, however, 'KP had managed to make the financial arrangements through someone else; nevertheless, F8TH, receiving 'KP's letter of thanks, went to REF Headquarters, collected the cards and returned them himself (having seen that they were all in order) and then wrote: "Now that, o.m., is just plain normal ham friendship and does *not* require any special thanks." This was an extremely nice gesture on the part of F8TH, and we would like to thank him through this column on behalf of G8KP.

Ten Metres

Yes, *Ten*! It's still alive — in fact, over BERU the VQ4's were easier to work on Ten than on the other three bands. During March GW3FSP worked them, as well as ZE's, ZS's and ZD6DU on CW; on phone he got MI3, VQ2, 5A2, most of South Africa, CX, LU and PY.

G2BW gave the band a workover and got VQ4, ZS, ZD6, LU and PY—all on CW, plus 4X4 on phone. G3HCU (Chiddingfold) sends a "Ten Metres Only" letter. He says the openings have been very fruitful, although overall conditions are poor in comparison with the winter months. Stations worked during March and early April were AR8PP, CR6BX, EA8AX, LU's, VQ2AT and 2DT, VQ3PBZ, VQ4's, ZS3O, lots of ZS6's and some 4X4's. 'HCU tells us that VQ3PBZ is going to Zanzibar and will operate for a spell as VQ1PBZ.

G3WP was lucky enough to catch an opening on March 30, which gave him his first VP8 contact—VP8AI was on the band. VQ3's and 4's were also worked; others heard were ZP7AW and OA4BC, as well as all the South American and South African stuff that would be expected when Ten is open.

Eighty

Nothing of note has been happening on 3.5 mc, although some nice DX was available during BERU, particularly ZE3, VQ4, ZS and the VP stations. G3ABG worked YU1AD and FA8DA, and heard TF3C, VP6AA and a CN8. G6QX raised EA9AP for his 47th country on the band. G3CQU (Coulsdon) worked a W2 with just over 10 watts. He heard TI2PZ and KG3AF, plus plenty of W's and VE's.

G3FPQ found CT2BO, MP4BAE, OY2A and SU1FX—and no Gotaways! He heard OY2Z again, and says Eighty is the best band still for those who want an OY contact.

G8KP pushed up his score with CT2BO, TI2PZ, EA9AP, SU1FX and MP4BAE; G5BZ collected VP6 and KP4. G3HJY and G2NJ are working on a 396-ft. wire held up by a kite. Tests will continue and reports will be welcomed.

G2BW also found the VP6 plus a VE. G3FXB had some pleasant surprises, including TI2PZ (0530), VP4LZ (0430), VP6AA (0400), and 3V8AB (2130). The TI and the VP4 both came back to "CQ W/VE" in the ARRL Contest! 'FXB also tells us that YU1AD has worked MP4BAE, HE9LAA

and KG4AF on the band. DL1FF has worked OQ5RA, and ZS3K has been in evidence.

EI9J is, we know, one of the star performers on Eighty, but he is too modest to let us know what goes on. Pity!

From Overseas

Bob Avigor of 4X4CJ is working with the Signal Section of the US Army in France, and has been operating from F7BB. F7AR, who operated from PX-land some time back, is now home at W8PQQ and naturally wants a PX expedition organised so that *he* can work them! So if you hear PX1BB and possibly 3A2BB . . . . By the way, 4X4CJ very much wants to contact F/Lt. Pope, who was formerly ZC6FP/ZC6JP and is now, he thinks, G3EXB; can anyone put them in touch?

"Benny" Hitchcock, formerly ZE3JQ, is still awaiting his G call, but is now on his way to the Middle East, complete with a pocket-size 15-watter. We await news of where he finally lands.

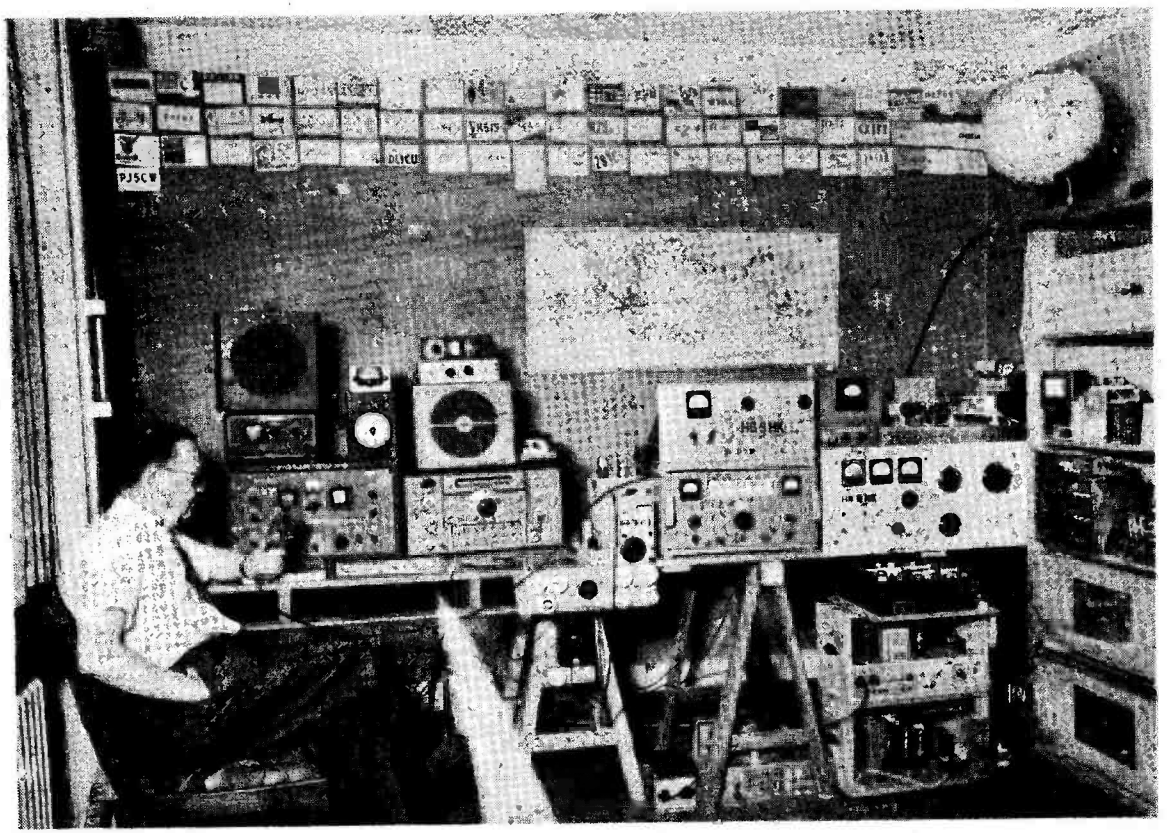
VU2DZ is in Karachi and hopes to obtain an AP call very soon. If anyone worked from VU2DZ is short of a card, they should write to him at Chartered Bank Chambers, P.O. Box 24, Karachi, Pakistan.

The former AP2Z is now home, and although he QSL'd 100 per cent., he thinks there may be a few that went astray. Sufferers, if any, should drop a line to him—George Shell, 26 New Kings Road, London, S.W.6. He adds that Geoff. Howard, the former VU2GH and AP4A, has taken over the old AP2Z rig and will be operating it from Karachi.

VS6HR/G3CDR tells us that his former junior op. is now VS6CL, but travelling homewards in search of a G call. He sends some photographs showing the difficulties encountered from his rather freakish location in VS6.

MB9BR was licensed as G3BDU; he sends photos of the rig in Austria, which is operated on Ten and Twenty only. An interesting point is that he has an experimental rig for the Top Band, on which he has not had much luck, owing to difficulties in obtaining spares. Lots of Top-Band country-collectors would be delighted to help him . . . .

The former VP9K (also G3CRY and VS7MC) is now in Singapore and (don't rush, now) likely to be in the Cocos Islands until mid-August. He has his transmitter with him, and if you should hear



Station of HB9HK, Kussnacht, Switzerland, covers all bands and is equipped for recording and playback. Some of the outstanding items and features at HB9HK are a panoramic receiver, voice-controlled-carrier modulation, a Hammarlund Super-Pro receiver, and a quantity of ancillary apparatus including an electronic key and wide-range grid-dip meter. HB9HK is also there on VHF (144 and 430 mc) with entirely separate apparatus for those bands. And as if this were not enough, his British MG car is fully equipped with Tx/Rx gear for mobile operation on all bands!

a ZC2MC or ZC2MAC—well, just hang around! He will be able to work all bands, with 50 watts of CW only. Also, please note: calls within 5 kc of his transmitting frequency will be *ignored*. He may well be on the air by the time you read this.

G3FWJ (Southend) sends some interesting gen. on VP8AJ, who is ex-G3AXN. The station uses 350 watts on CW and 250 watts on phone; the receivers were shipped from Port Stanley as deck cargo, and their condition on arrival can be imagined! VP8AJ normally uses 14128 kc, midnight to 0300 GMT, and operates from ten minutes after the hour until fifty minutes after, with a twenty-minute break for ionospheric observations. He has a daily sked with W7BD at 0115 GMT. G3FWJ would like to hear from any station working VP8AJ—either *via* Top Band or Eighty, or through the post.

ZC4RR is a new one in Cyprus, and asks us to say that he can't QSL until his cards arrive from the printers. VS1EV tells us that he intends to operate from VS4, when the licence arrives; he confirms that VU5AB is genuine and that he QSL's—but he is on 7 mc CW only, and at infrequent intervals. There are 18 stations in regular operation from VS1.

ZS6ACD sends 73 to all his G friends and says that he has worked 92 countries since he started up in December, 1950, with his 807 and 50 watts. His shack is on the fourth floor of a ten-storey building in Johannesburg!

Top Band Topics

G2NJ (Peterborough) reports that he worked OH3FR while it was still daylight, and that G6AB, on the same day, raised TF3AC, who is at an American Met. station in Iceland.

G3FXB passes on the news that VP4LZ is equipped for the Top Band, and KV4AA confirms that KG4AF was heard many times on 1998 and 1901 kc. G6QX says that KT1OC made some remark about a special QSL that he would send, but nothing more has happened.

G5MP (Hythe) writes to say that, without belittling KV4AA's phenomenal work on One-Sixty, it should be remembered that his contacts were over much more southerly terrain than the British Isles, which makes a lot of difference where conditions are concerned, although it increases the static problem. 'MP reminds us that the *northern* boundary of the USA is as far south as a line roughly through Cherbourg and Vienna, and the southern boundary is 'way down or about the same latitude as Morocco, Libya and Cairo. So he interprets the remark, "The DX is *there* if you go for it," as meaning that "there" entails the use of camels, donkeys or jeeps and a south-bound caravan.

Miscellany

G6TA (London, S.W.12) tells us that he has WAS, DXCC and EDXC, all on phone, and has qualified for AAA and WAVE but hasn't claimed them. All this with no aerial more than 16-ft. in length! The secret is the use of an ordinary beam on Ten and a "compressed" beam on Twenty. 'TA is making use of the bad conditions by getting TVI-proof on Twenty and building such necessities as a GDO, standing-wave indicator and noise generator.

G5BZ asks whether the Russians are trying to break up the 14-mc phone band—or, if not, what are the horrible "bagpipe" noises spread over the band at times. (Even a jammer can have parasitics, it seems! And presumably a parasitic can have even smaller fleas—and so on *ad infinitum*.)

Referring to the Complete and Utter Clot, G3GUM says that the cross-town "spitch spiv" must be included permanently in this category, and he hopes he will always be able to spare a couple of minutes to call a "purely helpful" CQ on top of these pests in the CW band. G3GVY (Buxton) told a DL9 he had a shocking note; the DL came back, "About my tone, Hi! Hi! Pse QSL via DARC." . . . .

G8KP reminds us that for the WAE Certificate, only *four* bands may be claimed for contacts; in other words, if a country has already been worked on 10, 20, 40 and 80, no additional points are available for a contact on 160. If, however, one of the other bands is missing, then the Top Band contact will count.

G6QX tells a sad story. His 7 mc final gave trouble, and he thought the pre-war T.125 had lost its emission; so he tapped it on the dustbin and it went off like a V2. He replaced it with an 810, and then found the same symptoms there! After rebuilding the grid side and getting matters right, he can hardly bear to think of the noble old T.125's feelings as it went on the rubbish

FOUR BAND DX TABLE

POST WAR

Station	Points	3.5 mc	7 mc	14 mc	28 mc	Countries
W2QHH	495	90	90	209	106	209
G6QB	486	51	94	206	135	223
G2AJ	433	42	81	192	118	211
G5BZ	404	52	89	202	61	206
G2VD	401	42	80	173	106	181
G5FA	365	33	111	148	73	163
G3FXB	329	42	94	150	39	159
G6QX	316	47	82	132	55	157
G6BB	310	38	80	138	54	147
HC2JR	293	3	15	143	132	183
G3ABG	279	33	79	139	28	142
G8VG	258	34	76	122	26	140
G6YR	255	16	33	105	101	152
G2BW	251	23	56	138	34	143
G2YS	248	40	45	123	40	136
GM2DBX	219	5	31	103	80	123
G6TC	213	17	58	110	28	118
G3GUM	213	31	38	143	1	154
GM3EDU	197	37	41	96	23	116
G2HKU	181	3	46	118	14	128
G3FXA	181	22	44	107	8	116
G3FPQ	159	40	16	97	6	104

dump.

G3ABG has a complete list of HB9 stations and their respective cantons for the "Helvetia 22" contest. He will let anyone have a copy on receipt of an S.A.E.

Contests and Ladders

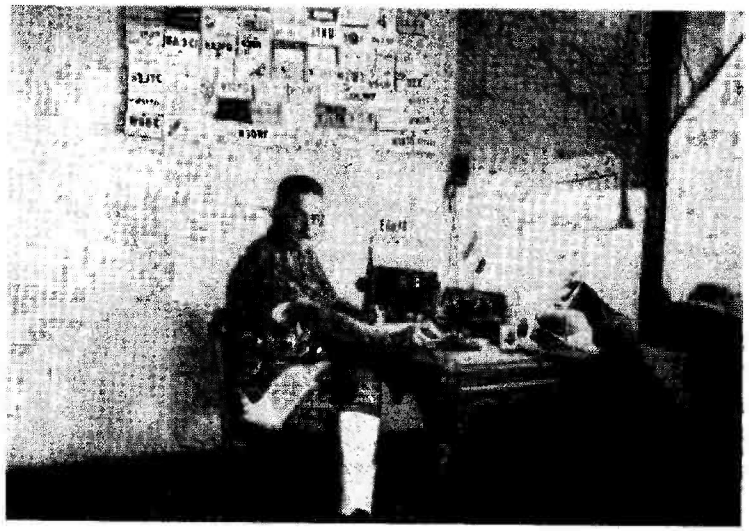
Talking of the competitive side, it is obvious that we shall have to get busy with a couple more "ladders" and some more certificates. The demand is widespread and constant, particularly from the "new boys" who can't rely on high power and super aerials for their DX.

So we have decided to issue Certificates for a limited number of achievements of the not-too-spectacular type which show all-round prowess on one or more of the bands.

One will be a "WABC"—Worked All British Counties—for Top Band only. The starting score will be 60 counties of the United Kingdom, and "stickers" will be available for each additional 10. The "possible" is 93 counties, as follows: England, 41; Scotland, 33; Wales, 13; Northern Ireland, 6. Don't send cards in yet, but wait for the full announcement of the rules.

Another will be a Four-Band Award, designed to reward not the DX-chasers but the consistent users of four bands. The Certicate will be available to those who can show a list of twenty countries, each one of which has been worked on four different bands out of the five available. For instance, you may claim OZ on 10, 20, 40 and 80; OK on 20, 40, 80 and 160; GC on 10, 20, 80 and 160; and so on. But each country claimed must have been worked on four different bands—and there must be twenty different countries. This will cause a bit of head-scratching and log-searching among those who haven't been too tidy with their records of these things!

For the more advanced 'chasers there will be two real DX certificates—by name the WNACA (Worked North American Call Areas) and a really tough one, the WFE (Worked Far East). The former is within reach of the newcomer and the low-power man; the latter will not be too easy for anyone except the really experienced DX worker.



EA0AD, on the Island of Fernando Po in Spanish Guinea, sent us this photograph of himself calling CQ on Twenty.

From time to time we will publish lists of Certificate Holders; and we will keep a pair of ladders going: one for the "WABC," showing the number of counties claimed; and one for the Four-Band Award, showing the number of countries with which four-band contacts have been made.

But no claims *yet*, please! Full details will be given next month. Meanwhile, G2PL (Wallington) remains the only holder of the *Magazine DX Award*, although G8KP tells us that he has 387 of the 405 cards required, so we are betting on him as No. 2.

And that's about the size of the DX news for a rather slender month. Without being unduly gloomy, we feel inclined to advise you not to look for too much DX now until the autumn and the opening of next season—and *that* may be better, or may even be worse!

Speaking for ourselves, we are going to get the shack into good order for next winter, without wasting too much time digging down for the scanty DX this spring and summer. (And there's always the lawn-mower and water-can!)

Next month's deadline is **first post on May 14:** for the benefit of overseas readers, the one after that will be first post on *June 11*. So, until next time, BCNU, 73, and (if you don't mind digging) Good Hunting.

P.S.: Last month's paragraph about G8VB and his "Snooper's Diary" seems to have struck a few readers as a Very Serious Matter. Of course, this was not our intention, and G8VB himself assures us that it was intended only in fun, and not to be taken seriously. So let us make it clear to everyone that the paragraph in question should have ended with at least two "Hi's" in brackets!

More about NBFM

PRACTICAL POINTS IN OPERATION

B. WARDMAN (G5GQ)

In this article, our contributor deals with some queries and difficulties which have arisen in the application of the NBFM principle. The notes below should be read in conjunction with his original discussion in our issue for November, 1951.—Editor.

SINCE the appearance, in the November 1951 issue of *Short Wave Magazine*, of the writer's original notes on NBFM, many enthusiastic letters and telephone calls have been received from readers. Possibly the tremendous NBFM signal being put in by TA2EKA, Ankara, during Christmas week, made many more realise its potentialities.

Working him recently, TA2EKA volunteered the information that he had been almost driven off the air in his home town in the States because of TVI. After trying every conceivable cure on his AM job, he turned to NBFM which gave him a 100% cure. So impressed was he with these results, that he took this NBFM transmitter to Ankara, to the exclusion of AM.

Two other correspondents ran into trouble. Here are the symptoms and the solutions.

The first one set up the reactance modulator and, upon coupling the VFO to his receiver, got perfect results when listening to the 28 mc harmonic. Highly delighted, he switched in his frequency doublers and the PA and was horrified to hear the most distorted and undermodulated speech, which seemed to vary from moment to moment. The answer is simple: Too much regeneration in the frequency doublers or PA.

Circuit Tests

Now, with any PA, there should be no sign or trace of regeneration; it's a bad thing under any circumstance, because a valve can *not* act as an amplifier and an oscillator (and regeneration means a tendency to oscillate) at the same time. Very few amateur rigs are perfect, but in the vast majority of stable transmitters the amount of regeneration in the PA is insignificant. A good test is to give that stage no bias, reduce HT volts to about one half normal, and see if it oscillates (without drive) at any setting to which any of the tuning controls are turned; or, if a grid milliameter is in circuit, there should be no variation of its reading *whatsoever*. That test should be applied to all PA's, irrespective of whether they are CW, anode or grid 'phone, or NBFM. If the PA does not pass this test, then key clicks and parasitic noises, plus poor quality speech will occur, however good the modulator.

Frequency doublers and triplers are quite different. A spot of regeneration improves efficiency, and most amateur rigs use this quite unintentionally! If it is taken a bit too far, the tendency is for the doubler or trebler to oscillate weakly for a few milliseconds after the drive to it is cut off. So most people key the multiplier stages as well; if their HT or screen voltage is cut off, then they just cannot oscillate, and the thing works happily on both CW and normal telephony.

Using NBFM, things are vastly different. The frequency of all stages must follow exactly the modulation. If a doubler or tripler stage oscillates on its own even for the tiniest part of a cycle, modulation is cut off for that period. As the stage comes back into control and starts passing the frequency modulation again, phase shift occurs as it is coming into step, and this means severe distortion. The nearest simile is of two men marching steadily along, in exact rhythm. Suddenly one of them breaks into a trot. His companion urges him to come back into step. He will not come immediately into exact synchronism; he will probably get the wrong foot forward first, change step, and after two or three paces will resume exact rhythm. That is exactly what happens to NBFM under the conditions mentioned, and if one can visualise the effect of these two marching men, then one can appreciate just how distorted good speech can become.

The answer is clear; if good NBFM is obtained at the VFO stage itself, any distortion or undermodulation is caused by the following stages and this is not a fault of the modulation but of the existing equipment being unstable.

Finally, on this point, the PA runs Class-C the whole time. The CW man will run a pair of 807's at 750 volts, 200 mA and they will work very nicely. He may stick to normal rating at about -90 volts grid and a milliamp or two of drive, or he may prefer to go against maker's rating and use -200 volts grid with

watts of drive. The valves will take this with the key down, and any reasonably efficient rig should pass this test. NBFM adds no further burden because it is only wobbling the frequency. So treat the job as a CW one with the luxury of phone added at *full* CW rating.

This point is important, because ratings must be reduced for both amplitude Class-B anode modulation, and for efficiency modulation systems such as grid or screen.

Modulation Factors

The second trouble was that of a fairly experienced "G" who built the thing up carefully, but seemed to get very thin modulation. He was using the output from a standard crystal microphone through a two-stage RC coupled audio amplifier. Even with the gain flat out modulation seemed very weak. He had checked the audio by the means described in the original article and it was definitely reaching the anode of the 6SA7.

Here the trouble was that of the control grid (No. 3) becoming charged statically. Obviously, layouts and efficiency vary from station to station, and here was a case in point. So instead of a 500,000 ohm resistor from grid 3 (audio) to earth, the writer suggested a much lower value, starting at 22,000 and going to 5,000 ohms if necessary. The 22k value cured it, and he had to turn the amplifier gain back almost to zero to prevent over-modulation. It is simply a matter of such charges leaking away to earth quickly enough.

Super Modulation Systems

A SURVEY OF CURRENT TECHNIQUES

O. J. RUSSELL, B.Sc., A. Inst. P. (G3BHJ)

As time goes on, the more advanced phone operator looks for something new in the way of modulation methods and techniques. This article deals very clearly with the theory of Super Modulation and shows that all such systems aim to make more effective use of the RF power generated in the output stage, much of which is wasted under the usual conditions of amplitude modulation.—Editor.

RECENTLY a number of Super-Modulation systems have been suggested for amateur use. It is as well therefore to consider the various methods for obtaining more efficient use of amplitude modulated transmitters.

All forms of improved modulation systems aim at getting a greater speech signal at the receiver. This can be achieved more or less satisfactorily in a large number of ways. It must be remembered, however, that one does not get "something for nothing," and all practical super-modulation systems obtain their benefits by the application of the basic fundamentals. This does enable a more efficient use of amplitude modulation methods.

The basics of a normal amplitude modulation system are the facts that with a steady sine wave modulation of 100%, there are two sidebands each having one quarter the power of the carrier wave. Thus of the transmitted signal, only one-third of the total power is in the sidebands, and the other two-thirds is in the carrier wave. Now the carrier wave itself conveys no information, but serves as a reference to enable the information to be extracted from the sidebands. This at once gives a clue to more than one method of "super-modulation," for as the essential part of the signal is contained in the sidebands, there is no need to transmit 66% of the radiated energy in the carrier wave. If the sidebands are increased in power, the audio output at the receiver will be greater for the same power expenditure at the transmitter, and the system efficiency as a conveyer of intelligence will be greater. From this starting point, we can consider briefly several circuit arrangements which achieve this. The term "super-modulation" is not usually applied to all of these systems, but in effect they all achieve to a greater or less degree the same object of increasing the sideband energy relative to the carrier.

In Fig. 1 we have the representation of the modulation envelope of a 100% modulated wave, and the two sidebands. If we attempt to increase the modulation with a conventional amplitude modulated carrier, we are immediately faced with the problem that the RF carrier will be cut off to zero for appreciable

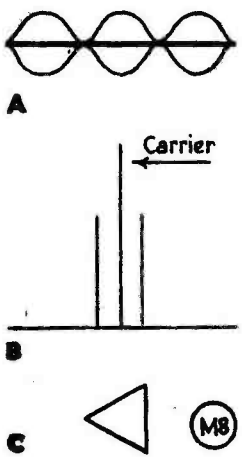


Fig. 1. Sine-wave modulation, 100%. (A) Modulation envelope; (B) Carrier and two sidebands; (C) Modulation pattern as seen on CRT. Ideally, with pure-tone modulation only two sidebands of half carrier peak amplitude are produced.

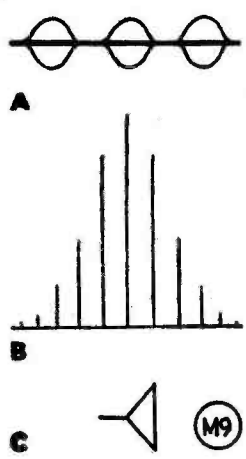


Fig. 2. Heavy sine-wave over modulation. (A) envelope showing breaks; (B) Carrier and sidebands; (C) Appropriate pattern as shown on CRT.

periods. This corresponds to modulating with a flat bottomed waveform. The sharp transition from the normal sine wave modulating wave to zero output for a period, corresponds to modulating with a wave having strong harmonic components. This is illustrated in Fig. 2, and instead of a carrier and two sidebands for a sine wave modulation, we have a whole spectrum of frequencies corresponding to the badly distorted discontinuous modulation envelope. This relates to the fact that in an anode modulated transmitter if the modulation voltage is excessive, the RF output ceases during the time the anode potential is swung in a negative direction. Usually, however, there is no difficulty in modulating *upwards* to an extent considerably greater than 100% modulation peaks. If there is a limit in the upward direction, it produces a flattening of the positive peaks of the envelope as well. In any case, an attempt to over-modulate produces considerable distortion, and the wide spectrum of sidebands is responsible for the characteristic "splatter" associated with over-modulation.

Quiescent Carrier

One way out of the difficulty was the "quiescent carrier" system, in which in the absence of modulation only a small carrier was transmitted. As modulation was applied, however, the carrier level was automatically increased so as to maintain normal modulation conditions. The advantage was that little power was required except upon modulation peaks, so that a transmitting valve of small anode dissipation could comfortably handle the reduced carrier, and still be able to withstand the momentary overloads on modulation. However, at all points the carrier was never more than 100% modulated.

The quiescent carrier system therefore still puts twice as much energy into the carrier as into sideband energy, and from that viewpoint was ultimately no more efficient than normal amplitude modulation systems. The advantage lay in the fact that the RF output valve merely had to supply peak power instantaneously, and normally was operating at a reduced input. A small valve could thus be made to give rather more output than under continuous Class-C conditions.

Returning to normal modulation, the fact is that in general we can modulate beyond 100% in the upward direction. If we try to do this with normal anode modulation, we are faced with the insurmountable barrier that the PA valve cuts off sharply as its anode goes negative. The PA cannot give less than zero output. It looks, therefore, as if we need a system that will give a "negative carrier," for then we could swing as much as we liked in a negative direction. What is a negative carrier? Well obviously a negative carrier applied to an equal and opposite positive carrier would cancel it out. This implies that a negative carrier is exactly 180 degrees out of phase with a positive carrier.

Super Modulation

This is exactly how one super modulation system works. To obtain a negative carrier,

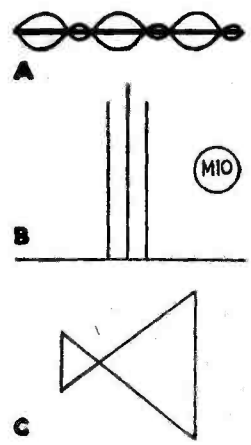


Fig. 3. Negative carrier insertion. (A) Modulation envelope accomodating "negative" modulation peaks; (B) Carrier and sidebands. While sidebands are much stronger than with 100% modulation, no spurious sidebands are introduced; (C) The characteristic double-triangle modulation pattern produced on the CRT.

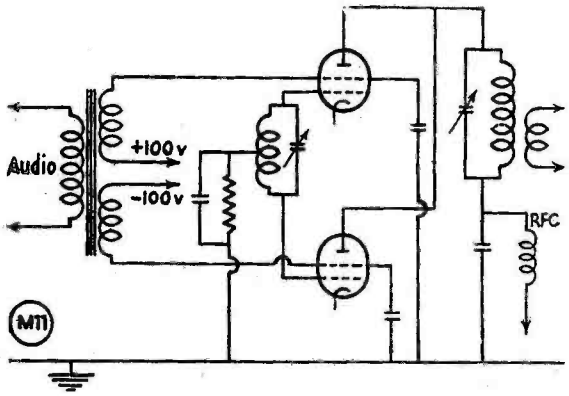


Fig. 4. Super Modulation with negative carrier, applied to the screen of the PA stage.

we add a second PA valve, arranged so that its output is in opposite phase to the normal PA. The " negative carrier " valve is arranged to be cut off until the modulation swings negative. On this negative side the " kicker " valve comes into action and supplies the 180 degrees out of phase " negative " side of the modulation envelope. The modulation envelope appears as in Fig. 3, and the trapezoid modulation pattern is actually a double triangle. In this way the concept of a " negative " carrier is realised.

Effectively this system produces a carrier, but the energy in the sidebands is greatly increased over the normal 100% modulation case. Furthermore, no spurious sidebands are generated and splatter is absent. In fact, the system was originally devised purely to suppress the distressing splatter effects produced by accidential over-modulation. It has now been seized upon as a means of deliberately increasing modulation percentage. A screen modulated version of this system is shown in Fig. 4. The grids of the PA stage are driven in push-pull, thus exciting them the required 180 degrees out of phase. However, the anodes are paralleled, so that their outputs into the common tank circuit are in opposition. The screens are *not* paralleled as for normal modulation, but are modulated in push-pull from a split transformer secondary. Where both screens to be maintained at the same DC potential, the carrier outputs from the two valves would cancel out, and only sideband energy would be radiated. However, one screen is kept at a negative potential, so that it only comes into operation just as the other valve cuts off. In this way the " kicker " valve supplies the negative modulation peaks.

The Rating " M "

With these systems, a new method of rating modulation power is necessary. The modulation index " m " (somewhat reminiscent of the " index " employed in frequency modulation systems) is utilised. A value of " m " equal to one corresponds to normal 100% modulation conditions. Higher valves of " m " correspond to modulation percentages exceeding 100%. In point of fact, providing moderate values of "m " are employed, the transmissions can be received without difficulty upon an ordinary receiver. If high values of " m " are produced, then it may be necessary artificially to boost the received carrier level at the receiving end. This can be done by zero-beating the receiver BFO, and enables the signals to be read without distortion. Another method, which is simpler and less liable to objections on other grounds, is to use the crystal filter so as to boost the carrier preferentially to the sidebands. However, even with " m " values not requiring carrier boosting at the receiver, considerable advantages are gained. The transmissions contain more energy in the sidebands than a normal phone transmission, so that the signal is louder effectively, more solid and less troubled by QRM.

Carrier Elimination

Naturally, one might ask : " Why not go the whole hog and completely eliminate the carrier and only transmit the sidebands ? " Technically, there is no difficulty about creating a suppressed-carrier double-sideband signal. All one has to do is to operate the system of Fig. 4 with normal screen voltage on *both* PA valves and the carrier is balanced out. The results of this are shown in Fig. 5.

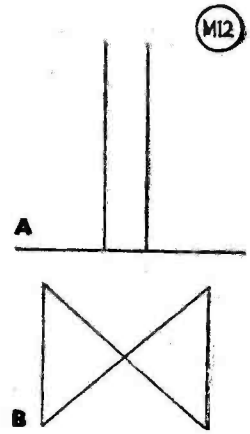


Fig. 5. Double Sideband Suppressed Carrier. (A) Two sidebands with no carrier; (B) The double-triangle pattern as seen on the CRT. This condition corresponds to a modulation index (and modulation percentage) of infinity. Such a signal is easy to produce but is impracticable for communication purposes owing to difficulties at the receiver.

and it will be seen that the cathode ray tube modulation pattern is a symmetrical double triangle corresponding to a modulation index of infinity.

But such a system is completely useless as a means of communication. The difficulty is that it is necessary to replace the carrier at the receiver. With a double-sideband system this has to be done with *complete accuracy* both in frequency and phase in order to reproduce intelligible modulation. The frequency requirement can easily be met, but the phase requirement cannot, and no suppressed carrier double sideband system has been operated under communication conditions.

The phase requirement can be eliminated, however, if only *one* set of sidebands is radiated. This is the better known single sideband suppressed carrier system, often abbreviated to SSSC, on which articles have already appeared in *Short Wave Magazine*. If either the upper or lower sideband is transmitted, the only necessity is that the artificial carrier added at the receiver is within a few cycles of the correct frequency. Thus the receiver BFO is carefully adjusted until intelligible speech is heard. Such a signal without the BFO is unintelligible, and sounds exactly like complete overmodulation, as indeed it is. However, the spread of the signal is not excessive, for only the genuine sideband frequency, and not spurious ones, is present.

Receiver Considerations

With the BFO on, careful tuning reveals a peculiar sounding voice that at one point resolves sharply into normal clear good quality telephony. To aid the BFO adjustment a very small amount of carrier is often transmitted, but this is about 20 dB down on normal carrier level. The BFO also serves to protect the signal against QRM, for it renders other phone signals unintelligible. Another advantage from the QRM viewpoint is that the single sideband signal occupies only half the ether space of a normal transmission, and in addition the absence of a noticeable carrier eliminates interstation heterodynes. Needless to say, all the radiated energy is sideband and hence intelligence, so that the power used at the transmitter is all employed in conveying information.

A number of amateurs are now using SSSC, especially on eighty-metre phone, and if one hears what at first seems a mere hash of overmodulation, then it is as well to switch on the BFO and try to resolve a signal. One of the difficulties of SSSC enthusiasts is the fact that other operators are not always aware of the necessity to switch the BFO on at the receiving end. As the signal is completely unintelligible until this is done, and furthermore careful tuning is necessary, it is difficult to get answers to a CQ !

There is not the place for a description of the methods by which SSSC signals may be produced. The simplest and most obvious systems use elaborate filter networks to select one set of sidebands and to reject the carrier and the other sidebands. Other more cunning arrangements employ special phasing circuits, while a further "carrier and single sideband" system employs a combination of anode modulation with frequency modulation.

It is hoped that the above has presented the essential aspects of Super-Modulation systems. While not all the modes described are called Super-Modulation, in fact they all possess the basic feature of concentrating useful power in sideband energy and suppressing the wasted energy needed to produce a carrier. By so doing, the efficiency of the transmitter as a communication device is increased, and a more effective signal is radiated. In fact, the improvement is such as to make communication successful where with the same transmitter power and normal modulation it might not be possible.

AMERICAN NOVICE AND TECHNICIAN LICENCES

The American licensing authority, the Federal Communications Commission, makes two very valuable concessions in their general licensing system. One is the Novice-class, issued for twelve months and not renewable, under which operation is permitted with crystal-controlled CW (only) over part of the 3.5 mc band; the Morse speed asked for is but 5 w.p.m., and phone working is permitted on VHF during the novitiate period. It seems that more than 5,000 of these Novice-class licences have been granted, and it is estimated that 200 or so of the operators concerned are active exclusively on VHF. For the Technician-class permit, intended for those engineers and others interested only in VHF, no Morse test is required, but transmission is not allowed on the normal communication bands (28 mc and below). Some 1,500 Technician-class licences have been issued on this basis.

Constant Modulation Controlled Carrier Working

DESCRIBING AN ADVANCED MODULATOR OF THIS TYPE

A. J. R. PEGLER, A.M.I.Mech.E. (G3ENI), *Lieut.-Cdr. (E.), R.N.*

Our contributor goes further into the practical application of a method of modulation which can be used at any power level, describing a "final circuit" which will be of great interest to all those who are experimenting with this system.—Editor.

THE two previous articles on this subject appeared on pages 336 and 588 of the August and December, 1951, issues of *Short Wave Magazine*. The basic problems involved were described together with simple practical circuits, operating data, advantages and disadvantages, and precautions in using this type of modulation. It is now proposed to describe a more advanced form of modulator which possesses the following features :—

(*a*) Ability to vary "float" of carrier from steady carrier to a change of 8 or 10 dB as required.
(*b*) Ability to maintain constancy of modulation over wide limits of audio input.
(*c*) The use of a carrier control circuit which is substantially independent of the main modulation circuit.
(*d*) Freedom from the effects of distortion due to clipping action in self-rectifying modulators.
(*e*) Provision for automatic volume compression in the speech exciter in order to raise the average level of modulation.
(*f*) Provision for impedance matching between modulator and power amplifying stage.
(*g*) Use of negative feedback to overcome effects of varying load on modulator.
(*h*) Provision for introduction of additional control grid modulation to permit waveform shaping of modulation envelope.
(*i*) Need to limit high frequency response of transmitter to prevent the occupation of too wide a channel.
(*j*) Ability to modulate the largest power amplifier valve or valves used at stations licensed for 150 watts.
(*k*) Desirability of using a compact modulator, simple to build and only requiring a minimum of components.

An improvement in modulation linearity and quality can be obtained in some tetrodes by using control grid as well as screen grid modulation, for envelope waveform shaping. This is easily effected by passing audio from the main modulation circuit through condenser C4, potentiometer P3 and condenser C5 to the grid circuit of the power amplifier. Up to about one-third of the audio voltage available at the screen grid of V2 should be applied to the control grid.

Resistance R2, by-passed for audio by condenser C6, is used to adjust the relationship between the AF and DC voltages applied to the screen grid of the power amplifier. This will enable an accurate 100 per cent. constant modulation to be obtained. Without these components the circuit will control at about 80 per cent. modulation. This, however, is ideal for local contacts.

A portion of negative voltage proportional to the average speech level which appears across the rectifier load resistance P2 can be used for volume compression purposes by taking it from the slider of the potentiometer P2. This voltage is taken *via* the filter and time constant circuit R6. C7 to the first valve in the speech exciter in which the compressing action takes place. Switch S1 removes this bias voltage when speech compression is not required.

The load on the modulator valve varies slightly during the modulation cycle and negative feed-back is used to offset the effects of this. Current feed-back is obtained by leaving the cathode resistance (R4) un-bypassed, and voltage feed-back is obtained by means of resistance R7.

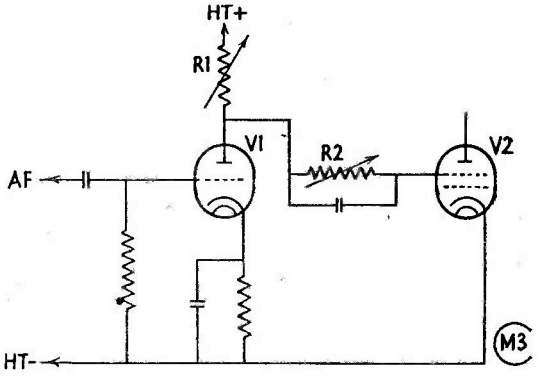


Fig. 1. Heising Constant Current Modulation on the screen-grid of a PA stage.

Adjustment

Adjustment of the circuit shown in Fig. 4 should preferably be carried out with the use of an oscilloscope. However, it is fairly simple to adjust with the aid of a voltmeter and a monitor. The procedure without using an oscilloscope is as follows :

(*a*) Set R4, P1, P2, P3 and R2 at zero.
(*b*) Set R1 at maximum.
(*c*) Advance audio gain of speech exciter, whilst speaking into microphone or introducing a 1000-cycle tone source, until voltage registered between the screen grid and earth is sufficient to allow the desired input to the power amplifier to be obtained. This voltage will be, in general, about one-third of the plate voltage.
(*d*) If insufficient screen grid voltage is obtained, reduce R1 as necessary.
(*e*) Set R4 to give desired amount of quiescent carrier. A working ratio between quiescent and maximum input of 1:4 is suitable for most applications.
(*f*) Advance P1 until quality in the monitor shows a *distinct* improvement. In this position distortion, high note emphasis and harmonics will be absent and there will be an improvement in the bass response.
(*g*) Advance P3 up to about one-third travel in order to obtain a further improvement in quality.
(*h*) Advance P2 until desired amount of speech compression is obtained. This should be followed by an immediate advance of the audio gain control in the speech exciter until the previous carrier input is restored.
(*i*) Advance R2 until 100 per cent. modulation is obtained.

All variable controls with the exception of the audio gain control can now be locked in position or replaced with fixed resistances of the appropriate value. If an oscilloscope is used during adjustment, it should be connected and read in accordance with customary practice. The trapezium diagram is the most convenient

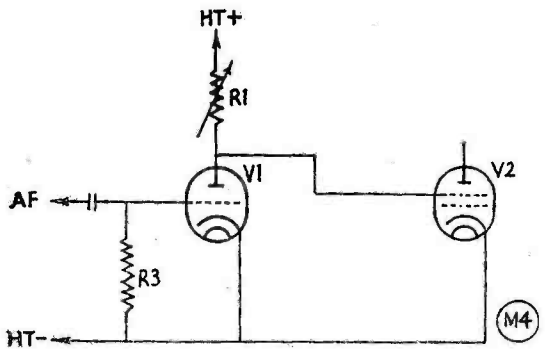


Fig. 2. Clamp Tube Modulation—which has been discussed in recent articles.

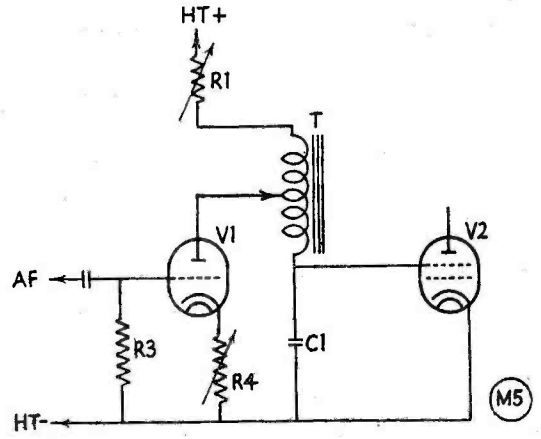


Fig. 3. An improved Clamp Tube Modulator circuit, discussed by G3ENI.

one to use and the adjustments described above should be made in the same order.

The basic adjustments and operating precautions have been described in the two previous articles and will not be repeated.

Final Observations

Fig. 5 shows, in skeleton form, an alternative circuit to that described. Although theoretically superior there is no difference between the results of either in practice. The same adjustment procedure should be adopted.

Development

In view of the fact that a controllable direct current is required for the screen grid of the power amplifier, the number of methods for screen grid modulation is limited mainly to :

(*a*) Series Modulation.
(*b*) Production of direct current by high level rectification of audio and subsequent modulation.
(*c*) Heising modulation and variants.

Of these, method (*a*) is practicable and satisfactory, but would be unnecessarily complicated if designed to meet all the requirements. Method (*b*) was described in the two previous articles.

Fig. 1 is self-explanatory and shows a circuit for Heising constant current modulation of the power amplifier (V2) screen grid. The modulator valve works in Class-A. Resistances R1 and R2 are adjusted to ensure correct screen grid voltage and to enable full modulation to be obtained without distortion. No controlled carrier action takes place.

Fig. 2 shows a variation which has become

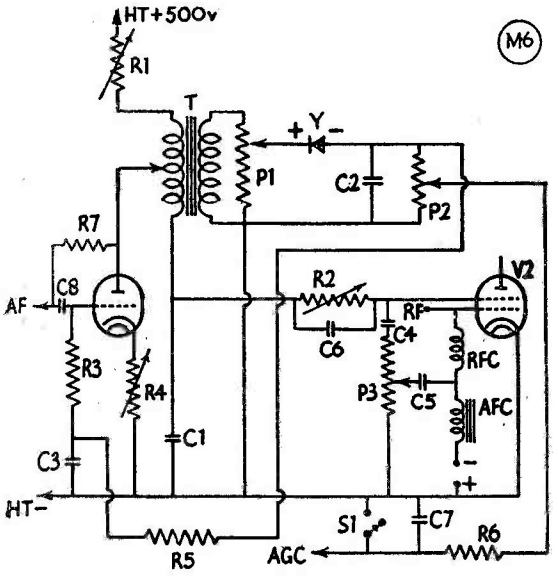


Fig. 4. The Controlled Carrier circuit as finally evolved by G3ENI and described in his article.

known as a "Clamp Tube" modulator. It has been described previously in *Short Wave Magazine*, but brief recapitulation here may be desirable. On applying audio to the input of the modulator, rectification of part of the positive cycles occurs and a negative bias is developed across the grid leak R3. This bias results in a reduction of current through V1 and an increase of voltage at its anode. This voltage increase also appears on the screen grid of V2, resulting in increased input. Meanwhile, the audio is amplified by V1 and superimposed on the screen grid voltage, thus effecting modulation. The quality resulting from this process has not been found very satisfactory, and the effects of asymmetrical speech clipping are very much in evidence. Modulation is not very full.

Fig. 3 shows a circuit which attempts to overcome the disadvantages of that in Fig 2. To start with, an impedance match of 1.4 and voltage step up of 1.2 is obtained by the inclusion of the centre tapped auto-transformer T. The effects of harmonic distortion are filtered out by means of an embryo low-pass filter which consists of condenser C1 and the inductance of the transformer. Finally, a pre-set standing bias is applied to V1 by means of the un-bypassed cathode resistance R4. This circuit is a distinct improvement over the previous one. Quality is better, modulation is more full and a variable quiescent input to V2

Table of Values

Fig. 4. Final Circuit for Controlled Carrier Working

C1	= .003 μF.	R5, R6	= 250,000 ohms, ½-watt.
C2, C3, C4, C5, C7, C8	= 0.1 μF.	R7	= 500,000 ohms, ½-watt.
C6	= 1 μF.	Y	= Selenium Rectifier.
P1, P2, P3	= 500,000 ohms, pot'meters.	T	= 1 : 1 Transformer
R1	= 25,000 ohms, 40-watt.	S1	= On-off switch.
R2	= 25,000 ohms, 10-watt.	RFC	= RF choke.
R3	= 1 megohm, ½-watt.	AFC	= AF choke.
R4	= 1,000 ohms, 2-w.	V1	= 6Y6G, triode connected.
		V2	= Any tetrode RF PA.

is obtainable on adjustment of R4. Quality of course improves with its increase.

Final Circuit

At this stage it was decided to dissociate the rectifying action from the modulator valve in an endeavour to remove all traces of speech clipping and distortion, and to obtain greater flexibility. Fig. 4 shows the circuit developed for this purpose. Audio is now taken from the secondary of the matching transformer (T) through the potentiometer P1, and is rectified by means of the selenium rectifier Y. The polarity is adjusted so that a negative voltage appears across the load resistance P2 with respect to earth. This negative voltage is applied, through a smoothing circuit (R5, C3), to the bottom end of the modulator valve grid leak. The positioning of the slider on P1 is determined by the fact that sufficient bias should be applied to V1 to enable it to pass

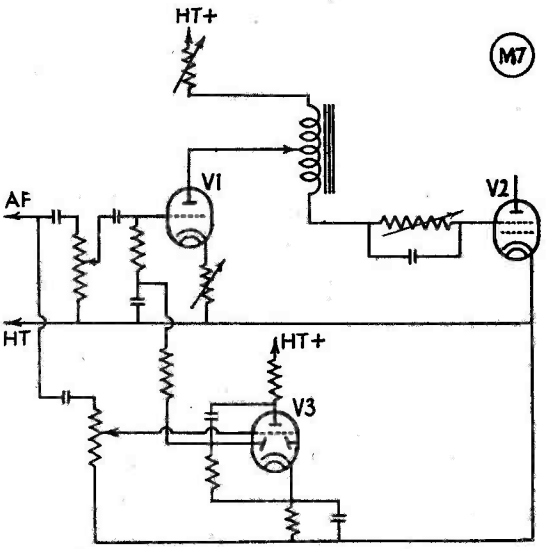


Fig. 5. Skeleton circuit of an alternative Controlled Carrier Modulator—see text.

the audio waveform without running the valve into grid current. Use of condenser C1 is not now essential, but it may be retained for the purpose of limiting the high frequency response. The time constant is determined by the values of P2, R5, C2 and C3. The attack time should be as quick as possible and the decay should last for about one-tenth of a second. The use of P1 as a high resistance input to the rectifier removes any possibility of distortion due to heavy loading of the transformer during rectification.

Protecting the PA Valve

BIAS OPERATED RELAY

C. A. WEBB (G5WB)

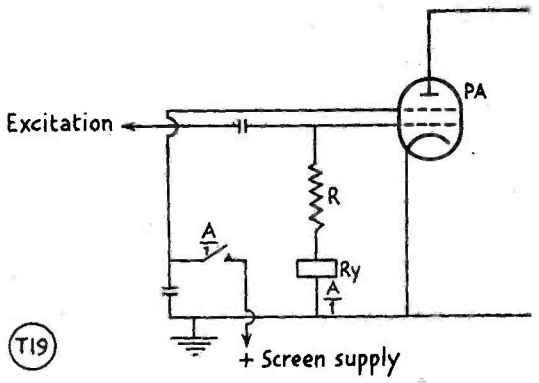
NO doubt, at some time or another, every operator has given some thought to the question of how to protect the PA valve in the event of failure of the excitation source, or the PA bias.

Bias batteries have the advantage of quietness and steadiness when new, but deteriorate when the grid current is high, with subsequent noise and fluctuation. A bias pack requires a low bleeder resistance which means a heavy and expensive filter. The protective valve, now widely used, is one solution, but is still open to the objection that the valve itself may break down, with drastic consequences for the valve it is protecting.

The system in use at G5WB has none of these objections and over a period of three or four years has been incorporated in every transmitter built. It is absolutely automatic, and has only to be used to realise the complete protection it gives.

The device consists of inserting a low current relay in the grid return of the PA valve, utilising the "make" contacts to complete its screen circuit. The transmitter is keyed in a stage prior to the PA and not until excitation is applied to the final does the relay come into operation and put the screen voltage on to the valve. The writer uses grid leak bias as it eliminates the disadvantages pointed out earlier.

It will be obvious that, with no excitation, no grid current can flow, no screen voltage is applied, and anode current is zero. Should the grid bias circuit fail, there will again be no grid current to operate the relay, and once more the valve is safe.



The circuit used by G5WB. The relay Ry cannot operate until drive is applied; it then switches HT to the screen of the valve. If drive fails or the grid resistor breaks down, screen HT is removed. The resistor R, with the relay resistance itself, should equal the total resistance required to give the necessary bias.

The only requirement is a relay that can be energised by the rated grid current, is sensitive enough to follow normal keying speeds, and has a resistance below the value required to provide the necessary bias. Any relay which has the above qualities is satisfactory. The author uses a "squelch relay" from some dismantled Service equipment and has found it excellent.

ALL-WAVE MAINS SUPPRESSOR

Readers troubled by interference from nearby domestic and industrial electrical apparatus might find it worth investigating a new mains suppressor unit offered by E.M.I. It has been designed after a close study of all forms of mains-borne interference, and provides a high degree of suppression over a wide frequency range—150 kc to 30 mc. It is housed in a neat case, easily fixed to the skirting board, and is suitable for any radio receiver or electrical appliance operating on 100-250 volts AC or DC, and drawing up to 5 amps. of current. The price is 49s. 6d. and, designated the Suppressor S.R.1, it can be obtained from E.M.I. Sales & Service, Ltd., Hayes, Middlesex.

VHF BANDS

E. J. WILLIAMS, B.Sc. (G2XC)

The Ethics of QSL'ing—

Improved Conditions and Greater Activity—

Station Reports and News—

Valediction G2XC!—

IN November, 1947, A. J. Devon handed over this department of *Short Wave Magazine* to its present conductor. Next month "VHF Bands" will be safely back in the hands of A.J.D., who so successfully aroused and maintained interest in VHF working in the pre-war period as well as the immediate post-war years. The four and a half years during which your conductor has been in charge have seen a number of notable occurrences on the VHF bands, and perhaps readers will excuse the recalling of a few of them on this occasion.

The writing of that first "Five Metres," as it was then called, was approached with a certain amount of doubt. Would there be sufficient to write about? Would anyone send along some news? As it happened, there was no need to worry. Six metres opened up in grand style and provided your previously anxious conductor with the best radio story in years for his very first effort.

February 21, 1948, produced a blizzard in southern England and prevented our attendance at a dinner in London for five-metre enthusiasts, organised by G4KD, and sponsored by *Short Wave Magazine*. At that dinner was born the idea of the Five Band Club and the VHF Century Club. The former now lists nearly 200 members, and the latter over 100.

Also, comes back to memory from the old five-metre days, the long lists of sporadic-E contacts which had to be sorted out in the summer months, and made into some sort of coherent story, not to mention the occasion when, thinking the existing bad weather would keep the band calm, your conductor went off for a week's holiday and, on his return, discovered that, within an hour of his leaving, an outsize in auroras had let the band run riot all one Sunday afternoon. That was August 8, 1948.

The following month saw the opening of the 2-metre band, where it seems auroras do not have quite so much fun; yet it has become quite normal to expect the unexpected to happen, usually just as "VHF Bands" has been handed over to the Editor, or even when it has got as far as the printers. And if sometimes G2XC has been missing when the DX was being worked, it was probably due to his spending many hours working out complicated trigonometrical calculations to determine other people's DX distances, or else delving into gazeteers to find exact QTH's and so settle a dispute as to who owned the latest record.

And now A.J.D. will be able to enjoy himself again doing likewise, and G2XC will be able to take pleasure in writing to him to point out where he is wrong! And complain that his counties' score has not been amended! Or send in a telegram announcing some new record just after "VHF Bands" has (so A.J.D. will think) been nicely finished off for the month!

But now for this month's comment and news.

Those QSL's

The numerous complaints about non-QSL'ing by prominent VHF men which have been made during recent months seem to be achieving results at last. Several correspondents have written to tell us that at least one of the culprits has recently sent out cards for contacts made up to two years ago. This is good news, but it is only a beginning and it is to be hoped that others will follow suit. Of course, the trouble now is that many of the old brigade do not know to whom they *have* sent cards! Perhaps the best scheme for non-recipients is to follow G3HVO's advice and send a card to all those on his "black list" *every* time he sends a batch to the bureau. In this way he has obtained 62 cards from 70 stations worked. However, in spite of all this, he has yet to get a card from Devon (not A. J.!), although he has worked three stations in that county.

Several people have urged the publication of a list of non-QSL'ers. G3VM thinks it would be a good idea, for he says that if his own call appeared in such a list he would know that one of his cards had gone astray and could send another. EI2W is also in support, saying that either we must carry out our obligations or throw the whole business of VHF CC rules and so on overboard. G3GHO comments: "Are some people trying to make VHF CC exclusive?" Many of the "bad boys," he says, are members of VHF CC; on the other hand, he feels that to publish a list of offenders would cause a lot of bad feeling, and as for their cards, he feels able to give them disposal instructions.

G2HIF suggests a monthly list of QSL's not received after 6 months, the individual submitting the list to guarantee that he himself is not more than three months in arrears. The main object of such lists would be to let the other man know you have not got the card he sent you (or thinks he did!) As G2HIF points out, this might avoid someone cursing the innocent.

All this we have much pleasure in passing to A.J.D. for his careful consideration!

Around the Stations

G3EHY (Banwell) has just completed 4,000 two-metre contacts in exactly three years on the band, and as he starts a new log book he has hopes of still better things to come. Particularly would he like to see more activity on this "best of all bands." Early March was good with him, but the snow and gales at the end of the month were not good for VHF DX, although he managed to keep some 100-mile schedules. Easter week-end brought an improvement with EI2W showing up on 'phone, and G2FZU producing an excellent signal from Ilkeston. G3FKO (Bath) hopes to be /P with the help of G3IWA on May 3-4 and the following week-end on top of a 750-foot hill. Similar activity is promised for other week-ends during the summer. With the exception of the mast, the G3FKO equipment is entirely transportable on a 149-cc Velocette, so it represents some careful planning and design.

G3IWA (Bath) has had his first contact with G3FIH, 8 miles away. The report was RST339, and, as the date was April 1, G3IWA became suspicious. However, the trouble was a broken feeder, so that in actual fact the contact was made without an aerial at all. The gear includes a 522 transmitter and a cascode receiver into a BC348. The aerial is a modified "City Slicker" using half-wave open wire phasing lines. G3FIH (Radstock) writes to say he is still active, and has been all the winter, although with little achieved. The gear has been overhauled, and the receiver is now crystal-controlled and uses a cascode RF stage. The 4-over-4 has been replaced by a City-Slicker, and although this latter is probably not quite as good, it makes band searching easier, due to its greater angle of acceptance in the horizontal plane. His new converter uses an 8084 kc crystal operating on its fifth overtone in a Squier circuit. No birdies are produced in the range 144 to 146 mc.

G5BM (Cheltenham) will be portable on Clyro Hill, Radnorshire, on May 10 and 11, using 145.35 mc. A new miniature transmitter has been built for both home and portable work. It uses 6F6 crystal tripler, 6AG7 FD, 832 tripler and 829B final with resonant lines. A modulator is built on the same chassis for use when portable and can modulate up to 20 watts input to the 829B. He comments that the efficiency of the long-lines circuit is noticeably better than the previous coil - and - condenser arrangement. G3IER (Cheltenham) also reports activity on Two. He is using a modified S.440.B with a City Slicker, and has worked several locals in the first fortnight since receiving his licence.

G3HVO (Parkstone) has been using 25 watts to an 829 at his home location, the aerial being a 5-element Yagi, and the receiver a crystal-controlled converter with two 6AK5 RF stages into an Eddystone 750. He tells us that G8OO is again active in Dorchester after a long illness. During the Easter week-end G3HVO went /A in London with 12 watts to an 832, a 4-element Yagi and his home converter. He wishes to thank G6TA for loaning him a change-over switch and G6QN for standing by for initial tests. G3HVO suggests that any 2-metre operator *outside* the London area who wishes to know what 2 metres sounds like *in* the London area

TWO-METRE ACTIVITY REPORT

G2HDZ, Pinner, Middlesex.
WORKED: G2FTS, 3CNF, 3DIV, 3FAN, 3FEX, 3HCU, 3HXC, 3MI, 4FB, 5DS, 5LK, 5TP, 6GR, 6JP, 6NB, 6OH, 8AO/A, 8OU, GW2ADZ, 5MA/P.
HEARD: G2FNW, 2FZU, 2XV, 3DJQ, 3FGT, 3FUW, 3GWB, 3GZM, 3HAZ, 3HVO, 3HXJ, 4MW, 5ML, 5SK, 5YV, 6YU, 8HK, 8KL. (*March* 9 *to April* 14).

GW5MA/P, Llanybyther Mountain, Carmarthenshire.
WORKED: G2AHP, 2AJ, 2BMZ/A, 2HDZ, 2HIF, 2NH, 2XC, 3BLP, 3EHY, 3FAN, 3FRY, 3GHI, 3GZM, 3MA, 4CI, 4HT, 5BM, 5DS, 5RP, 6NB, 8ML, 8OU, 8VZ. (*April* 12 *and* 13).

G5DS, Surbiton, Surrey.
WORKED: G2BRR, 2FTS, 2FZU, 2HDZ, 2KI, 2PU, 2UJ, 2UN, 2XC, 2XV, 3BLP, 3BPM, 3BVG, 3CCP, 3CGQ, 3DAH, 3EHB, 3EYV, 3FEX, 3GBO, 3GHO, 3HAB, 3HCU, 3HWJ, 3HXS, 3IAI, 3WW, 5BC, 5HN, 5LC, 5LK, 5RP, 5RW, 5UD, 5YV, 6NB, 6OH, 6PR, 6YP, 8AO/A, 8HK, 8OU, 8PX, GW5MA/P.
HEARD: G2AHP, 2AIW, 2AJ, 2AVR, 2BN, 2CRD, 2DD, 2DTO, 2FVD, 2HCG, 2MQ, 2MV, 2NH, 2TP, 2YC, 3ABH, 3ASG, 3AVO/A, 3BK, 3CFR, 3CVO, 3CWW, 3DIV/A, 3DJX, 3DVQ, 3DW, 3EHY, 3ENI, 3FFX, 3FQS, 3FUL, 3FZL, 3GDR, 3GGJ, 3GHI, 3GMZ, 3GSE, 3HAZ, 3HBW, 3HSC, 3HVO/A, 3HZK, 3MI, 4CI, 4FB, 4HT, 4KD, 4MR, 4MW, 5LQ, 5QB, 5QL, 5RD, 5TP, 5UM, 6AG, 6CB, 6GR, 6HG, 6JK, 6JP, 6LR, 6QN, 6RH, 6TA, 6UH, 6XY, 6YU, 8DV/A, 8HY, 8LG, 8SM, 8VR, 8VZ, GW2ADZ. (*March* 9 *to April* 13).

G3HVO, Parkstone, Dorset.
WORKED: G2BMZ, 2DGB, 2DTO, 2DSW, 2MC, 2XV, 3ABH, 3ABH/P, 3AUS, 3BNC, 3BPM, 3BVG, 3CFR, 3CGE, 3GBO, 3GOP, 3HCU, 3HXS, 4HT, 5RP, 5UF, 6RH, 8DV/A, 8HK, 8IL, 8OO, 8VR.
HEARD: G2FTS, 2UN, 2XC, 2YB, 3BLP, C3TM, 3DAH, 3DIV, 3EUQ, 3FEX, 3FQS, 3GAV, 3HAZ, 3HSC, 3HXJ, 4MW, 4SA, 5YV, 6AG, 6NB, 6OH, 6TS, 8DM, GC2CNC, GW8UH. (*March* 10 *to April* 10).

G3BVG, Ealing, W.5.
WORKED: G2AJ, 2AVR, 2BN, 2BZ, 2CRD, 2MV, 2TP, 2YC, 3CCP, 3CNF, 3CVO, 3DAH, 3FEX, 3FMK, 3GBO, 3GMZ, 3HSC, 3HVO, 3MI, 5BC, 5LN, 6JK, 6JP, 6NB, 6PR, 6QN, 8RH, 6TA, 8AO/A, 8NB, 8OU, 8VZ.
HEARD: G2AHP, 2DTO, 2FTS, 2FVD, 2HDZ, 2KI, 2XC, 3BNC, 3BPM, 3CGQ, 3CWW, 3DIV, 3ENI, 3EYV, 3FZL, 3FZU, 3GHI, 3GHO, 3GMJ, 3HAV, 3HCU, 4FB, 4MW, 5DS, 5DT, 5GR, 5QL, 5RW, 6AG, 8DV/A, 8KL, 8KZ, 8LN. (*March* 2 *to April* 7).

G3HVO/A, Merton Park, London.
WORKED: G2DTO, 3EYV, 3HAB, 3HSC, 4HT, 5DS, 6CB, 6OH, 6QN, 6RH, 8VR.
HEARD: G2AHP, 2AIW, 2BN, 2KI, 2FKZ, 2XC, 3CNF, 3CWW, 3EHY, 3GHI, 3GVO, 6AG, 6PR, 6TA, GW5MA/P. (*April* 12 to 14).

G5AM, Ipswich, Suffolk NGR 62/179509.
WORKED: G2AJ, 2BCB, 3ANB, 3DAH, 3DIV, 3FIJ, 3GDR,.
HEARD: G3CWW, 3CZY, 6OH.

G3CVO, Gerrard's Cross, Bucks.
WORKED: G2AHP, 2BN, 3BPM, 3BVG, 3DAH, 3EFP, 3FQS, 3GBO, 3GHI, 3HAB, 3HBW, 5TP, 6PR, 6GR, 6YP.
HEARD: G2FKZ, 2MQ, 2KI, 2YC, 3FZL, 3FEX, 5DS, 5LK. (*March* 19 *to April* 16).

G3HCU, Chiddingfold, Surrey.
WORKED: G2BN, 2DSW, 2DTO, 2FVD, 2MQ, 2PU, 2TP, 2UN, 2YB, 3BPM, 3BVG, 3DAH, 3ENI, 3FAN, 3FEX, 3FSD, 3FSG, 3GOP, 3HAB, 3HSC, 3HVO, 5DS, 5LK, 6GR, 6KB, 6OH, 6RH, 6TA, 8DM, 8DV/A, 8HK, (*March* 12 *to April* 14).

G3FIH, Radstock, Somerset.
WORKED: G2BMZ, 2BMZ/A, 2FTS, 3AUS, 3EHY, 3FKO, 3IWA, 4MR, 6NB, 8DV/A, 8HK, 8OO, GW8UH.
HEARD: G2AAW, 2AO, 2NH, 3DJX, 3IAI, 3WW, 5UF, 8IL, 8OU, GW5MA/P.

G2XC, Portsmouth, Hants.
WORKED: G2AHP, 2ANT, 2BN, 2FVD, 2IQ, 2OI, 2UN, 3ASG, 3BLP, 3BNC, 3CFK, 3FAN, 3IBY, 4HT, 4MR, 5DS, 5LK, 6JP, 6TA, 8DV/A, 8IL, 8VR, GW5MA/P.
HEARD: F8AA, 8JR, G2AJ, 2FTS, 2NH, 3EDD, 3EHB, 3GAV, 3GHI, 3HVO, 3VM, 5ML, 6AG, 8SY, GW5MQ. (*March* 15 *to April* 17).

G6FO, Buckingham. NGR 42/717344.
HEARD: G2DLJ/A, 2HCG, 2HCG/P, 2HDZ, 2PU, 2WJ, 3AVO/A, 3BLP, 3CCP, 3CGQ, 3GDR, 3GHI, 3GHO, 3HXS, 3WW, 5DS, 5UD, 6NB, 8DV/A, 8PX, 8VZ. (*April* 15 *to* 18).

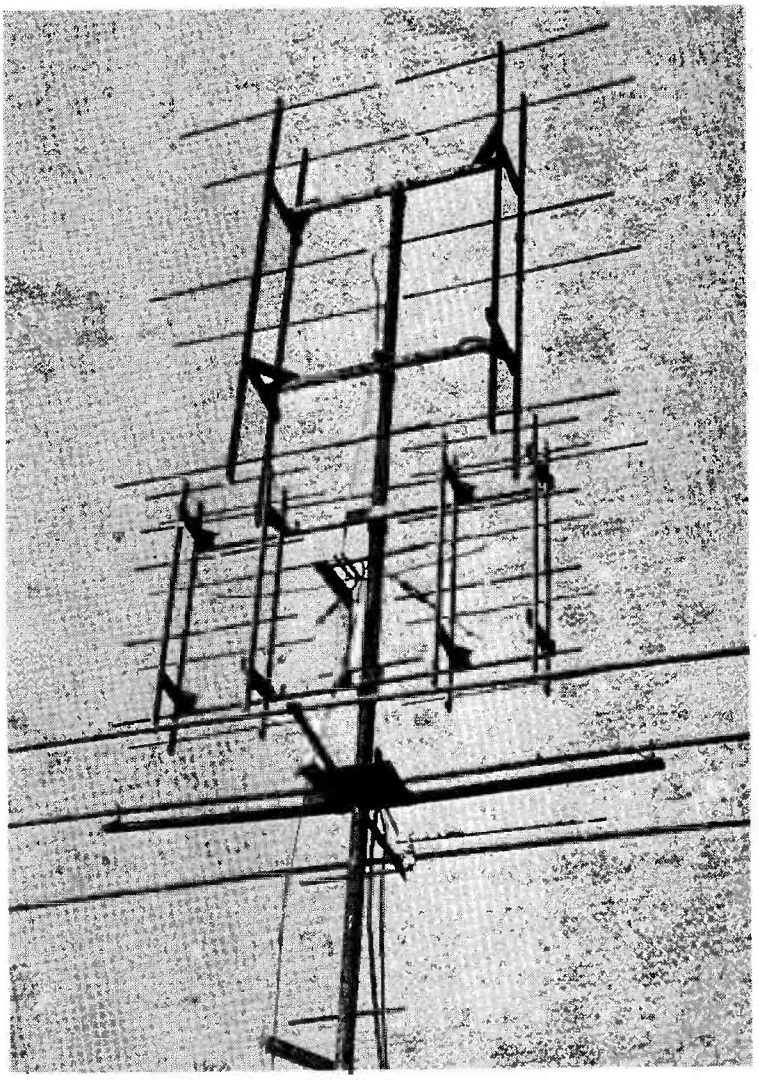
GW3ENY, Llandudno.
WORKED: G2CBR, 2OI, 3AOO, 3DA, 3FMI, 3GUU, 3HII, 5YV, 6LC, 8GL.
HEARD: G2HWC, 2HGR, 3BLP, 3BPJ, 3QV. (*March* 20 *to April* 1).

should listen on 40 metres on a Sunday morning; he was amazed at the high level of activity. G3HVO joins the Five Band Club. A new station active on the south coast is G3IBY at Lancing (Sussex).

G3AVO/A (Watlington) has been off the air for some weeks due to a spell in hospital, but we are glad to know that he is now fit again. He has taken down his beam and improved the matching. He is also experimenting with NFM and wants some information on it. G3GHO (Roade) has been active all the winter with a few exceptions, and these have usually been the good nights. He is 367 feet a.s.l., but from what he hears he feels he must be *below* sea level. G6GR (Rickmansworth) has found conditions much better than one would expect for the time of year. Fading has been bad at times, but on many occasions DX signals have been heard at remarkable strengths and the band cannot have been far from wide open. A surprisingly large number of new stations at moderate ranges have been worked, and on April 17 a very good telephony contact made with F8AA. The G6GR transmitter uses an 832 lightly run to drive a pair of Eimac 15E triodes in push-pull. These are battery biassed to cut-off with HT volts at 650; a drive of 50 mA is easily obtained and the input to the PA is 70 watts. On the subject of high modulation power on VHF, G6GR says that he can use far above the normally accepted ratio of audio-to-RF-power without any ill effects. He suggests that this may be due to the virtual impossibility of cutting off the carrier of a two-metre final by reducing HT to zero, as there is always an appreciable leak through stray capacitances from drive to plate tank. In his case, his driver power is one-third as great as the PA input! Hence, on negative modulation peaks the carrier is never completely cut-off. Finally, G6GR mentions that he will be /P at Seaview in the Isle of Wight again in August and September.

G5AM (Ipswich) has built a new exciter which is working well and driving his RK34 PA adequately. It is also TVI-proof; a wide-spaced Yagi is giving results about equal to his 6-element stack, but seems unaccountably better on some signals than others in comparison with the stack, even when both are accurately beamed. Some useful schedules have been run with G3ANB, G3FIJ and G2BCB nightly with no QRM or trouble, and he wonders what the LF chaps think about it. Further up the coast, G3CFK (Gt. Yarmouth) has been active since January, 1939, and now joins the Five Band Club. He uses a 4-over-4, while the Tx is an 832 final. A 3 x 6J6 converter works into a 640 Rx. G3CFK also joins the Five Band Club.

G3VM (Norwich) has always seemed to miss the openings on Two, and generally has found both activity and conditions poor when he has been on the band. He reports G5IX active at weekends on 144.7 mc from Swannington, Norfolk. G3AJP and G4PV



The aerial array at DL3FM (Mulheim-Ruhr), who can receive on 70 cm and has done very well on Two—see April "VHF Bands."

are also active. G3WW (Wimblington) sends news of the doings in and around Cambridge. G3WW himself has acquired an auto-sender and asks that nobody be alarmed if they now hear a perfectly-sent CQ on CW! Amongst recent contacts have been G2COP (Lichfield) and G2FFG (Shefford). G3AKU, we understand, is likely to be going /P, perhaps in Rutland, while G2XV did *not* go /P in Dorset at Easter, as originally intended.

G2FQP (Ramsey) joins the Five Band Club. He first came on 145 mc in October, 1949, and since then has been regularly active, as the Counties Table will show. He says there are now three stations active in Peterborough: G3DJM, G3EEL and G3EHG. G6YU (Coventry) reports having heard G3BW twice recently. G5ML (Coventry), on 144.42 mc, still hopes for some super-DX and asks "where is everybody between 1830 and 1930?" Main occupation at G5ML is the construction and destruction of beams. Amongst those tried out recently are a 4-over-4 with very wide spacing of elements, delta matching from 300-ohm tubular and 55 feet high; a 4-over-4 with 0.2 spacing fed with 150-ohm line and 36 feet high; an 8-element stack; a 12-element stack and a 5-over-5 (at present under construction). So far, tests show the first of these to be easily the best. (Cheers from G2XC, who uses the same), and the stacks fail to do their stuff in comparison. Future plans at G5ML include a portable outing to a point 4 miles NW of Coventry.

G5YV (Leeds) has had an indirect report that his signals were heard on two metres by CT1BW last September. He is trying to get this confirmed. During more recent weeks he has found conditions excellent on many occasions, although usually not much activity. ON4BZ has been worked twice, and contact made with EI2W, who is on about 144.1 mc.

Among the more exciting events of the month was G5MA's visit to Carmarthenshire, where, operating as GW5MA/P 1319 ft. up on Llanybyther Mountain, he provided a new county for many southern stations. A full list of these is given in the Activity Report. The input was about 12 watts to 2-6C4's. Conditions were not in any way oustanding during the Easter week-end, but GW5MA/P managed to work some 23 stations, including several in the London area. In North Wales, GW3ENY (Llandudno), who joins both Five Band and VHF Century Clubs, has been active since mid-March; he is using 25 watts to an 832, while the aerial is a 3-over-3 fed with open wire and about 75 feet a.s.l. at low tide. With the portable rig a 6-element stack is used.

G2HDZ (Pinner), one of the lucky Londoners to work GW5MA/P, only did so after many attempts, and mentions that G4HT only managed to raise the Carmarthen station after he had dismantled his beam and polished the elements! G2HDZ found it necessary first of all to empty the water out of his 300-ohm tubular feeder, after which it worked at once. G3EYV (S.W. London) has noticed signs of an awakening on the band. Some of the old call-signs which have been missing since the autumn are creeping back. G4CI (Worcester Park) asks us to give G5MA fullest credit for his trip to Carmarthenshire, as this involved a very intensive preparation, including the design of much new equipment. G2AHP (Perivale) is busily working on his new transmitter, but is having some trouble with keying. Regarding conditions, he has been finding slow, deep fading a nuisance recently. G3BVG (Ealing) has had trouble with mains transformers. He was very pleased to be the first to contact G8AO/A moored off Limehouse and testing. It is hoped that G8AO/MM may soon be in operation. G3BVG is anxious to get reports from the north, as he is having difficulty in working in that direction. G3BLP (Selsdon) is having some trouble with QRM from a local power station.

EI2W (Dublin) recommenced operations on April 1, but found conditions generally poor during the earlier part of month. EI9N provided a strong local signal. G3FMI was a good signal on April 3, and GI3GQB has been worked almost nightly at excellent strength. Other GI's active include GI2HML, GI3AXD, GI3BIL and

TWO METRES

ALL-TIME COUNTIES WORKED LIST

Starting Figure, 14

From Fixed QTH Only

Worked	Station
54	G2OI, G3BLP (522)
53	G3EHY (340)
52	GW5MQ (186)
48	G2AJ (408)
47	G2NH, G3BW, G5WP, G6NB, G8SB
46	G4HT (476), G5BY, G5YV
45	G6XM (356)
44	G2XC, G3ABA (222), G4CI, G5MA
43	G3COJ, G3WW, G5DF
42	G5BD, G5DS (329)
41	G3BA, G3DMU, G5BM
40	G3BK, G3CGQ, G8OU
39	G2IQ, G4SA, G5LI (285)
38	G3APY, G3VM (208), G6YU (140)
37	G2FNW, G2HDZ (257), G8IL
36	G3CXD, G3FAN, G6CB (312), G8IP
35	EI2W, G2FQP
34	G3AVO/A, G3HAZ (113), G4RO, G5JU
33	G3FZL
32	G2AHP, G6CW, G8QY
31	G3HBW (115), G5RP
30	G2HIF, G5NF
29	G6CI
28	G5ML
27	G2FVD, G3BNC, G3DAH, G3GSE, G3HCU, (152) G6GR
26	G3CFR (125), G3FIH, G4MR (170)
25	G5SK, G8VR
24	G3FD, G3FXG, G3GBO, G8KL
23	G5PY
22	G3AEP, G3BPM, G3CWW (221), G3GOP (100), G8IC, GM3BDA
21	G3AGS, G5MR, G6XY
20	G3EYV, G6TA (123)
19	G3SM, G5LQ (176)
18	G4LX
16	G2AOL, G3FRE, GC2CNC, GM3EGW
15	G2DVD
14	G3CYY, G3FEX

Note: Figures in brackets after call are number of different stations worked. Starting figure, 100.

TWO METRES

COUNTRIES WORKED

Starting Figure, 8

12 G3BLP (DL, EI, F, G, GC, GD, GI, GM, GW, ON, OZ, PA).

11 G5YV (DL, EI, F, G, GD, GM, GW, ON, OZ, PA, SM).

10 G2HDZ, G6LI, GW5MQ.

9 G3WW, G5BD, G5DS, G6XM.

8 G2AHP, G2FQP, G2XC, G3ABA, G3BK, G3EHY, G3VM, G5BY, G5MA, G5UD.

GI6VU. Several G's have also been worked from EI2W. On April 9 the 32-element array crashed during a storm, and a temporary 5-over-5 was erected for use during the Easter week-end. It performed very well, and employs a special coupler mounted in the centre (*see* January *QST*).

The tables scattered through the story this month re-state the two-metre records to date and remind us all once more that there are records to be broken, countries to be worked and new achievements to be chronicled during this coming VHF season. Operators who qualify are invited to join the Countries Worked and DX Marathon Tables—and, of course, we also want to keep the Counties Worked tables right up-to-date. Remember, too, that comprehensive lists of active stations, with QTH's, appeared in *Short Wave Magazine* for December, 1951, and February, 1952.

Seventycems

G3CVO (Gerrards Cross) has been busy on 70 cm. He is using a 6J6 overtone oscillator to get to 72 mc, followed by 6J6 to 210 mc, CV53 to 430 mc, and then a CV53 PA, output being about 6 watts. A helical beam and a 6-element Yagi are available. The converter uses a 6J6 osc. trebler, CV102 mixer and EF54 first IF, all up on the pole. Output is on 45 mc and is fed to TV set or other IF amplifier. He mentions that G5ZT/T (Plymouth) is transmitting pictures on 425 mc with an 832 trebler and requires reports and help. GI3FWF/T is also trying out vision, while G3AKJ and G3CVO hope to be /P/T at Dagenham in August. G3CVO would like to hear from anyone who has an ex-No. 10 Set CV90 cavity.

G3EHY bemoans the apparent lack of enthusiasm for the 70 cm band, but hopes that a really good spell on Two might pave the way for some 70 cm work. GI3HXH (Derry) would like information on the P29 receiver which covers the 70 cm band. G5ML has two modified ASB8's working on 70 cm, and contemplates constructing a 24-element stack later in the year. He will be glad to make schedules with any other Midlands stations.

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/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/EI	GC2CNC-EI2W	8/10/51
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/GM	GI2FHN-GM3OL	1/7/49
GI/GW	GI2FHN-GW3ELM	8/7/49
GM/EI	GM3BDA-EI2W	12/6/51
GW/EI	GW2ADZ-EI8G	19/4/51
DL/OZ	DL6SW-OZ2FR	4/3/51
DL/SM	DL2DV-SM7BE	10/3/51
EI/ON	EI2W-ON4BZ	21/9/51
ON/OZ	ON4BZ-OZ2FR	3/6/51

E.J.W. HANDS BACK TO A.J.D.

With this issue, Ted Williams (G2XC) relinquishes the responsibility of producing "VHF Bands"—a task which he has long performed with great skill, steady devotion and conspicuous success. Our new contributor will be another old friend, A. J. Devon, who in fact established this feature fourteen years ago and has himself been the originator of many VHF activities. The identity of A.J.D., though often guessed at, has never been revealed. He is of course an active VHF operator, who spends many hours just listening. In taking over "VHF Bands" once again after a long absence, he asks for the continued support of old friends and he hopes also to make many new ones from among those of his correspondents who have come on VHF during the last four years.—*Editor.*

Sayings of the Month

"We hope to work out of the country this year" (G5ML) . . . "How can GI stations in Belfast ever hope to get near the century mark unless every contact sends his card?" (EI2W) . . . "I think all stations should give their QTH when calling, especially when they are not beamed on you" (G3BVG) . . . "I notice that some of the stations who only come on at competition times or, say, when GW5MA/P is operating, find their pet frequency occupied by a newcomer to the band" (G2AHP) . . . "I hope that all those stations who worked GW5MA/P will show their appreciation of his splendid effort by sending him cards without delay" (G2HDZ) . . . "As far as I know, I have QSL'd 100%, but if *anyone* has not had one *when promised,* will they please contact me *forthwith*" (G3WW) . . . "I've yet to hear G2FVD" (G2HIF) . . . "This year one hopes to work GD-GI-GC and EI at least, leaving VE and W to the DX hounds!" (G3VM) . . . "I have not yet had a card from G— or G——; is it poverty, pride or procrastination?" (G5AM) . . . "I can't preach, as I wasn't on much myself in December or January—it's too cold in the shack" (G6GR) . . . "Heaven help us if the suggestion to use NGR's as numbers in Contests was adopted. At least, it would slow up G3BLP" (G3GHO) . . . "I could only work one or, at the most, two stations at a time during my /A expedition in London" (G3HVO).

TWO-METRE PROGRESS

British Records

		Miles
Sept. 1, 1948	G2BMZ-G6LK	140
Sept. 5, 1948	G2AJ-G5MQ	164
Sept. 14, 1948	G5BY-G5MQ	220
Sept. 14, 1948	G3APY-G5BY	227
Sept. 17, 1948	G5BY-G6OS	287
Nov. 12, 1948	G5BY-PAØZQ	380
Jan. 1, 1949	G2BMZ-PAØEO	384
May 13, 1950	GW2ADZ-PAØHA	417
June 28, 1950	G5BY-DL3FM	470
Sept. 13, 1950	G2BMZ-DL4XS/3KE	520
June 1, 1951	G5YV-SM7BE	602
Oct. 9, 1951	G5YV-F9MG	620

TWO-METRE DX MARATHON

Station	Miles
G5YV (F9MG)	620
G3EHY (OZ2IZ)	580
G6LI (SM7BE)	566
G5BY (DL4XS/3KE)	540
GW5MQ (OZ2FR)	526
G2BMZ (DL4XS/3KE)	520
G3HAZ (OZ6PX)	519
G3DIV/A (OZ2FR)	501
G2HDZ (OZ2IZ)	497
G2XC (DL3MH)	486
EI2W (ON4BZ)	455
G6CW (OZ2FR)	452
G3WW (OZ6PX)	432
G3BNC (DL4XS/3KE)	420
G8VR (DL3NQ)	417
G6XM (DL4XS/3KE)	415
G5BD (DL4XS/3KE)	412
G3BK (DL3MH)	411
G4LX (OZ2IZ)	408
G8AO (OZ2IZ)	404
G3ABA (DL1LH)	400

Minimum distance for this Table is 400 miles. Claimants should state NGR or Lat. and Long. for both ends of contact.

Personal

And so your conductor comes to the end of his last "VHF Bands." Perhaps he had better make it clear that the only reason for relinquishing the task is entirely a matter of his now having insufficient time available for it, with so many other commitments. It has been good fun, writing "VHF Bands," and many friends have been acquired as a result—and, possibly, a few enemies, but not too many, it is hoped! The consistent support which has been given by the VHF fraternity in general has been very greatly appreciated, and particularly pleasing has been the fact that many of you have not been offended when your ideas have not found favour in this column. Your regular monthly letters will be greatly missed, and in their place G2XC will have to get used to sending along a monthly report to A.J.D. Much, if not all, depends on these regular letters, so please continue to send them in to "VHF Bands," where it is certain your new (or not so new?) conductor will receive them with gratitude.

Once again, chaps, many thanks for the support. CU on Two!

In Conclusion

Next month's letters, reports, comments, claims, news, suggestions, and ideas should be addressed to A. J. Devon, *Short Wave Magazine*, 55 Victoria Street, London, S.W.1, to reach him **by May 16** latest.

TWO METRES

COUNTIES WORKED SINCE SEPTEMBER 1, 1951

Starting Figure, 14

Worked	Station
45	G3EHY
43	GW5MQ
41	G5YV
37	G3BK, G3WW, G5DS
36	G4HT
35	G2XC
34	G5MA
33	G4SA, G3FAN
32	G2NH, G2HDZ
29	G6YU
27	G2FNW, G3VM
26	G2AHP, G2FVD, G3AVO/A, G8IL
23	G5ML
21	G2OI, G3BNC, G6CB
20	G2FQP, G4MR, G6TA
19	G3CWW, G3GHO, G3HCU
18	G8VR
16	G3FIH, GM3EGW
15	G3GOP, G6CI

Note: This table will run for one year until August 31, 1952.

Versatile Two-Stage Transmitter

GIVING FOUR-BAND OPERATION

R. L. PLUCK (G4AY)

To the 25-watt man, or QRP operator wanting a simple transmitter design capable of operation on several bands, this article will be of particular interest. Giving CC or VFO control at will, it can be built economically in terms of both cost and space.—Editor.

THE writer is a member of that not inconsiderable body of radio amateurs who have two main considerations to bear in mind when planning the construction of transmitting equipment, *viz.*:

(1) Cost, and (2) Compactness. (All gear at G4AY is housed in an oak cabinet and operated in the living-room.)

These factors largely determined the production of the circuit shown in Fig. 1, which, it is claimed, constitutes a versatile Four-Band transmitter with optional crystal or VFO control at a very low cost.

The ubiquitous 807 valve is employed in both oscillator and power-amplifier stages, and performs excellently on the low HT voltage used on the oscillator to minimise the possibility of frequency drift on VFO.

Circuit Arrangement

The oscillator, it will be seen, is either Hartley connected or crystal controlled, depending on whether the toggle switch S1 is open or closed. With this switch in the open position, the 807 operates in a Pierce crystal circuit, and it should be noted that it is *not* necessary to remove the Hartley coil from its socket when running on the crystal.

The fixed capacity Cx from grid to earth will generally be found necessary to ensure optimum output from the CO, unless the crystal employed is of very good activity, in which case Cx may be omitted. An average value for this capacity is 50 $\mu\mu$F, but is best found by trial and error.

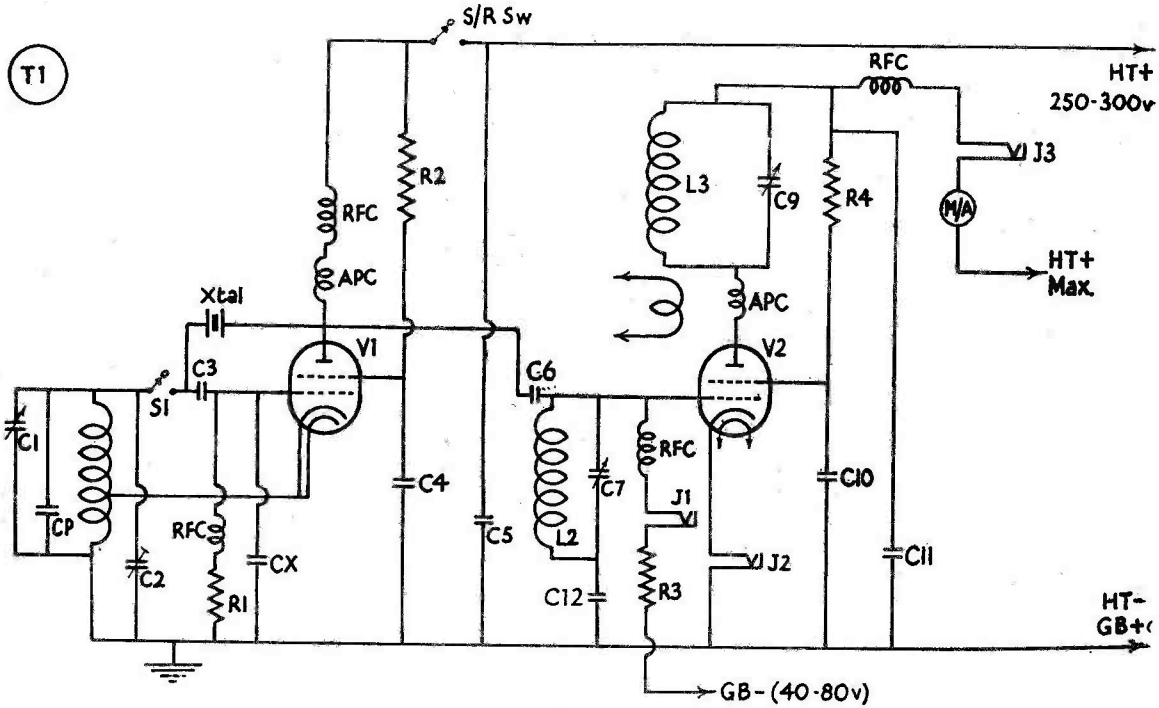


Fig. 1. Circuit of the 807 two-stage four-band transmitter suggested by G4AY. APC are aperiodic RF chokes, and the condenser from the bottom of L2 to the base line is C12, of .001 μF.

With switch S1 closed and crystal removed, the oscillator circuit becomes the familiar electron-coupled Hartley with choke-capacity coupling from the anode to the grid of the following PA stage.

This Hartley circuit is "sure-fire" in operation and gives a large RF output, a point to bear in mind when switching over from crystal to VFO. In the writer's case, the output on 1.7 mc when using the Hartley is about one-third greater than is obtained from the Pierce crystal circuit on the same frequency, and a small readjustment of the PA grid tuning condenser may be necessary to bring the drive down to a reasonable level.

The 807 power amplifier stage is quite conventional in design and operation, and neutralisation has not been found necessary. An external source of bias is used in preference to the more common cathode-resistor system, and ensures efficient operation of the PA together with a good control of the valve operating conditions. Either an old HT battery

FREQUENCY TABLE

OSCILLATOR MC	PA GRID MC	PA OUTPUT MC
1.7	1.7	1.7
1.7	1.7	3.5
1.7	3.5	3.5
3.5	3.5	3.5
3.5	3.5	7.0
3.5	7.0	7.0
3.5	7.0	14.0

Table of Values

The G4AY Two-Stage Transmitter

CX	*See text.*		
C1	150 μμF main tuning.	R1	20,000 ohms.
C2	60 μμF preset.	R2	30,000 ohms. 5 watt.
C3	200 μμF mica.	R3	20,000 ohms.
C4-5	.002 μF.	R4	30,000 ohms. 10 watt.
C6	50 μμF mica.		
C7-C9	100 μμF variable.		
C8	.01 μF.	S1	Midget toggle switch.
C10-C11	.002 μF.	SRS	Send-Receive switch.
Cp	Padder about 100 μμF.	J1-J3	Closed-ckt. jacks.
L1	24 turns 19 SWG enamelled wire close wound. Cathode tap 9 turns from earth end.	Xtal	Crystal in plug-in holder.
		V1-V2	Type 807.
L2-3	Plug-in coils to suit band in use.		
	APC	Anti-parasitic choke, 20 turns 19 SWG enamelled on 1 meg. resistor.	

or "HT eliminator" can be used, but if the latter it must be well smoothed. This external bias arrangement is also most satisfactory if grid-bias modulation is contemplated, and a jack is incorporated in the GB lead for the audio injection.

The tuned grid circuit of the PA permits doubling if required, thus enabling the PA valve to operate "straight through" on, say, 3.5 mc with the oscillator on 1.7 mc.

By making the Hartley oscillator tuned circuit cover both the 1.7 and 3.5 mc bands on one coil, it will be seen that output can be taken on four bands in a variety of ways. The Table makes this clear. The input to the PA stage depends on the HT resources of the constructor, and may be anything between 350-550v. At G4AY only low power is used, and a 350v. pack suffices.

Construction

The circuit described can be built up in almost any form to suit individual requirements, and component values are by no means critical. It is recommended, however, that the power supply be built on a separate chassis and connected by the usual plug-and-socket method to the transmitter unit. Wiring of the Hartley circuit must be rigid, but the writer has found no need for elaborate screening precautions. Both oscillator and grid coils are wound on standard 1¼in. British four-pin formers (Eddystone plug-in type).

The combination of fixed padding, preset and main tuning condensers for the Hartley results in both high stability and ease of tuning coverage for the 1.7 and 3.5 mc bands. A slow-motion drive for C1 is not really essential, but can be added as a useful refinement. The power-pack employed by the writer, as already mentioned, gives an output of 350v. and employs choke input filter, as neon stabilisers are not incorporated. Good transformer regulation and a substantial bleeder resistance are, of course, essential.

Operation

Keying of the transmitter can be effected in any of the usual ways, cathode keying of the PA valve being favoured by the writer, and with this system a truly T9x note is obtained on VFO operation. If it is desired to key the oscillator, neon stabilisers should be put in on the power supply to this stage to prevent any possible tendency towards "chirp."

To tune up on crystal control, it is only necessary to resonate the two tuned circuits of the PA stage with the crystal in use, C1 being inoperative. The PA anode circuit is adjusted for minimum current dip, and output is taken *via* link coupling to the aerial.

On VFO, an absorbtion wave-meter is necessary to check the oscillator frequency, and an accurate independent frequency check must be made before the transmitter is put on the air. It is advisable to allow about 7 minutes' warming-up period before using the Tx on a radiating aerial, frequency drift on VFO being absolutely negligible after this initial period.

Conclusion

It is not intended that the circuit details given in this article should be rigidly followed by an intending constructor, as there is nothing better than a certain amount of "trial and error" practice to suit individual requirements. However, the information herewith and the circuit should prove useful to anyone wishing to build an inexpensive yet versatile little transmitter conforming to modern amateur practice.

J. BULL & SONS

It is reported that Mr. Ian Baxter has been appointed a director of J. Bull & Sons, the well-known mail order house. Mr. Baxter is now in his 10th year with the company and was general manager before joining the board.

XTAL XCHANGE

Insertion in this space is offered free, but is confined to exchanges of crystals only; buy-or-sell notices can *not* be accepted. Offers should be set out in the form shown below, on a separate slip headed "Xtal Xchange — Free Insertion," stating whether calibration certificates are available. All dealings should be discussed direct.

G3CEG, 5 Byron Road, Cheltenham, Glos.
Has 8072.73 kc crystal, no certificate, ¾in. mounting. Wants 8000 or 10,000 kc, similar mounting.

G3CEU, 56 Chilvers Bank, Baldock, Herts.
Has FT243 4035 kc, Temco 4015 kc (7), 6000 kc (2), ¾in. spacing, no certificates. Wants frequencies 3500-3575 kc.

G3FIT, 20 Stradling Avenue, Weston-super-Mare, Somerset.
Has Brookes 7042 kc crystal, ¾in. mounting, certificated. Wants crystal 3520 kc, or near, with certificate.

G3FPK, 79 Murchison Road, London, E.10.
Has 8001.43 kc and 8007.7 kc crystals, ¾in. mounting. Wants any frequency 8047-8070 kc, or overtone crystals suitable for VHF Zone J.

G3IAN, 2 Grinton Avenue, Welbeck Street, Prince's Avenue, Hull, Yorks.
Has 3725 and 3800 kc crystals, FT-171-B ¾in. mounting, no certificates. Wants any frequency 7005-7050 kc.

SWL, 1 Hillington Road, Edgeley, Stockport, Cheshire.
Has Type R5587 6013.3 kc crystal, ¾in. mounting; FT243 6500, 6600, 7600; 7775 kc, ½in. pin spacing; and FT243 57 mc X-cut crystal. Wants frequencies 1800-1900 kc, 3500-3575 kc, 7000-7050 kc, and 100 kc, 500 kc and 1000 kc bars.

WORLD'S FIRST FIVE-CORE SOLDER

A closely-guarded secret, disclosed at the opening of the R.E.C.M.F. Exhibition on April 7, was the development by Multicore Solders, Ltd., of the world's first five-core solder.

This new type of Ersin Multcore Solder has five separate cores of flux, with each core situated very close to the circumference of the wire. Extremely rapid melting of the solder and quick liberation of the flux is achieved by the flux area being concentrated in the outer 10% area of the cross-section of the wire.

Advance samples of the new five-core Ersin Multicore Solder were shown at the Exhibition, including wire in 22 SWG which was little thicker than a hair. When magnified, the five separate cores could be clearly seen.

Multicore Solders, Ltd., were the first firm in the world to manufacture solder wire containing more than one core of flux; and their Ersin and Arax Multicore solders, incorporating three and two cores of flux respectively, have enjoyed world-wide sales, supplies manufactured in England being exported to more than 50 countries overseas.

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DON'T FORGET

That we can still supply the *DX Zone Map* (6s. post free, new edition). The *Zone Map* gives you all the essential information on DX working and is a handsome addition to the shack wall.

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DR. E. W. SMITH, OF TELCON

The appointment of Dr. E. W. Smith, Ph.D., B.Sc., M.I.E.E., to the Boards of The Telegraph Construction & Maintenance Co., Ltd., and its subsidiary, The Selborne Plantation Co., Ltd., to fill the vacancies caused by the retirement of Lord Riverdale, was recently announced. A director of Submarine Cables, Ltd. (owned jointly by Telcon and Siemens) since 1947, Dr. Smith is one of the leading authorities on world submarine telegraph and telephone cables. His 42 years' service with the Telcon organisation, formerly as chief electrician and latterly as manager responsible for producing some 3,500 nautical miles of submarine cable a year at Telcon Works, will undoubtedly be of great value to the Board of Telcon.

Dr. Smith joined the Company in 1910 at the age of 16. In 1926 he accompanied the expedition to lay the Cocos-Perth loaded telegraph cable, primarily for the purpose of conducting research on the cable after it was laid. Similar work in connection with the Pacific loaded cable took him later in that same year to Vancouver. He was also with the expedition to Newfoundland which laid the first duplex loaded cable in 1928.

It was this work which provided him with the material for the thesis which gained for him the degree of Ph.D. of the University of London. He subsequently went to Tenerife in 1929 in conjunction with research on coaxial telephone cables, presenting a paper on the subject to the Institute of Electrical Engineers. He was elected associate member of the I.E.E. in 1924 and member in 1931.

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PHOTOGRAPHS

We are always glad to see photographs of general radio interest, for publication in *Short Wave Magazine*. Prints, which should be clear and sharp with a note describing the subject, are used as opportunity offers and paid for immediately on appearance.

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FOREIGN SUBSCRIPTIONS

We are asked to remind readers that subscriptions to all foreign technical periodicals—including *QST* and *CQ* and the American radio press generally—can be paid in sterling through Gage & Pollard, Publishers' Agents, 55 Victoria Street, London, S.W.1. When you get your sub. reminder, send them the notice with the sterling equivalent. Lists of American technical journals, covering all trades, industries and professions, with the subscription rates quoted in sterling, can be obtained on application.

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GIFT SCHEME

You may have an overseas contact to whom you would like to make an acceptable present. The answer is a year's subscription to *Short Wave Magazine*, which costs you 30s. and guarantees him a copy of one of the world's leading radio periodicals regularly for twelve months, by direct mail. Order on The Circulation Manager, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

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G.E.C. REVIEW OF THE YEAR

From the General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2, comes a very interesting and comprehensive review of the activities of this great organisation over the year 1951. While in our particular field, the G.E.C. is associated with Osram valves and cathode-ray tubes, the BRT-400 communications receiver, and telecommunications and electronic engineering generally, the General Electric Co., Ltd., is also very active in a great many other spheres of engineering, including heavy mining equipment, railway electrification and marine electrical installation. On the telecommunications side, the Review mentions multi-way telephone circuits, wide-band amplifiers for the TV cable networks, a new tone-signalling device, a power-line carrier system providing a communications network over the electricity supply lines, methods of electronic measurement, an automatic unattended one-kilowatt CW/Phone transmitter with auto tuning over the frequency range 2-17 mc, and new developments in the use of germanium crystal rectifiers in place of valves.

NEW QTH's

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

G2CIP, F. E. Moor, 6 Allerton Road, Southport, Lancs.

G2CJN, A. W. H. Wennell, 145 Uxendon Hill, Wembley Park, Middlesex.

G2FAF, J. Garbutt *(ex-ZL1AGC)*, Dock House, Victoria Dock, Hull, Yorkshire.

G2RU, H. C. Hall, 294 West Street, Dunstable, Beds.

G3APO, I. R. Richard, 20 New Church Road, Hove, 3, Sussex.

G3BRJ, L. J. N. Kirkby *(ex-VS1AW)*, 6 The Terrace, H.M. Dockyard, Chatham, Kent.

G3EKC, W. J. Blakeley, 6 Lily Avenue, Newton-le-Willows, Lancs.

G3FGN, A. C. Earl, 6 Eldon Square, Newcastle-on-Tyne, 1, Northumberland.

G3HHU, J. C. W. Ickringill, 25 Cranbourne Road, Chellow Dene, Bradford, Yorkshire. *(Tel.: Bradford 45300.)*

G3HPL, Cpl. J. Crudge, U.S.A.F., Burtonwood Air Force Base, Nr. Warrington, Lancs.

G3HUM, H. W. Powell, Sliema, Main Road, Little Wakering, Essex.

G3HWP, Ixworth Radio Club, Radio House, Stowmarket Road, Ixworth, Bury St. Edmunds, Suffolk.

G3HZP, H. D. James, 74 Woodland Road, Leicester.

GW3HZZ, D. M. Williams, Hill Crest, Pleasant View, Ebbw Vale, Mon.

G3IAF, M. J. Marlow, 158 Epsom Road, Merrow, Guildford, Surrey.

G3IBD, H. I. Martin, R.A.F. Station, H.Q. (U) Bomber Command, High Wycombe, Bucks.

G3IBG, M. Prutton, 20 Spring Road, Letchworth, Herts. *(Tel.: Letchworth 1204.)*

G3IBH, D. G. K. Guy, 7 Wellesley Road, Eastbourne, Sussex. *(Tel.: Eastbourne 6446.)*

G3IBI, R. G. Scutt, 121 Vauxhall Bridge Road, London, S.W.1.

G3IBL, F. Clay, 546 Cherry Tree Hill, Chaddesden, Derby.

G3IBN, A. R. Bailey, Scarr Croft, Parkside, Bingley, W. Yorkshire.

G3IBO, B. G. Barnard, 85 Fairview Avenue, Wigmore, Gillingham, Kent.

G3IBY, T. Wilmshurst, Harebells, Ring Road, Lancing, Sussex.

G3ICG, K. McFarlane, 3 Millais Road, Leytonstone, London, E.11.

G3ICJ, T. E. Measures, 36 Shaftesbury Avenue, New Sawley, Long Eaton, Notts.

G3IFB, F. H. Bliss, 12 Elmsleigh Avenue, Kenton, Harrow, Middlesex. *(Tel.: WORdsworth 7544.)*

G3IIP, J. L. Wennell, 9 Gordon Road, Yiewsley, Middlesex.

GI3IJM, J. R. Moorhead, 32 Hillsborough Road, Lisburn, Co. Antrim.

G3IXL, S. Horne, 7 Newland House, Avignon Road, Brockley, London, S.E.4. *(Tel.: NEW Cross 6032.)*

GW4CG/A, H. G. Hughes, Hill Top, Baglan Road, Port Talbot, Glam.

CHANGE OF ADDRESS

EI4X, V. Patterson, 49 Glenabbey Road, Mount Merrion, Co. Dublin.

EI5B, R. J. Toby *(QSL to G2CDN, 7 Prospers Road, Archway, London, N.19.)*

G2ACI, G. H. Mackereth, Oaklands, Chipping Hill, Witham, Essex.

G2AFQ, C. R. Goodall, 57 Swinton Crescent, Unsworth, Whitefield, Nr. Bury, Lancs.

G2CRF, L. H. McEwan *(ex-GW2CRF)*, 12 Villiers Close, Surbiton, Surrey.

GI2DZG, W. E. Caughey, 35 Gilnahirk Park, Cherryvalley, Belfast.

G2NR, G. F. Bloomfield *(ex-VS2CQ)*, 22 Elmwood, Welwyn Garden City, Herts.

G3AGX, L. D. Colley, 25 Chiltern Street, Selby Street, Hull, Yorkshire.

G3AJV, A. S. Eastaugh, Flat 2, 23 High Skellgate, Ripon, Yorkshire.

G3BER, W. Medland, 43 Hutton Avenue, West Hartlepool, Co. Durham.

G3DFC, Royal Air Force Amateur Radio Society, Medmenham Section, c/o F/Lt. D. E. C. Lockyer, Officers' Mess, R.A.F. Station, Medmenham, Marlow, Bucks.

G3DOQ, C. P. Pirnie, 16 The Avenue, Loansdene, Morpeth, Northumberland.

GM3DZB, A. I. Duncan, Drumduan, Bellevue Road, Banff, Banffshire.

G3EMU, I. R. N. Cline, 15 Knight Avenue, London Road, Canterbury, Kent.

G3EWE, A. P. Carrington, 15a Church Street, Dorking, Surrey.

G3FVD, R. K. Mildren, 7 Chapel Row, St. Clare Street, Penzance, Cornwall.

G3GRX, E. L. Simpson *(ex-D21B)*, 20 Ennerdale Avenue, Workington, Cumberland.

GW3GSJ, E. E. Hewins, 224 Gladstone Road, Barry, Glam.

G3HCL, F/Lt. D. E. C. Lockyer *(ex-GW3HCL/MD1D/ZC1CL)*, Officers' Mess, R.A.F. Station, Medmenham, Marlow, Bucks.

GM3HGA, J. McCall, Post Office Engineering Dept., Lerwick, Shetland.

GM3HGA/A, J. McCall, 58 Middlefield Crescent, Aberdeen.

G3HJT, V. Totten, Redstacks, Unwin Avenue, East Bedfont, Middlesex.

G3HPY, G. Mayo, 84 Carterknowle Road, Sheffield, 7, Yorkshire.

G3LS, R. W. Stewart, 1 Allendale Street, Seaton Carew, West Hartlepool, Co. Durham.

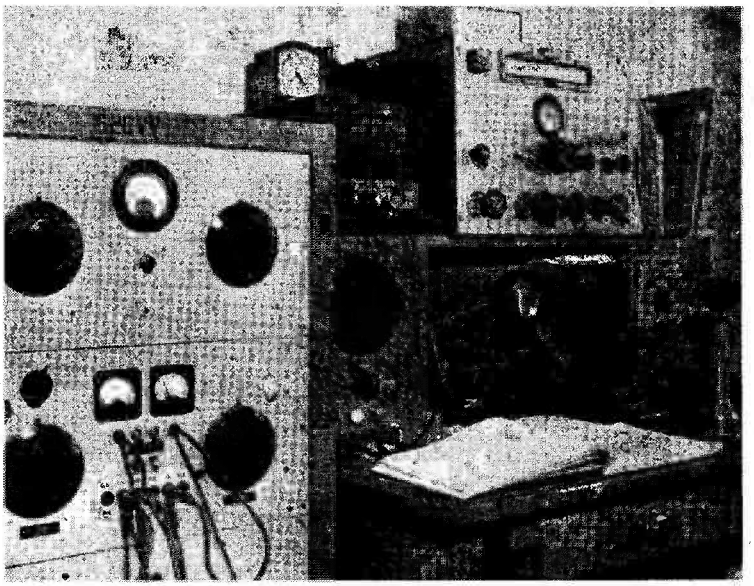
G3SB, T. C. Bryant, 15 Filton Avenue, Horfield, Bristol, 7.

GI4RY, R. Walsh, Agolagh Lodge, Cushenden, Co. Antrim.

G6HM, E. R. Henman, 34 Wimborne Drive, Kingsbury, London, N.W.9.

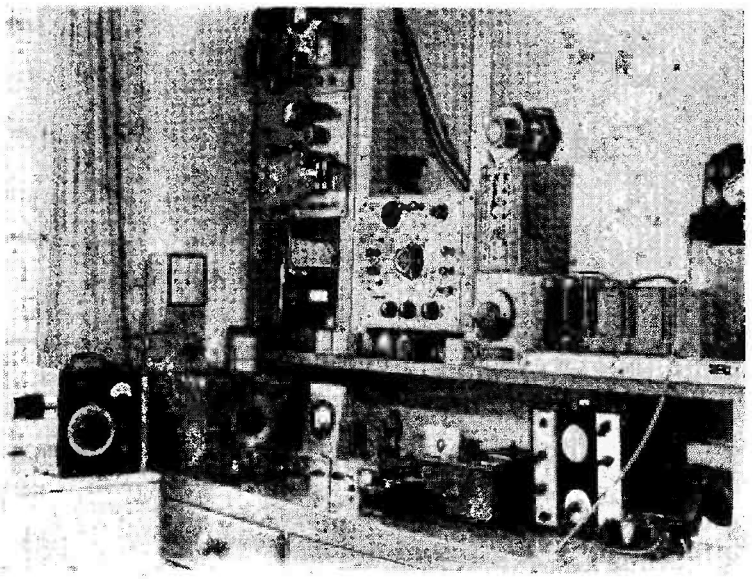
G2CVV

The Other Man's Station



THESE interesting photographs —of G2CVV, F. C. Ward, 5 Uplands Avenue, Littleover, Derby —show the present form of a station which was established first as an SWL in 1932, then as 2CVV (AA) in 1937, finally becoming G2CVV with full radiating facilities immediately on the resumption of transmitting activities after the war. Main interests are operation on the LF bands—though Twenty is used occasionally—and the construction of test gear and demonstration models.

The view of the operating position (above) shows the transmitter for 80/160, using KT41-ACO44, modulated by a pair of 2A3's driven by a speech-amplifier consisting of a 27 into a 56. (Most of these valve types will be unfamiliar to the present generation of amateurs!). The left-hand panel on the operating table carries the house inter-com unit, and the BC-348 receiver is stand-by. On the right-hand panel is a crystal calibrator, and on the top shelf a pre-amplifier for remote control working. The station main receiver is a CR-100. For Top Band operation, G2CVV is fortunate to have a 400-ft. long-wire, with a separate aerial system for Eighty.



At the test gear position (below) we see a fine array of equipment; notice also the great variety of plug and socket points, appropriately fused, on the power output panel, top left. The AC and DC power supplies are variable, and the range of gear includes an AC Bridge, Standard Condenser, Absorption Meter, Grid Dip Oscillator, Signal Generator, Crystal Grinding Test Oscillator, Oscilloscope, and a GP Test Oscillator. Most of these items, neatly built in, are home-constructed, be it noted.

The station as a whole is a reflection of G2CVV's skill and experience, and is in many ways typical of those whose owners have graduated through the successive phases of short wave activity — starting from ground level as an SWL. G2CVV himself has been honorary secretary of and prime mover in the Derby and District Amateur Radio Society since it was re-formed in 1947 from the old Derby Wireless Club, which he first joined in 1936.

The Month With the Clubs

This month we acknowledge receipt of the following Club publications: News Letter (MIDLAND), "G3BRX" (WANSTEAD AND WOODFORD), News Letter (CLIFTON), Monthly News Sheet (SANDERSTEAD AND PURLEY), and Newsletter (WIRRAL).

May we once more ask all Clubs who publish their own broadsheets, circulars, magazines and the like to forward a copy to us? We are always glad to see such publications and will, of course, acknowledge them in this space.

And, as usual, may we remind secretaries that we always want good Club photographs with which to illustrate this feature. Pictures of meetings, Club events of any kind, or just groups of members, are welcome, and payment is made on publication for all prints used.

Please address Club reports, photographs, publications and any other relevant matter to "Club Secretary," SHORT WAVE MAGAZINE, 55 Victoria Street, London, S.W.1.

Next month's deadline is **first post on May 14.**

And so to this month's reports, from 25 Clubs . . . .

Spen Valley
Radio and Television Society

Future events include a talk on Sound Reproduction (May 21), an Open Meeting (June 4) and a visit to Messrs. Brookes Motors, Huddersfield (June 18). Normal meetings are at 7.30 p.m., Temperance Hall, Cleckheaton.

Tees-Side
Amateur Radio Club

The stand at the Tees-Side Model Engineers' Exhibition was a great success. Lectures recently given covered Cathode Ray Tubes (Mr. L. M. Arrowsmith), Industrial Instruments (Mr. Braithwaite of I.C.I.), and other subjects. Informal talks have also been held. New members will be welcomed at any meeting, and the AGM will be held on the first Thursday in May.

Eastbourne and District
Radio Group

The March and April meetings were well attended, and final arrangements made for NFD. The Club is running two VHF stations in the 2-metre Field Day on May 10. Lectures and Film Strips have filled the time at other meetings; the next are on May 15 and 29. All summer visitors to the town are welcomed at the Headquarters, 333 Seaside.

Romford and District
Amateur Radio Society

A full programme was organised for April, with meetings on all five Tuesdays. They included a Junk Sale, a talk and demonstration on Test Gear, a General Talk, a lecture on Fundamentals, and a TV transmitting lecture and demonstration. Attendance at these meetings has increased greatly, but new members will still be heartily welcomed.

Worcester and District
Amateur Radio Club

The average attendance of members keeps very steady, but there is still room for improvement. Enthusiasts who have, as yet, not "sampled" the Club are asked to turn up on any Thursday evening and make themselves known. Readers are also asked to watch local shop windows for special announcements. G5JU spoke at the April meeting and was supported by G6OI, of the Stourbridge Club.

Warrington and District
Radio Society

Recent activities have included two lectures—one by G2HW on Speech Clipping, and one by G3EXG on Valve Construction. General meetings are held at the King's Head Hotel, Warrington, on the third Tuesday of the month, and lecture-meetings on the first Tuesday. Forthcoming titles are Radar Principles, Two Metres, SSB Transmission and Reception, and a number of Film Strip lectures.

Manchester and District
Radio Society

Meetings are held on the first Monday at the Manchester College of Technology, 7.30 p.m. Visitors and new members are always welcome, and should contact the Secretary. (See panel for new QTH).

Sanderstead and Purley
Amateur Radio Society

There seems to be a certain ambiguity about this Club's AGM, since we are given the date of April 24 on one sheet, and May 22 on another! We may therefore state that, if it has not already occurred, we presume that it will be on May 22.

Coventry
Amateur Radio Society

A number of interesting lectures and events have been held throughout March and April. On April 20 the MARS/CARS Contest was held, and the Club is entering for the Two-Metre Field Day on May 10-11. Forthcoming events: G2LU's Night (May 12); D-F, by G3RF (May 26); "CW," by G5GR (June 9); and an Auction Sale on June 23.

Slade
Radio Society

At a recent meeting there was a demonstration of home-built tape recorders; on May 9, G3BUR and G3BHD will talk on The Use of VHF in Mobile Radio Schemes; and on May 23, G5BJ gives a lecture on FM for amateur use. Meetings continue at the Parochial Hall, Broomfield Road, Erdington, on alternate Friday evenings; visitors are always welcome.

Ravensbourne
Amateur Radio Club

Members took part in an exhibition of work held at Holbeach Road School, London, S.E.6, last month. Home-built gear was shown by ten members. Club members will also be exhibiting gear at Durham Hill School, Downham, on May 17, when G3HEV will be in operation. Visitors are welcome to all meetings — Wednesdays at 8 p.m.

Brighton and District
Radio Club

A full and varied programme has been arranged for May and June, and various manufacturers have been approached in the hope that they will give talks and demonstrations of their equipment. Club meetings are held every Tuesday, 7.30 p.m., at the Eagle Inn, Gloucester Road, Brighton. The members voted, by a large majority, *not* to join the newly-formed Sussex Union of Radio Clubs and Societies.

Bristol and District
Amateur Radio Society

Preparations are in hand for NFD. with G3GZA as "manager." Club members hope to visit Bath to meet a visitor from Sweden who is being entertained by G2CZU. Forthcoming attractions are a talk by G3HSD on his electronic keyer and 70-cm transceiver, a visit to the local Fire Station, and, of course, the regular meetings—every Friday at Redcliffe Community Centre.

Grafton
Radio Society

The current series of lecture-demonstrations draws very good attendances, and the Morse classes also keep up the good work. Latest successes are G3ICT and G3IGE. A Creed tape machine is being used to help out with the advanced class. New members welcome at all meetings —Mondays. Wednesdays and Fridays.

Hastings and District
Amateur Radio Society

This Club held its first Dinner and Social on April 8, and, despite its recent formation, managed to raise nearly 40 members and friends for this extremely enjoyable event. Club membership now numbers about 25, and new members will be welcomed at any of the meetings—alternate Tuesday evenings at the Saxon Cafe, Hastings.

R.A.F.
Amateur Radio Society

At the recent AGM, G/Capt. A. T. Monks was elected President and W/Cdr. W. E. Dunn (G2LR) Vice-President. The Committee consists of ex-Y11HF, G3AIR, G3GNS (ex-ZB1Q), G5DV and G3HNL. G8FC is on the air on three bands every afternoon, and will be glad to contact RAF and ex-RAF amateurs. Frequencies are 3525 (1330-1430); 7025 (1430-1530); and 14025 (1530-1630)—all Mondays to Fridays on CW. On Sundays the station will be active on 3725 kc phone.

Surrey
Radio Contact Club

At the AGM, G8TB was elected Chairman and G3BLP Vice-Chairman. G3FWR remains in office as Secretary and G2DN is Treasurer. Meetings continue on the second Tuesday, 7.30 p.m., at the Blacksmith's Arms, South End, Croydon. On May 13 Mr. Betts, of the East Surrey Club, will talk on the Telekinema, and local readers, whether members or not, are welcome to attend.

Wanstead and Woodford
Radio Society

This Club recently put on a show at a local exhibition of the Essex Education Committee at Chigwell, where the Club 2-metre Tx was working. Wanstead are very keen to know whether there would be enough support for a VHF Club Contest. At the moment it seems that only a very limited number of them are actively interested in the subject—but we shall be glad to hear from those that would support such a venture.

West Lancashire
Radio Society

This newly-formed club meets on Tuesday evenings, 8 p.m., in a room over Gordon's sweet shop, St. John's Road, Waterloo, Liverpool, 22. Meetings with a set talk or attraction will be held every four weeks, the other meetings being devoted to general discussions and technical talks to help members in pursuit of a licence.

W.F.S.R.A. ("Bedfast Club")

Steady progress continues, and a panel of three Bedfast members has been formed to decide on the best uses for the Club's various assets. Mr. Harris, of Bridge Cottage, Great Bealings, Woodbridge, Suffolk, says that he can cope with many more of the "Shack Display Cards" which he produces for all those sending in donations to the Club funds. More reading matter is also required, and should be sent to John Gill, 30 Sholebroke View, Leeds, 7.

Wirral
Amateur Radio Society

Recent meetings have included Discussion Nights on Aerials and Matching Systems, and The Ideal Communication Receiver. G3ERB talked on Top Band Propagation Conditions at another meeting. Forthcoming events include a Gadget Contest sponsored by G3FRT. Membership still increases, and the Junior Section has made a good start.

Chester and District
Amateur Radio Society

Member societies of the Association of North-Western Radio Societies were well represented at the annual dinner on April 4. The Hon. Sec. of the Chester Club has taken the post of permanent secretary to the Association, which helps to improve liaison between clubs and a general exchange of ideas, including the pooling of lecturers. Chester meetings are held every Tuesday, 7.30 p.m., at the Tarran Hut, YMCA Grounds, Chester.

East Surrey
Radio Club

At a recent meeting the Club welcomed G2AJS, of Caterham School, who gave a practical demonstration of some of the uses of a double-beam scope. These included the tracing of a faulty rectifier in a receiver, and the aligning of a superhet. The April meeting was held on the 17th.

Southend and District Radio Society

At the meeting on April 25, the Hon. Sec. demonstrated the performance of a dipole and a Yagi array, and also the polarisation of electric waves, with the aid of some 2-metre gear. May 3 was the date of the Annual Hamfest, held at the Middleton Hotel.

South Manchester Radio Club

Activities continue strongly, and at the April 25 meeting a lecture was given by G3DQU on Antenna Matching. Several new members have recently joined and the club is in a healthy state. Future events are a lecture on Top Band Topics (G3HZM on May 23) and a Wire Recorder Demonstration (G3DDO, June 6).

NAMES AND ADDRESSES OF CLUB SECRETARIES REPORTING IN THIS ISSUE

BRIGHTON: R. T. Parsons, 14 Carlyle Avenue, Brighton 7.
BRISTOL: N. G. Foord, 71 Brynland Avenue, Bristol 7.
CHESTER: W. Lloyd, 124 Tarvin Road, Chester.
COVENTRY: K. Lines, G3FOH, 142 Shorncliffe Road, Coventry.
EASTBOURNE: W. A. Allwright, G2AON, 55a Latimer Road, Eastbourne.
EAST SURREY: L. Knight, G5LK, Radiohme, Madeira Walk, Reigate.
GRAFTON: W. H. C. Jennings, G2AHB, Grafton LCC School, Eburne Road, London N.7
HASTINGS: G. W. Spray, G3FXA, 255 London Road, Bexhill, Sussex.
MANCHESTER: P. Dean, Fairfields, Park Lane, Whitefield, Manchester.
R.A.F.: Hon. Sec., RAF-ARS, RAF Locking, Weston-super-Mare, Somerset.
RAVENSBOURNE: J. H. F. Wilshaw, 4 Station Road, Bromley, Kent.
ROMFORD: D. L. K. Coppendale, G3BNI, 9 Morden Road, Chadwell Heath, Essex.
SANDERSTEAD AND PURLEY: T. R. Young, G2AYM, 41 Lansdowne Road, Purley.
SLADE: C. N. Smart, 110 Woolmore Road, Birmingham 23.
SOUTHEND: J. H. Barrance, M.B.E., G3BUJ, 49 Swanage Road, Southend.
SOUTH MANCHESTER: F. H. Hudson, 21 Ashbourne Road, Stretford, Manchester.
SPEN VALLEY: N. Pride, 100 Raikes Lane, Birstall, Leeds.
SURREY (Croydon): S. A. Morley, G3FWR, 22 Old Farleigh Road, Selsdon, South Croydon.
TEES-SIDE: H. Walker, G3CBW, 64 Ayresome Street, Middlesbrough.
WANSTEAD: J. Binning, G3AJS, 150 Upton Park Road, London, E.7.
WARRINGRON: S. Wood, G3EZX, 12 Thelwall Lane, Latchford, Warrington.
WEST LANCS.: S. M. Sugden, G3GSS, 44 Gores Lane, Formby, Liverpool.
W.F.S.R.A. (Bedfast Club): J. Beavan, G3GBL, 296 Fore Street, Edmonton, London, N.9.
WIRRAL: A. H. Watts, G3FXC, Woodend, 14 Grange Crescent, Hooton, Wirral.
WORCHESTER: J. Morris-Casey, G8JC, 4 Kennels Road, Station Road, Fernhill Heath, Worcs.

BOAT RACE CONTROLLED BY RADIO-TELEPHONE

The boat race on Saturday, March 29, was controlled by VHF radio-telephone from two Port of London Authority vessels.

Specially equipped with Pye PTC 113, the *Nore* and the *Ranelagh* were under the supervision of River Superintendent and Chief Harbourmaster, Commander Coleman, R.N. (ret.). The *Ranelagh* was ahead of the two crews keeping the course clear of obstructions, whilst the *Nore* followed astern of the race. These two boats were in constant touch with each other over the radio-telephone.

Pye Radio Telecommunications provide all the VHF for the Port of London Authority vessels as well as for the P.L.A. Police.

Radio control stations for the P.L.A. boats have been set up on Tilbury and Woolwich landing-stages for the direction of ships and vessels in the Port of London.

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NEW NETHERLANDS ORGANISATION

We are officially informed that the Vereniging Van Radio Zend Amateurs (V.R.Z.A.), the Dutch Society of Radio Transmitting Amateurs, is now in being and is confined to licensed PA's only. The main reason for the formation of V.R.Z.A. is that the PA membership of V.E.R.O.N. (the Dutch post-war organisation formed by the merger of two earlier societies) amounted to 18 per cent. only of the total. The transmitting fraternity in Holland was therefore not fully represented, and felt the need for a new organisation of their own. The V.R.Z.A. QSL Bureau (P.O. Box 190, Groningen, Holland) handles cards for all PA transmitters, and the society also publishes *CQ-PA* as its own journal.

STATEMENT FROM E.M.I. RESEARCH LABORATORIES, LTD.

Certain references in recent press reports suggest that difficulties have been experienced in obtaining satisfactory results from the high-power television transmitter to be supplied to the B.B.C. by E.M.I., for Kirk O'Shotts, and that it is not yet working.

Messrs. E.M.I. therefore desire to make it quite clear that, although delays have been experienced due to the new design and to labour and material shortages, the transmitter is now operating at a higher power and efficiency than any other known television transmitter. It was, in fact, demonstrated, working, to B.B.C. senior executives some weeks ago.

★

THE QSL BUREAU

Our QSL Bureau handles cards on a world-wide basis, mainly by direct mail. Its full use (both ways) is confined to direct subscribers and BSWL members. Cards inwards are accepted for any G operator, irrespective of whether he is a subscriber.

The Bureau address is: BCM/QSL, London, W.C.1.

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BROADCAST RECEIVING LICENCES

Approximately 12,687,000 broadcast receiving licences, including 1,386,000 television, were current in Great Britain and Northern Ireland at the end of February, 1952. For the second month in succession the number of television licences has increased by more than 100,000.

Motorists are reminded that they need a separate broadcast receiving licence for a wireless set fitted in a car.

SMALL ADVERTISEMENTS

9d. per word, minimum charge 12/-. No series discount ; all charges payable with order. Insertions of radio interest only accepted. Add 25% for Bold Face (Heavy Type). No responsibility accepted for errors. Replies to Box Numbers should be addressed to The Short Wave Magazine, 55 Victoria Street, S.W.1.

TRADE

METALWORK : All types cabinets, chassis, racks, etc., to your own specifications.—Philpott's Metal Works, Ltd. (G4BI), Chapman Street, Loughborough, Leics.

ROTARY BEAM Antenna indication. Magslip transmitters from 10/- (listed £16). Stamp for circuit and full details.—Engineering Facilities, Ltd., 29 Rea Street, Birmingham, 5.

WANTED: RCA Speech Amplifiers, Type MI-11220 J or K, and Aerial Tuning Units, BC 939 A.—Offers, stating quantity and price, to PCA Radio, The Arches, Cambridge Grove, W.6.

WANTED: BC-610 Hallicrafters, ET-4336 transmitters, SX.28's, AR88's. Receivers and spare parts for above. Best prices.—Write Box 864, c/o Spiers Service, 82 Centurion Road, Brighton, Sussex.

A £1 IN THE HAND . . . Send me that list of Valves you have for disposal, and I will, by return post, offer you the best price for them ; no lot too small or too large.—Norman H. Field, 68 Hurst Street, Birmingham, 5.

ATTRACTIVE QSL's at reasonable prices ; also Club Headings. Send for samples.—Rowe, 101 Fawnbrake Avenue, Herne Hill, S.E.24.

SMALL ADVERTISEMENTS, TRADE—*continued*

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

ENGRAVING: All classes of work undertaken; prices and styles on application.—Bradleys, 23 Mill Street, Bedford.

G3CSD, 6J6, 12AT7, 10/-; EAC91, EC91, EL91, EF92, D77, 6C4, 6/6.—Skillman, Franchise Street, Weymouth.

QSL CARDS: Neat, attractive; reasonable price.—Samples, Lovedee, BRS.15643, Mill Street, Barwell, Leicester.

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

PERSONS required to undertake dignified spare-time work.—Send S.A.E. for full details to Dept. BH/113, Bentom Supply, Gray Street, Loughborough.

TRANSMITTERS Required Urgently; Types ET4336, BC610, etc.; also spares. Highest prices paid.—Pype-Hayes Radio, 606 Kingsbury Road, Birmingham. *(Erdington 4942).*

ROTARY **BEAMS**: Lightweigh Alloy Tubing for **BOOMS**:—
Lengths of 10ft. 2in. x 1⅝in. x 16s. (approx.) 25/-
„ „ 7ft. 0in. x 1¼in. x 14s. „ 18/6
„ „ 13ft. 0in. x 1⅞in. x 16s. „ 37/6
Carr. extra; element price on application.—Panda Radio Co., 58 School Lane, Rochdale. *('Phone Rochdale 47861).*

WANTED: Valves, small or large quantities; 6K8, 6V6, 5Z4, 6AC7, IR5, IS5, FW4/500, 6Q7, 12K8, 80, VU39, EBC33, 3S4, etc., etc. PROMPT CASH.—WM. CARVIS, 103 NORTH STREET, LEEDS, 7.

BC348 FILTER UNIT and DYNAMOTOR (not used in conversions); three required.—Offers to Box 1088.

SITUATIONS VACANT

CROWN AGENTS FOR THE COLONIES. RADIO OFFICER required by the East Africa High Commission for the Directorate of Civil Aviation for one tour of 48 months in the first instance. Commencing salary according to age and experience in scale £687, rising to £893 a year (including cost-of-living allowance). Gratuity between £74 and £96 a year, payable on the satisfactory completion of final service. Outfit allowance £30. Free passages. Candidates, under 40, should hold a First Class Certificate of Proficiency in Radio Telegraphy issued by the Ministry of Civil Aviation; or alteratively hold the Provisional Aircraft W/T Operator's Licence and have had not less than 1,000 hours' flying experience on civil aircraft.—Apply at once by letter, stating age, full names in block letters, and full particulars of qualifications and experience, and mentioning this paper, to the Crown Agents for the Colonies, 4 Millbank, London, S.W.1, quoting on letter M.25107.B. The Crown Agents cannot undertake to acknowledge all applications and will communicate only with applicants selected for further consideration.

SITUATIONS VACANT—*continued*

CROWN AGENTS FOR THE COLONIES. RADIO OFFICER required by Nigeria Government Posts and Telegraphs Department for one tour of 18-24 months in the first instance, with prospect of permanency. Commencing salary in scale, £711, rising to £915 a year (including expatriation pay and temporary allowance). Outfit allowance £60. Free passages for officer and wife and assistance towards cost of children's passages or their maintenance in this country. Liberal leave on full salary. Candidates must possess a Postmaster General's Certificate in Radio Telegraphy, an Air-Operator's Certificate, or an equivalent Service qualification, have a thorough grounding in I.C.A.O. codes and procedures and have had recent experience with an administration or air operating company outside West Africa in operating wireless and direction finding ground stations for air services.—Apply at once by letter, stating age, full names in block letters and full particulars of qualifications and experience, and mentioning this paper, to the Crown Agents for the Colonies, 4 Millbank, London, S.W.1, quoting on letter M.29270B. The Crown Agents cannot undertake to acknowledge all applications and will communicate only with applicants selected for further consideration.

RADIO ENGINEER with practical knowledge of R.A.F. or Fleet Air Arm Radio or Radar equipment required.—Applicants should apply in writing to Chief Inspector, A. J. Whittemore (Aeradio) Limited, Croydon Airport.

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.

WANTED: Marconi Magnetic Detector ; D.E. and Multiple Tuners ; 101, 106, 107 and 112 Receivers ; Fleming Valves ; Coherers ; and other early wireless gear, valves and literature.—FRANKLIN WINGARD, Rock Island, Illinois, U.S.A.

1355 CONVERTED Sound with RF26 p/p, Holme Moss or Sutton, £5 10s.; VCR97 Magnifier, £1 ; 6v. 8amp. Transformer, 230 volt mains, 10/-. Superhet Valves: 78, 6A7, 78, 75, 6V6 and 80 (Rect.), 25/-. Transformer to match, 25/-. Valves 1/6 each: VR92 (8); VR54 (2); VR53 (2). 2/6 each: 6H6 (4); VR56 (2); VR136 (3); 6SH7 (9). 5/- each: 6SL7 (1); VU39 (1); OZ4 (1); 6SG7 (4); 6SA7 (1); VR150/30 (1). 6/6 each: 6V6. WANTED: BC221, AR88, BC248. —Box No. 1089.

FOR SALE: BRT400, G.E.C. latest model ; brand-new ; in excellent showroom condition ; £100.—Baw, 42 Baronsmede, London, W.5.

HRO Bandspread Coils for 10 and 20 metres wanted ; must be perfect. Delivery taken in U.K.—ST2GL, c/o 51 Essex Street, Norwich, Norfolk.

CONNOISSEUR'S Tx, 150 watts, perfectly modulated ; 6ft. rack, 5 panels, fully metered, VFO, 3.5 mc ; built-in xtal calibrator ; £80 complete. Offers?—G2ASL, 68 Middle Park Road, Birmingham.

SMALL ADVERTISEMENTS, READERS—*continued*

101 SIGNAL GENERATOR ; unused, unmarked; in transit case ; complete all cables, plugs, charts.—Offers, cash or as new equipment, to: Thomas, 7 Evelyn Road, Skewen, Glam.

HRO and 35-watt Tx for sale. Best offer over £30 secures.—18a, Station Road, West Drayton.

R 107, good condition, £10. Two Type 47 p/packs, 1200v., 200 mA (one requires slight attention), pair £5. PT15 (3), CV57 (4), 100 kc xtal, 1000 kc xtal, 10/- each. Auto Transformer: 230v. in ; 110, 150, 190 volts out, 1.6 KVA, 30/-. TU5B, 15/-. Carriage extra. — 2, Leawood Road, Trent Vale, Stoke-on-Trent.

FOR SALE: RME-69 with DB-20 unit ; also super 150w. six-deck Tx. All-band, 813 final—TZ40 Modulator—VFO or crystal ; all Woden transformers ; hardly used. Set new spare valves, inc. two 813's. Separate or lot.—Sensible offers, please, to: Coates, Greenways, Crofton Lane, Orpington, Kent.

SALE: HRO, excellent condition, £27 10s., or part exchange AR.88, SX.28. — Details (S.A.E.) Lancs., Box 1079.

R 1155A, little used, as new ; also well-smoothed mains power pack and output stage for same, 15 gns. All or near offer. — Cornerways, Exeter Road, Honiton, Devon.

FOR SALE: Eddystone 640, as new, complete with matching speaker and phones. This is a genuine bargain in perfect condition ; £20.—Box 1080.

WANTED: Receiver (ready for working) for Television sound, 10, 20, 40 and 80 metre bands.—Walker, Hilbre, Oldfield Drive, Heswell, Wirral.

SALE: R.1155F, £5 ; BC624, 20/- ; RF24, modified, 10/-; 80 valves ; 723A/B, 30/-; CV129, 40/- ; 5CP1, 20/- ; etc. *Short Wave Magazine*, January, 1948 - August, 1951. Numerous other components. S.A.E. details.—Colgrave, Grange Farm, Welford, Nr. Rugby.

CARAVAN TO LET, 4-berth, fully equipped ; situated Whitecliffe Bay Caravan Site, nr. Bembridge, Isle of Wight. Booking (Saturday to Saturday). Any period, May to September, except first and last weeks of June and from July 19th to 30th August inclusive.—G3YK, 32 Emerson Avenue, Middlesbrough. *('Phone 87557).*

SALE: CC Exciter, 6V6-6L6-6L6, with coils for all LF bands ; Band-switched p/p 813 PA for 80 to 10 metres. All first-grade components and ready to operate ; £15 together or offers separately.—G6ZH, 4 Estcourt Street, Devizes, Wilts.

EDDYSTONE 750 ; 669 Strength Meter ; 688 Speaker ; all immaculate. First £50 (or nearest above £45) secures despatch passenger train. Letters answered.—Moses, 65 Railton Avenue, Crewe, Cheshire.

DST100 WANTED, any condition ; also Gen. on this receiver. What service used it? Has it another name? Who was the manufacturer? Any information welcomed.—G. Mogg, Kinross, Lavernock Road, Penarth, Glam.

SMALL ADVERTISEMENTS, READERS—*continued*

MARCONI TNS2 Transmitter Type 8 Power Pack, 1000v. 500 mA, less valves; 60ft. telescopic aerial mast. Lot £20, O.N.O.?—Pratt, Hoyland, Vicarage, Barnsley.

WANTED: Late Model U.S.A. Communications Receiver; Hallicrafters, SX71 or SX62, or similar model.—Write full details, price required, Box No. 1081.

GARRARD Auto-Changer, 10/12-in. unmixed, crystal pickup, replaced by 3-speed model; perfect; £7 10s. (carr. pd.). 5CP1, mounted in part-stripped APN4; bargain, £2 (carr. extra). Pair 807's, new and boxed, with ceramic holders; £1 (p.p.). WANTED: Command Tx, any condition; state frequency.—G3HLJ, Blackmorevale Square, Gillingham, DORSET.

HRO, 8 coils, 2 power packs, £25; 50-watt xmitter, CW/Phone, complete, £10. Valves, wavemeters, numerous items.—239 Bath Road, Hounslow West, Middlesex.

WANTED: Manual for AR77E; also spares, chassis cabinets, anything, any condition, for same. State price. All letters answered.—Biggs, 303 North End, Northallerton.

NATIONAL 1-10 Receiver, complete with valves and eight coils. First £6 secures.—Box 1082.

W1117, immaculate condition, with calibration charts; £3 15s. Include 30/- deposit for returnable packing case. — G3FJ0, 10 Seymour Avenue, Heysham, Lancashire.

AMATEUR SELLING OUT: 150-watt transmitter; PA Unit p/p 35TG's, driver 807, fully metered, £5; VFO/Exciter Unit 6SN7-6SJ7-6L6 output, built-in p/pack, metered/stabilised, £3; Power Unit, 500v. 250 mA, 6.3v. (Woden) for 807 and LT for 35TG's, £4; Modulator/Speech amp. Unit, 100-watt, SP61 p/p-ML6's-p/p 807's AB2 (UM3), built-in p/packs, bias, £10. All in black-crackle cabinets. HT PA Unit, Type 45, 1200v. 200 mA, £5. Or £25 the lot and tea-chest good useable "junk" spares, condensers, resistors, coils, chassis, etc., free to buyer. CAY "Range C" Unit, 12/6; TN5B, 15/-; TU7B, 10/- (all brand-new). BC453 "Q-Fiver" 12v. vibrator-pack, speaker, converted car radio, circuit, etc., can be re-converted, 70/-. Transformers, 750v. plus 350v. 250 mA, heaters, 30/-; 700v. 200 mA, 15/-. Must clear.—54 Wyncliffe Gardens, Leeds, 7. (*'Phone Leeds 66191*).

BC221 with power supply, new condition, £25. VALVES: New EF50, 2/6; 37, 2/-; 6R7G, 4/-; 89, 2/-; PEN44, 6/-. Garrard Gram Motor, 12in. table (needs cleaning), 35/-. *Antenna Manual*, by Editors & Engineers, latest, 10/-. *Radio Amateurs' Handbook*, 1950, 5/-. Wanted: AR88D, mint condition. Stamp reply.—2 Cliff Road Gardens, Leeds, 6.

SALE: BC221 with stabilised power unit, £15; Eddystone S.640, £16; both perfect. TVI proof exciter unit, 3.5 - 28 mc, inc. wideband bandswitched, complete with valves (3)—6AG7, 807 6V6, VR150/30; standard 19in. panel, less power supply; £12. Three-stage Clapp VFO, 1.7 - 3.5 mc, complete with power supply, £5. S.A.E. for details.—G6IF, 5 Squirrel Lane, Booker, High Wycombe, Bucks.

SMALL ADVERTISEMENTS, READERS—*continued*

WANTED: Exciter or low-power Tx covering 7, 14, 28 mc bands, preferably TVI-proofed.—Details to: J. Davidson, 31 Highburgh Drive, Rutherglen, Glasgow, 11.

EMIGRATING. Table-top Tx 50/150w plus, 6V6-807-813, built-in 500v. power, all in American steel cabinet, separate 1250v. metal rectifier power, £35. Three Portable Bench Cabinets, fitted plastic trays; three Wooden Bench Cabinets, fitted drawers, all filled high-quality components; worth £60, sell £20. Two Wooden Transit Cases, fitted top tray, both filled unused mod. transformers, chokes, etc.; £15, offers? 6ft. Rollered Rack, black crackle panels, £2. Eddystone S640, as new, £20. 150 Valves, guaranteed, £15 lot. S.A.E., London Area.—Box No. 1086.

BC312, good condition, with mains power unit for 230v. 50-cycle, speaker, xtal filter, manual, £13 (carriage extra).—G3IZ, 31 Stephen Hill Road, Sheffield, 10.

WANTED: Hallicrafter SX42 or Collins 75A.—James, 14 Rosebery Street, Burton Latimer, Northants.

FOR SALE: CR100, with manual, £20; VRL complete with power pack, speaker and manual, £25.—Borchard, 98 Bannerdale Road, Sheffield, 7.

WANTED: HRO Mx or later model, complete all accessories; mint condition and unmodified only considered; good price offered.—Box 1083.

FOR SALE: Brand-new Labgear Pre-Selector/Converter for five, ten, twenty metres, £14.—Elm Tree, Bridge Street, Mansfield.

SALE: Woden Modulation Transformer UM2, perfect, costing 4 guineas; accept 45/-.—G2AKT, 25 Walmington Fold, London, N.12. *(HIL. 4860).*

813 (4), 45/- each; 811's (6), 25/- each; 832A's (5), 30/- each; 6AP5's (6), 15/- each; all new, boxed, guaranteed.—Box No. 1085.

WANTED: Good AR88 Cabinet. SALE: The DL2MU Tx, VFO controlled, bandswitched exciter, p/p 807, 120w., modulated. Class-B 829B. PA coils for 40, 20, 10. First-class job in table rack, ready to operate. Selling domestic reasons. Offers about £50 (half cash down). Transformers: Class-B driver 500 ohm CT to p/p 805, 15/-; Filament, 230/190 input, 2.5v. 5a CT twice and 10v. 10a. CT. 25/-; 10v. 5a CT twice, 12/6; 721A in 10 cm rhumbatron with xtal mixer assembly, £1; 464A and 446B, lighthouse triodes, £1 each.—G3BCW, 4 Estcourt Street, Devizes. *(Tel. 378).*

W1191 WAVEMETER for Sale; band-new, converted to AC mains; complete with power pack, crystal, calibration chart and eight original spare valves; £12. Also brand-new valves, boxed: 813, £2; 837, 12SN7gt, 12SC7m, 12AH7gt, 2 of 12SL7gt, 2 of 12SJ7m, 12SA7gt, 12SG7m, 4/6; 1633gt, 12A7g, 1625, 28D7gt, 2X2/879, 2 of 2051g., 4/-. The lot for £5.—T. A. Gallivan, EI4E, Avenue House, Killarney.

CANADIAN 58 Tx/Rx, unused; new complete outfit, with spare Rx/Tx; £20.—45 Stanhope Avenue, N.3. *(Finchley 2902).*

SMALL ADVERTISEMENTS, READERS—*continued*

FOR SALE: Hickok, 177 valve tester, £8; Universal Avominor, £4 10s.; 500v. megger, £5; Ferranti Universal Testmeter, £4 10s.; AVO mains oscillator, £8; TT15—200 mc 27w double tetrodes—25s. each. WANTED: UM1 Xfmr, xtal mike.—Box No. 1084.

HALLICRAFTERS 5-10 metre Receiver, £10; VHF 1-10 metre Converter Unit, in rack with Type 3 power pack, 7 mc IF, £12. Or exchanges?—Sutcliffe, 103 City Road, Bradford.

AR88LF, perfect condition electrically and mechanically; nearest £60. Radiovision 2-valve pre-selector, £10. Buyers collect.—10 Moor Park Road, Northwood, Middlesex.

WANTED: Morse Key, 1914-18 period, Air Ministry pattern; believed manufactured by S. G. Brown, Ltd. Key has grey metal cover with circular inspection disc; beautiful movement. Good price paid for key in sound condition. B2, preferably complete. Crystals for CW Section of Amateur Bands.—Box No. 1087.

TAYLOR Oscilloscope, Model 30, as new, £18; New Meter, 3in. scale, 0-50 M/amp, £3; P/Pack for MCR, £2; new Valves, 7R7, 12/6 each. —S. Walker, 20, William Street, Staincliffe, Dewsbury, Yorkshire.

SALE: 8v, Rx, 7 mc band only, £5; *Wireless World*, 1946-1952; few QST's, *Radio News*. Offers?—G3GRV, 26 Monmouth Road, Hayes, Middlesex.

MARINE Communication Receiver, 24-110-230 volt working; excellent condition. Also unused 2-seater alloy Canoe, complete. Offers wanted; buyer collects.—Fawkes, St. Chloe, Amberley, Stroud.

WANTED: Enclosed 19in. Rack, about 5ft. high; 1131 or similar would do; good price paid.—G3HFJ, 62 Hibbert Road, Harrow Weald.

R89/ARN5A (less xtals), £4 10s.; R3/ARR2X, £3; BC453, £2 10s.; BC454 (less valves), 15/-; BC455, 35/-; BC453 (less valves), 25/-; R26/ARC5, brand-new, £3; R28/ARC5, 35/-; BC1206C, 35/-; Triplett valve tester-multimeter, £9; BC458, £2; U.S.N. RBZ portable, 5-13 mc, £7. S.A.E. list other items. WANTED: SCR274N manual.—72 Royston Avenue, Chingford, E.4.

Printed by The Courier Printing Co., Ltd., Tunbridge Wells, for the Proprietors and Publishers, The Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1. The *Short Wave Magazine* is obtainable abroad through the following: Continental Publishers & Distributors, Ltd., William Dawson & Son Ltd.; AUSTRALIA AND NEW ZEALAND—Gordon & Gotch Ltd.; AMERICA—International News Company, 131 Varick Street, NEW YORK. Registered for transmission to Canada and Newfoundland by Magazine Post. *May.* 1952.