The SHORT WAVE Magazine

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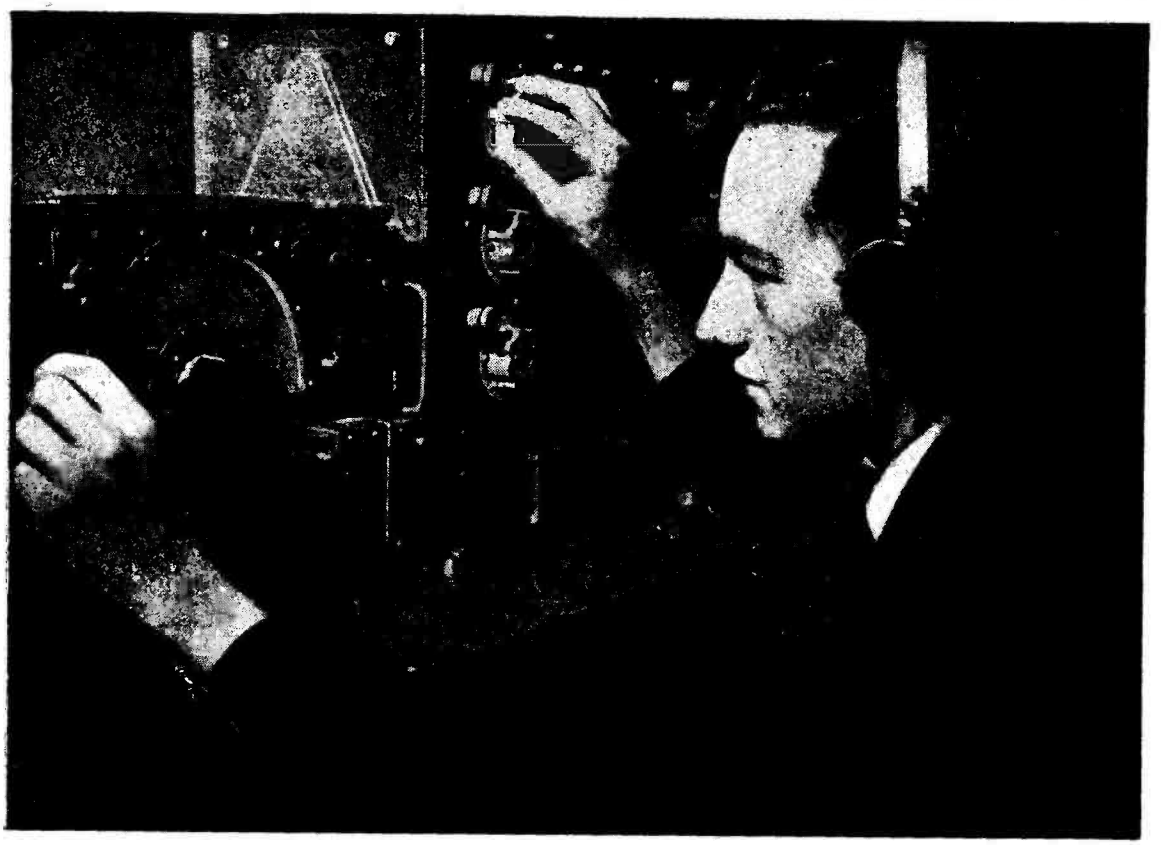
VOL. XII JANUARY, 1955 NUMBER 11

WORLD WIDE COMMUNICATION



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SHORT WAVE MAGAZINE

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FOR THE EXPERIMENTER FOR THE RADIO ENGINEER

The SHORT WAVE Magazine

EDITORIAL

Scope

In these days of rapid development in the art of electronics — for it is now an art as well as a science — the field is so vast that no one individual can have much knowledge, and certainly very little experience, outside his own particular range of activity. The cleverest men are those who realise how little they know and how much there is to learn.

As radio experimenters, many of us are not bound by the limitations of the professional radio engineer, who has to keep his mind on the particular aspect of the subject that earns him his living. As free-lance radio men, we can range over the whole field at will — whether it be communication, HF or VHF, CW or phone ; UHF experimental work ; audio and high-fidelity engineering ; recording ; transistory in its many new and developing applications ; the enormous field for what are known as "electronic devices," meaning those used for switching, counting, computing, sampling, checking, heating and even cooling ; television ; remote control by radio (in which great strides have been made in the Service research establishments) ; and a great many more lines of development to which electronics can be applied.

All this gives the intelligent amateur a wider range of interest than the professional and it can be said that many an amateur is, thereby, a more competent practical man than his professional confrère. Of course, this cannot apply in every case, or even in the majority, but it is beginning to become evident to an increasing extent.

And it is this fact that enables the amateur to hold his own in the field and to make him a useful, as well as a very important, member of the whole fraternity of radio men.

Austin Forbes G6FO.

The Skeleton Slot Aerial System

DESIGNS FOR HF AND VHF APPLICATIONS

B. SYKES (G2HCG)

Our contributor is well-known as the originator, and very successful VHF user, of the Skeleton Slot type of radiating system, on which he now holds patent rights. What is perhaps not so well known is that the Skeleton Slot principle can usefully and effectively be appled on the HF communication bands as well as on VHF, physical dimensions being quite reasonable for the bands 14-28 mc. The advantages are lightness, ease of construction from established data, low-angle radiation, good beam effect, and the fact that a Skeleton Slot can be mounted as a simple metal framework without insulation. In this article, the Skeleton Slot is discussed from the practical point of view for all bands on which its dimensions are manageable, and ample design details are given for the experimenter interested in aerial construction.—Editor.

IT is normal practice in aerial design first to ascertain the performance one requires, and then to design the system to give this performance. In the case of the Skeleton Slot type of aerial, however, the writer obtained the performance before any logical reason could be given for it !

Reversal of the normal procedure was therefore necessary, and it was decided to carry out exhaustive practical tests and measurements on a Skeleton Slot, under controlled conditions, to accumulate a mass of experimental data which could then be analysed and explained by established theory.

A VHF Skeleton Slot was set up and all possible measurements were taken of the impedance at various points. The method by which these figures were obtained is beyond the scope of this article—which sets out to explain how Skeleton Slot systems can be constructed—but it can be said that even at the initial stages a considerable amount of detective work was necessary to make the facts fit the theory !

First Facts

The important fact which soon emerged was that a purely resistive feed point could be achieved at a certain relationship between size and frequency. The frequency was therefore concentrated upon, and Fig. 1 illustrates the model Skeleton Slot, with measured impedances and correct sizes for the frequency on which tests were carried out.

Considering the section A-A′ to B-B′, the fact that there is no standing-wave present—namely, a 500-ohm impedance throughout—suggests that the characteristic impedance of this section should be 500 ohms, and a check on the sizes proves this to be so.

From the normal transmission-line formula:

$$Z = 276_{\log} \frac{D}{R}$$

where D = spacing (12 ins. in this case)
and R = 3/16-in. (diam. of elements $\frac{3}{8}$-in.)

and the answer to the calculation is 500 ohms.

Consider now the sections B-B′ and A-A′: The waveform thereon is suspiciously like that of a dipole and the length, allowing for the bend, is very near a half-wave.

It can therefore be assumed that the Skeleton Slot in the form shown in Fig. 1 consists simply of two end-fed dipoles. This supposition is confirmed by the polar diagram. (The fact that the ends of the dipoles are bent down has little effect on the performance, since radiation takes place from the current maxima.)

The overall length of the Skeleton Slot should be at least half-wave to allow for adequate spacing between the dipoles, and the optimum element length has been found, experimentally, to be 0·56 of a wavelength. The width (spacing between elements) has likewise been found to be one-third the length for optimum performance and band-width. The band-width of the system in this form is considerable, since a change of frequency, *i.e.*, a change in the length of the dipole sections, simply moves the points A-A′ and B-B′ up or down the section.

HF Band Application

Where space is at a premium, as in the lower frequency applications of the Skeleton Slot, the length may safely be reduced to 0·43 of a wavelength ; the reactance introduced at the feed-point is of little importance at the lower frequencies since feeders are normally short in terms of wavelength and the whole system can be tuned.

The design of a Skeleton Slot system for purely resistive feed should therefore comply with the following specification:

Ratio of length to width = 3:1
Ratio of width to Conductor diameter = 32:1 (for 500 ohms)
Length of sides = 0.56 λ at design frequency

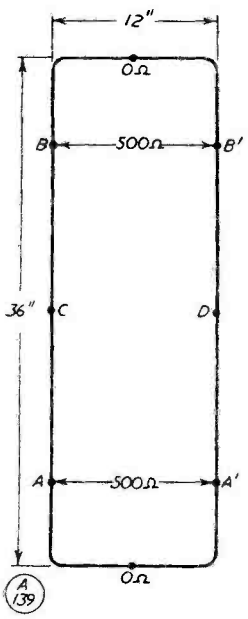


Fig. 1. Experimental set-up for measurement and checking of the performance of Skeleton Slots under practical conditions. The frequency used was 185 mc. and the construction in ⅜-in. diameter rod.

An important factor in the performance of the Skeleton Slot from the amateur point of view is the absence of high-impedance points, which renders the system insensitive to the proximity of nearby objects. This is particularly important on the HF communication bands, where it is nearly always impossible to erect an aerial right in the clear. It is not perhaps generally realised that the average amateur aerial on, say, the 14 mc band, is in terms of wavelength very close indeed to surrounding buildings and other obstructions. A practical example will illustrate this:

On 14 mc, a typical amateur aerial is a half-wave dipole at a height of 30 feet or so across a garden between two rows of houses about 150 feet apart. In terms of wavelength, this would be equivalent to a two-metre dipole at a height of 40 inches between two buildings about 14 feet apart! Nobody would expect the 145 mc aerial to operate correctly as a dipole under such conditions, yet it is clear that the average installation for the 20-metre band is at the same order of disadvantage. (The different angles of radiation called for on the two bands in question are not considered here—only the effect such nearby objects must have on feed impedance and resonant frequency.)

A Practical Installation

A Skeleton Slot system for the 14 mc band has now been in use for some considerable time at G3HSN (Northampton) with remarkably successful and consistent results—and to him much credit is due for making the apparently impracticable suggestion that a Skeleton Slot might be built to work on Twenty! The size of the system is not such a drawback as might at first be thought, since the width is only some 12 ft., enabling an effective rotary beam to be used as a low-angle radiator, with no overlapping of next-door's property.

In order to comply strictly with the specification already laid down above, the optimum size of the system for the 14 mc band would be 38 ft. 4 ins. high, 12 ft. 9 ins. wide, constructed from $4\frac{3}{4}$ in. diameter tubing (!). This looks on the face of it impossible as regards diameter of tubing, but the conditions could, in fact, be met by making up the elements of multiple wires, using, say, six wires with $4\frac{3}{4}$ in. diameter circular spreaders. The need for this diameter of element is admittedly something of a problem, even using the six-wire technique, but a little thought on how much latitude may be taken here is worth while. (The horizontal sections would have to be solid to preserve the shape.)

The design data calls for an impedance of 500 ohms for the two uprights, and fortunately the change in impedance resulting from a reduction in diameter of these sections is small. In the case of the 14 mc design, reducing the

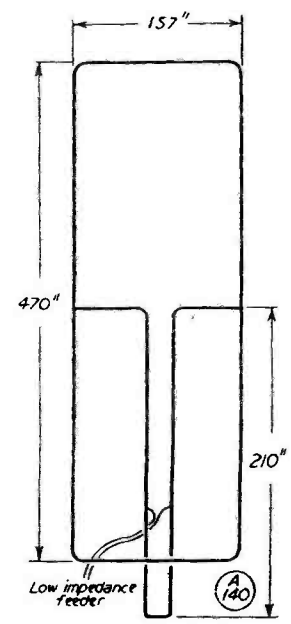


Fig. 2. Low impedance feed for a Skeleton Slot aerial on the 14 mc band. As single-band operation only is considered, a closed quarter-wave stub is connected at C-D (see Fig. 1) with 72-ohm feeder tapped in at the correct point.

size to 1⅛ in. tubing results in an increase to 680 ohms, which does not materially affect the performance when one considers that the end-impedance of the dipole sections has likewise risen. But a word of warning here: This process of reducing element diameter *cannot* be continued much further, as the end-impedance of the bent dipole does not rise with reduction of conductor diameter in the same ratio as that of the upright sections. Hence, a Skeleton Slot for 14 mc constructed of 16 SWG wire definitely does not work—G3HZF has tried it!

However, as we can see from the Table of Sizes herewith, there are practicable diameters in this region of frequency. A design frequency of 18·5 mc covers the 14 and 21 mc bands, and this size therefore becomes irresistible as the system now covers two bands. Unfortunately, however, the feed will be reactive on both bands, but this can be overcome very conveniently by the use of *tuned feeders*, 300-ohm feeder being connected at points corresponding to C-D in Fig. 1, and the normal Zepp method used, either series or parallel tuned, depending on the length of the feeders.

For single-band working, low-impedance feeder can be employed. With the beam intended for 14 mc only, a quarter-wave closed stub should be connected at C-D, and 72-ohm feeder tapped at the appropriate point on the stub, as shown in Fig. 2.

TABLE OF SIZES

FREQUENCY COVERAGE, MC	DESIGN FREQUENCY	LENGTH INCHES	WIDTH INCHES	OPTIMUM TUBING SIZE, INCHES	MINIMUM TUBING SIZE, INCHES
7 11.2	9.2 mc	720	240	7¼	2
10.8—17.2	14	470	157	4¾	1¼
14—22	18.5	360	120	3⅝	1
16.2—25.7	21	312	104	3¼	⅞
20—30.5	26	255	85	2⅝	¾
21.5—34	28	235	78	2⅜	⅝
28—44	36.5	182	60	1¾	½
115—177	145	45½	15	½	⅛
140—210	180	37	12½	⅜	⅛
340—530	435	15¼	5	⅛	⅛

Performance on Twenty

The performance of his Skeleton Slot system on 14 mc, as reported by G3HSN, is quite phenomenal where DX is concerned, although inferior to normal aerials at distances up to about 1,000 miles—in most cases, this is positively an advantage, as it tends to eliminate Europe. The DX performance is, of course, due to the very low angle of radiation achieved. In this sense, results on 7 mc Europeans would undoubtedly be poor, but the prospects for 7 mc DX look very rosy indeed—if anyone dare attempt to put up a Skeleton Slot for that band!

The radiation pattern of a single Skeleton Slot is a figure-of-eight in both planes, with exceptionally sharp nulls off the sides—very useful for minimising QRM.

Slots in Pairs

The use of two Skeleton Slots mounted a quarter-wave apart horizontally is quite practicable if uni-directional radiation is required, and the beam can be fired in either direction by suitably phasing the feed to each Slot; this avoids the bother of rotation.

Mounting arrangements are relatively simple since the centre of each horizontal section is at zero potential—thus, no insulation is required—and a rope attached at this point, passed over a pulley at the top of a 50 ft. mast or other support allowing the beam to hang clear, is all that is needed for initial tests. The lower end (bottom horizontal section) should be at least 7 ft. off the ground on 14 mc.

The foregoing discusses the application of the Skeleton Slot on 14 and 21 mc. Of course, design for 21 and 28 mc is equally practicable, and for these bands the dimensions become more manageable. The use of two Slots for uni-directional radiation is quite a practicable possibility, and even a two-stack beam for 28 mc is within bounds.

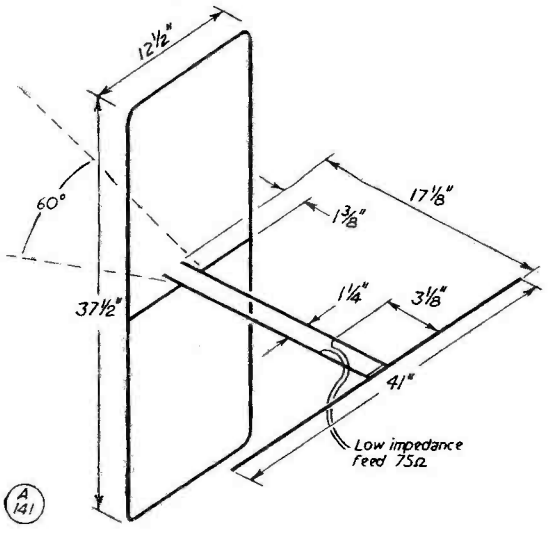


Fig. 3. All dimensions for a two-metre Skeleton Slot, using closed-quarter stub matching. Construction is in ⅜-in. diameter rod and no insulating material is called for anywhere. Mounting can be on a metal mast section, bolted to the stub end. An ideal beam for portable work.

VHF Application and Performance

At VHF the dimensions are relatively so small that one would normally use the full-size design specification. However, mechanical and electrical considerations involved in the design of the array renders the use of closed quarter-wave stub matching very necessary. This principle is illustrated in Fig. 3, which shows a single Skeleton Slot for two metres. It will be noticed that only one reflector is used—it can be assumed, by the way, that reflectors are impracticable for mechanical reasons where the HF bands are concerned. The reason for the one reflector, instead of two, in the 145 mc design is that thereby a certain constructional advantage is gained, in that the reflector can be mounted across the shorted end of the supporting stub, as shown in Fig. 3. The loss in performance by the use of one reflector instead of two is not more than 10%, and is well repaid by the simpler constructional advantage obtained.

The use of a quarter-wave matching stub makes it possible for the minimum dimensions of Slot to be used on two metres, since any reactance introduced by the smaller sizes can be balanced out by adjustment of the stub. Because the dimensions of the stub are rather critical, it is advised that the sizes given in Fig. 3 be strictly followed.

On VHF, too, stacking of Slots is quite simple. Optimum performance is achieved at wavelength-spacing (centre-to-centre), although where local site conditions demand it, a worthwhile increase in performance over one Slot can still be obtained using reduced spacing. A typical example of a reduced-space Slot system is the two-stack array at half-wave spacing, which gives a performance equal to a three-stack dipole system.

Fig. 4 illustrates the layout, mechanically, of a two-stack array at wavelength spacing giving a performance equal to a four-stack dipole assembly, Slot dimensions being as in Fig. 3. The use of stub matching here facilitates the mounting of the Skeleton Slots, in that no support need interfere with the operation of the central phasing lines. The use of open-wire phasing lines is strongly recommended. Ribbon transmission line phasing sections introduce undesirable unbalance effects due to proximity to the metal structure; moreover, the velocity factor of this type of line, unless accurately known or measured, can introduce serious phasing errors, and thereby nullify all the advantages to be gained from the array. *over*

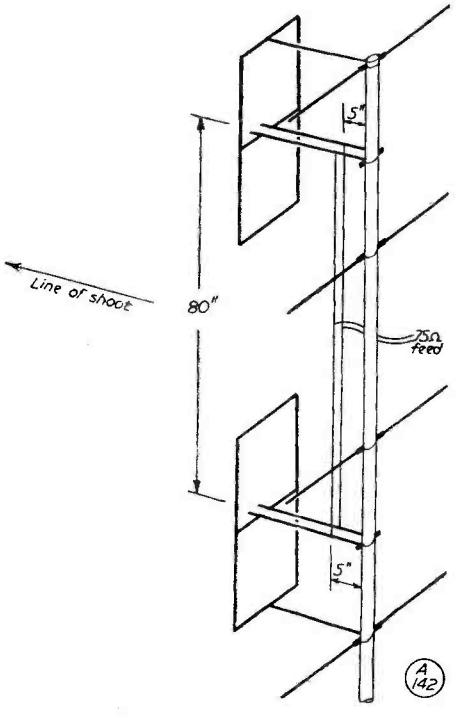


Fig. 4. A two-stack Skeleton Slot system for the 145 mc band, with one wavelength spacing between sections. Construction is in ⅜-in. diameter rod, and all dimensions (except as marked) are as given in Fig. 3.

VHF DX Beam

A highly-efficient, compact and successful array for two metres is a three-Slot system at wavelength spacing, with six parasitic reflectors —as used by G3GWB/P for recent Field Day events. The aperture or horizontal beam width of this system is still some 60°, while the vertical beam width is very narrow indeed, giving much improved DX coverage, together with a reduction of fading and aircraft flutter effect.

Conclusion

The advantages of the Skeleton Slot type of array for VHF operation can be summarised as follows:

(1) Extremely simple feed arrangements, rendering the common phasing and mismatch errors in the design of stacked arrays much more unlikely,
(2) No high-impedance points, thus making the system insensitive to the influence of nearby obstructions,
(3) Complete immunity to any weather conditions,
(4) Simple all-metal construction, without the use of any insulating material.

It is hoped that those interested in DX on any band from 14 to 430 mc will find in this article the guidance and information they may require on a practical aerial system of great experimental interest, capable of giving excellent results when constructed on the principles discussed here. Patent protection obtained by the author does not preclude individuals from building Slot systems for their own use.

Ohm's Law Ready Reckoner

HOME-MADE CALCULATOR

W. E. RIGG (VQ2WR)

SOME years ago the simple device to be described was made up as an aid to memory when using Ohm's Law. It is a fact that even the most experienced — unless they use them in their daily work — cannot always repeat, without hesitation, all the formulae in connection with Ohm's Law. Even the tyro can tell one that $I = \frac{E}{R}$, but how many can unhesitatingly say that $I = \sqrt{\frac{W}{R}}$? Every amateur radio enthusiast is aware that $E = IR$, but only a small percentage of them can usually state instantly that E is also equal to $\sqrt{WR}$. These formulae are most useful in any radio work and are undoubtedly utilised more than any other.

Years ago, when working at the old Radio Maritime Training School in Hammersmith, London, in preparation for the examination for the P.M.G. Certificate, the writer pasted the formulae on to the inside of the cover of his copy of the *Handbook of Wireless Telegraphy* and made frequent use of them during the course of training. Again, years later, whilst serving as radio officer in the Mercantile Marine, the device described here was made up during a six weeks' spell of boredom while at anchor in Monte-Video Roads — in sight of land, but unable to go ashore !

A segment of 90 degrees was cut from a piece of sixteenth aluminium plate, 3" square (Fig. 1). Also, from the same material, a disc of 1.4" radius was cut (Fig. 2), and the various formulae applicable to volts, ohms, amperes and watts were marked on with a scriber, the marks being filled in with Indian ink to make

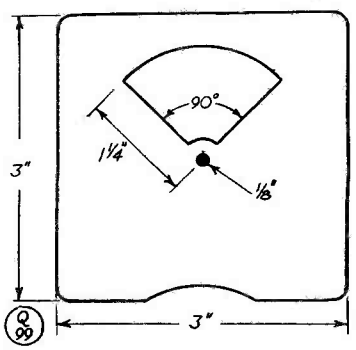


FIG 1

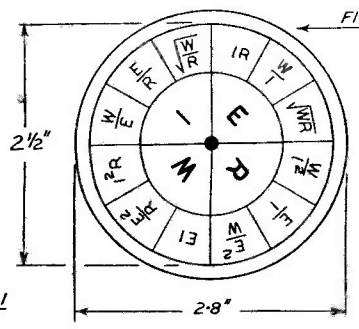


FIG 2

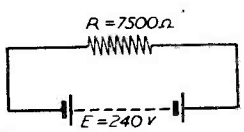


FIG 3

The device described in the article—above is a checking example

them stand out. A hole of $\frac{1}{8}$" diameter was drilled through the centres of both disc and plate, the former being mounted beneath the latter and secured by means of an aluminium rivet. At the bottom edge of the plate an indentation was made to facilitate the rotation of the disc by the thumb. Thus, if the formulae applicable to Watts are required, the disc is rotated until " W " is centred in the segment, the formulae EI, I^2R and $\frac{E^2}{R}$ being read off immediately above.

The formulae to be used are shewn marked upon the disc in the four quarters (Fig. 2). They are correct, but as an example and as proof we can take one of the factors, say " I," and prove the three relative formulae, using a hypothetical circuit (Fig. 3) consisting of an EMF of 240 volts and a resistor of 7500 ohms. To find the current . . .

$$I = \frac{E}{R} = \frac{240}{7500} = .032 \text{ amperes.}$$

$$I = \frac{W}{E} = \frac{7.68\ (IE)}{240} = .032 \text{ amperes.}$$

$$I = \sqrt{\frac{W}{R}} = \sqrt{\frac{7.68}{7500}} = \sqrt{.001024}$$

With a number such as .001024 evolution is simplified by means of logarithms, as follows:

$$\log .001024 = \bar{3}.0103$$

$$\bar{3}.0103 = \bar{4} + 1.0103$$

$$\frac{\bar{4} + 1.0103}{2} = \bar{2}.5051$$

$$\text{antilog } \bar{2}.5051 = .032 \text{ amperes.}$$

This simple device has proved very useful over a number of years of both marine and amateur radio activity and is passed on for what it may be worth.

Microphone Types and Applications

SURVEYING CHARACTERISTICS AND USAGE

W. N. STEVENS (G3AKA)

Most of us make use of microphones in one way or another, and many of us operate phone transmitters with various types of microphone —one of the essential links in the chain. This article will be of value and interest to those who may not be quite clear as to the differing principles of construction and methods of use of the several varieties of microphone from which a choice can be made.—Editor.

THE main group of microphones falls in the category known as *Pressure* type, which produce an output voltage in direct proportion to the sound wave pressure applied. In this class are the carbon, crystal, moving coil and electrostatic types. Most of the pressure microphones use a diaphragm which is actuated by the pressure waves ; these, being equal in all directions, will vibrate the diaphragm from any direction. The back of the instrument is sometimes sealed off to prevent sound waves striking the diaphragm from the rear in an incorrect phase relationship.

The first half-cycle of a pressure wave arriving from the front direction displaces the diaphragm. During the second half-cycle there is a rarity of pressure causing the diaphragm to spring back to its normal position. All diaphragm-type microphones have directional properties, responding primarily to sound waves arriving from the front. But should the sound-wave impinge from a sharp angle to the axis of the microphone, and if its wavelength is short compared with the width of the diaphragm, several points of pressure and rarification will result with consequent frequency distortion, due to the irregular motion of the diaphragm.

The frequency response of a microphone to such angularly-exerted pressure waves is quite different from that for waves arriving from the front, particularly in regard to the higher frequencies which become progressively attenuated with the increase in angle. To obtain better fidelity for angular pick-up, a small diaphragm is required ; but as this would also reduce the output it is customary to make a compromise in the design even though this is true mainly of the middle and lower frequencies — the higher frequencies tend to radiate as a beam and are consequently deflected.

Fig. 1 shows the response curves of a typical diaphragm-type microphone to direct and side-pressure waves. As the angle of application

increases so does the high frequency attenuation, the 90-degree curve showing how severe this can be. Fig. 2 shows the directional effects in another way. The outer circle is the maximum, or 100%, sensitivity line, the inner circle 50% sensitivity and the centre being, of course, zero sensitivity.

Superimposed on the sensitivity circles are three hypothetical curves representing the response at three spot frequencies. For the purposes of illustration an arrow " X " is shown at the 45-degree angle to the diaphragm axis. It will be seen that sound waves at 500 c/s show little attenuation at this angle, but a 1000 c/s wave is attenuated 25% and a 4,000 c/s wave as much as 50%. A wave arriving at the microphone 90 degrees off the axis will have maximum attenuation, regardless of frequency, but the diagram will show that the higher frequencies are excessively reduced in proportion. Even a cursory glance at the three frequency curves will show how non-linear the sensitivity characteristics can be as the frequency increases — the low frequency waves being more or less uniformly effective from any angle.

The Carbon Microphone

The modern carbon microphone is essentially the same as its 19th century forerunner invented by Professor Hughes, which was used in land-line circuits long before the advent of radio-telephony. There are three sub-types: the single button (or " solid back, or Post Office), the double button and the transverse current types. In operation they rely on the fact that if two bodies of carbon are placed in contact, the resistance of the contact decreases as pressure is applied.

The " button " in such a microphone is a small cup-like container fitted with a flat carbon backplate and filled with finely ground carbon granules. This type of filling is used because the greater number of contacts thus provided will increase the sensitivity. The button is placed against a metal diaphragm, insulated from it by a mica or felt ring and supported on a clamping ring. The mechanical details of individual types vary quite considerably, but the principle is the same.

Terminal points are made to the diaphragm and to the fixed electrode, across which a polarising voltage is applied, causing a current to flow through the complete circuit. When sound waves impinge on the diaphragm it vibrates and exerts pressures on the carbon granules, thus varying the resistance in the circuit and consequently the current flowing through it. A

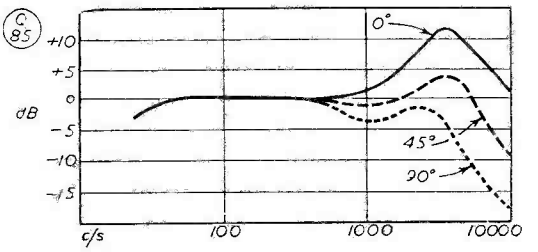


Fig. 1. Showing sensitivity of particular types of microphone at different " angles of attack "— see text for discussion.

step-up transformer, with as high a ratio as is consistent with good quality, is also required and a variable resistor may be included in the circuit to adjust the button current.

Thus, a series of sound waves of given frequency and amplitude exert corresponding pressures on the diaphragm, changing the resistance of the carbon contacts, the current in the circuit and, finally, producing alternating voltages in the transformer secondary.

Such a microphone has quite a high sensitivity and output over a wide range of frequencies, but much of this is due to mechanical resonances in the diaphragm and the frequency response is therefore very " peaky," falling off particularly at the higher frequencies. If these resonances are reduced to provide a more linear response, the output drops considerably —this being an illustration of the broad rule that in microphones, the better the quality the lower the output.

Such generalisations are also true of the transverse current type — better frequency response, but much smaller output. It is basically similar to the button type except that the diaphragm is of mica or some other non-conductive material and two fixed carbon electrodes are used. The diaphragm directly conveys the variation in pressure to the granules, thus varying the resistance across the two terminals and hence the current passing between them.

Carbon microphones are widely used where good sensitivity is required and high quality is not essential.

For: Relatively high output and sensitivity. Low internal impedance. Reliable and rugged. Inexpensive.

Against: Limited frequency response, with peaks. Requires polarising current. Has high inherent noise level, increasing with use. Has tendency to " blasting " on loud noises. Can produce harmonic distortion and has unwanted directional effects.

General: Broadly speaking, the best type is the transverse current version, with its higher impedance, improved frequency response and lower output. Double-button types are useful for special applications.

All carbon types become insensitive with use, the particles tending to pack together through continual pressure changes with a consequent lowering of resistance and sensitivity. A gentle tapping will restore the instrument to normal, but eventually the granules must be changed or a new microphone installed.

The polarising voltage must be kept as low as possible (usually 4 to 6 volts is suitable). If it is excessive there is a likelihood of the particles fusing together and the electrodes becoming burned and pitted with consequent noisy operation.

Carbon microphones should be suspended or mounted on rubber cushions to prevent pick-up of floor vibrations and they should always be used with the diaphragm in the vertical plane. When the polarising potential is switched on or off the gain control of the amplifier must be turned low otherwise there is a risk of damaging the diaphragm and amplifier components due to the sudden surge in current.

Despite the disadvantages, the carbon microphone will no doubt continue in popularity—even though alternative types possess superior characteristics — due mainly to its cheapness, sensitivity and robustness.

The Electrostatic Microphone

This type of pressure microphone, sometimes called a Condenser microphone, consists of a stretched flat metal electrode arranged as a diaphragm, behind which is mounted a second metal electrode. These are insulated from each other by an air gap of some 1/1,000th of an inch and form a "condenser" of between 300-500 $\mu\mu$F capacity.

A polarising potential is applied to charge the "condenser" initially and to compensate for insulation losses. It is fed *via* a series resistor high enough not appreciably to affect the voltage variations developed by the microphone. The impact of sound waves vibrates the diaphragm so that the condenser alternately charges and discharges, setting up the required AF voltages. Since the diaphragm movement produces only very minute capacity changes, the output voltages are very feeble so that the sensitivity of the instrument is rather low. Air damping is provided to reduce the mechanical resonances of the diaphragm plate.

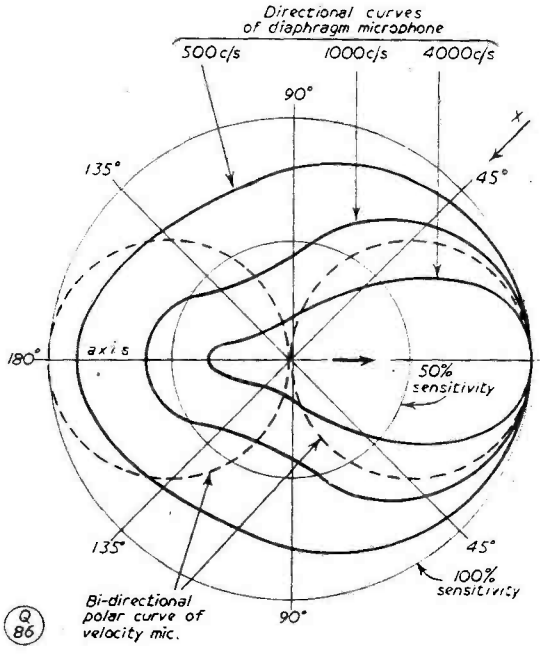


Fig. 2. Directivity and frequency response patterns of various microphones, as explained in the article.

For: Reasonably good frequency response, although inclined to be peaky. The noise level is exceptionally low.

Against: High impedance, low sensitivity. Inclined to be bulky and fragile. Exhibits frequency discrimination and directional effects. Good models are expensive.

General: The low output necessitates a stage of pre-amplification which must be close to the microphone itself to avoid losses which would be serious if the capacitances of the leads was large compared with that of the internal structure. A head-amplifier is sometimes fitted.

Although now largely overcome by perforated back plates or special air vents, early models were prone to air cushioning between the electrodes causing damping and loss of sensitivity. The electrostatic microphone can be used in any position but dampness must be avoided in use or storage otherwise noisy operation may result.

The Crystal Microphone

The crystal (or piezo-electric) microphone is a firm favourite with the amateur fraternity, having a good frequency response and low background noise—both advantages over most of the other pressure microphones. There are two distinct sub-types (the Diaphragm and the

Sound Cell), both of which depend on the well-known property of certain crystals to generate a potential difference across their opposite faces when subjected to mechanical pressure, this voltage being proportional to the applied force. Compression or elongation may be produced, the polarity of the voltage changing direction accordingly.

In a crystal microphone two Rochelle salt crystals in the form of thin plates, coated with wax to avoid effects of dampness, are cemented together to make a "sandwich" and mounted on plated foil electrodes with clamps at both ends. As the electrostatic capacity is in the region of about ·005 μF the impedance is quite high.

On the application of pressure, one crystal slice is compressed and the other stretched; they are so arranged that the voltages generated by the two crystals are equal and in phase and therefore additive. In the diaphragm type, the diaphragm (fixed to the centre of the crystal assembly) vibrates the crystal which generates feeble currents in sympathy. In the Sound Cell type, the diaphragm is omitted—a small crystal unit being directly actuated by the pressure waves, the crystals being housed in spring-loaded mountings to reduce mechanical shock. In this system diaphragm resonances and directional effects are overcome.

The crystal unit is mounted in an insulated housing with an air chamber between the two slices. To increase output further and lower the impedance several sets of crystals may be used connected in series, parallel or series-parallel. Although crystal microphones are usually non-directional, special types are available using two crystal assemblies—one omni-directional and the other directional—arranged to be additive for sounds from one direction and differential from the opposite direction.

For: Excellent frequency response and low noise level. Reasonably rugged, due to flexible crystal mounting and therefore suitable for indoor or outdoor work. No polarising current or transformer required. Usually small physically.

Against: Low output, high impedance, requiring amplification. In the diaphragm models, frequency discrimination and unwanted directional effects.

General: The diaphragm type is cheaper and more sensitive, but it has directional effects and frequency discrimination, whereas the sound cell type is substantially free from such undesirable characteristics. It is also better suited to high-fidelity applications owing to its superior frequency response and non-directional properties.

Due to the rather low output, connecting leads should be short and well screened for, although frequency characteristics are unaffected by excessively long lines, the output *is*, and it may be necessary to instal a preamplifier to compensate for line losses. A coupling input transformer is sometimes used to avoid loss of sensitivity due to cable capacitances.

These microphones are not unduly affected by vibration and cord noise. They are insensitive to jarring because mechanical vibrations of this nature which reach the microphone other than through the air would cause the crystal slices to move in the same direction. The resultant voltages generated are out of phase and cancelled out so that no "noise" output is obtained. The diaphragm types are excellent for "close talking."

The Moving Coil Microphone

Although there are many versions of this microphone, sometimes called Dynamic or Electro-dynamic, the principle of these instruments is similar to that of the moving coil loudspeaker.

A light-weight "moving coil" of a few turns is attached to a diaphragm and suspended in the gap of a permanent magnet. Pressure waves striking the diaphragm cause it to vibrate, thus moving the coil in the magnetic field and generating minute currents by induction in sympathy with the incoming sound waves. Often of high impedance, such microphones can be coupled directly to the amplifier, although for long cable runs a low-impedance model with transformer coupling is almost essential.

The moving-coil microphone combines some of the merits of the electrostatic type (in regard to frequency response) and the carbon type (high sensitivity) in addition to possessing a low background level.

For: Relatively good frequency response. High sensitivity. Extremely robust and reliable. Low noise level. Long connecting leads can be used without serious loss of fidelity or sensitivity.

Against: In cheaper models the high frequency response is not very good, with resultant woolly or boomy reproduction. However, more expensive models are designed to minimise resonances and improve linearity and give a considerably improved performance. Directional types exhibit frequency discrimination, and some models are prone to "flutter" by wind when used out of doors.

General: As there are so many types, it is difficult to generalise. A poor moving-

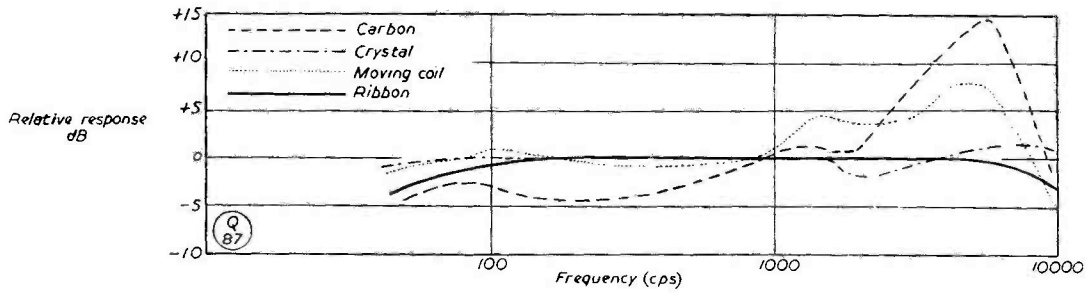


Fig. 3. Average frequency response of various types of microphone. In amateur radio-telephony working, the crystal microphone is probably the most widely used, followed closely by the carbon type in its several variations.

coil microphone can be very poor, but a good, well-designed instrument can be extremely good. Small moving-coil loudspeakers can be (and are) used for sound conversion purposes, but the frequency response is generally very inadequate owing to the excessive mass of the coil and diaphragm. Some types use an iron diaphragm which, in vibration, varies the magnetic flux through a coil. Others use energised field windings.

This type of microphone may be used in any position and it is not affected by dampness to the same extent as some other pressure types.

The Velocity Microphone

The Velocity (or Ribbon) microphone differs basically from the pressure-actuated types inasmuch as it responds to the difference between the instantaneous pressure on the back and front of the pressure gradient. Whereas the pressure microphone generates voltages due to the pressure of sound waves, the ribbon microphone follows the changes in velocity, the moving parts vibrating according to the displacement of the applied sound waves. It is similar in some ways, however, to the dynamic microphone in that currents are generated in a conductor vibrating in a magnetic field.

A thin metallic ribbon of corrugated aluminium foil (of about 1/10,000th inch thickness) is suspended between the poles of a powerful electromagnet. When the ribbon is actuated by sound waves it vibrates according to the velocity and displacement of the waves, cutting the magnetic field first in one direction and then the other, producing varying voltages across its extremes. The pole pieces of the magnet are used as baffles to improve the frequency response.

Unlike the pressure types, the velocity microphone uses a single conductor so that the voltages generated are very weak and generally at a low internal impedance, in the region of a fraction of an ohm. It does, however, possess exceptionally good frequency response characteristics which more than offset the disadvantage of low sensitivity.

There are high-impedance models for direct coupling to the amplifier or low impedance types for transformer coupling, the latter being suitable where very long cable runs are necessary.

Generally bi-directional, being equally responsive to vibrations in the forward or rear directions and non-responsive to pressures from the sides, the velocity microphone shows a polar diagram similar to that of the horizontal dipole, *i.e.*, the " figure eight," and this is shown in dotted line in Fig. 2. The microphone develops negligible harmonic distortion—a common failing in many pressure types — albeit with a somewhat lower output.

Some models are designed so that the ribbon will respond only to sounds from one direction, this being accomplished by terminating the " deaf " side in an acoustic impedance. There are also multi-ribbon versions with a common magnetic system which give a larger output, higher sensitivity and impedance.

For: Exceptionally good frequency response, substantially linear. Low inherent noise level. Negligible frequency discrimination. Directional pick-up range.

Against: Often of low impedance. Liable to wind flutter and draughts owing to delicacy of ribbon suspension, necessitating some form of hood or shield to reduce the effect when used outdoors.

General: This instrument is best used at some little distance from the source of sound (say, 12-18 inches from a speaker's mouth). In close work, boomy quality will result owing to phase shift between pressure and particle velocity. It will, however, " take " very loud sounds without blasting, providing that the source is not too close to the microphone itself.

[Over

Input shielding is most important and cable runs must be kept as short as possible.

In this brief survey of microphone types, most of the commoner varieties have been covered. Types such as the cardiod (a combination instrument embodying two different pressure units or one pressure and one velocity unit) have been omitted as of little practical interest.

In all microphones care must be taken with connecting leads as they are particularly prone to pick-up from nearby electrical circuits. The high impedance instruments (condenser, crystal, carbon) are very susceptible to electrostatic pick-up, whereas the low impedance devices (ribbon, moving coil) are more liable to magnetic induction (hum) pick-up. Good shielding cable, adequately earthed, is necessary to minimise such effects.

Feedback due to echoes is a common trouble, due to the acoustic properties of certain rooms. To reduce the effect a microphone with restricted pick-up angle should preferably be used.

In amateur telephony work, where the main consideration is the transmission of intelligible speech, a frequency response substantially flat from 200-3,000 c/s (or a little higher) is generally reckoned to be adequate. However, peaks in the response may be exceedingly unpleasant. For instance, the carbon microphone fulfils the requirements mentioned, but the low frequency peaks may seriously impair the quality. Going deeper there is the question of such matters as harmonic distortion, which is one of the carbon microphone's failings ; it can produce poor results besides causing sideband interference. For this, and other reasons, it is usually advisable to invest in a more efficient sound converter which does not possess the inherent failings of the simpler devices.

The final choice of a microphone will obviously depend on many factors — including cost, sensitivity, frequency response, robustness, convenience—and it is hoped that these notes have outlined some of the more important features of the various types that are likely to be encountered.

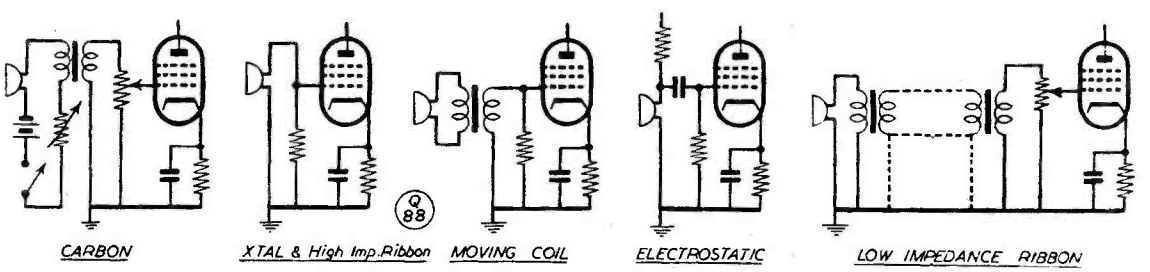


Fig. 4. Input connection circuits for several different types of microphone. The valve is, in each case, the first stage of the speech amplifier. With less sensitive microphones, extra gain is necessary, as discussed in the text.

COUNTY SCORING — NEW IDEA !

It will be of interest to all who work counties, either on VHF or Top Band, to hear that we have had a suggestion that would increase considerably the number of "workable counties." It is that if motor-vehicle licensing authorities — who include counties proper, county boroughs (the larger towns and cities with county status) and certain other local authorities not at present covered by our ruling— were to be accepted as defining the areas within which stations could be worked, it would widen the scope for county chasers. So much so, in fact, that it seems that on this basis the attainable total for the U.K. and Eire would be about 225 ! This is more than twice the present maximum ; our figure has been obtained from the list of motor-vehicle licensing authorities given in the *R.A.C. Handbook*. Such a change in the established procedure for county working would be a major one, and it has both advantages and disadvantages. The main advantage is that it would increase interest in county working and therefore in activity. An obvious disadvantage is the complication involved in settling the county status of many stations ; another objection might be that the present holders of our WABC Certificate would find the value of their Award much depreciated. Be it noted that for the present this new county scheme is A Suggestion Only!

CLASSES IN TV/FM SERVICING

Commencing from January 10, a one-day-a-week Course in Band III TV and FM Broadcasting, designed to be of direct assistance to servicing personnel, will be held at the Northern Polytechnic, Department of Communication Engineering, Holloway, London, N.7. Prospective candidates should apply to the Secretary of the Department for full particulars of the Course, an extension of the very successful one already held, which terminated at Christmas.

Measuring Unknown Frequencies

USING THE BC-221

J. E. MAXWELL (GI3ML)

MOST amateurs are familiar with the BC-221 wave-meter and its variants such as the LM10, and are conversant with the method of using it for checking the frequency of a transmitted or received signal.

It has, however, one possible application which is not generally realised—the ability to measure the frequency of an oscillator the frequency range of which is entirely unknown, though the experienced amateur, by a glance at the size of coil and condenser, may be able to make a bold guess at the part of the frequency spectrum likely to be covered.

In order to understand how this can be done it is necessary to consider how beat notes are produced between the oscillator and frequency meter. They can be generated in two ways :

(a) If the oscillator fundamental is low compared with the fundamental of the BC-221, loud beats will be produced between the oscillator harmonics and the BC-221 fundamental. (There will, of course, be weaker beats between the harmonics of the oscillator and harmonics of the BC-221, but these can be ignored, since they do not enter into the method of measurement.)

(b) If the oscillator fundamental is high compared with the fundamental of the BC-221, loud beats will be produced between the oscillator fundamental and the BC-221 harmonics. Again, the weaker beats may be ignored.

Taking case (*a*) first, it can be seen that if we let the unknown fundamental be represented by fx, and the successive harmonic frequencies by f1, f2, f3, etc., then.

$$fx = f3 - f2 = f2 - f1, \text{ etc.} \quad \ldots\ldots (1).$$

i.e., the fundamental frequency is the difference between any two adjacent harmonics.

Now, taking case (*b*), the conditions are somewhat different. If we let the successive frequencies to which the BC-221 is tuned when beats are obtained be f1, f2, f3, etc., and the harmonics of the BC-221 causing these beats be n+1, n−1, etc., we have

$$fx = (n+1)f1 = nf2 = (n-1)f3, \text{ etc.}$$

whence

$$n = \frac{f1}{f2 - f1} = \frac{f3}{f3 - f2}$$

and substituting

$$fx = nf2 = \frac{f1f2}{f2 - f1} = \frac{f2f3}{f3 - f2} \quad \ldots\ldots (2).$$

i.e., the unknown fundamental is found by taking any two beats, obtaining the product of their frequencies, and dividing by the difference of their frequencies.

Using the BC-221

In using the BC-221 for this purpose, therefore, we first tune in three adjacent loud beats, ignoring any weaker beats we may come across as we tune the BC-221 through its range. We measure these beat frequencies reasonably accurately, and by inspection find out whether the frequency difference between adjacent beats is the same. If it is, then condition (*a*) exists, and the fundamental of the oscillator is this difference frequency. If the difference between successive beat frequencies is not the same, then condition (*b*) exists, and to find the frequency of the oscillator we use the formula given at (2) above. Slide rule accuracy is sufficient to find the approximate frequency, which can then be measured exactly using the BC-221 in the ordinary way.

A word of warning is necessary ; always use the fundamental frequency of the BC-221 when making measurements by this method, as the use of the harmonic frequencies shown on the BC-221 calibration chart will give incorrect results.

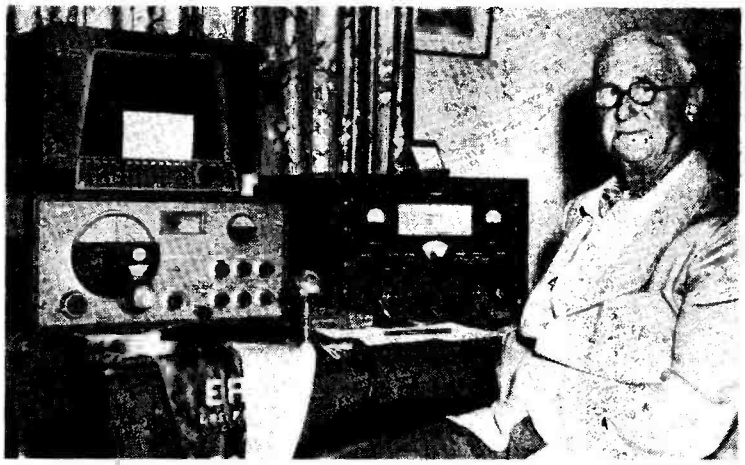
In conclusion, it should be stated that the writer has used this method to measure the frequency of an oscillator in a two-metre receiver, the frequency being 132 mc. The expression "loud beats" used above is of course relative, and at such a frequency as this one has to listen very intently, and tune the BC-221 very slowly and carefully, if one is to hear any beats at all !

QSL's FROM G3AAT/OX

The British North Greenland Expedition station, signing G3AAT/OX, was operated by Instr. Lt./Cdr. R. Brett-Knowles, R.N. (G3AAT), C.R.E. H. Dean and P.O.Tel. K. Taylor. We are informed that QSL's will be sent in due course for all contacts and reception reports—a task that may take the Expedition operators some little time, as many contacts were made.

DX COMMENTARY

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



ZS1RG/G6UT

UP one month and down the next, that's us . . . We try to be optimistic for once, and dilate on the excellence of conditions, and then someone overhears and pulls the big switch. Result, another very disturbed month, with the ionosphere in roughly the same state as the weather. There *have* been good days, but not many of them, and the promise of October/November has been well and truly broken, not to say shattered.

Ah, well, we still have the Top Band to turn to, and what a comfort that can be to someone who is hungry for a decent QSO and fed-up with wasting his time around the DX bands when they are nearly dead.

The first bout of the Trans-Atlantics was not too inspiring, but conditions were reasonably good for reception, and plenty of interesting stuff was heard. Stations worthy of mention are WØNWX, W9PNE, KP4CC, 4DV and 4KD, KV4AA and 4BB. Compare this with two or three years ago, when a single KV4 was quite an achievement, and you will agree that things are not too bad. All the above, of course, refers to December 5.

On the other bands, we have to report the usual dearth of real DX on *Eighty* (much of 3.5 mc is taken up by the most amazing miscellaneous non-amateur noises that we have ever heard); a rather similar state of affairs on *Forty* (very interesting if you're the type that starts off by calling a ZS and ends up listening to Spanish propaganda directed to the Turks from Uzbekistan!); the usual quite unpredictable state of things on *Twenty*; and wide open spaces all through the week on *Fourteen*, with a trebling or quadrupling of activity at week-ends. (*Ten?*—R.I.P).

Not a very pretty picture, is it? But there's one consolation. One can be pretty sure that each bout of good conditions from now on will be a little better than the previous one. We can also hope that they will become a little more frequent. We are round the bend, even if we don't see very far ahead.

CALLS HEARD, WORKED and QSL'd

Top Band DX

We propose to touch only with a fairy lightness on the Trans-Atlantic Tests because, as usual, they will be dealt with comprehensively in the early Spring. G5JU (Birmingham) made four contacts on December 5, all with 9's or Ø's; on December 12, an "unofficial" morning, he heard several, including W1BB calling YV5DE. GW3INO (Neath) heard quite a nice bunch on December 5, including two W4's, a W9 and a KV4.

A bulletin from W3RGQ (Nescopeck, Pa.) contains a lot of useful information, including a definite promise from HK4DP to be on the air at week-ends, 1870 and 1890 kc, using *one kilowatt*. Others mentioned include YV5DE and 5FL, VP4LZ, TI2BX, LU3EL, VO4B, W4KVM/VO6 and VP7NG. All very nice indeed for the W's, but only mouth-watering stuff to us. (Now if we were allowed even a modest 100 watts . . . .) Still more stations who are "interested" are HR1UA, KH6IJ, PY1AJ and YU1GM. W3RGQ, a keen 160-metre man, has sent out *eighteen* 160-metre crystals to various DX stations, thanks to a group of W's who have formed a "crystal bank" to provide these free of charge.

W1BB himself reports excellent publicity for the tests from the ARRL's W1AW, and confirms that he himself has worked YV5DE and heard LU3EL several times

Conditions for the tests were good for the second leg—on Sun-

day morning, December 19—with many G/W contacts made. But there was a certain amount of irresponsible operating on the part of two G3's, one G4 and a GM2, who, coming on late, apparently did not know the form and proceeded to VFO *on* to the DX. Two G's who strayed below the 1825 kc limit were suitably reprimanded by others who were playing to the rules. And Ostend Radio on MCW, and very rusty phone, was a menace!

Novice Morning

It has been suggested on both sides of the Atlantic that the January 30 Test should be dedicated to the "novices" who, so far, have not met with much success in these Trans-Atlantics. This doesn't mean that everyone who has worked a W is asked to stay in bed; but it *is* suggested that those who are regularly successful, and those who get good reports time after time, should stand down for this one morning. With their conspicuous signals out of the way, the W's feel that they would have a chance of reading many stations who, hitherto, have fallen just below the QRM level. Will the experts please co-operate in this? They can have a private field-day on January 23 instead . . . but for just this one morning, January 30, we hope that their beds will be more than usually attractive.

January 16 is likely to be a dead loss as far as the Trans-Atlantic Tests are concerned, because once again there is a clash, unexpected and quite unnecessary, with a local U.K. contest, which could have been held over one of the week-ends *between* our Tests. However, never mind — !

Medium DX, Top Band

G3HDQ (Woodford) reports working YO7XL on November 19 at 2200 GMT. He is still wondering whether he was genuine, but conditions were good, and a few minutes later he raised OH2YV.

G3JBK (Bexleyheath) kindly forwards a letter from OH7OH, who is very active with 30-40 watts input and a 250-ft. aerial some 60 feet high. OH7OH has special permission to work Top Band, and is very keen on getting a WABC, towards which his score is now 55 counties worked, 53 confirmed. (OH3NY holds the first and only WABC sent outside the British Isles . . . looks as though OH7OH should qualify for No. 2).

G3JXK (aboard the Troopship *Dilwara*) logged some G's while near Gibraltar on November 21. They were G3FKF/A (579), G3CHW (579), G3BFP (449), GW3EOP (469) and GC3HFN (569)—all just before dark. By 1810 the band became too noisy for further use.

And a late airmail from 4X4CJ (Tel-Aviv) says that on the morning of December 19 he heard HB9CM, OD5LX, OK1, OK3, two ZC4's, W4KFC and G6GM (559), all on frequencies between 1815 and 1855 kc, from 0435 to 0518 GMT. 4X4CJ will be listening on Top Band every week-end and will report to us anybody heard out there. His report for December 19 will certainly be of interest to all 160-metre CW operators!

County-Chasing

The rest of the Top Band news mostly concerns inter-G contacts and the usual routine, but shows a tremendous amount of activity on this band and a phenomenal level of keenness. In fact, as we said at the outset, it is hard to imagine what we should do without One-Sixty during prolonged spells of bad conditions.

HUNDREDTH OF A SERIES!

With this offering of "DX Commentary" G6QB hits the century — for it is the 100th time this feature has appeared under his name, representing more than eight years' activity in the field of DX on the bands from One-Sixty to Ten Metres. All readers of "DX Commentary" will hope to see him make another century.—Editor.

G3BRL's amusing account (last month) of the lengths to which he and others went to get a QSO with Cambridge has brought a letter from G3WW (Wimblington, Cambs.); he says that a 2½d. stamp would have saved 'BRL all that trouble, as a written request for a Top Band contact will be joyfully accepted at any time. The transmitter and receiver sit waiting, and QSL's will be sent on receipt of the incoming card. All the same, 'WW says he wrote to a GM who was complaining of never having worked Cambs., and his offer of a sked didn't even bring forth a reply . . .

G3DGN (New Barnet) joins our WABC ladder with 45 worked, 32 confirmed. G3JEQ (Great Bookham) rises to 87 worked, 86 confirmed, but says the going is now extremely sticky. G3DO (Sutton Coldfield) worked GM3DOD

". . . . Take your ring—and I hope you and the Top Band will be very happy . . . ."

(Renfrew) and GI3CVH (Londonderry) for new ones, and has new cards in to make a total of 64 confirmed.

EI8J (Dublin) is still not doing well with QSL's, presumably because the county-happy types realise that his card will not improve their status. For 45 worked he can only muster 20 confirmed—which is hardly good enough. He has raised OK1HI and HB9C during the month.

G3HZM (Manchester) would like county contacts with stations in Dorset, Hereford, Leicester, Monmouth and Oxon. G3JHH (Hounslow) now has 70/69 on the slate and is finding the going harder—he is another gunning for Oxfordshire, as well as Argyll and Renfrew.

TOP BAND COUNTIES LADDER

(Starting Jan. 1, 1952)

Station	Confirmed	Worked
GM3OM	93	95
GI6YW	91	91
G5JM	91	91
G2NJ	91	91
G3HIS	90	91
GM3EFS	89	91
G6VC	87	87
G5LH	87	87
G3JEQ	86	87
G3HDQ	85	85
G3HIW	83	88
G3CO	83	84
G3JML	80	81
G3IVH	79	83
G3BRL	76	76
G3EUK	75	82
G2AYG	73	74
G3HYJ	71	77
G3FTV	69	79
G3JHH	69	70
G3IGW	66	81
G3DO	64	67
G3GYR	64	66
G3HQX	63	68
G3GSZ	62	62
G3GZB	62	62
G5AO	61	64
G3IND	60	60
G3HZM	58	60
G3ITY	55	70
OH7OH	53	55
G3JJZ	50	56
G2HKU	48	50
G2CZU	44	45
GM3JNW	43	46
G3JBU	41	45
G3JBK	38	48
G3DGN	32	45
G3IAD	25	57
G3FAS	25	40
G3HMF	22	28
EI8J	20	45
G3FTV/A	13	60

Keep Clear of Them

G2NS (Bournemouth) says "the *Magazine* has certainly populated the desert wastes of 1.8 mc by fostering nocturnal county-chasing." But he adds a warning to those who complain of coastal station and fish-phone interference. Surely they know the frequencies of the coastal stations by now, and can keep off them! Coastwise traffic is liable to come up at any time, and a spot that sounds clear may suddenly be tenanted by QRO—but that doesn't imply that they have VFO'd on to you! So, in the words of G2NS, "those who choose to call CQ on frequencies allotted to such Billingsgate-boosters as Oban, Wick, Humber, Niton or Land's End should not express disappointment when the QSO is ruined by strong interference."

G3GQS (Helston) tells us that he and G3JOJ plan an expedition to the Scillies. This, of course, will not take place until the winter weather is over, and we hope to be able to give everyone due notice some time before Easter.

GM3EFS (Alexandria) says that two regulars to watch out for are GM3DOD (Renfrewshire) and GM3KAI (Berwickshire), both of whom should be in some demand. 'EFS himself has joined the select band whose score is in the nineties, although he has only 89 confirmed as yet.

G3FAS (High Wycombe) joins the ladder and says he came on the band with the idea of getting some Morse practice, but has stayed with the goal of WABC before him. He reminds G6VC (in search of Anglesey) that GW2BMN is there; another QSO that pleased him was with OK1AEH—but the QSl situation is not quite so cheerful as the actual QSO's.

G3ILO (Slimbridge) is a little worried because his first contacts were made as G3ILO/A—from the same QTH. He wonders whether he has to start WABC again, now that he has lost the "stroke A." No—certainly not! They all count. He is using a half-wave aerial, but contemplates a "very long wire" in the near future.

G3JJZ (London, S.E.6) remarks that G2BB (Camberley) has returned to the band after a long absence, and should score as three counties—his postal QTH is Surrey, his station is actually in Hants., and part of the aerial is in Berks! 'JJZ has worked some OK's and heard some W's, but is still experimenting with aerials.

G3JBK would like to see a third column on the WABC ladder—for contacts confirmed on *phone*. As he says, WABC phone is not outside the realms of possibility. We have sounded the customers on this one, though, and the response was very small. We can only say that if anyone does submit the necessary cards for a phone WABC, we shall be delighted to issue a specially endorsed Certificate for it.

NOVICE MORNING

January 30, 1955: It is specially requested that those stations who are regularly able to make Trans-Atlantic contacts shall "stand down" for this one occasion, in order to give others with weaker signals a chance of being heard by the DX stations.

If the "regulars" like to co-operate by listening and sending in their logs, it will be appreciated. But if they think that temptation will win, they are asked to stay in bed!

G3JXK (s.s. *Dilwara*) is now well on the way to the Far East and is still prepared to listen on any band—but Top Band chances must be a bit slender by now. From G2NJ (Peterborough) we have it that G2BVM is good for Suffolk and G3HYZ for Oxon. Stations are, however, wanted on in Kinross, Selkirk and East Lothian. G2NJ has worked

HB9CM—who was very QSA on the December 19 Test morning. G3JML (Huddersfield) goes up one to 81/80 and wants a card for Aberdeen.

The DX Bands

For almost the first time in living memory, the news about real DX is so slender that we can lump all the bands together and deal with them in a very few paragraphs. Conditions are mostly the reason for this, but the pre-Christmas rush is another factor, and one can hardly blame even a hardened DX-addict for not stopping to write a letter about a month like this, when he is buried under Christmas QSL's and parcels!

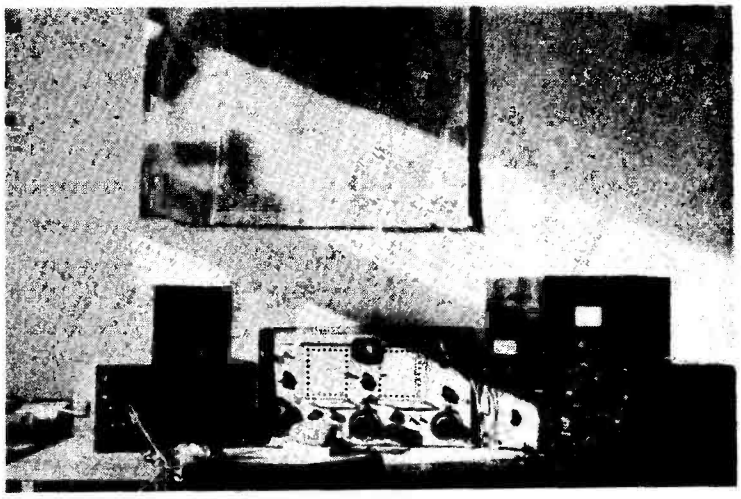
G2YS (Filey) raised MD5FH on *Eighty* at 2315 one night, and also increased his score on *Forty* with 4X4FK and SV1AB. His luck on *Fourteen* has been right out.

GW3AHN (Cardiff), one of the faithful devotees of *Fourteen*, says that VK and ZL phones have been very consistent during the last few weeks, and he has worked lots of them, as well as VP9, KV4, KP4, VP6 and a heap of African countries. CW work has brought in LZ, VK, ZD2, ZS9, CR6, FF8, YV, PJ, OA and "scores of W's" as well as much other stuff. On December 12, ZD4BL was worked, and he said that ZD4AB had left and was on the boat, homeward bound—so another well-known call is off the air. Apologies to GW3AHN for moving his countries score in the wrong direction last month! He now shares the top rung, with 112.

EI4X (Dublin) hunts the DX on phone and CW, mainly on *Twenty*, and has gained some new countries recently—mentioning among others VK1AC (Macquarie Is.), VK1DY (Heard Is.) and HK3PC. On *Eighty*, EI4X reports good QSO's with VE/W on phone and FF8 on CW.

G3IGW (Halifax) has also been picking them out on the 80-metre band. He has worked 20 stations in W1, 2, 3, 4, 8, as well as some other interesting ones like CT3AB, VO3X and I1BLV/Trieste.

GM2DBX (Methilhill) has been keeping a crafty eye on all bands, and has improved his Five-Band score accordingly; he, like all of us, finds it very sad that *Fourteen* should only be really open at week-ends. He was a little short of hours in the DX Contest, but even so he put in a phone score of 8,772 points. But the best contact for a long time was a "three-way" with a VE6 in Alberta, and his mother, in Darlington, on the telephone at the same time.



An unpretentious station, but on the air 18 hours a day, 365 days a year — MB9BJ, operated by a group of fourteen G exiles in Austria. They run 35w. to a VFO-BD-PA with an ATP-35 in the final; receivers are an HRO and a BC-312, and the aerial a N/S dipole. Whoever is on MB9BJ is always glad of a chatty QSO with a U.K. station.

Those Were the Days

Since the recent DX news is so scanty, we have been digging through all our post-war January issues to see what has been happening at this time of year when conditions have been behaving themselves, and afterwards. The following short extracts certainly make it clear; don't let them depress you, but rather reflect that the cycle is on its way round again!

From January 1947 we read "*Ten* appears to be very reliable this winter; there has not been a single fade-out during the month, but very long skip is making things difficult in the morning. Stations have been RST-289 on account of echo. W6 and W7 are very reliable in the afternoons . . . Judging by the number of 25-watters who have been making phone WAC's on the band, it will soon suffer a lack of popularity through being too easy." (No comment!)

Some of the stations mentioned in January 1948 (mostly on *Ten*) are C8YR (Zone 23), VQ1HJP, VQ8AZ, CE7AA, UAØKQA (Zone 19), KG6AW/VK9, KM6AA, VR5PL and a whole stack of KG6's. In January 1949 we alluded to the 1948 WAZ Marathon, in which the high scorers by mid-December were G8KP (40 Zones and 168 Countries) and G2EC (40 and 167). In the phone-only section G3DO was leading with 35 and 112. AC4RF (*see* p.559, last month) was reported as having set up in Lhasa, active on 14 and 28 mc phone and CW. Other outstanding calls mentioned were PK6HA, VP8AP, VK9BI, ZK2AA and UA1KEC (Franz Josef Land).

The first signs of discontent are noted in January 1950, with the words "December has not been what one would call a howling success," although we still read of contacts with KH6, KL7, CR5, PK, XZ, HH, ZS8, KR6 and KG6—all on *Ten*. By January 1951 the wording is even more dismal. To be precise, "December seemed pretty grim to us on all bands" . . . although we read, soon afterwards, that W6 and 7 were banging through in the old style in the

afternoons, and that ZS2MI (Marion Island), HS1VR and VT1DF were very active. Under the heading "DX QTH's" appear the calls of *six* VK1's!

January 1952 almost came in the horror-comic category! *Ten* was "pretty grim," *Twenty* "pretty foul," and when we come to *Forty* we read: "When Ten and Twenty go bad on you, you usually expect Forty to turn up trumps. Alas! this month it has been as bad as the others."

Even so, the leading station in the 1951 Four-Band Marathon, then in its last stages, showed a score of 158 countries during the year (151 of them on *Twenty*). But the rot was obviously beginning to set in.

Its progress is definitely established by the opening paragraph of the Commentary for January 1953: "A year ago we had to report that November and December, 1951, were about the worst DX months experienced since the war. Now we may as well cancel that statement, for the last two months of 1952 have surely touched a new low."

There is no need to bring things right up to date; the pattern is familiar enough. But at least we can now make a cheerful statement, to the effect that the past two months have *not* been any worse than the corresponding months of 1953. If anything, we think they have been better. The fact that not much DX has actually been reported does not mean that none has been worked, and we have *heard* quite a lot of good QSO's going on—apart from making a few ourselves.

So cheer up, everybody—good times are around the corner, and by the end of 1955 we shall probably be wondering what all the fuss was about!

News From Overseas

G3AUT (Rugby) arrived in Canada in August, and he now holds the call VE2ATU in Montreal. His gear is accumulating slowly and he hopes for plenty of contacts with G-land as soon as he is active.

4X4CJ (Tel-Aviv) was pained to read our reports of poor conditions, and sends a specimen list of stations heard there during ninety minutes' listening on November 19, on *Twenty*. Among them are JA8AQ, VK1EG, DU7AG, LU1PA, KL7FAF, KA2YA and many Africans. The times, by the way, were between 0430 and 0600 GMT. 4X4CJ has been QRT for over two years, but hopes to get back soon.

VS1GN (Singapore) is ex G3JFC, and is now on the air. His times are 0330-0530 and 1330-1630 GMT, and his frequencies 7007, 14014, 21021 and 28028 kc (yes—one crystal!) He will be running 25-50 watts and will QSL "one hundred per."

DL2RO (Hamburg) confirms all that we have said about conditions, compared with those of the previous month. He finds that you can still dig DX out of *Forty* if you can stand the racket, and during early December the W6 and W7 signals (long way round) were quite good between 1600 and 1700 GMT. *Twenty* he found very poor, especially during the "popular working period" of 1600-1800; but when a contact *was* made, the RST report was usually excellent. A type signing ZA1BB was noted, and treated with the usual reserve. *Fourteen* deteriorated until mid-December, when very little was to be heard on the band. Special mention is made of the consistent signals of CR6AI and W4DGW/MM; other contacts have been with VK and ZL. VP6FR, ZD2DCP, and VS6CQ.

DL2WY is G3HPA of Southwick and has recently arrived in the Zone—having previously been ZC6JU (1948), ZB1BB (1950), MD7AR and SU1LN, and he has even had time to visit Australia! DL2WY is on 80-14 metres inclusive, and particularly wants contacts with VK3's in Melbourne.

If you hear (or work) XE4PA, he is on Maria Magdalena Is., in

21 mc MARATHON

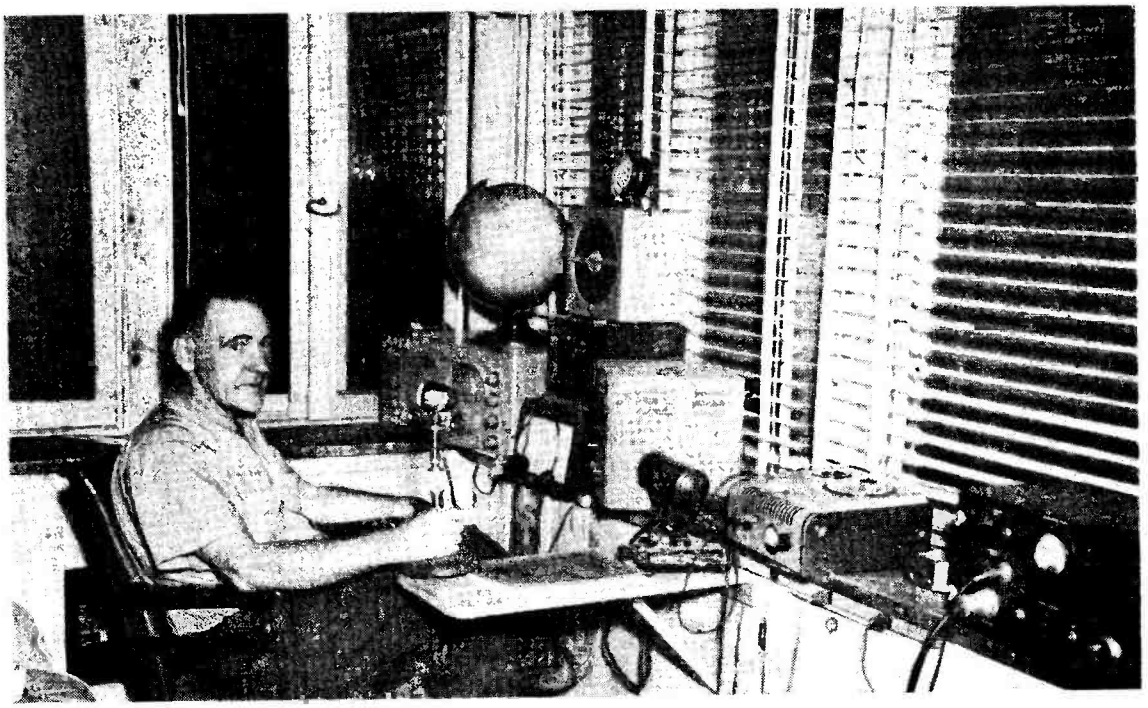
(Starting July 1, 1952)

STATION	COUNTRIES
GW3AHN	112
G4ZU	112
VQ4RF	108
G4ZU (Phone)	108
G5BZ	108
DL2RO	99
G2WW	98
G3HCU (Phone)	94
G2BW	92
GW3AHN (Phone)	85
G6QB	82
G2BJY	81
G2VD	80
G2YS	78
G3DO	74
ZS2AT	70
GM2DBX	67
G3FXB	65
ZB1KQ	64
G3CMH	64
ZB1KQ (Phone)	63
G3CMH (Phone)	62
5A2CA (Phone)	60
GM2DBX (Phone)	58

FIVE BAND DX TABLE
(POST WAR)

Station	Points	3.5 mc	7 mc	14 mc	21 mc	28 mc	Countries
DL7AA	649	85	154	216	90	104	221
G6QB	598	52	108	221	82	135	235
G5BZ	573	62	111	227	108	65	230
G2VD	511	48	94	180	80	109	189
G4ZU	499	12	45	210	112	120	214
G2WW	488	23	70	190	98	107	198
G3DO	449	24	46	198	74	107	222
G2YS	399	56	76	143	78	46	160
G2BW	360	24	57	144	92	43	161
GM2DBX*	359	33	31	156	58	81	167
G8KU	335	22	50	160	28	75	168
ZB1KQ	284	6	34	118	64	62	139
G8VG	280	36	76	124	18	26	141
G3IAD	218	27	84	98	8	1	128
G2DHV	177	20	23	108	11	15	112

*Phone



W1AUR of Fayette, Maine, a well-known 28 mc phone. With the rapid improvement in HF conditions, he may well be heard again very soon.

the Pacific, and can be QSL'd *via* L.M.R.E., Box 907, Mexico City. XE4PA looks for G's during 0200-0300 G.M.T. on 7010 kc, and is also on 14020 and 21030 kc.

The Hon. Sec. of the Radio Society of East Africa informs us that the WEA (Worked East Africa) Certificate has now been suspended indefinitely. Outstanding claims will be attended to, but no further applications will be considered. They hope, however, to issue a new Certificate, and details wil be sent in due course.

VS2DB, who has been in GI on leave—trying to keep warm, with VS2DG and VS2DV—will be back in Malaya in the New Year.

We hear also from David Mitchell (ex-GW6AA and ZL1MP) who has now found himself a delectable island paradise in the Bahamas—he is VP7NI on Eleuthera Island, and can be reached *via* Box 83, Governor's Harbour. We hope to be in QSO ere long.

Helvetia 22 Contest

This annual contest is coming round again, the dates and times being March 19, 1500 GMT, to March 20, 1700 GMT. Participating stations outside Switzerland should call "CQ HB" or "CQ H22"—all bands 3.5 to 28 mc, CW to CW or phone to phone. Scoring—three points for each HB station on each band, total multiplied by the number of Swiss Cantons worked, the total number possible being 22 on each band. Five or six-figure numbers will be exchanged, made up of the RST (or RS) report plus a three-figure serial starting from 001 and proceeding with the number of contacts.

Swiss stations will indicate which Canton they are in by a two-letter abbreviation (*e.g.* ZH, AG, GR, VD and so on). Entries must be mailed by March 31 to HB9CZ, with each band on a separate sheet, and the usual declaration that the station was operated in accordance with the rules and spirit of the contest.

DX Strays

VQ6LQ is, for the present, off the air, having returned home for Christmas leave. ZC3AC is said to be on from Christmas Island—ZL2FA has worked him, says he is a newcomer and "easily frightened." Some time in January, as previously reported, VQ8AL and 8AR are due to make an expedition to Rodriguez Island.

W1JRA is expecting to make a three-month stay in Afghanistan, and is applying for an amateur

TRANS-ATLANTIC TESTS
1954-55 SEASON

Dates:

January 16 and 30, 1955
February 13, 1955

Times:

0500-0800 GMT

DX stations call at 0500-0505, 0510-0515, 0520-0525, and so on. Europeans call 0505-0510, 0515-0520, 0525-0530, and so on. Clocks should be synchronized by WWV on 2500 kc.

Frequencies:

Europeans in band 1825-1875 kc, preferably keeping to 1830-1870 kc. W/VE stations, according to location, in bands 1800-1825 kc, 1875-1925 kc and 1975-2000 kc. They will know where to look for us, and contacts should be carried out cross-frequency to minimise interference. All Europeans are asked to keep clear of the DX channels.

ticket. He will be at the US Embassy, so there may be a real hope of some genuine YA contacts.

Anybody know KD6AT, heard on the air towards the latter part of November? No clue at all, but he says the QTH will be on his card—if you get it . . . .

VO3X is operating on 1817 kc around 0715 in the mornings, and can also be contacted on *Eighty* many nights.

Others heard and, in some cases, worked by W's. include ZM6AI, FR7ZA, VR6AC, AC3PT, HKØAI.

(Thanks to KV4AA and the Southern California DX Club for some of the above information.)

Forthcoming Attractions

We feel it would be pointless to organise any sort of Marathon contest during 1955, with conditions still as unsettled as they are. What we hope to do is to switch off the Five-Band DX Table at the end of this year and to start it again from scratch, with a "1956 Marathon," so that everyone, including the newest newcomers, will have a look in.

Certificates will be issued as usual, and the Top Band Counties Ladder and the 21-mc Marathon Table will also continue. We hope, however, to organise some short, sharp contests if we can find a clear week-end or so, and we have some unusual ideas up the sleeve for this purpose.

For the moment, with the Trans-Atlantic tests still going on, and the higher frequency bands liable to be mostly closed, we are holding off.

Meanwhile, however, we should like to know how much support would for forthcoming for a week-end 21-mc Contest? This would *not* be one of these continuous 48-hour affairs, but would consist of two sessions of twelve hours each, one on the Saturday and one on the Sunday, probably running 0800-2000 GMT each day. Send us your views on this, and, with sufficient promise of support, we can arrange it for the early Spring.

Now it only remains to wish all readers a Happy New Year. May 1955 bring you prosperity, good health, happiness and plenty of DX.

Deadline for next month's news and notes is **first post on Friday, January 14.** Address everything to "DX Commentary," *Short Wave Magazine*, 55 Victoria Street, London, S.W.1. Until then, as always, 73, Good Hunting, and BCNU.

TRANSISTOR TOPICS

Oscillating Crystal Diodes

Some Early Experiments

A Practical Circuit

TTX Activity Notes

IT was mentioned last month that an oscillating crystal was nothing new, the earliest reports dating back to 1910.

Reports of Russian results "hit the headlines" of the technical press about 1924. The evidence available suggested a great new future for the humble crystal. Communication over a mile or so had been achieved using a crystal oscillator, and a host of circuits were produced for heterodyne receivers, long-wave receivers, short-wave (medium by present standards?) receivers and LF amplifiers and oscillators. Well-known periodicals, such as *Wireless World* in this country and *Radio News* (now *Radio Electronics*), were optimistic. Hugo Gernsback in *Radio News* said "That the radio industry is due for an entire revolution through this invention there seems to be no doubt," although he admitted "it may take many years for the oscillating crystal to be perfected in such a manner that it will supersede the vacuum tube." (How right he was!).

Now why was it that the subject, apparently so full of promise, was forgotten for more than twenty years? The answer is that the oscillating crystal, as then described—a zincite detector with one cat's whisker—did not really have the future predicted for it. The main handicap suffered by workers of those days was ignorance of the *nature* of the device, though they knew well enough how to use it. It was through no fault of theirs that they were twenty years and more before their time. In the last few years immense strides have been made in the Physics of the Solid State, and it was in the course of experiments with semi-conductors that Bardeen and Brattain made their historic discovery, in the Bell Telephone Laboratories in 1948, of "Transistor Action" with two adjacent whiskers on the crystal.

Diode Oscillators

To return to 1924, however, let us see how the crystal was used. Consider the circuit of Fig. 1 for testing the reverse characteristic of a crystal detector (germanium or otherwise). For different voltages applied, different currents pass, and, knowing the current through R, the voltage drop across it can be calculated, and hence the actual voltage across the diode. In order to keep R high and stabilise the current, it is preferable not to connect a voltmeter, unless it is of very high resistance, directly across

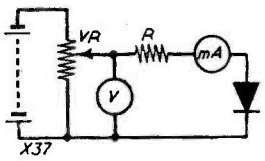


Fig. 1. Testing the reverse characteristic of a crystal. The voltage across the diode can be calculated, and an I/E curve plotted.

the diode. (A voltmeter of known current deflection could be used in place of R and both readings obtained on one meter). If we now plot a curve of the voltage across the diode against the current through it, we may get a result such as is outlined in Fig. 2. The initial rise is the reverse resistance, and the steeper it is the better the rectifier. The top of the curve is the turn-over voltage and is the highest voltage the diode can withstand. Beyond this, the resistance, as it were, *breaks down*, and we get a negative or downhill slope. In other words, over this range we have a negative resistance. How can this negative characteristic be used for an oscillator? In a simple LC circuit an oscillatory current, once started, will die away as the energy of the circulating current is absorbed in the resistive damping of the circuit. If this resistance could be reduced to zero, the oscillation would continue. This is where the negative resistance comes in handy, for we put it in series with the positive resistance to add up to zero!

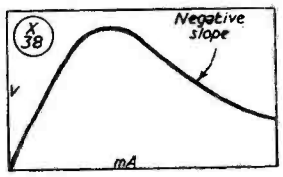


Fig. 2. Curve of the voltage across a diode against current through it, as obtained from Fig. 1. It is by virtue of the negative slope that the crystal can oscillate — see text.

The coil, condenser and crystal are connected in series, while the correct biasing is applied through a high resistance. Provided the downhill slope of the diode is steep enough, the circuit of Fig. 3 will go into continuous oscillation, limited in amplitude only by the extent of the negative slope. Chokes in the biasing leads to the crystal might be advisable to keep the oscillatory currents where they belong.

The idea of using a negative resistance to maintain oscillation is not confined to the crystal diode. The arc transmitter of ancient times (pre-valve), the screen-grid valve dynatron oscillator of not so long ago, and the base-tuned transistor oscillator of modern times all make use of a negative resistance in some device where the current increases as the voltage decreases (or the current decreases as the voltage increases).

For a crystal, it was discovered that a special zincite using a steel whisker gave the best negative resistance. The preparation of the zincite savoured rather of black magic! An article in *Wireless World* in that year (1924) suggested the following process: Place the zincite on an iron plate and sprinkle with manganese dioxide. With a carbon and the iron, strike an arc over the zincite and bring to white heat. After cooling, break off outer crust and use inner core for experiments.

It is interesting to compare these crude methods of preparation with present-day practice in the preparation of germanium. The germanium is purified to a state where the impurities, in some cases, are less than one part in 1,000,000,000, so that controlled impurities of one part in 100,000,000 may be added. In view of the significant effect the impurity produces, it seems unlikely that reproducible results could have been obtained by the early methods.

A typical working point for a zincite crystal oscillator was 6 or 7 volts at 2 or 3 mA. The modern equivalent point-contact diode also shows the same characteristics, but, being a better rectifier, it has a much higher turn-over voltage. The writer has an audio oscillator of this type going, to the circuit of Fig. 3; the working point is, in fact, about 7 mA at 40 volts. This means over-running the diode to a degree at which overheating becomes serious (0.3 watts), and the life is probably limited. The oscillator can only function over the restricted range of the negative resistance, and thus can only give a limited output in return for the large standing input needed to fix the operating point.

This gross inefficiency seems inherent and is the real cause of the failure of this device. It is unlikely that it could be of any practical use unless special suitable semi-conductors were developed, and this would hardly be worth while, as we now have the germanium *triode* which can give such a good account of itself.

A useful way of examining the diode characteristic is by displaying the curve on a CRO, as this enables suitable diodes for the experiments to be quickly sorted. Even at 50 cps, the return trace does not follow the initial trace—presumably because of heating that takes place over the cycle. It seems fairly certain that this negative resistance is a temperature effect, as very rapid traces obtained by pulse techniques are said not to show it. It is therefore probable that the frequency could not extend much above MF.

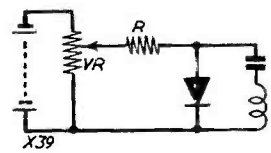


Fig. 3. Practical oscillatory circuit for a crystal diode. It is fairly easy to get oscillation on medium frequencies.

Before abandoning the subject, let us examine, as an example of the 1924 technique, a circuit from an issue of *Wireless World* of that year and reproduced in Fig. 4. This is a heterodyne crystal set, to enable CW to be received without valves. The heterodyne oscillator (or BFO) is arranged to oscillate at the right frequency by the tuned circuit L2, C2. The setting up was very tricky, even with a crystal that worked (don't forget the whisker had to be adjusted as well as the voltage). It was therefore usual to get the crystal oscillating first at an audio frequency by switching to L1, C1 and listening in phones tapped across the choke L1. Once oscillating, the HF circuit was brought in, loosely coupled to the crystal receiver and tuned to give a beat with the desired signal.

Diodes for Home-made Transistors

Research into solids has been as dependent on the production of single crystals as on any other development. It is vital in the production of junction transistors, and single crystals are always used in commercial point-contact types. It is not essential for diodes, however, so the chances are that the diodes we use for home-made transistors are polycrystalline. No different to look at, they do consist of a conglomeration of minute crystals instead of one single one, the latter being more difficult to make. As such, considerable patience must be expended on finding a "good spot," this being, in fact, getting both emitter and collector on to one of the crystals making up the whole. It is known that a few GEC diodes were made with single crystals, and it is believed that some BTH diodes are similarly made from one single crystal of germanium. These should be ideal for transistors, if they have suitable reverse resistance, and no searching for the right spot should be necessary. Unfortunately, there appears to be no way of identifying these, although it might explain why some diodes seem to give results more easily than other apparently similar ones.

The Amateur Radio Show

There were several items of transistor interest at this year's Amateur Radio Exhibition. Quite a few amateur-built TTX's were on show. GEC had a curve tracer for testing transistors, and STC demonstrated a 7 mc oscillator using a TP2 point-contact transistor. The *Short Wave Magazine* stand displayed several items, including some excellent examples of transistors home-made by G3CSZ, which attracted much attention, especially as one was a tetrode. Also on show was the photo-cell battery for the sun-powered transistor transmitter; a small TTX using a home-made transistor; and an audio oscillator which visitors could listen to on a headset, energised by either a single photo-cell or a penny-aluminium cell for its sole power supply. This was the oscillator described in "Transistor Topics," pp.387-388, in the September 1954 issue of *Short Wave Magazine*. It ran all the four days of the Exhibition on the penny-aluminium cell with a piece of wet blotting-paper separating the two plates, but was not so successful on the photo-electric cell with indirect artificial light. The BBC took a story on the *Magazine* daylight-powered transistor transmitter, for their Overseas Service.

Activity Notes

At a recent Transistor meeting in Buckingham, those present were G3CCA, G3HMO, G3IZS and G6FO; G3IYX was there by duplex radio, though not in person. Many matters of interest were discussed. It was suggested that future operations on TTX might centre around 1825 kc as being rather better than most Top Band frequencies. (The Leicester group are VFO, so they can slide about quite easily). It is suggested that others operating TTX might like to do the same, and that eventually we should try to secure, for transistor working, a narrow band about 5 kc wide in the neighbourhood of 1825 kc. It was also agreed to arrange a meeting, early in the New Year, for all those interested in Transistory, this to be held in Buckingham as a convenient centre.

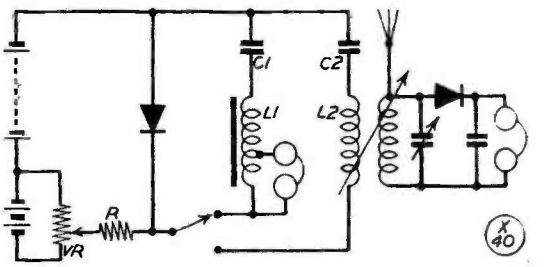


Fig. 4. Heterodyne crystal set, enabling CW to be read on a simple crystal receiver. The diode oscillator functions in the same way as what we now call a BFO. A circuit of this type is of academic or experimental interest only — the whole point is that it was suggested 30 years ago, when diode crystal oscillators became practical.

The most interesting information that G3CCA brought to the meeting was of an entirely new method of getting transistors going on HF. It seems to have a great future in the practical application of transistors, and in due course full details will be given in *Short Wave Magazine*. Using this principle, on December 12 G3CCA was heard in Buckingham, on two "overs," at RST-558/578, before the Sunday afternoon QRM clamped down. This was over a distance of 45 miles, and the power input was only 8 milliwatts—to a *junction* transistor!

Up in Liverpool, G3CSZ has now got a VFO-PA, using home-made transistors, working satisfactorily on the Top Band, with very good oscillator stability; keying is by frequency-shift on the VFO (quite permissible in ultra-QRP equipment), and the note is reported T8. G3CSZ's total of stations worked on TXX is now 19. We hope to give the circuitry and operating details of his transmitter — which incorporates the G3CCA VFO and the G3HMO PA—in our next issue.

All interested in Transistory are invited to let us have notes on their results and experiences for discussion under this heading. Address: "Transistor Topics," c/o The Editor, *Short Wave Magazine*, 55 Victoria Street, London, S.W.1, and the closing date this time is January 14. With all good wishes for the coming year, during which we shall see tremendous strides and great development in this interesting new field.

BOOK REVIEW

"TRANSISTORS AND CRYSTAL DIODES"

Transistory is now settling down; the first excitement of the discovery is over and a fairly clear picture of the device, its possibilities and limitations, has emerged. It is now within the grasp of the amateur to find out something about the transistor for himself. Commercial transistors are freely available, and the odd one or two are not beyond the

average pocket. Before commencing any experiments, some introductory book of guidance is advisable, as irreparable harm can follow misuse.

Mr. Bettridge, of the Osram Valve and Electronics Department of the General Electric Company, already well known in this field for his practical receiving circuits, has stepped into the breach with *Transistors and Crystal Diodes*. In this little "what they are and how to use them" book he has set out to describe current germanium diodes and transistors and their circuits. The approach is primarily practical and is directed to the amateur and semi-professional user. Semi-conductor theory is very brief and no more than an outline of the subject. A simple picture of the operation of the *p-n* junction and point-contact diode and also the junction and point-contact transistors is given.

The diode is treated with the same detail as the transistor. Very little practical information is available elsewhere, and so a review of all the important uses of the diode, together with relevant circuitry, is very welcome. It can replace the thermionic diode in many circuits and can be used where the thermionic diode would be impracticable, *i.e.* where special filament transformer or very high heater-to-cathode insulation would be necessary. However, the right diode to use in a particular instance is often a subject not well understood. Here the matter is explained in each application and a suitable diode is recommended. The applications include video, sound and a 200 mc mixer for television use as well as the crystal set, FM detector, bias supply (useful for transistor power supply) and meter rectifier circuits.

Transistor circuits are discussed in one chapter. This is followed by what for many will be the most interesting chapter, "Practical Radio Circuits for Point-Contact Transistors." Treated here are the reacting detector, a simple 0-V-1 type of receiver, a push-pull output stage, an HF/IF amplifier and a novel frequency changer. Oscillator circuits are mentioned, together with a trigger circuit, but unfortunately little information is given in these uses of the transistor. Junction transistors and their circuits are dealt with next. These refer, of course, to LF applications, although an interesting series-tuned IF stage is suggested.

A short but most useful chapter on simple methods of checking serviceability of diodes and transistors is followed by an introductory discussion on the use of formulæ for those who intend to take the subject seriously. An appendix contains abbreviated data on many British and American diodes and transistors. Mr. Bettridge concludes by hoping that his book will encourage the experimenter to "experience the pleasure of sharing, instead of passively watching, the early stages of a fascinating new branch of electronics." And with that your reviewer is in full agreement.

Transistors and Crystal Diodes, pp.72, illustrated line and half-tone, by B. R. Bettridge, A.M.Brit.I.R.E. (General Electric Co., Ltd.), published by Norman Price, Ltd., 283 City Road, London, E.C.1, price 5s.

J.M.O.

Cavity Converter for Two Metres

THE ON4BZ VERSION OF THE G3BKQ DESIGN

MANY readers will recollect the excellent 430 mc converter design by G3BKQ in the July, 1954, issue of *Short Wave Magazine*, pp. 256-264. In this, G3BKQ used tuned cavities for the mixer and oscillator sections, with a CV-364 (BTH) crystal diode in the mixer stage. Many reproductions of this converter have been built, some with various modifications—which may or may not have been improvements on the original design, which was perfectly all right as it stood !

However, one of the most ingenious applications of the G3BKQ design is its modification as a *two-metre* converter, using the same general principles as propounded by G3BKQ for his 70-centimetre version. For this, ON4BZ has been responsible, and readers will have noticed recent references in "VHF Bands" to his results and experiences.

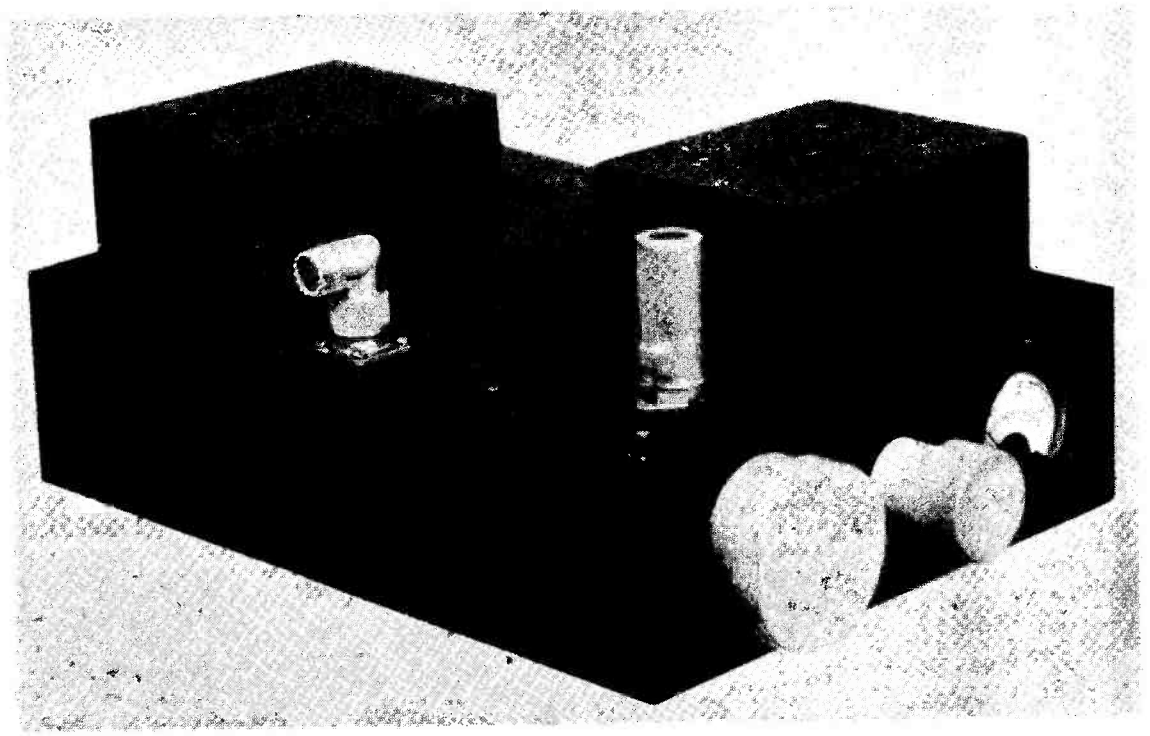
We now have, from ON4BZ himself, the details of his modification to make an exceptionally good converter for two metres ; these are discussed below for the benefit of those who have asked for the information, and for the guidance of those who would like to try something different in the way of VHF converters.

The Cavities

The most important variation on the original is, of course, in the sizes of the cavities. ON4BZ gives these as: 11½ ins. long for the oscillator, and 10½ ins. for the mixer, diameters as used by G3BKQ.

In every other respect (except for the addition of the RF stage and the cathode follower alteration) G3BKQ's original design values have been taken : hence, for those wishing to repeat the ON4BZ version as pictured here, reference shou'd be made to G3BKQ's article of last July for all other details.

The large upper-view photograph shows what a fine iob ON4BZ has made of the construction. The mixer and oscillator cavity control knobs are left and right respectively along the lower front edge (once adjusted, they are left



General appearance of the ON4BZ version, for two metres, of the G3BKQ design for the 430 mc band. The major modification is in the size of the cavities — all necessary details are given in the accompanying notes.

set), with the crystal current check meter to the far right. Above is the screening box containing the oscillator section, running 8133 kc in the grid of the first half of a 12AT7 with the 5th overtone taken out in its plate, into the second half as a tripler; this gives 122 mc injection into the oscillator cavity, and thus an IF tuning range of 22-24 mc.

The box to the rear of the chassis contains the head amplifier, or IF amplifying chain, as in G3BKQ's original. Both these boxes, oscillator and head amplifier, are well ventilated.

Results

With a selected CV-364 mixer diode, the best noise figure obtainable was around 7-8 dB. On aural test the converter seemed to outperform any other yet tried—why? Because the lack of input sensitivity resulted in an "uncanny silence," broken only when a strong signal was tuned in; then, the high gain of the IF amplifier produced terrific output and shattered the silence. The effect was rather similar to that given by an 0-V-3—no response on low level signals, but very good output on strong ones. (So many other converters exhibit the same characteristic!—*Ed.*)

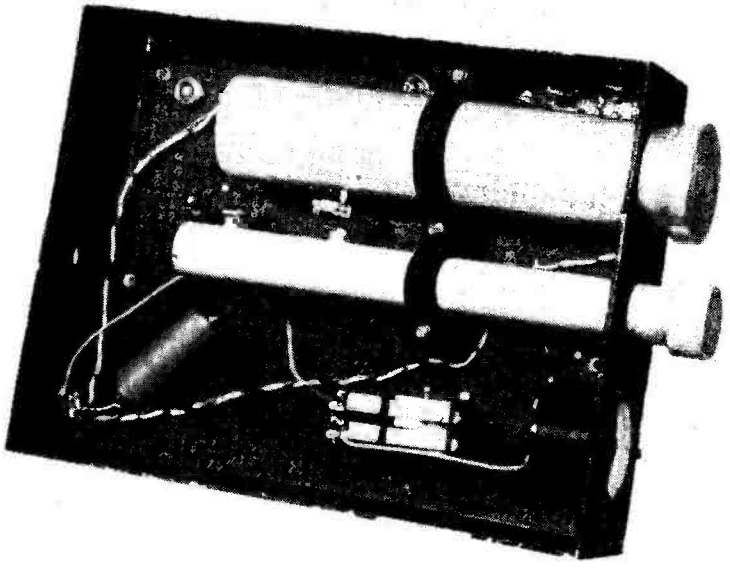
At this stage, it was decided that front-end gain was essential if the best was to be made of the converter. So ON4BZ put a 6J4 GGT RF stage on (seen as the shielded valve at left front in the upper chassis view) and immediately the NF improved to about 3 dB. The weakest signals became audible, though aural tests suggested that the converter was actually more noisy than in its original condition!

Connecting the RF Stage

This RF stage arrangement has been mentioned already in "VHF Bands," but for completeness is repeated here.

The plate of the 6J4 is connected to the "hot" end of the mixer cavity, two inches back from the front of the adjusting cap, through a fixed capacity of about 50 $\mu\mu$F. The plate circuit is completed by an RF choke in series with the HT feed. The grid of the 6J4 goes to earth, also the heaters are by-passed to earth, to avoid the need for any RF choke at this point.

On the cathode side, the input circuit is the



Under-chassis view of the ON4BZ cavity converter for two metres. The chassis is approximately 13 ins. long by 10 ins. wide by 2½ ins. deep, these dimensions being necessitated by the size of the cavities for the 144 mc band. The relay connected to the meter, just below the oscillator cavity, opens the crystal diode earth return on transmit, to prevent RF over-loading.

same as that used in ON4BZ's "6BQ7 Converter," as described on p.114 of the April, 1953, issue of *Short Wave Magazine* – except that the input inductance in this case is only 4½ turns of 16 SWG, ¼-in. diameter, air-spaced. (It is necessary to complete the cathode return by a suitable RF choke across the input.)

The big extra gain given by the 6J4 RF amplifier has to be cut down in the IF amplifier, *i.e.*, the "head amplifier" of the G3BKQ unit. So the final 6AK5 in this section, previously pentode-connected, is now used simply as a cathode follower, giving all its advantages in this position in the circuit. In the under-view photograph, a relay will be seen: this is connected to open the earth return of the mixer crystal to avoid RF overload when the transmitter is radiating.

As finally evolved, this converter is, says ON4BZ, a splendid performer on 145 mc—thanks to the excellent data given by G3BKQ in his original article. But he still questions the NF measurement on the 430 mc version! For our part, we would congratulate ON4BZ on the ingenuity he has displayed in making this interesting conversion. *A.J.D.*

AMATEUR EXHIBITION IN GD

The Isle of Man Amateur Radio Society will be having a stand at the Manx Fair and Trades Exhibition, to be held in the Palace Ballroom, Douglas, I.o.M., during January 22-29. It is hoped that the Club station (signing GD3FLH, operating 10 a.m. to 9.0 p.m. daily) will be able to make a good showing on the 80, 20 and 14 metre bands, as this is the first time the society has undertaken anything of the sort. Especially, it is hoped, that Manxmen overseas will be worked. An incidental attraction—organised by the sponsors of the Exhibition—is that the distant operator who happens to be in contact with GD3FLH at a certain time on any one day will be offered a ten-guinea hotel voucher, acceptable at any of the Island's hotels, for next summer! The draw will be made by the Exhibition authorities, the I.o.M.A.R.S. being in no way responsible for this little gamble.

RADIO SHOW 1955

The National Radio Show for this year is to be held at Earl's Court, London, during August 24-September 3. A smaller exhibition is being arranged at the City Hall, Manchester, for May 4-14. Organisation of both shows is in the hands of the Radio Industry Council, 59 Russell Square, London, W.C.1.

VHF BANDS

A. J. DEVON

EDX Opening, December 3—
Europeans Appear in South Wales—
News and Activity Reports—
Calls Heard and The Tables—

BY now, most VHF men will know that the curious change in the weather at the beginning of December produced a most remarkable EDX opening on December 3. Though of short duration, it was one of the best winter spells we have had, in terms of steadiness and strength of European signals and absence of fading. Many new contacts were made — and opportunities lost!

For it is also true to say that this opening was distinguished by a regrettably low level of U.K. activity, due in part, at least, to the number of beams "lost or damaged" in the great gales towards the end of November.

In particular, everyone will wish to sympathise with G8OU, of Ashtead, Surrey, whose beautiful new *fifty-six* element array for two metres, which was giving him such excellent results, crashed on the night of November 25/26. He had put much time and labour (and cost) into its design and construction, and its loss is no small matter. Bad luck, John—but you will be back again, and we all hope it will be soon.

Another case of bad luck, though of quite a different character, was that the G6LI/PE1PL schedule broke during December 2-4 inclusive because of receiver trouble at the Dutch end and a u/s transmitter at G6LI! And, on this theme, we also hear that two keen VHF operators who can be found not 100 miles from Cardiff are still kicking themselves lustily because, having spent the early evening of December 3 with GW3EJM, he switched on when he got home, but they didn't—and GW3EJM worked DL3NQ, ON4BZ and PAØFB, three very fine contacts right in the tradition of a really good EDX opening.

Signs and Portents

Your A.J.D. might perhaps remark here that in the South Midlands all the weather indications pointed to the possibility of an EDX break over the southern part of the country. In the event, the condition that did develop was such that the Europeans would have been workable with the simplest equipment and almost any sort of aerial—or "a piece of wet string of approximately the same length." Several correspondents remark upon the fact that their beams appeared to become very "flat," in the sense of loss of directivity; this is quite a usual effect when a really strong reflecting layer develops.

These very interesting experiences on December 3 once again confirm the contention that good DX conditions can and do develop during the winter. In fact, a browse back through "VHF Bands" over the last few years shows that winter DX results have been discussed on many occasions, some of them noteworthy. As it happens, this time last year we were talking about "wide openings on November 20-23 and December 1st."

The moral is, therefore, to forget about "winter conditions" and to watch the weather for a high-to-falling glass, and a marked change in temperature; if the sky is clear of heavy cloud and well defined stratification of the existing cloud layers can be seen (as was the case during the late afternoon of December 3) then the right condition is developing and it is Well Worth While Coming On.

Late Note. The evening of December 27, when there was a particularly striking sunset, exhibited—at least in the southern part of the country—the stratified cloud effect to a very marked degree. At an estimated height of 5000 feet, the layer could be seen extending for miles in every direction. During the week December 21-27, conditions were good for GDX distances.

Calls Heard and The Tables

It is natural that, at this time of year, there is a falling-off in the volume of reports, and the calls h/w lists are therefore somewhat attenuated. The total of claims for the Tables was about 25, and these movements have been duly recorded.

We would like to see many more calls h/w lists for the Activity Report and, in particular, more lists for the 70-centimetre band. There is steady work going on in various parts of the country on this band, and it is important that it should be recorded. So we hope to hear a good deal more about 430 mc activity.

Though this is the season of the year when many stations are rebuilding (or are being operated on other bands for a change!) there is no real reason why operators who consider themselves "active on two metres" should not come on regularly irrespective of conditions, even if only to talk round the locals. Whatever happens, do not let us fall into the *habit* of thinking that the band is dead because conditions are not good for DX—for the really keen operator, there is much else to be done besides working DX.

VHF Contest Notes

From HB9LE, in charge of VHF matters on behalf of USKA, the Swiss amateur organisation, we have a sheaf of notes, from which the following are the main points:

The first European contest in 1955 is the USKA-REF-UBA (Swiss, French and Belgian) event

during the week-end April 30-May 1st, which is also billed as an "Open contest for all organisations." The week-end July 2-3 is likewise booked for an open two-metre contest, as is August 6-7.

September 3-4 is given as the week-end for the big event, the European VHF Contest for 1955. As yet, rules have not been circulated, and it is not quite clear which is the organisation responsible for producing them. We shall, however, pursue this point and endeavour to publish the necessary information in good time.

HB9LE also gives the results of last year's "European VHF Contest"—the one for which rules were not received in time for publication by anyone except a few of the Continental radio periodicals. The results-sheet shows that twelve countries were represented by a total of 106 entrants, of whom nine only were G's; of these, G5KW (339) and G5YV (309) were the leaders. Their scores compare with F8GH (562), DJ1DC (497), PAØWO (489) and EI2W (382), who were the leaders for their respective countries; all other scores ranged a good deal lower than these figures. An interesting point is that there were 13 Italian entries, the leading operator, I1FA, making 226p.

This very useful report from HB9LE also mentions several active VHF call-signs which are of the more exotic variety from the G point of view—LX1SI, OE2JG and OE9BE—any one of which would start the bells ringing if they could make themselves well heard in the U.K. And according to HB9LE, there is also VHF activity in EA, SP and YU.

Some Station Reports

G3GHO (Roade) lost his slots in a gale, and is now putting up a 4-over-4 instead, by way of a change—he says it looks a much bigger array than the slots. On December 3, Bernard was getting the Europeans on an indoor Yagi . . . .

G3FIH (Combe Down, Nr. Bath) goes up in the Tables, but was out on the evening of December 3 . . . G3JXN (London, N.6) writes to report his debut, and though he has only been on two metres for a couple of months, he *was* there on December 3 and succeeded in working DL3NQ and ON4BZ with but 13w. to an indoor flat-top. So, says G3JXN, and not without reason, "I have enjoyed myself immensely." It is not the first time that a newcomer to the VHF air has found himself working Europeans never even heard yet by seasoned operators who have been waiting months, if not years, for the opportunity! But that's how it goes.

G3DLU (Compton Bassett) is still busy on the constructional front, and G3IRA (Swindon) is now running 150w. to a pair of 8012's, with NBFM; the receiver is a 6J6 RF stage into a crystal mixer with 18-in. tuned lines; G3IRA is busy on a G3BKQ converter for 70 cm. G3DO (Sutton Coldfield) has achieved 274S in 40C in the All-Time, and G6TA (London, S.W.16) goes to 28C in the Annual, with 355 stations worked.

During the period, G2FJR (Sutton Bridge, Lincs.) booked in 5 new counties for the Annual, and GM6WL/A in Wigtown for the All-Time, making him now 56 in that Table. G5BD (Mablethorpe) was in Scotland a short time ago, and reports that the level of activity up there surprised him; the G5BD/GM3EGW schedule, one of the long-haul paths over difficult country, still continues successfully, and shows what can be done with good equipment—and determination at both ends. Arthur G5BD, one of the old-timers of Amateur Radio as well as a very experienced VHF operator, is now up to 60C in All-Time Counties.

G2AIH (New Malden) writes in for the first time—though he has been a follower of this column since 5-metre days and active on VHF all those years—with details of his operations on the 430 mc band, on which he has recently started; seven stations in the London area have been worked, using a QQV03/20 tripler at 18w. input on 434.25 mc, the aerial being a 6-element Yagi. The 70 cm receiver at G2AIH is an EC91 grounded-grid RF stage into a modified G2DD converter, the IF/AF amplifier being a home-built receiver tuned over 23-29 mc.

G2AHP (Perivale, Middx.) has

TWO-METRE ACTIVITY REPORT

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

G3WW, Wimblington, Cambs.

WORKED: DL3NQ, G2AHL, 2AIW, 2ATK, 2CZS, 2DJM, 2FJR, 2FQP, 2HCG, 2JF, 2NM, 2TP, 2XV, 2YB, 3BJQ, 3BTC, 3DOV, 3FAN, 3FQS, 3FUL, 3GGJ, 3IEX, 3IIT, 3IOO, 3IRA, 3JFR, 3JMA, 3VI, 4AJ, 5DT, 5JU, 5ML, 5MR, 6RH, 6XM, 8BP, 8KW, 8PX, 8RW, ON4BZ, PAØFB.
HEARD: F8LP, G2ADZ, 3CCH, 3DF, 3GHO, 3GJZ, 3IWJ, 5BC, 5IG. (*Month to December* 13).

G8VN, Rugby, Warks.

WORKED: G2AHP, 2AOK, 2ATK, 2BVW, 2COP/A, 2DCI, 2HOP, 3APY, 3BA, 3BJQ, 3CKQ, 3DKF, 3FUW, 3GHO, 3HXS, 5JU, 5ML, 6CW, 6YU, ON4BZ.
HEARD: G2ABD, 2FNW, 2HCG, 3EHY, 3EJO, 3FIH, 3HTY, 3IJB, 3IOO, 3ISA, 3JGY, 3WW, 4PR, 5CP, 5DS, 5MA, 5MR, 5RZ, 6NB, 6XM, 8BP, 8KW, 8OU. (*November* 13 *to December* 13).

G2FJR, Sutton Bridge, Lincs.

WORKED: G2DJM, 2YB, 3CLW, 3GJZ, 3GPQ, 3IUD, 3VI, 5CP, 8BP, PE1PL.
HEARD: G2CZS 2FCL, 2FNW, 2HCG, 2HOP, 2XV, 3EPW, 3GCX, 3GHO, 3GKZ, 3GLW, 3WW, 5AU, 5MA, 5MR, 5YV, 6CW, 6NB, 6XM, 6XX. (*November* 15 *to December* 13).

SWL, London, S.W.18.

HEARD: F8LO, 9CQ-G2ABD, 2AHP, 2AIW, 2BPC, 2CZS, 2DP, 2DTO, 2DVD, 2GG, 2HCG/A, 2MV, 2RD, 2TP, 2YB, 3AGR, 3AIM, 3CLW, 3DF, 3DO, 3EBW, 3ENY, 3EYV, 3FMI, 3FQS, 3FSD, 3FUH, 3FUL, 3FYY, 3GDR, 3GSM, 3GXG, 3HAO, 3HPW, 3HXS, 3IES, 3IJW, 3IRW, 3JMA, 3JXN, 3WW, 4AJ, 5BC, 5CP, 5DT, 5KV, 5KW, 5MA, 5TZ, 5US, 5YH, 6JK, 6LL, 6NF, 6OH, 6RH, 6TA, 6XH, 8GD, 8KW, 8OV, 8RV, 8RW, 8SK, 8VN. (*November* 17 *to December* 12).

G2CZS, Chelmsford, Essex.

WORKED: F3LP, 8LO, 8OL, G2BBN, 2HCG/A, 2MV, 2YB, 3ANB, 3BTC, 3CLW, 3CVO, 3DF, 3EOH, 3GGJ, 3IIT, 3IJW, 3IRW, 3JMA, 3WW, 4OT, 5KW, 5UM, 6LL, 6NB, 6TA, 6XH, 6YP, 8KW, 8LN, ON4BZ.
HEARD: DL3NQ, F8GH, G3GSM, 3JFR, 4AJ, 6CW. (*November* 14 *to December* 12).

G3JXN, London, N.6.

WORKED: DL3NQ, G2AHP, 2RD, 2WS, 3BII, 3CLW, 3EOH, 3EYV, 3IRW, 3ISA, 3WS, 5DS, 5UM, 5YH, 6AG, 6NB, 6RH, 8OU, 8RW, ON4BZ.

HEARD: G2ABD, 2ADZ, 2AIW, 2ATK/M, 2BBN, 2DUV, 2FTS, 2UN, 2XV, 3FAN, 3FIH, 3FYY, 3GXG, 3HZJ, 3IAM, 3JEP, 3FD, 5DT, 5KW, 5MA, 5TZ, 5US, 8SK, PAØFB. (*November* 15 *to December* 14).

70-Centimetre Band Only

G2AIH, New Malden, Surrey.

WORKED: G2DD, 2RD, 3FP, 3FSD, 3JQN, 5DT, 6NF.

HEARD: G2DSP, 3FZL, 3GDR, 5CD, 5KH.

TWO METRES

ALL-TIME COUNTIES WORKED LIST

Starting Figure, 14
From Fixed QTH Only

Worked	Station
71	G5YV
68	G3BW
64	G6NB
62	EI2W (209), G3BLP (630)
60	G5BD
59	G3EHY, G4SA
58	G8OU
57	G2OI (349), G8SB
56	G2FJR, G3CCH (257), G3GHO
55	G2HIF, G3WW, G5BM, GW5MQ
54	G3IUD (201)
53	G2AJ (519), G2HDZ (416), G3FAN, G4CI
52	G2NH, G3IOO, G5DS (565), G6XX, GW2ADZ
50	G3ABA
49	G5MA
47	G5WP
46	G4HT (476), G5BY, G5ML (280), G6YU (205)
45	G2XC, G6XM (356)
44	G3BK, G3HAZ (262), G8DA
43	G2AHP (500), G3BA, G3COJ, G4RO, G5DF
42	G3FIH, G3GSE (424)
41	G2DVD, G2FQP, G3DMU, G6CI (184)
40	G3BNC, G3CGQ, G3DO (274), G3HWJ, G5JU, G8KL
39	G2IQ, G3GBO (434), G3HBW, G3VM, G8IL (325)
38	G2FCL (234), G3APY, G3WS (183), G6TA (355)
37	G2DDD, G2FNW, G2FZU (180), G3DLU
36	G2DCI (155), G2HOP, G3CXD, G6CB (312), G8IP
35	G3BJQ, G3FZL, G3HCU (224)
34	G3BKQ, G5MR (235), G8IC
33	G3FYY (187)
32	G2CZS (178), G2FVD, G3IER, G8QY, G8VN (151), G8VR
31	G3HXO, G5RP
30	G3FRY, G3GOP (208), G3GVF (129), G3IRA, G5NF, GM3D1Q, GM3EGW, GW8UH
29	G3AGS, G3AKU, G3FIJ (194)
28	G8DL, GC3EBK, GM3BDA
27	G3DAH, G3ISA (160), G6GR, GI3GQB
26	G3AEP, G3CFR (125), G3SM (211), G4LX, G4MR (189)
25	G3JMA, G5SK, G6PJ
24	G3CVO (190), G3FD, G3FXG, G3FXR
23	G3CWW (260), G5PY, GW3GWA
22	G3AGR (135), G3ASG (150), G3BPM, G3HIL
21	G2AOL (110), G3DVQ, G3IWJ, G6XY
20	G3EYV, G3HSD, G3IOE, G3YH
19	G3FEX (118), G3GCX, G5LQ (176)
18	G3DBP, G8NM, GC2CNC
17	G3CKQ
16	G3FRE, G5AM
15	G2BRR, G2DRA, G3IWA
14	G2DHV, G3CYY

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

now worked his 500S on two metres, by finding several stations new to him just recently, and also added four counties for the Annual Table; G2AHP remarks that "the biggest fish missed this month" was G3IOE of Newcastle.

G5MR (Hythe, Kent) was in the thick of it on December 3, getting very strong signals not only from the Europeans but also from numerous unusual G stations—including GW3EJM, who was busy with the Continentals. G2CZS (Chelmsford) worked three F's and ON4BZ on December 3, all at very good strength, with DL3NQ heard. G2CZS is looking for contacts to the south-west, and for G2ADZ.

The situation of December 3 repeats itself with G8VN's report, who says that ON4BZ was very strong in Rugby for a long time, and was successfully worked at 2345—with G8VN still on the indoor beam. The Rugby group is very anxious to encourage more Midlands activity for regular local working; G8VN lists some 14 quite well-known calls now rarely to be heard, and suggests that they try and be there occasionally between 1830 and 1930; he also mentions G6PO of Coventry as a new station on the band.

G5CP (Nr. Chesterfield) is now running a pair of 4X65A's, and has worked G3IWJ of Liverpool many times across difficult country, also G3IUD (Wilmslow) over the same sort of path; the G5CP/G5MA schedule continues very successfully, and G5CP has also succeeded in working PE1PL. He is anxious to encourage increased activity and offers two-metre schedules any day during 0800-0845, 1230-1330 or 1715-2300.

G3WW (Wimblington, Cambs.) has improved the plant on two metres by fitting a high-level speech clipper, and is doing better on the modulator with 811's in

". . . . . Let's work break-in, OM —it's much snappier . . . ."

place of the TZ40's previously used; he gets a good cut-off and has had very encouraging reports on a number of VHF contacts. Several new stations were raised during the period to December 13, including a first-phone QSO with G5MR of Hythe, always workable on CW only on previous occasions; this was on November 21, when conditions were good and the band wide open all day, as reported by several others. The Europeans were good with G3WW on December 3, and he heard a number of interesting EDX contacts being made by G's; he also comments upon the excellence of G3CCH's new phone signal.

G6LI/PE1PL Schedule

Though it was tough going, between November 15 and December 15 contact was established on 20 occasions, generally with low signal strength and much fading; one of the best days was December 14, R5's both ways, when the barometer stood at 1010 mb, rising.

G6LI feels that results so far on this schedule have been highly satisfactory; the full picture will not emerge until they get on into the Spring, as intended, by which time there will be a day-by-day record of results and conditions over several months. G6LI is making very full observations, and his data will undoubtedly be of much value to those who are

TWO METRES

COUNTIES WORKED SINCE SEPTEMBER 1, 1954

Starting Figure, 14

From Home QTH only

Worked	Station
40	G5YV
35	G2HJR
33	G3GHO
29	G3WW
28	G6TA
27	G3FIH
23	G2CZS, G2DVD
22	G3FYY, G5MA, G8VN
21	G3BJQ, G3DO
20	G2AHP, G3DVQ, G3HWJ
19	G5BM
18	G3DBP
16	G3IER, G3IRA
15	G5DS
14	GM3DIQ

Note: This Annual Counties Worked Table opened on September 1st, 1954 and will run for the twelve months to August 31, 1955. All operators who work 14 or more Counties on Two Metres are eligible for entry in the Table. The first list sent should give stations worked for the counties claimed; thereafter, additional claims need show only counties worked as they accrue. QSL cards are not required for entry in this table.

SEVENTY CENTIMETRES

ALL-TIME COUNTIES WORKED

Starting Figure, 4

Worked	Station
26	GW2ADZ
23	G3BKQ
16	G2XV
15	G4RO
14	G3HBW, G6NF
13	G3IOO
11	G2HDZ, G5YV
7	G2HDY
6	G3FAN, G3JMA
5	G3FUL, G3IRW
4	G2DDD, G3IGY

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

studying VHF propagation in terms of weather.

VHF Century Club

We are glad to notify the election of B. B. Gale, GC3EBK of Guernsey, as the latest member of the VHF Century Club, with Certificate No. 175; he has had some difficulty in getting his cards, and there are still a number outstanding. As he says, "If a GC cannot get the QSL's, how do the G's get on?"

Those bobbing on their VHFCC, or interested in acquiring it, are reminded that cards should reach us by registered post, addressed to A. J. Devon, with a check list; this is *essential*. The Certificate is issued and the cards returned as quickly as possible, but the period may vary from a few days to a fortnight or so, depending upon the amount of general work on hand when the claim comes in. (Your A.J.D. is heavily involved in *Magazine* matters other than the writing of this feature, and sometimes it is not possible to deal immediately with Certificate claims).

Finally—

And so, friends, that's it for another month: the record is interesting, even if a bit thin, because that opening on December 3 again gave us a sample of the unexpected way in which an EDX situation can develop — and how important it is to be ready for these conditions when they do arise.

G3ARL of the Isle of Wight operating P on Bembridge Downs. The beam is a single-section Skeleton Slot with two reflectors, the transmitter runs a pair of 6C4's in the PA, on 145.35 mc, and the modulator is 12AT7-p p EL32. Power is from a 250v. rotary converter run off the 12v. car battery.

Your A.J.D. would like to thank those correspondents who were kind enough to remember him in their seasonal greetings and to offer them good wishes for the coming year; it should be a good one on VHF, and many will say it could hardly be worse than the year just passed, during which we got so very few breaks compared with 1952-53.

Dead-line for the February issue is **Monday, January 17,** addressed A. J. Devon, "VHF Bands," *Short Wave Magazine*, 55 Victoria Street, London, S.W.1. With you again on February 4, all being well.

"SOME HRO MODIFICATIONS" — NOTE

VQ4FB expresses his regret for having omitted C13, 250 $\mu\mu$F, from the circuit Fig. 3, p.544, of his article in the December issue. This condenser should be across the outer ends of R12, R13.

YOUNGEST EI/GI?

David Fennelly, of Galway, was licensed on December 11 as EI4V, for the 7 and 14 mc bands. He is but 17 years, and wonders if he is the youngest licensed amateur in Ireland.

WINDING VHF COILS

FOR FILTERS AND TUNED CIRCUITS

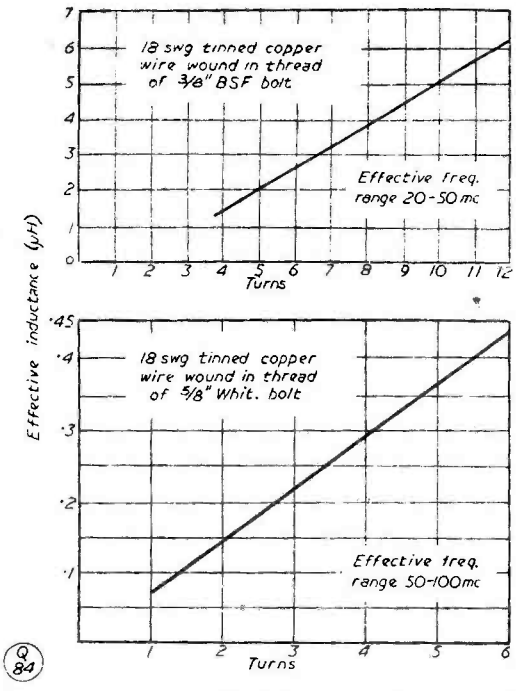
S. T. CHREES (G3DZW)

COILS of low inductance are frequently required when constructing filters for TVI suppression, and circuits for the frequency-multiplier stages of VHF transmitters and similar equipment.

A convenient method of making such a coil is to wind it in the thread of a bolt. Best results, from the point of view of mechanical rigidity, are obtained if one end of the required length of wire is held in a vice, and the wire then stretched to be free of kinks. With the wire held taut, the free end can be wound in the screw thread. When the desired number of turns has been wound on, the bolt can be screwed out, leaving a perfectly formed coil.

The curves give winding data for coils of *effective* inductance as shown, using a $\frac{3}{8}$-in. bolt for the 20-50 mc range, and a $\frac{5}{8}$-in. for 50-100 mc. Coils constructed from this information will be found to have quite close tolerances, since the screw-thread accurately selects the diameter and pitch.

It will be observed that the effective inductance is not proportional to the square of the number of turns. This is due, among other things, to the self-capacity of coils at these frequencies.



The curves referred to in the text, from which accurate coils can be wound. By using a bolt, of the diameter given, the turns are equally spaced and true for shape.

MULLARD ALL-GLASS FUSION SEALED GERMANIUM DIODES

The main causes of failure of germanium point-contact diodes fall into two groups: First, contamination of the germanium by traces of foreign substances, such as water; secondly, by minute movements of the contact point.

The envelope of a germanium diode must, therefore, perform the twin functions of protecting the contact area from chemical contamination and physical movement. It must obviously be composed of a material which is strong and rigid and chemically inert. The use of accessory sealing materials such as solder and fixing cement is deprecated, since they may themselves be a source of chemical contamination.

Glass is an obvious choice of envelope material, and is, in fact, widely used. The possibility of employing true glass-to-metal fusion seals for the leads has not in the past been greatly exploited, however, because of the danger of altering the characteristics of the germanium by raising it to a high temperature during the sealing process. Mullard have developed a special fusion-sealing technique suitable for germanium diodes, and the first fusion sealed diodes of a new range have been in use for some time. These are the OA70 television diode and the OA73 low forward resistance high frequency diode for communications and industrial use.

NEW MOBILE RADIO LABORATORY FOR FIELD WORK

A completely self-contained mobile test unit, incorporating the most up-to-date equipment, will shortly be going into service with the Technical-Commercial Department of Philips Electrical Limited.

Not only will this facilitate more thorough standard field tests under customer conditions at all stages of design and production, but it will also enable the company's engineers to conduct wider researches into problems connected with VHF broadcasting and Band III Television.

Equipment carried in the van includes an oscilloscope, field strength meter, valve volt-meter and signal generators. Soldering equipment for making on-the-spot circuit changes has also been fitted. Where local conditions permit, power will be obtained by running out a cable to the nearest mains supply, but, to make the unit completely independent of outside resources, it has its own 24v. DC-230v. AC rotary converter. The batteries are stored in a specially ventilated compartment, and re-charging is carried out while the van is on the move. A full range of interchangeable receiving aerials to cover radio and television transmissions on all frequencies will be carried, the aerial in use being mounted on a fitted extending ladder which can be adjusted to a maximum height of 40 ft. A small electric motor, operable from inside the van, rotates the aerial in any required direction.

Link Coupling Precautions

AVOIDING LOSSES AND INACCURATE RF READINGS

E. JOHNSON (G2HR)

MANY amateurs fail to realise the queer and exasperating effects which can arise through faulty link-coupling. These remarks are primarily addressed to those operators who use perhaps the most fool-proof of all aerials — the dipole fed by a low impedance line and link-coupled directly to the final stage. Under correct conditions of matching, *i.e.* using an 80-ohm line, there are no standing-waves on the feeder and all the energy "goes up the spout." In practice, of course, the radiation resistance may depart somewhat from the theoretical figure, but with normal aerial heights any mis-match is unlikely to be serious and the line current will be substantially "flat."

Failure to Match

Under matched conditions, it is permissible to estimate the power output by means of a straight application of Ohm's Law, *i.e.* I^2R, where "R" is equal to 80 and "I" is the feeder current. Conversely, if we know roughly the RF power output of the transmitter, it is easy to estimate the approximate feeder current. But what is the explanation when, despite everything being apparently "according to the book," the line current differs wildly from the calculated value ?

Is the Link "Cold ?"

We all know that the link should be coupled to the "cold" or earthy end of the tank coil.

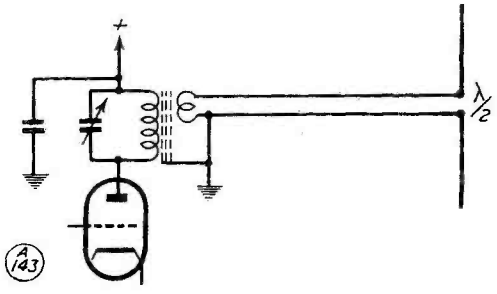


Fig. 1. Normal coupling arrangement for a low-impedance line between PA and load, showing precautions taken to minimise electrostatic coupling.

Now, with link-coupling we need inductive coupling and nothing else. There will inevitably be a capacitative component, but no energy will be transferred *via* this source provided link and cold end of the coil are at the same potential. The low potential side of the tank is effectively at earth. Care must be taken about this by ensuring that there really *is* a short and direct by-pass to cathode. As we agree that the link coil must be at the same potential, it is equally important to earth this. Nevertheless, despite these precautions, it is virtually impossible entirely to eliminate all electrostatic coupling unless we go to the length of using an electrostatic or Faraday screen. This may be constructed of a screen of

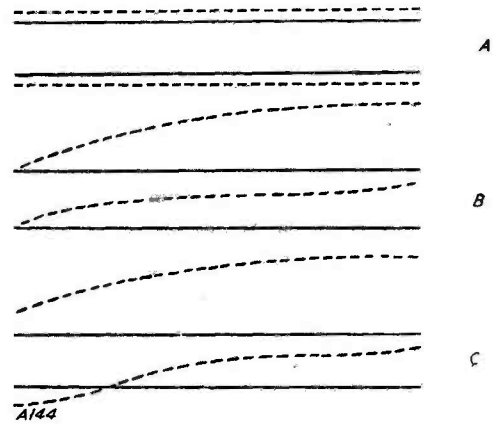


Fig. 2. Distribution of RF current on a twin feeder line under three possible conditions — (a) Properly matched, showing equal anti-phased currents, with the feeder operating as an RF pipe; (b) The "Marconi effect" caused by unwanted electrostatic coupling, with the current in the two arms of the feeder in phase, and increasing along the line; (c) The resultant of (a) and (b), with the two arms unbalanced, the currents being unequal and out of phase. Condition (a) is, of course, what is required for correct operation.

wires, *joined at one end only*, and interposed between link and coil.

Midleading Results

If these precautions are not taken, a transfer of energy from the capacitative coupling will take place. This capacitative current will not discriminate between the two feeder limbs, and owing to their close spacing will, in fact, look upon the line as a single wire. In other words, the current will divide between the two arms. More important still, the two components *will be in phase*. We already have our normal feeder current equal and anti-phased. An examination of Fig. 2 (feeder spacing exaggerated for clarity) will show the likely effects, assuming feeder length of roughly

¼-wave. In parenthesis it may be remarked that a matched line can be of any length, but it is desirable to make it an integral number of ¼-waves long, thus minimizing the effect of any small residual standing-waves. The result of the combination of normal feeder current and capacitative current will produce a standing-wave on the line *irrespective of normal matched conditions*. In fact, the whole system tends to work very much in the Marconi fashion. Obviously a meter at the home end of the line will show the vector sum of the two currents, which may be too low or too high having regard to the power output.

Effects

The nett effect of this spurious current is two-fold. First, the unbalance in the feeder will destroy its non-radiating characteristics and upset the polar diagram of the aerial as a whole. Secondly, a low-impedance line under these conditions will develop quite high voltage and current loops. This inevitably spells high losses.

Inter-Stage Coupling

The same precautions should be observed when link-coupling between stages. Impedance matching with short line lengths is not usually a major point, particularly as short lengths are often largely self-adjusting in this respect. On the lower amateur frequencies, certainly 28 mc and lower, the line is almost invariably very much less than ¼-wave. On higher frequencies, however, this condition may not apply. A ¼-wave link line properly coupled to the cold end of one stage will develop a high voltage at the other end (Fig. 3). In these circumstances, therefore, one must be sure of designing the line to work under properly terminated conditions. In the case cited above, conditions would be just right for high transference of energy *via* the residual capacitative component, with all the consequent evils detailed above.

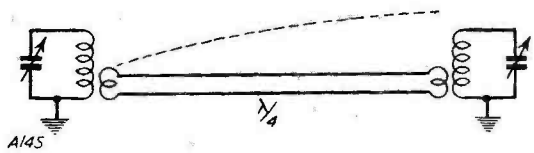


Fig. 3. Showing the voltage distribution along a link line which is about a quarter-wave in length. High voltage is developed at one end, promoting ideal conditions for the capacitative transfer of energy.

SOME LOG BOOK MEMORIES

AND ON KEEPING A GOOD RECORD

N. P. SPOONER (G2NS)

"KEEPING the Post Office quiet is the only value a log book has," a certain amateur was heard to exclaim when complaining about the paper-work involved. What would his reactions have been had he gone to sea with a two-part telegraphy log ? Of four sections in the first part, three are for duplication and the fully-duplicated second part requires the recording not only of some nineteen different occurrences but also the station's working during the whole voyage. The paper-work involved might have concerned not only himself and the PMG but perhaps the owners, the master, a marine radio company, the chief operator, a marine office superintendent, a W/T surveyor and the Ministry of Transport !

After adding a separate two-section telephony log with a duplicated second section for recording the entire voyage's working and some eight different occurrences, it will be realised that amateur operators have been let off quite lightly by International Regulations.

To conform with them and to secure personal benefit therefrom, log books should be taken quite seriously even if only for the reason that a simple entry may provide the strongest of alibis. During a TVI witch-hunting era such as the present, a record of the hours spent out of the shack is almost as important as those spent in it, and this fact probably determined the authorities to ask for the GMT a station is closed down after each session. Shallow thinking has now become so prevalent that the slime smeared across TV screens by interference from local hair-dryers, electric drills and immersion-heaters — to mention only three possible sources — is actually diagnosed by some viewers as being a " message " passing between one amateur and another. Everybody knows the whereabouts of the nearest " experimenter " so the poor old black sheep of the neighbourhood should, in self-defence, take more than a passing interest in log entries that may obviate much gnashing of teeth.

Log Book Format

The printed column headings found in approved books and those suggested by the Licence for entering in any book (other than a loose-leaf one) are quite adequate for the transmitting amateur but the writer has in addition always entered his own personal remarks concerning individual contacts, together with full details of every renewal and modification made to receiver, transmitter, aerial system or auxiliary equipment.

Over the years this habit not only builds up a useful reference of comparative results but it also impresses upon one's mind the known cause of any blow-up or breakdown that has occurred. It facilitates above all

the absorption of knowledge and the attainment of proficiency while " self-training in communication by wireless telegraphy," as the new Licence quite neatly puts it. The procedure is rather more tangled for the SWL, and so much has already appeared concerning what should and should not be reported that anything added here by the writer may only fall on stony ground. With apologies therefore to the listening fraternity, it might be reiterated that when aiming at clear, intelligent reports and essential data, the Queen's English and the authorised Q Code should be used in preference to " ham patter." The type of receiver and aerial, together with prevailing interference, static and fading should be mentioned. Truthful estimation of RST is very necessary, together with the comparative RST of any other stations heard emanating from the same district or country at the time. Except when requested, SWL reports should not be sent to stations in the British Isles, unless an obvious service, like the following example, can be rendered by doing so :

The writer had answered an OQ5's CQ but heard nothing further. A listener, tuned-in to both stations, was able to report that the OQ5 had actually come back with RST, name and QTH.

Although an exciting subject, random VHF reports to stations in the British Isles lose their value if the distant station is in contact with another situated near the listener. Except for requests and, of course, the 1.8 mc band, reports should *not* be sent to the USA or Canada. European stations also are not usually interested in reports, except for VHF. It would appear that as an amateur transmitter can obtain a first-hand report at the time of contact, the demand for SWL assistance is unlikely to increase above its present level. This may cause some to ponder the unassailable truth that Communication is the world's ruling need — whether it be by signs, articulation, the written word or by telegraphic messages ; 80% or more of the world's affairs are being translated into Morse, in spite of its low efficiency, and any listener who puts aside reporting on SW broadcasting and amateur telephony to concentrate instead on becoming proficient in code will be far happier for it, in the long run.

This statement is not made from any personal bias in the Phone *versus* CW wrangle — both should be available for use at all amateur stations, since both have their parts to play in different circumstances. But CW telegraphy remains the basic method of amateur communication. The SWL still belongs to the amateur world while learning Morse, he makes a better use of his listening time and he places himself half-way towards a transmitting licence. Even if this is not pursued, he will still be able to bring the busy world to his own fireside by casting his net into the teeming traffic lanes and taking his pick of news, drama, mirth and knowledge from land, sea and air.

Log Book Stories

A log book remains the property of an amateur, even if available for regular inspection, and while it is not intended as a personal diary it is nevertheless a diary of one's radio-life, so to speak. As such, it inherently weaves quite a saga of amusing incidents, instruction and achievements that can be repeatedly enjoyed whenever the pages are turned. An excellent

From the G2NS archives — at front, his log book dated 1934 ; above, a copy of the very first issue of " Short Wave Magazine," dated March 1937. The receiver is, of course, an Eddystone S.640, and is dated 1948.

time to re-live past contacts and re-acquaint oneself with some of the old gang is perhaps during one of those long days when conditions on the air seem to almost resemble some English summers ; when the absence of the Bikini spreads alarm and despondency in coastal areas ; when even inlanders feel no urge for constructional work. Or it might be during one of those long evenings when DX is warm but the shack is too cold. Whatever the day or hour, Fleet Street has no monopoly of the Adventure that so often lies hidden in the dullest routine, nor of the Romance and Sentiment that so often await just round the corner. When grasped, they provide a store of rich memories to draw upon in old age. (Some readers may wish to ejaculate : " *Blah, blah, blah,*" at this stage, so just for encouragement, let us dip into one of the writer's old log books).

We amateurs have been harassed by unauthorised interference since the very birth of Amateur Radio — even a Spanish civil war was fought all across the 40-metre band, it may be remembered. Sympathy could therefore hardly be felt for the complaining citizenry who howled so long and so loudly when a local pirate, honestly announcing himself on alternate Sundays as " Radio NBG " and " Radio Nincompoop," drifted out of the unappreciative 1.75 mc band and settled

permanently, with his gramophone records, on the nearest BBC frequency. The uproar was deafening, the chase was fierce and relentless but an imposed fine of £5 eventually forced him to stage one last defiant fling as " The Continental Experimental Short-wave Station at St. Malo."

Could it possibly have been this craving for monitored harmony or was it a greed for gold that next infected a licensed G some 50 miles away ? He worked far into the night constructing one-valve fixed-tuned receivers set to his Top Band crystal frequency. These sold like the proverbial hot cakes and he then pumped out regular hours of gramophone entertainment. How the listeners' veins tingled with erotic fires as the jungle rythm roared through the district. But one evil day the skipper of a passing coaster tried to contact the operator of a nearby ship-shore service station to ask that a berth be arranged for him at a certain port. All the shore could unscramble was an apoplectic seafarer's blasphemies riding on and through a mighty cataract of sound in which a coloured gentleman assured his honey that he loved her so. The precipitous arrival of the little green van assured our budding disc-jockey that the PMG's love for him had suddenly grown cold, " perhaps because of some rule that has been broken " was the lament.

But someone somewhere in every walk of life is always breaking one of the rules. Would the amateur who told another over the air that the rating of his PA power-pack was 4000 volts at 500 mA ever be tempted to become one of these types? Such a likelihood is nothing compared to a sworn exploit by young Jimmy, who lives near the sea. Hardly had he started the introduction of Amateur Radio to some feminine visitors in his shack than the adjectival fluency of a trawler skipper belched at them from the loud-speaker. Cutting the visit as short as possible he got back to the shack to find the air still quivering with nautical expressions. He warmed up his push-pull Hartley, that had punch and quality, whipped out its two bias resistors from their holders, slipped in two smaller ones to run the input up to 50 watts and then, awaiting his chance, he came up on the listening frequency and called the trawler that had repeated its name several times when announcing the fact that its skipper was " looking round for that b- - - Bill that it hadn't heard all the evening." Imagine therefore Jimmy's amazement when the trawler actually came back to him. Said he, in as magisterial a voice as possible : " This is a government monitoring station. We are reporting you to your Owners for grossly foul and indecent language. Close down at once." And, according to Jimmy, that was completely swallowed because back came a hesitant and obviously subdued reply : " I regret this. I shall close down at once."

Swallowing is quite an elastic function, and another example was when the XYL broke the news that : " While you were out, the man with the crystal set at Number Ten sent round to say that he is a very keen follower of the Test matches but didn't know that G2NS was actually in touch with the Oval. He was heard calling ' Hullo Test ' during the afternoon and it was much louder than the BBC."

At the best of times BCI, in most shapes or forms, can be a queer business ; there was the one-and-only occasion when a contact with a Dutchman on 3.5 mc phone on a sultry summer evening competed with Tommy Handley in an *Itma* programme on 307 metres at a house eight miles away.

But the log shows that not all reception and not all QSO's are spoiled. Three interesting CW contacts that spring to the writer's mind are those he had with a ZC1, a sergeant in the Arab Legion ; an FF8, a corporal in the Foreign Legion and, in 1937, the VK2 who came back with an early-morning 14 mc report of S7 and " loudest G I've ever heard."

Not all memories, of course, can be happy ones ; this will be understood if in the past one has met the Demolition Squad. Consternation swept through some 4000 happy homes in 1939. For readers who were not concerned in such matters it should be mentioned that the amateur and the licensing authorities have always got along well together. It is believed, that with a free hand, the PMG would have determined all transmitting licences but ordered owners to box and list their own gear for official checking, closing-up and sealing ; a periodical examination of the seals being made, to settle the minds of all concerned. But he was apparently over-ruled by higher-ups infected with spy-mania and an ignorance of radio and the amateur fraternity. To them, those amateurs were a big family of chattering monkeys ; peace-time caretakers of frequencies valuable to the armed forces during hostilities. Instead of locking up the caretakers' mops and pails " for the duration " they wanted them confiscated and a removal van sent round to collect them, into the bargain. So confiscation it was. Spies ? No doubt, but *not* in the ranks of the amateurs, and as for confiscation, any traitorously-inclined amateur could within a few hours have been back on the air using the interior parts of his BC receiver or radiogram.

The idea of clearing the air of all unauthorised signals so that, by their operating procedure, those heard thereafter could be identified as friend or foe was delightfully simple, on paper. In practice, it demanded a sudden and herculean effort by the PMG's department. All ranks were roped in for the job ; some had a knowledge of radio gear, others had not ; some stations were wrecked, others were left almost untouched ; some owners were given receipts, others had none (although useless in any case, because of no compensation). The short time available demanded a whirlwind fury of energy ; even aeroplanes were chartered to bring in the gadgets and the gubbins from the far-flung outposts of GC and GI, so that the balloon might go up on time. From a few examples, multiplied by about 4000, readers will marvel how the PMG's men ever managed to get the safety-curtain down so securely as they did on such a screaming pantomime. In one district G5— started the ball rolling by saying he was going out but the gear was " all on the table." When the Demolition Squad arrived, the dismantler-in-chief and his mate (two unhappy GPO linesmen hastily roped in) were led by mother up the garden path to the shack. She left them to their barbarous work but was soon brought scurrying back by howls of distress. The mate lay struggling on the floor beneath the entire assemblage and the overturned table, with pangs he experienced by grasping a large, fully-charged smoothing condenser

by its terminals. G4— gave no trouble because he was struck speechless when an old battery receiver and a Morse practice oscillator were seized with the rest of his gear. But naughty old G6—, with many afterthoughts, had to make several journeys through the attic cobwebs while the dismantler held a torch in the trap-door. At G4—, the classic beauty of a huge Zepp not only sealed its own fate but proved the undoing of its ravisher when an attempt was made to take it into precautionary custody. As the agile mate balanced on the shack roof, the corner gave way and left him, half-throttled by a ceramic spreader, clinging precariously to the swaying feeders. These obligingly snapped and unerringly dropped him into the open mouth of the expectant water-butt. The movements of those two unhappy linesmen during the two and a half hours that followed have never been verified but, in due course and a new pair of trousers, the mate turned up at G2—. *He* had seen war before and guessed what was coming ; his gear was all neatly laid out on the table for removal, in exchange for a receipted inventory and sackcloth-and-ashes. Three empty days had passed when there came an imperative hammering on the front door. Accompanied by the apologetic mate, there stood " the Law " in all its majesty. A question-and-answer catechism of the " What is your name, N or M ? " style of thing ensued but quickly changed to a positive thirst for information about a certain transmitter, once authorised for 56 mc portable operation. This had been stripped some ten months previously but only the presentation of its empty metal cabinet would appease the Law, who solemnly handed it over to the mate.

The dust gathered thickly, but six and a half weary years later many old log books were joyously re-opened to take up the history of Amateur Radio once more. Come war, hell and high water ; the inventive genius, the flair for adaptation and the fraternal spirit does not die ; it is inherited by and lives on in those who follow. In the steps of the Old Timers who pass on, tread the New Timers to become, in their turn, the Old Timers. Take a quiet pride, therefore, in your lawful achievements — and don't forget to record the details, will you ?

Watch Those RF Chokes

RESONANCE EFFECTS ON ONE-SIXTY

K. E. FELTON, B.E.M. (G3IEF)

A NEW Top Band transmitter was recently completed at this station and two unusual troubles cropped up, both due to RF chokes.

The line-up of the transmitter is SP61 ECO, SP61 buffer stage (untuned) and an 807 PA.

The 807 PA is protected by the use of a third SP61 as a screen-grid clamper valve and the transmitter is keyed in the cathode of the oscillator stage ; this had an RF choke in its anode circuit, fed from a regulated 150 v. supply. It was found that on standby the transmitter went into rough unstable oscillation at about 1·4 mc when the PA anode tuning condenser was tuned to the 1·8 mc region of the band.

This was eventually tied down to the RF choke in the oscillator anode which, with its self-capacity was resonant at approximately 1400 kc. Taking the HT line as being at earth potential to RF (which is desirable !) this tuned circuit was in effect between the grid and cathode of the untuned buffer stage and when the output circuit of the PA stage came near to resonance with it (1·8 mc) the whole transmitter took off.

In the search for a cure a further RF choke was connected in series with the existing one ; now, the transmitter was perfectly stable over its tuning range and all seemed well—until a QSO occurred near 1816 kc, when it was found that during the short period of change-over from " transmit " to " receive," and before the carrier of the station in QSO came up, *music* could be heard which was eventually identified as the BBC Home Service !

Tests were carried out and a frequency meter check confirmed that the frequency of the interfering signal was exactly double that of the Home Service on 908 kc, *i.e.*, 1816. First conclusions were that the Home Service was pushing out a second harmonic, but this could be discounted for, as a general rule, a high degree of suppression is enforced by the BBC ; and so, other causes had to be investigated.

During the course of a QSO with G3OF he remarked that he could hear the Home Service at 1816 kc on his receiver whether his transmitter was in the standby condition or completely off, and that he had often heard other stations complaining about it. So the transmitter at G3IEF was duly switched off and a check made, when it was found that the interference could still be heard faintly, nowhere near the same level as when the transmitter was in the standby condition. Matters had by now become complicated, since there were two sources of signal bearing the Home Service modulation on a frequency of 1816 kc !

Any Answers ?

Possible explanations of the interference heard when the transmitter is completely switched off are :

(1) True second harmonic radiation by the BBC (not thought to be the answer unless the

QTH is very close to the BBC's transmitter).

(2) Non-linearity in the RF stages of the receiver producing 1816 kc from the strong field of the Home Service, or the 908 kc signal getting into the frequency changer due to poor screening or poor selectivity in the preceding RF stages.

(3) Radiation from the aerials or conduction by the mains wiring of domestic BC receivers in the locality.

At G3IEF the strong 908 kc signal produces a large AVC voltage in the domestic receiver which on application to the frequency changer stage biases it to a point where it becomes an efficient *doubler*, radiation and/or conduction of a modulated signal on 1816 kc then taking place.

It was now, however, found that with the transmitter on stand-by the interfering signal could be peaked on the receiver by tuning the PA condenser in the transmitter and, furthermore, that other stations were doubling and even trebling from the MW band to the Top Band, tunable to a peak with the transmitter PA condenser ! (The Third Programme on 647 kc was a strong signal on 1941 kc.) So the transmitter, in its earthed case, was picking up all the MW band stations, frequency multiplying and re-radiating them — or so it seemed.

Finding Cures

It was soon found that the buffer amplifier grid had a hand in the matter and decoupling was tried between the two RF chokes in series in the anode of the oscillator.

This stopped the doubling frequency effect, but reintroduced the first trouble of oscillation at 1400 kc. Reduction of the grid leak of the buffer stage did not have any effect, even when it was reduced to quite a low value.

A cure was, however, at last effected by replacing the RF chokes in the oscillator anode by a *resistive load*.

It would appear that the combination of the two chokes was resonant in the MW band, this resonant circuit appearing once again between the grid and cathode of the untuned Class-A buffer amplifier. Stray pick-up was in consequence amplified at the fundamental and passed to the PA grid.

The PA being in a non-linear condition as a result of being partially cut off by the operation of the clamp stage, operated as a frequency multiplier. This type of "interference" may be the cause of quite a few unexplained happenings in the harmonically related portions of the amateur bands.

For instance, when you are tuned up on 80 metres, and old Joe down the road bends your S-meter on the stop calling "CQ Top Band," remember he could *be* on Top Band and not have the second harmonic output you think he has, either—and he won't hear you if you call him on 80 to tell him to get himself sorted out !

Moral

The point which emerges from all this is that it is wise to consider the resonant frequency of RF chokes—most people (and G3IEF is no exception) reach for a likely looking one in the junk box and worry about it afterwards. However, it is not now considered wise (at G3IEF anyway) to use an RF choke at all in the anode circuit of a keyed oscillator, especially when that oscillator is followed by an untuned buffer amplifier.

OBTAINING A DL2 LICENCE

Arising from many enquiries, we have obtained—through the good offices of DL2RO—information on the procedure for getting a DL2 licence. The controlling authority, who will provide an application form on request, is: The Office of the Assistant Controller-General, SX (CTG) Branch, B.A.O.R 19. The application when completed is sent back to this address; the applicant, if in the Services, will need to have his C.O.'s permission to establish an amateur station, and this authority is incorporated in the application form. *There is no Licence Fee.*

If the applicant has held a G licence, or holds a current one, and forwards proof of this with his application for a DL2 call, he will normally be granted a licence straight away. Should he not have held a licence previously, he will have to pass a technical examination and take a Morse test. As in the U.K., there are numerous Service and/or professional qualifications which exempt the candidate from either or both the examinations.

MORE TV LICENCES

From the GPO we have it that during the month of October 1954 the number of TV licences increased by 163,872. This is the largest monthly increase ever recorded. (*Up the TV Detector Squad!*).

HARMONICS AND BBC TV

With reference to the interesting article by G2NS in our December issue — "Practical Harmonic Detector"—it should be noted that in Table A on p.541 the frequency of the Truleigh Hill TV transmitter has been changed to that of Channel 2 (North). This alteration was notified after going to press.

IN the same breath with which we wish all our readers a Happy New Year, one would also remark that we are now embarking on our *tenth* year of post-war radio, incredible as that may seem. We all think in terms of eleven years nowadays—or, at least, all of us who are DX-conscious certainly do—and by the time two more January issues have gone through the mill we shall be back where we started with the Cycle. Yes, in those palmy days of January, 1946, when you could tune round the ten-metre band and hear Okinawa, the Cocos Islands, and no QRM of any kind! An eleven-year cycle is a biggish slice out of anyone's life, and it will be quite an event when one more has been completed. But we are getting ahead of ourselves, when what we meant to do was to wish you all a Happy Tenth Post-War Year. We hope that all your gear keeps running; that all your brain-waves work; that every station you call comes straight back (except the one that we are after as well) and that all your QSL's arrive promptly. In short, Happy Days!

THE PARAGON

We have for some time been meaning to spare a word for a character that we know well. He is a tremendously keen amateur, but you never hear him shooting lines about his DX or his equipment. He has bits of everything, most of which he lends out with great readiness, but nothing luxurious or expensive. He always has a problem to propound, usually concerning an aerial that won't "draw," a VFO that won't stay put, or a keying system that is constantly haunted by a chirp. He always turns up at outdoor events, and if he doesn't supply the tent, then it's either the refreshments, the transport, or the 1 kW petrol generator. His XYL seems to have freshly-made tea and sandwiches on call at the most surprising times of day or night. On the air, his code seems a little shaky, and his 'phone is seldom what you would describe as BBC quality. His name? Well, you all know him, or we sincerely hope you do. For there seems to be just about *one* of him in every Club; and though he would be mighty embarrassed if you told him so, he is the backbone of Amateur Radio.

STRUCTURAL ALTERATIONS

December's gales, hurricanes, whirlwinds and tornadoes must have put a good many stations off the air in unseemly haste. Judging by the alacrity with which TV aerials changed their shape and form, there must have been quite a few amateur beams reposing in their back-gardens after some of the worst nights. (We heard one unfortunate saying that his pride and joy, a three-element rotary, had been transformed into a 48-element stationary). Long-wires, too, can become tricky in such conditions, especially when hung on trees. One never knows which is the correct technique—to use 8 or 10 gauge and pull it so tight that you can play it like a harp-string, or to stick to 18 gauge and leave it hanging in a gentle festoon. The number of TV unipoles that broke off is clear proof that the general design is not yet robust enough; what of the amateur two-metre beams, not to mention the occasional mammoth twenty-metre affair? We may only get storms like that once in five years, but they find you out!

COMPLEXITIES

We have often reflected that, as an original invention is improved upon and developed, it always becomes more complicated, *never* more simple. Look at the gear we all use to-day in order to talk to, say, a W2 station in New York. And then reflect that some of us were talking just as effectively, more than twenty years ago, with a transmitter and receiver consisting of one valve each! Yes—we know this is an over-simplification; that stability has been improved; that interference, owing to the increased number of stations, makes high selectivity essential; that TVI-proofing has done its worst, and all that. But the essential fact remains—that the gear *is* far more complicated than it was 'way back. Improved, yes, and vastly so; but what a pity that improvement of an invention, it seems, can never take the form of simplification and rationalisation. Look at the motor-car and the incredible complexity of to-day's models compared with the veterans or even the cars of the 'twenties. What a pity!

LIVING OR DEAD?

From a correspondent comes the suggestion that we are all so blinded by technicalities that we don't see the wood for the trees. In other words, we treat our hobby as an excuse for technical fiddles instead of using it (as it could be used) for the making of lasting friendships over the air. He says that too many of us hear a call-sign and immediately visualise it as a new QSL on the wall, without even giving a thought to the kind of fellow behind the key or the mike. And he scores a point by saying that he has frequently heard DX-chasers of the most virulent type confessing how much pleasure they get from a regular schedule with someone who may not even be "DX" at all, but has become a human friend instead of a familiar call-sign. Certainly, with all the inherent possibilities for making friends (in which our hobby is quite unique), we are extremely foolish if we neglect them and relapse into the well-known rubber-stamp mentality. Try thinking of "him" instead of "it" . . . .

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.

G3HXP, C. H. Brockman, 2 Hoy Mansions, The Parade, Margate, Kent.

G3JGW, G. L. Wilson, 4 Southfield Road, Enfield, Middlesex. *(Tel.: Howard 3806).*

G3JHY, E. W. Bonson, 70 Kensington Avenue, Manor Park, London, E.12.

GM3JSM, M. W. Smith, 59 Freeland Drive, Priesthill, Glasgow, S.W.3.

G3JUO, C. M. Flatley, 7 Claremont Avenue, Stony Stratford, Bucks.

G3JXI, A. J. Harper, 6 Poplar Grove, Hammersmith, London, W.6.

G3JYJ, E. Jackson, 2 Cecilia Road, Ramsgate, Kent.

G3JZG, R J. Riding, Fibbersley House, Fibbersley, Willenhall, Staffs.

G3JZI, W. D. Wildigg, 76 St. Mary's Road, Longton, Stoke-on-Trent, Staffs.

GW3JZL, W. K. Montford, R.A.F. Valley, Anglesey, North Wales.

G3JZT, R. A. Cheetham, 7 Parkway, Cheadle Heath, Stockport, Cheshire.

G3JZU, G. Tomlinson, 22 Queen's Drive, Billingham, Co. Durham.

G3JZW, H. W. Gadsden, 17 Drovers Way, Dunstable, Beds.

G3JZX, H. G. Lassman, 268 Amhurst Road, Stoke-Newington, London, N.16.

G3JZZ, 588179 A/A Nicholls, P., Hut 358, "C" Squadron, Aircraft Apprentice Wing, R.A.F. Station, Locking, Weston-super-Mare, Somerset.

GW3JZZ, P. Nicholls, 5 Victoria Road, Prestatyn, Flintshire.

G3KAA, L. S. Cutting, 62 St. Michael's Crescent, Luton, Beds. *(Tel.: Luton 428).*

G3KAE, J. A. Rowley, 634 Chester Road, Bacons End, Coleshill, Nr. Birmingham.

G3KAF, J. F. France, 18 Newson Street, Ipswich, Suffolk.

G3KAG, A. Parker, 714a Harvey Road, Alvaston, Derby, Derbyshire.

G3KAS, F. H. Sturdy, 21 Lingwood Gardens, Osterley, Middlesex. *(Tel.: Hounslow 8328).*

G3KAT, R. L. Poulter, 80 Ellesmere Street, Moss Side, Manchester, 16.

GC3KAV, J. C. de Carteret, La Mare Denis, St. Martins, Guernsey. *(Tel.: Guernsey 8645).*

GW3KBC, J. Ll. Cutler, 20 George Street, Llanrwst, Denbighshire.

G3KBD, J. G. Lambert, 81 Station Road, Billingham, Co. Durham.

GC3KBG, B. W. Crockford, Homleigh, La Variouf, Forest, Guernsey, C.I.

G3KBI, T. S. Waller, 66 High Street, Loftus, Saltburn-by-Sea, Yorkshire.

G3KBK, T. G. Musgrove, Millbank Farm, Bedlington, Northumberland. *(Tel.: Bedlington 3326).*

G3KBL, C. Field, 103 Harborne Road, Warley, Birmingham, 32. *(Tel.: Bearwood 1303).*

G3KCJ, A. H. Webb, 12 Ashleigh Drive, Leigh-on-Sea, Essex.

G8BP, W. H. Hill, 13 Uplands Avenue, Wolverhampton, Staffs.

CHANGE OF ADDRESS

G2COG, A. A. Leith, 12 Leigh Road, East Ham, London, E.6.

G2DOT, K. Clark, Wyncroft, Guisborough Road, Great Ayton, Nr. Middlesbrough, Yorkshire.

G2HAO, T. H. Salisbury, 17 Berrington Road, Nuneaton, Warks.

G2HCG, B. Sykes, 41 Booth Lane North, Northampton, Northants.

G2HDZ, A. E. Breese, Cuckoo Hill Farm, Cuckoo Hill, Pinner, Middlesex. *(Tel.: Pinner 7722).*

GM3DIQ, W. C. Bradford, c/o Dodds, 78 Craigleith Hill Avenue, Edinburgh, 4.

G3FWV, R. J. Monk, 17 Hartsgrove, Chiddingfold, Godalming, Surrey.

G3GCY, Sgt. T. C. Brewer, 19 A.M.Q., R.A.F. Station, Dishforth, Nr. Thirsk, Yorkshire.

G3GGL, A. W. G. Wormald, 85 Hollin Lane, Middleton, Lancs. *(Tel.: MIDdleton 2558).*

G3GXA, J. A. Payter, 359 Bath Road, Hounslow West, Middlesex.

G3HIS, G. Berrisford, 10 Derby Lane, Cubley, Derby, Derbyshire.

GD3HQR, A. W. Anderson, 27 Greeba Drive, Onchan, Isle of Man.

G3HWX, B. J. Whitty, 4 Kimberley Avenue, Great Crosby, Liverpool, 23.

G3IFV, W. P. Lewis, The Beeches, Nicholls Lane, Winterbourne, Glos.

G3ILO, T. G. Spencer, The Western Lady, Cherry Tree Cottage, Slimbridge, Glos.

G3JKZ, F. W. Lynes, No. 2 Sunnyside, Field Assarts, Minster Lovell, Oxon.

G3JQE, A. Wormald, 85 Hollin Lane, Middleton, Lancs. *(Tel.: MIDdleton 2558).*

G3JTH, W. J. G. Hector, 4 Porthcressa Terrace, St. Mary's, Isles of Scilly.

G5HZ, Lt.-Col. N. I. Bower *(ex-VS1DZ)*, Little Priory, Peppard, Henley-on-Thames, Oxon.

G8SS, J. Clough, 670 Bradford Road, Birkenshaw, Nr. Bradford, Yorkshire.

G8TS, J. St. C. T. Ruddock, 44 Hazell Road, Farnham, Surrey.

THE OTHER MAN'S STATION

G2HJT

THIS neat installation is that of G2HJT—owned and operated by E. J. Wellman, 306 King's Road, Ashton-under-Lyne, Lancs.—whose complete station is built into a living-room recess, 4ft. wide by 20ins. deep, beside the fire-place.

The transmitter, fully TVI-proofed, is a CW/AM/FM job running 100 watts input to a pair of 807's in parallel, with a pi-section output linked to an aerial tuning unit; the output end incorporates a low-pass filter to the design by GM3IAZ in the February 1954 issue of *Short Wave Magazine* ("Keeping Back Harmonics"). This transmitter is band-switched on the five bands 3.5 to 28 mc, and is relay-operated, controlled by a single "send-receive" switch.

A point of particular interest about this station is the fact that the transmitter operates in the same room as a standard commercial TV receiver; this is fitted with a high-pass filter to prevent swamp interference. The result is that even on 14 mc there is no noticeable TVI, thanks to careful screening of the transmitter and the filter designs used. G2HJT has devoted much time and trouble to bringing this about, and is another who shows that it can be done.

He says that the "weak link" in his chain on the amateur bands is his receiver, which at present is an R.1155 fortified by an R9'er. This combination is operated with a BC-433, but converters are contemplated for the HF communication bands.

For aerials, G2HJT has a W8JK and a 67-foot Zepp, the W8JK being directed on the U.S.A. Main interests at the station are working DX on Twenty—and then trying to collect the QSL's!

This brief description of G2HJT will be of interest to many readers for the reason that not only does it show that the problem of TVI can be solved, but it also suggests how an active station can be fitted into the domestic scene. On the subject of TVI, G2HJT remarks that though we may curse it, TVI is a challenge, and once the local problem has been overcome, it gives one a sense of achievement to see a QRO transmitter and a TV receiver working side-by-side, as it were, without mutual interference—either electrically or on the domestic front.

SMALL THOUGHT

The quickest way to lose your friends over the air is to record them and then play their own transmissions back to them.

THE EUROPEAN TV NETWORK

The system by which eight European countries are now linked for TV is a triumph of engineering in the radio, electronic and telecommunications fields, and reflects the greatest credit on those responsible for planning the system and bringing it into being. It puts the BBC far ahead of any possible commercial competitor, and it is much to be hoped that such a great technical achievement will not be prostituted by unworthy, second-rate programme material, or features devised merely for their mass-appeal.

HENRY'S (RADIO) LTD.

We much regret that in the December 1954 issue, the address of our well-known advertisers was inadvertently left off the outside back cover. It is, of course, 5 Harrow Road, London, W.2.

THE NINTH MCC

• The Magazine Top-Band Club Contest •

NOVEMBER 20-21 : 27-28, 1954

THREE things about MCC are rapidly becoming traditional : at all events, for the last three years we have had them each time. They are : a total of 28 entries, a win for ***Neath and Port Talbot,*** and a photo-finish !

In 1952 there was actually a dead-heat between ***Neath*** and ***Chester.*** In 1953 ***Neath*** pulled it off by a mere two points. And in this, the 1954 contest, ***Neath*** again head the list, with only three points separating them from ***Clifton,*** the runners-up. They, in turn, are only two points ahead of ***Surrey*** (Croydon), who take third place for the third time.

1st : Neath and Port Talbot Radio Club, GW3EOP (402)

2nd : Clifton Amateur Radio Society, G3GHN (399)

3rd : Surrey Radio Contact Club, G3BFP (397)

The scores are very slightly higher than last year's, the difference being only a few odd points in a total of 400, which suggests that it is not possible to make many more contacts in the time available, and with 28 Clubs to supply the valuable three-point scores.

All down the list, until about the seventeenth place, scores remained very tightly packed. With the winner's figure of 402, compare the eighth place (351) and the fifteenth place (302). These, too, differ very little from last year's totals.

The Winners

The team who scooped the pool for ***Neath*** consisted of GW3FSP, 3BQY, 2AVV and 3EPM, who shared the operating hours. A new transmitter was built for the Contest, but it did not behave as it was intended to, and a late start was made, using alternative gear.

On the second Saturday a newly-erected 266-ft. Zepp would not behave, and the start was again delayed, GW3INO almost having to swim back to the shack after attending to it ! Despite these trials and tribulations, the result worked out as ***Neath*** intended that it should.

Clifton are to be congratulated on their second place. They were third two years ago, but their fortunes fell last year and they were down to tenth. This time their efforts put them only three points behind the winner — just one more contact with a Club would have given us another dead-heat ! Operators and assistants at ***Clifton*** were G3IGZ, 3JJZ, 3FNZ, 3HLX, 3FVG, 3DIC, SWL's N. Moore, D. Bennett, E. Strong, J. Green and E. Smith, and Miss B. Eaglen — truly a Club effort. The transmitter was a Tesla VFO/BA/PA with an input of 8 watts ; the receivers were a BC-348 and a German E.52B, and the aerial was a 250-ft. end-fed wire.

Surrey (Croydon) nominated G3BFP as their station, since they have no permanent headquarters or Club station. G3BFP himself was assisted by G6LX. They used an 807 running at 10 watts in a VFO-FD-PA transmitter, with 158-ft. Marconi aerial. The receiving department was an HRO and a Q5'er. Their comment is " Jolly good fun, but charged rain made things bad on the second Saturday."

Honourable follow-ups to the first three positions were achieved by ***Sheffield*** (389), ***Medway*** (381), ***Coventry*** (374) and ***Hounslow*** (363).

Scoring Technique

As always, it seems to have been the single-point contacts that decided what sort of final score a Club was able to make. Two Clubs who have not sent in entries were on the air for a large part of the time — RAFARS (G3IRS) and Walsall (G2FPR). (Walsall's entry, with a claimed score of 230, arrived some days after the closing date.— *Editor*). Contacts with these two stations were, of course, allowed to count for three points.

In passing, we might mention that the usual optimists were found among the entrants, two or three of whom had their scores as sent in very drastically pruned by the judges. All except a few Clubs made the odd slip here and there, resulting in an adjustment of their score (always in the downward direction !).

Taking the entry of Clubs as 28, it was, of course, possible for each entrant to work 27 others on each of the four sessions. This would give a total of 108 Club contacts at three points each. It is very interesting to note that ***Sheffield,*** G4JW, actually did make 108 such contacts, but ended in fourth place. G3BFP in third place made 107 ; G3GHN in second place made 106 ; and GW3EOP, the winner, made only 102. This bears out our contention that the single-point contacts were

TABLE I

POSITIONS AND SCORES

	CLUB	CALL	POINTS
1.	Neath and Port Talbot	GW3EOP	402
2.	Clifton	G3GHN	399
3.	Surrey (Croydon)	G3BFP	397
4.	Sheffield	G4JW	389
5.	Medway	G2FJA/P	381
6.	Coventry	G2ASF	374
7.	Hounslow	G3FHD/A	363
8.	Gravesend	G3GRS	351
9.	Wirral	G3CSG	349
10.	Salisbury	G3FKF/A	345
11.	Cheltenham	G3CPW	337
12.	Nottingham	G3EKW	332
13.	Rugby	G3BXF	319
14.	Sutton and Cheam	G2BOF/A	307
15.	Nottingham University	G3DBP	302
16.	Stoke-on-Trent	G3GBU	298
17.	Thanet	G3DOE	288
18.	Edgware	G3ASR	271
19.	Bristol	G3GIS/A	268
20.	Chester	G3ITY	252
21.	Scarborough	G4BP	242
22.	Grafton	G3AFT	234
23.	Slade	G3JBN	198
24.	Liverpool	G3AHD/A	192
25.	Torbay	G3GDW	191
26.	Kingston	G3ILC	185
27.	Wellingborough	G2AUA/A	121
28.	Ravensbourne	G3HEV	107

tremendously important, and obviously GW3EOP gained considerably more one-point QSO's than anyone else. Actually they made 96 of them, compared with 81 by G3GHN, 76 by G3BFP and 65 by G4JW.

We are glad to be able to mention that the scoring corrections made by the judges, although reducing the figures, did not alter the order of finishing. Actually the claimed scores of the leaders were 410 by ***Neath***, 401 by ***Clifton*** and 399 by ***Surrey*** (reduced to 402, 399 and 397).

Reductions were made for the following reasons : claiming three points for a non-Club contact ; more than one QSO with a single-pointer ; wrong logging of QTH or QRA ; non-agreement of RST reports from the two ends of a contact. In many cases the judges were, perhaps, unnecessarily lenient. When a station known to be G2XYZ was logged as G3XYZ, it *might* have been a copying error but was just as likely to have been a typing error during the writing-up of the log. And several Clubs are once more reminded that contacts made *after* 1830 GMT were duly noted by official observers — in some cases with considerable amusement at the crafty technique employed ! But no points resulted from such contacts . . . .

The ambiguity factor (Club or non-Club) was much less troublesome this year, owing to the insertion of the word " Club " after the QRA. There was really no excuse for doubt in most cases, and the non-competing stations were very helpful and refrained from calling " CQ MCC." Most of them enjoyed the affair and there were several complaints about the way in which the band seemed to go quite dead around 1830 each Contest evening !

Operating Standards

There seem to have been very few complaints this year about " behaviour on the band." ***Neath*** say " Operating by Club stations was of a high order and most of the transmissions were very nice to hear." ***Clifton*** agree and say " With very few exceptions the standard of operating was high." ***Coventry*** remark " Operating standards consistently high " — and practically all the participants go out of their way to say that there were no complaints on this score. It is very pleasant indeed to compare this state of affairs with that which prevailed four or five years ago. At that time practically every Club was complaining of hoggish behaviour on the part of someone else !

One of the best things about MCC, it seems to us, is the good spirit that prevails throughout. Each Club has the feeling that the others are facing the same sort of problems and possibly enduring similar discomforts and inconveniences. The mere fact that so many Clubs have rounded up their members to do a job of operating at the same time must make for a feeling of good fellowship.

The Ham Spirit

While on this subject we must mention a good example of the genuine " Ham spirit " which was brought to light by one of the contestants. ***Nottingham University*** G3DBP, has some unforeseen trouble with their BC-348, and in this crisis got in QSO with ***Nottingham***, G3EKW, their nearest neighbour and, of course, a rival entrant. The result was the immediate loan of an AR77, delivered by the secretary in his car in time for G3DBP to be set up and working by 1430. How pleasant to be able to record this within a few weeks of having read of a contest (*not* in this country) in which an entrant actually carried out a bit of minor sabotage on a rival's station during the previous night !

Comments in Brief

" A grand contest, no complaints even if we are rather northerly and find it a struggle to raise the southern stations " . . . . (*Wirral*) ; " Congratulations to all Clubs on the very much improved operating by all taking part " . . . . (*Cheltenham*) ; " We noted that G9BF was active on Saturday, November 27 and was obviously having a heck of a time " . . . . (*Rugby*) ; " Somewhat handicapped due to Distress Traffic being handled by GNF, only a few miles away, and swamping the receiver " . . . . (*Thanet*) ; " We were hearing stations from London and the Midlands from the start of the

contest, but they invariably went back to stations exchanging stronger reports both ways. We seldom worked more than three or four stations in the first hour" . . . . (*Scarborough*).

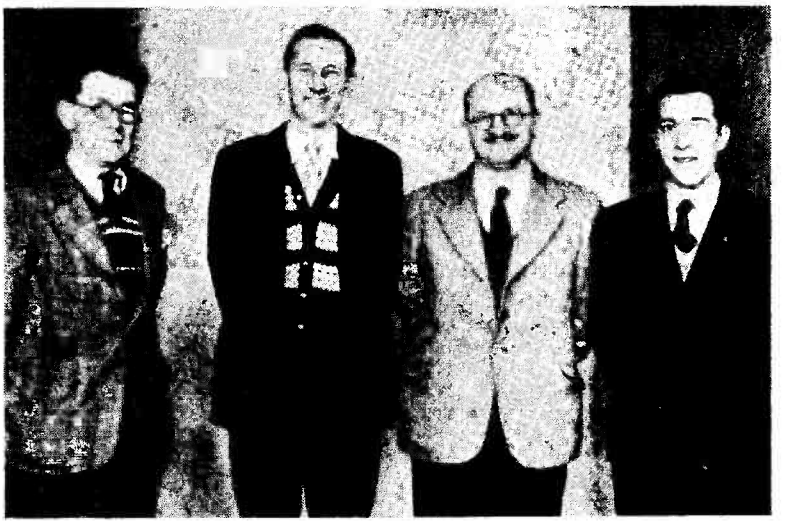
Other Comments

Very few GM operators came on, and apparently no GI's or GD's at all. Certainly there were no Club entries from any of these areas. Some contestants did make contact with GC3HFN (Guernsey), who claimed to be a Club, but as he was apparently only on for short periods and obviously did not intend to be counted as an entrant, these contacts have been reduced to one point.

On the DX side, HB9T and OK1KTI were raised by several stations. The latter, it is true, was a "Klub"—but again it was decided that it was fairer to award only a single point. Still better DX was covered by some of the lucky ones. We have at hand a report from G3JXK, aboard the Troopship *Dilwara*. While near Gibraltar, between 1600 and 1800 on November 21, he logged G3BFP (449), G3FKF/A (579) and GW3EOP (469). As it got dark out there the static level increased and it was quite impossible to hear any G signals.

System pays dividends — some entrants were in trouble deciding whether a station they heard had already been worked or not. ***Stoke*** mention that they had one member permanently employed listing the Clubs on a blackboard, and shouting out whether they had been worked or not, and if a call-sign belonged to a Club station.

Cheltenham make the suggestion that a five-mile limit might be imposed another time, to prevent an excessive number of very local contacts with individual members who go to their own stations, work their own Club, and then go QRT! It is true that GW3EOP's log shows no fewer that 22 contacts with GW stations around the Swansea/Neath/Port Talbot area, but if they can do it, most Clubs in populous areas could do even better. We have an open mind on this, however, and if there is any strong expression of opinion we would be prepared to consider a minimum local distance limitation in future.



Again the winners of the Magazine Club Contest, and for the third successive year, the team on GW3EOP, Neath and Port Talbot Radio Club. Operators, left to right: GW3FSP, GW3INO, GW3EPM and GW3BQY. They are to be congratulated on having put up another very fine performance.

TABLE II

ROLL OF HONOUR

Year	1st	2nd	3rd
1946	Coventry	Cheltenham	Grafton
1947	West Cornwall	Warrington	Coventry
1948	Rhigos	Coventry	Wirral
1949	Rhigos	Neath	Coventry
1950	Rhigos	Neath	Coventry
1951	Coventry	West Cornwall	Surrey
1952	Chester, Neath	—	Clifton
1953	Neath	Chester	Surrey, Salisbury
1954	Neath	Clifton	Surrey

Statistics

Although the number of entries is the same as last year's, seven of last year's entrants dropped out, and seven new ones appeared to take their places. This year ***Clifton*** jumped up eight places — from tenth to second; a very creditable showing. ***Sheffield*** climbed ten — from fourteenth to fourth. ***Coventry*** remained in their sixth place; ***Salisbury***, despite their terrific signal, fell from third place to tenth. ***Cheltenham***, eighth last year and eleventh this year, took part in the very first MCC, way back in 1946, when they were second. ***Coventry*** and ***Grafton***, both in this year's contest, were first and third in that same historic event in 1946.

If we award three points for a win, two points for second place, and one point for third place, the order for the Contest over its entire nine years puts entrants in the following order: ***Neath***, 13 points; ***Coventry***, 11; ***Rhigos***, 9; ***Chester*** and ***West Cornwall***, 5 each; ***Surrey*** and ***Clifton***, 3 each.

Judges' Summing-Up

A very good clean contest, with singularly few difficult decisions to be made. Throughout the entire

list, the occasional reduction in points did not, fortunately, affect the order of placing.

Again this year, some Clubs obviously did not attach enough importance to single-point contacts. On many occasions a Club was heard signing-off with an outside station, and almost immediately afterwards another Club on the same frequency, which could easily have called the same station, would start calling CQ.

As always, there was too much crowding in the area 1820-1870 kc, with practically no activity outside it.

Sending (and presumably copying) was very good on the whole, and many Clubs were not afraid of a burst of speed. Incidentally, in spite of this, not a single request for a "QRS" was heard, and very few repeats were called for.

Logs, as ever, were extremely varied. Some were faultless and a pleasure to check. Others made the smallest possible differentiation between Club and non-Club stations and were correspondingly difficult to decipher.

[Special judges' bouquets for outstandingly *good* logs are hereby handed to Clifton, Liverpool, Grafton, Gravesend, Coventry, Surrey, Salisbury, Rugby, Edgware, Bristol and Cheltenham. This does not imply that the others were bad; let us say that they started at "satisfactory" and went downwards from there.

The team on G3BFP, Surrey Radio Contact Club, third in the Ninth MCC. Seated, front: G3BFP. Standing, left to right: G6LX, G3IRP, SWL Morrison. Surrey have been in third place on two previous occasions, in 1951 and 1953.

Station of G3GHN, Clifton Amateur Radio Society, second in this year's MCC with 399 points. When the photograph was taken, G3IGZ was on the key, with SWL Strong keeping the log. Clifton did very well against powerful opposition. This is not their first success in the "Magazine Club Contest," as they gained third place in the 1952 event.

Once more we thank all entrants for their sportsmanship and for all the trouble they took to put up a show.

We congratulate the winners, naturally, but several other Clubs labouring under such local difficulties as noisy sites, poor aerials and shortage of operators turned in equally creditable performances. Every entrant played a part in making the Ninth MCC another outstanding success.

All being well, next year's MCC will run to practically the same rules, with the possibility of making each of the operating periods one hour later (that is to say, from 1530 until 1930).

Club Secretaries please note that next month's deadline for routine reports is **Friday, January 14.** They should be addressed to "Club Secretary," *Short Wave Magazine*, 55 Victoria Street, London, S.W.1.

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

YOUR PRICE PAID for BC453, good condition, less Dynamotor and Valves.—Ekert, 63 Dunmere Road, Torquay.

VALVES (over 3,000 in stock): 6AM6, EF92, 6AL5, EAC91, 1L4, 5/- ; 12AT7, 12AX7, 6CH6, 6AK5, 6BW6, 6J6, 6F33, 6BR7, EC91, EL91, CV284, CV286, 85A1, 85A2, 7/6 ; 12AU7, 12E1, 6SN7, 6SL7, 6SJ7M, R10, 9/-.—Skillman, Franchise Street, Weymouth.

FRAMES D. & P., 10-wire Mk. 3 Sets, ref. No. YA.6562 ; quantity available ; accept 10/- per set for minimum quantity of 50.—Box 1533, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

BRAND-NEW, original cartons: RF Units, Types 26, 27/6 ; 25, 15/- ; 24, 11/- ; postage 2/6.—E.W.S. Co., 69 Church Road, Moseley, Birmingham.

WANTED: BC-610 Hallicrafters, ET-4336 Transmitters, AR88D's and LF's ; receivers and spare parts for above. Also BC-221 Frequency Meters. Best prices.—P.C.A. Radio, Beavor Lane, Hammersmith, W.6.

WANTED: Aerial Tuning Units, BC-939a.—P.C.A. Radio, Beavor Lane, Hammersmith, W.6.

SITUATIONS VACANT

APPLICATIONS are invited from licensed radio amateurs between the ages of 25 and 35 for the appointment as Development and Service Engineer to a manufacturing company located in Central London. Applicants should have sound technological background and wide practical experience, with initiative and adaptability, and be able to work with the minimum of supervision, carrying through development projects to a satisfactory conclusion, including breakdown into manufacturing stages. Ability to prepare Service Literature, and to give Service Advice to the Company's Agents is essential. Knowledge, in addition to transmitting and receiving equipment, of the following is desirable: FM receivers and transmitters ; Fidelity audio amplifiers ; Test equipment ; Recording equipment, tape and disc. The position is one that will eventually become managerial, and is of considerable responsibility. Initial salary will be in the range of £416-£468.—Applicants should send details of age, education, and appointments, in confidence, to Box 1534, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

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: Transmitting Valves, type STC 4069A, or RK28. FOR SALE: Receiver, R1155, with speaker and power/pack, £6. Also home-built Tape Recorder, £6. All in working order. —G3BXI, Farlow, 55 Mount Pleasant Road, Chigwell, Essex.

SX28 RECEIVER wanted, good condition; no Mods. — Details and price to: Smith, 95 Mulgrave Street, Liverpool, 8, Lancs.

BC348 with Mains Pack, £12; TCS Receivers, 7-valve, 1.5 to 12 mc, £5 (offers considered); 6L6M, EL35, KT66, 6/6; 6V6GT/G, 1L4, 6AC7, 5/-; 6J6, 3/6; many others. 6v.-230v, 100 mA. Vibrator Packs, £1.—Box No. 1532, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

R103A SHORT WAVE RECEIVER; internal mains power-pack, plate switch, S-Meter; other band adaptor provision; £6 15s. Write first.—44 Parkgate Road, Watford.

NATIONAL 120/RAO6, 3 RF stages, Xtal; sell or exchange SX28, HQ120, AR77E. — Lenny, 73 Louisville Road, Tooting, S.W.17.

VALVES.—At 3/6: 6AC7 (3), 6C6, 6D6, 6SH7, 12A6 (2), 12AH7, 12C8, 12J5, 12SH7, 12SQ7, 1625 (2), EBC33, EF50 (6), VMP4G. At 5/-: ECH35 (2), VR150/30 (2).—G5AX, 35 Moss Lane, Leyland, Lancs.

ET4336, unmodified, complete with Wilcox Gay VFO, for sale. Seen working. — Saracen's Head Hotel, Daventry (*Phone: 351*).

BC342, COMPLETE, p/pack and manual; FB condition; £15 (or near); buyer to collect.—G3BII, Harrias Cottage, Hedgerley Lane, Beaconsfield, Bucks.

WANTED: Manual for CR100; also *Short Wave Magazine*, February 1949; July 1951 to September 1954 inclusive.—Gay, 22 Claremont Road, St. Margarets, Twickenham, Middlesex.

HOTTED-UP B342N, noise limiter, S-Meter, etc., £15; "Tobe" Ham-Band Rx, £5; B2 Rx, £3; QRO Gear: 200w. Modulator with spare valves, £10; RCA Plate Transformer, 2300-1750-0-1750-2300v., 800 mA, 130/-; RCA 450w. Modulation Transformer, 70/-; Driver Transformer, 20/-; Fil. Transformer, 2.5v, 10A twice, 25/-; two Chokes, 10H 600 mA, 5kVw., 20/- each; two Plate Transformers 1000-0-1000v., 500 mA, 45/- each; 12 Condensers, 2mF 3000vw., 10/- each; 12 Condensers, 2 mF, 1000v.w., 3/- each. Tank Condensers, 500 + 500mmF, 0.25" spacing, 60/-; 280 + 280, 0.3" spacing, 30/-. Tapped Plate Coils, 6/- each; 0-6 ARF Meters, 10/- each. Valves: 100TH (8), 45/- each. Masses of other Valves, Transformers, Chokes, Condensers, Relays, Meters, etc.; s.a.e. for list. WANTED: HRO Coils, 15m. and 10m. B.S.—The Limes, Church Street, Little Shelford, Cambs.

SMALL ADVERTISEMENTS. READERS—*continued*

WANTED: Panda Table-Top Tx ; state age and model. Also required: AR88 Receiver ; state price required. FOR SALE: Taylor 45A Valve Tester, perfect. Offers? — 82 Framingham Road, Sale, Cheshire.

WANTED URGENTLY: Manuals for BC-348R and ARN7 Receivers ; also three 6AJ5, two 6K6 and one CV405 Valves ; good price paid.—G2ZV, 7 Willow Road, Colnbrook, Bucks.

B2 Tx/Rx and AC power supply, perfect, £10 ; Handbooks, BC221, AR88, 15/- ; Q.C.C. Xtals, 7044, 7055, 7079, 7090, 7147, 7149, 500 kc, 10/- ; Bliley 100 kc, 10/- ; 1131 Modulator, less valves, perfect, £6 (with valves, £8); Power Supply, £4.—G3HVO, Highwood Road, Parkstone, Dorset.

QSL's and LOGS by MINERVA. The best there are.—Samples from Minerva Press, 48 Queen's Road, Brentwood, Essex.

WANTED: TUNING UNITS TN17, TN18, TN19, and R54/APR4 ; £50 each offered.—Box 1383, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

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

WANTED VERY URGENTLY: Collins 75A-3 Receiver and 32V-3 Transmitter ; exceptional cash price paid mint equipment ; will purchase separately, and will collect in U.K. Earlier models considered.—Full details, serial number, etc., with first letter, G2AMJ, 27 Westella Road, Kirkella, Hull, Yorkshire. (*Phone*: *Kirkella, Hull, 56358*).

TAYLOR, 45A Valve Tester, little used, perfect, £17 ; Taylor 20B, Circuit Analyser, little used, perfect, £12 ; unused Denco C.T.7, 5-waveband Coil Turret, with dial, drive, 3-gang condenser and chassis, £5 10s. *Modern Practical Radio & Television*, Quarrington, 4 volumes, unopened, £2. *Modern Electric Wiring*, Cowley, unopened, 15/-. Many bargains in valves and components. S.A.E. for list. —118 Moscow Drive, Liverpool 13.

EDDYSTONE 640, mint condition, 50 hrs. use ; complete with manual and phones ; £15.—Raynor, 22 Hadbury Road, Basford, Nottingham.

RME-69 RECEIVER, excellent condition throughout ; one owner since new ; completely overhauled, re-aligned and re-valved by Webb's ; £26. Delivered free in London and Home Counties.—Box 1526, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

CANADIAN R103 Communication Staff Car Radio, 1-16 mc, BFO, RF gain, 6v., brand-new.—17 Kent Road, Atherton, Manchester.

FOR SALE, or Exchange for Hallicrafters S20R Sky Champion (must be in original and good condition ; cash adjustment), 48 MK1, T/R, new, with accessories, batteries and instruction book ; £10. Denco Coil, Turret-type CT3, 200 kc-40 mc, unused (no data), with IF 1.6 mc, to suit ; £3. New 8 x 30 Binoculars, £8. Or nearest offers?—(Callers Tues. and Thurs. Evenings), A. J. Hibberd, 13 Coverley Place, Croop Hill, Rugby.

SMALL ADVERTISEMENTS, READERS—*continued*

VALVES, Tx Types: 813, 100TH, at 45/-; 803, TZ40, 5D21, 808, 811, 812, 15E, 836, 1616, at 17/6; 35T, 24G, 837, 866, GU50, CV187, at 8/6. Rx Types: VR150, 6V6M, 6AG7, 5R4GY, 6SK7, 807, 6SN7, 6A7, 6SA7, 6L6G, 5Z4, 5Y3, at 6/-; 6SG7, 6V6G, EL32, 6J5GT, 76, 77, 78, 6D6, 6C6, KTW61, 1629, 6B8G, 89, at 5/-.—Box 1525, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

FOR SALE: Heavy Duty AVO, recently overhauled, good condition, £10.—Apply 231 Boundary Road, Leyton, London, E.17.

CR100 PARTS: Coil Pack, five IFT's, BFO 4-gang, reduction drive, dial, cabinet, £6; Lane tape-deck, £4.—Martin, 13 Broom Water, Teddington, Middx.

HAM SELLING UP, going QRT: Send s.a.e. for list; total value over £400, incl. Tele-radiogram, Auto-radiogram AR88, PR120, S27CA, etc. The whole lot at a bargain price.—Box 1527, Short Wave Magazine, Ltd., 55 Victoria Street, S.W.1.

HRO SENIOR, complete with power/pack, LS and 11 coils, £28; Army 19 Set, with power/pack, £8. Price or nearest secures.—Walker, Vagg, Yeovil, Somerset.

WANTED: Hallicrafter S72 or similar recent model mains, portable, battery (self-contained) receiver with RF and two or more IF stages.—Box 1529, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

SUPER RACK Tx 10-15-20 metres, 250 watts, Class-B Modulator, 250 watts, 10/- per watt.—Box 1528, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

AR88, excellent condition, S-meter, bargain, £45. Eddystone 358X or similar accepted in part exchange.—Butcher, 79 Kettering Road, Northampton. (*Phone*: *4451*).

FOR SALE: S.640, perfect; Modr., 12 watt, with "Matchmaker" OP, two inputs; TU5B with case, unmodified. Components for 1200v, 400 MA P/Pack. Set complete. Rx1147, modified, part only Sig. Gen., 100-155 mc, Coax Rotary switch, 24-volt. Offers?—Box 1531, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

SALE: Transmitter T.1131, professionally converted for 7-14-28 mc bands, with switched crystals and Acoustical mike, regenerative CO, FD, FD/LA with p/pull DA41's modulated by pair DA41's, Labgear coils with aerial link. Excellent results. Also Receiver AR88 in very good condition, complete phones and Eddystone speaker. Also Radio-Aid Quartz Frequency sub-standard CC346 for AC mains. Output: 1 mc/100 kc/10 kc; harmonic selector and mod. switch. Accepted GPO as reliable frequency meter. Purchaser collects. — Offers to "Advertiser," Heatherwood, Hordle, Hants.

MAKERS' MANUALS, £1 each; AR88D, AR77, CR100, one owner, no modifications, £20.—Box 1530, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

SALE: Hallicrafters Skyrider SX24 and Class-C Wavemeter, £20 o.n.o. Buyer collects.—Roebuck, 13 Waverley Street, Savile Town, Dewsbury, Yorks.

SMALL ADVERTISEMENTS, READERS—*continued*

SCR522 Tx, 8 mc Xtal, all valves except 832's, £6; Collaro GP27 pick-up with standard and LP heads, virtually unused, 50/-; pair T20's, 25/- pair; 866's, unused, 25/-; RF unit 27, 30/-; 0-1 mA meter, 3in. scale, square case, 30/-; 60 *Practical Wireless*, 15/-; 80 *Radio Constructor*, 22/6.—Crossan, 8 Pine Avenue, West Wickham, Kent.

WANTED: *CQ*, January, March, April, June, November, December 1945, May 1946; *Radio* before 1936; *R/9* before April 1935; *QST* before 1924. Many *Amateur Radio*, *Break-In*, *Ham Chatter*, *QTC*, *Radio ZS*, *Xtal*, *Calling CQ* (de Soto). —G3IDG, 95 Ramsden Road, London, S.W.12.

SUPERB Complete Amateur Station for sale as whole or individual equipments; s.a.e. for description, lists of transmitters, receivers, power units, beams, indicators, frequency meters, etc.— Hinton, 11 Wellington Road, Bulford Camp, Wilts.

WANTED: VFO/Tx, Phone/CW, 3.5 mc to 28 mc, complete with P/Pack, to run from 230v. AC mains.—G3JUE, 20 Meads Close, Ingatestone, Essex.

EDDYSTONE 680X, perfect condition, less than 100 hours' use. Offers around £70 (buyer collects).—10 Moor Park Road, Northwood, Middx.

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