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CONTENTS

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FOR THE RADIO AMATEUR AND AMATEUR RADIO

The SHORT-WAVE Magazine

EDITORIAL

Resolutions

It is again the season for Sound Advice and Good Resolutions—and it hardly needs saying here that in our world of Amateur Radio much useful advice could be given and a long list of excellent resolutions could be catalogued.

But as always, amateurs will remain as individuals who pursue a great hobby as the spirit moves them—they are not really much concerned about what others may be doing or thinking.

Now, the interest may be DX and the thrill of beating the other man to a new contact. Later, it may be the interest of building a new piece of equipment. Or coming up on QRO phone for the first time—or trying QRP after years of working with full power. Or breaking out on a new band. Or the supreme satisfaction of helping a newcomer to obtain his first results. Or a hundred-and-one other possible lines of activity.

The very fact that there are so many aspects of Amateur Radio is one of the reasons why it always remains so fascinating, even after years of activity and a long experience on the air.

So instead of offering advice for the New Year to those who may glance over this page, we would simply say that we wish all our readers, all over the world, the best of luck, happiness and good fortune for the coming year, and success in whatever direction their amateur activities may lead them.

Austin Forsyth
G6FO

Simple Variable Voltage Power Supply

METHODS, AND A PRACTICAL CIRCUIT

J. M. MACINTOSH, B.Sc.

This is another of those units which once it has been built and tried will be found invaluable for bench and test work generally. The principles discussed by our contributor can, of course, be applied to a larger version if greater output voltages are required.—Editor.

A VERY useful piece of equipment which appears to be somewhat overlooked in Amateur Radio is the variable voltage power supply. It is difficult to see why this should be so because it is quite a simple and inexpensive matter to make one, or to convert an existing "fixed" voltage power unit to give a continuously variable output voltage.

Basic Circuits

Variable voltage power supplies suitable for amateur purposes fall roughly into two classes. Both types require a direct voltage for their operation, either straight from DC mains or, more commonly, from a conventional full-wave rectifier circuit, so that for the moment only the output voltage control methods will be considered.

First of all there is the potentiometer method shown in Fig. 1. Practical interpretations often include coarse and fine controls for the output. The disadvantage of such an arrangement is that the load current flows through part of the potentiometer, causing poor regulation and relatively large power dissipation in the potentiometer.

The second method of control requires the use of a valve normally connected as a cathode follower and is shown in Fig. 2. In this case the load current does not flow through any part of the output control R2, so that R2 does not influence the overall regulation, which depends on the regulation of E2 and the valve characteristics. Adjusting the slider of R2 will cause the cathode potential to "follow" the slider potential fairly closely. R3 is there to prevent excessive grid current from flowing. The advantage of the cathode follower as a voltage control is that it has a very low output

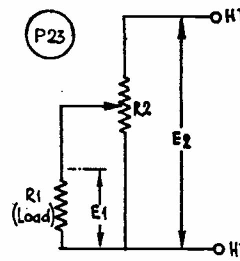


FIGURE 1

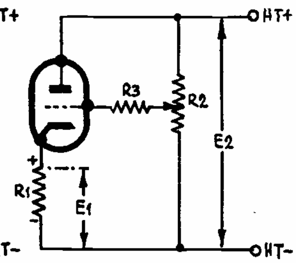


FIGURE 2

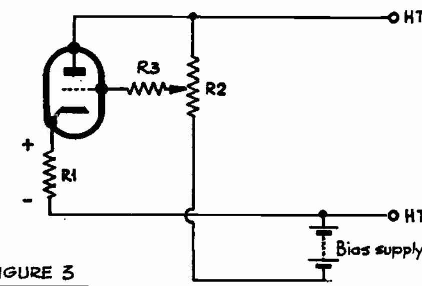


FIGURE 3

Figs. 1, 2 and 3 are explained in the article, and lead to the discussion around Figs. 4 and 5.

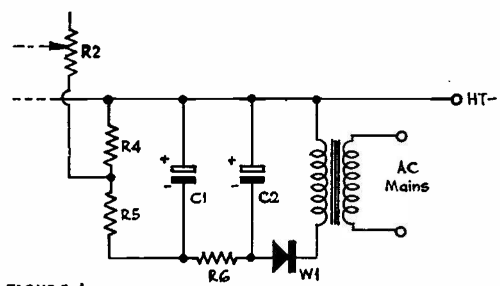


FIGURE 4

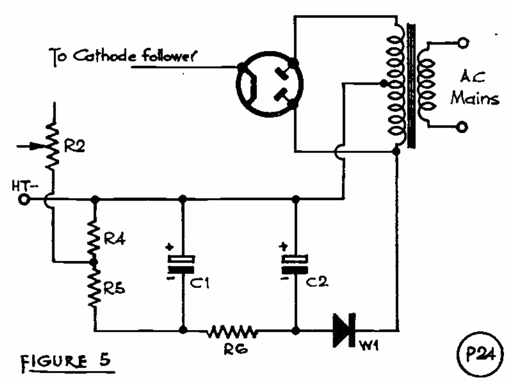


FIGURE 5

Figs. 4 and 5. Power supply and control circuits for the Variable Voltage unit.

impedance and consequently is a vast improvement over the arrangement of Fig. 1 from the point of view of regulation.

Limitation of Simple Cathode Follower

As it stands, however, the basic circuit of Fig. 2 is not really suitable for voltage control; the reason for this is that even though the slider of R2 is set to zero there will still be some output voltage across the load R3. In other words, it is not possible to obtain voltages right down to zero. For instance, a triode-connected 807 will give a minimum output of about 60v. under no-load conditions. Lower minimum voltages can be obtained with other valves but at the expense of output current.

Modified Cathode Follower

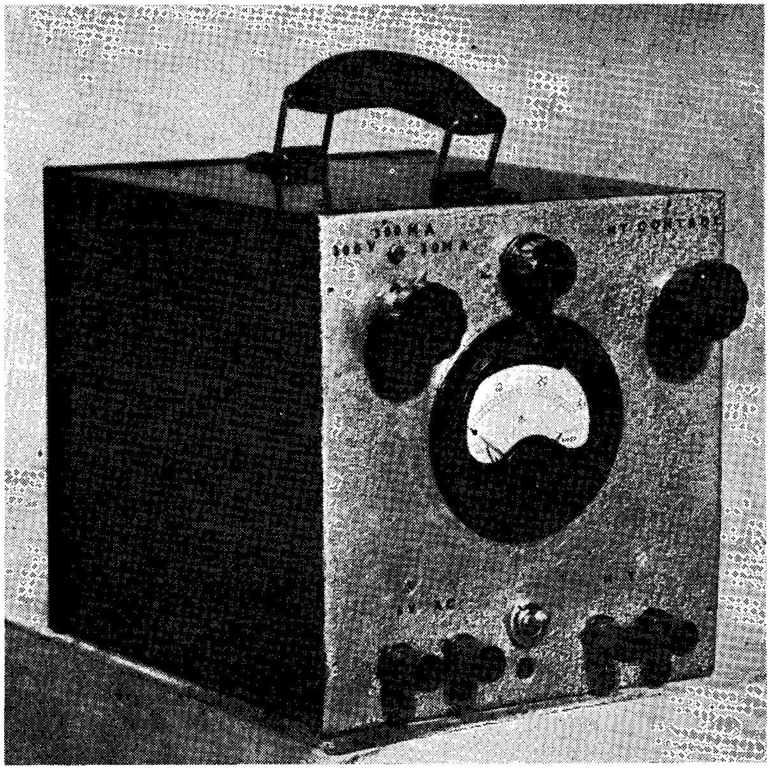
This difficulty can be overcome by incorporating a bias supply and connecting the potentiometer as shown in Fig. 3. This follows logically from Fig. 2, since the inability of that circuit to provide a zero voltage output arises from the fact that the potential of the slider could not fall below that of HT—. With a suitable value of bias voltage, however, the slider potential (and also the grid potential) can go sufficiently negative with respect to HT— to bring the cathode potential down to that of HT—, thus giving zero output voltage.

For a particular control valve the necessary bias voltage can be found from the makers' anode characteristics, by measuring the grid voltage required just to produce cut-off when the anode voltage has a value equal to E2. The actual bias voltage should be made slightly greater than this—but not too much so, otherwise there will be a large arc of R2 for which the output voltage is zero.

Obtaining Bias Voltage

Two methods are shown in skeleton form in Figs. 4 and 5. In Fig. 4, a transformer having an output voltage in the region of 100v. is used; since it is only required to deliver a few mA it need not be large. R4 and R5 form a voltage divider, the ratio of R4 to R5 being chosen such that the correct bias is developed across R4. The polarity of the metal rectifier is important and it should be noticed that the positive ends of C1 and C2, if electrolytic, are both connected to HT negative.

The transformer of Fig. 4 can be avoided by using one of the mains transformer half-secondaries in conjunction with the half-wave metal rectifier and its smoothing circuit. This is shown in Fig. 5. Again the rectifier and condenser polarities are important and the values of R4 and R5 will be correspondingly different.



General appearance of the Variable Voltage Power Unit as described in the article. Size can be judged from the fact that the meter is a 2½-inch dial instrument. Output is continuously variable over a wide range by the circuit arrangement shown in Fig. 6.

Design

The unit as described and illustrated here was intended to have the following features:

(1) A variable output voltage from zero to at least 200v. at any current up to 50 or 60 mA,
(2) An output of 6.3v. AC rated at 2A,
(3) Switched metering for both output voltage and output current,
(4) Simplicity.

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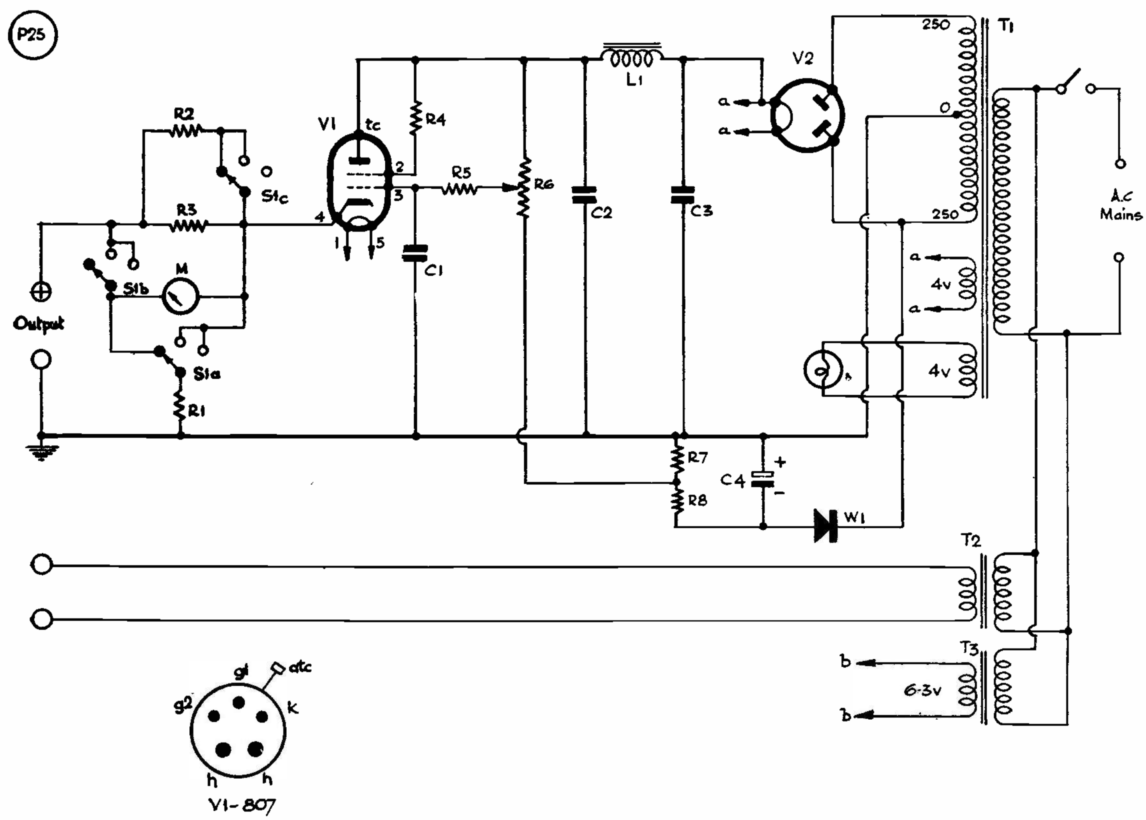

Fig. 6. Circuit diagram of the Variable Voltage Power Supply Unit discussed in the text; some load curves are shown in Fig. 7, from which it can be seen that a useful range of outputs is available. The circuit can be adapted to individual requirements, and the output meter switching arranged for either current or voltage measurements. No particular constructional problems are involved in a unit of this sort.

For the sake of simplicity no measures were taken to effect stabilisation but there is no reason why the cathode follower control valve could not be supplied from a conventional stabilised power supply, using a series regulator valve and having an output of about 300v. If this is done then the low internal resistance of the cathode follower can be used to the best advantage, giving good regulation as well as variable voltage.

The design centres round the control valve. Using a 250-0-250 mains transformer, the no-load output voltage from the main rectifier will be about 350v. so that the valve should have a maximum anode voltage rating of at least that amount. Also the valve must be capable of passing a cathode current of at least 60 mA. The anode dissipation is greatest when the output voltage is nearly zero and the output current is maximum, *i.e.* about 60 mA. The input voltage to the valve will then be about 300v., giving a maximum dissipation of approximately 18 watts. Finally, the voltage drop across the valve when carrying full current should not be too great, otherwise the maximum output voltage of the unit will be rather low when delivering its highest current. This difficulty can be minimised to a certain extent by making R5 in Fig. 6 of such a value that a small grid current of about 1 mA can flow if necessary.

The 807 was found to be satisfactory in all these respects and is therefore used in the practical circuit. It is possible for the screen

Table of Values

Fig. 6. Circuit of the Variable Output Power Unit

C1	= 0.1 μF, 350v.	R6	= 500,000 ohms
C2	= 8 μF, 350v.	R7	= 100,000 ohms, 1w.
C3	= 8 μF, 350v.	R8	= 220,000 ohms, 1w.
C4	= 8 μF, 350v.	W1	= H/W rectifier 250v. 30 mA.
R1	= multiplier for 300v.		
R2	= shunt for 300 mA.	V1	= 807
R3	= shunt for 30 mA.	V2	= U10 (or similar)
R4	= 3,000 ohms, ½w.	L1	= 5Hy., 100mA.
R5	= 47,000 ohms, ½w.	S1, S1c	= Suitable Switch

voltage, however, to exceed the maker's maximum rating by about 50v. when the output voltage is zero. This was not considered to be very serious and the decision to use an 807 in spite of the possible over-running of the screen was somewhat influenced by the fact that the writer had a few 807's for which there was no immediate use ! Anyway, the unit has given a few months' service at the time of writing and no ill effects have been noticed. For those not wishing to use an 807, the G.E.C. KT66 with its maximum rated screen voltage of 400v. is suggested as an alternative.

Construction

The basis of the construction was the case and chassis of a commercially-built wobbulator which the writer did not need as such. It contained a power unit using a 250-0-250 mains transformer having two 4v. windings and used in conjunction with a U10 rectifier. The unnecessary wobbulator components were removed and the components for a variable voltage output were added to the original power supply, the completed circuit being shown in Fig. 6. (The U10 is, of course, obsolete but any standard rectifier for a 250v. or 350v. mains transformer will be satisfactory). The absence of a 6v. winding on the writer's mains transformer meant that two heater transformers were necessary instead of one if a standard transformer with 6v. and 5v. windings had been available. Alternatively, if a 250-0-250v. transformer with two 6v. windings is on hand, then the 6v. sections can be used instead of T2 and T3, provided metal rectifiers replace V2.

The meter fitted in the unit was a 2½-inch moving coil type with a full scale deflection of 30 mA. The internal shunt was removed so that it could be used as a voltmeter, the full scale deflection then being about 5 mA without the shunt. The meter ranges chosen were 0-300v., 0-300 mA, and 0-30 mA. R1 is the multiplier for the 0-300v. range, R3 is the shunt for 0-30 mA, while R2 is the additional shunt to give a range of 0-300 mA. R1 is always in circuit even on the current ranges, so that switching the meter to read voltage does not appreciably change the output voltage.

Regulation curves for different no-load settings of output voltage are shown, together with the regulation curve for the U10 rectifier and smoothing circuit alone. The purpose of including the latter curve is to show that, provided the no-load output voltage setting is not much above 250v., the use of V1 to control the output voltage gives regulation which is of the same order as that of the conventional

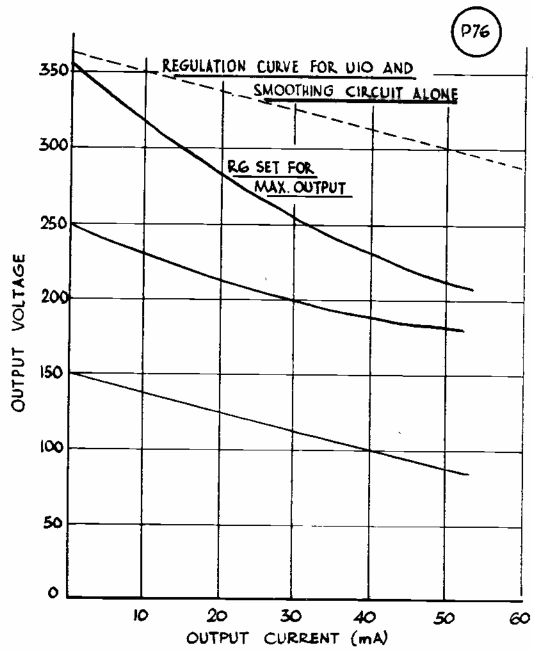

Fig. 7. Output and regulation curves obtained with the circuit of Fig. 6.

supply alone. If desired, an improvement in regulation can be obtained by supplying the top end of R6 from a separate supply of about 350v. This can be derived from one of the mains transformer half-secondaries in conjunction with a suitable metal rectifier. This improvement, however, will only be present over a limited range of load current unless the no-load output is in the region of 150v. or less.

NEW BBC TV STATIONS — PETERBOROUGH AND ORKNEY

New BBC television stations are to be built near Peterborough and in Orkney. The Orkney station will, in addition, carry sound broadcasts on VHF. Tests are starting forthwith on a possible site for the Peterborough station and construction will begin as soon as all the necessary consents have been obtained ; the station will work in Channel 5 (vision 66.75 mc, sound frequency 63.25 mc) with an effective radiated power between 1 and 2 kW, with horizontal polarisation. A 560-foot mast will be built and will be so designed as to be suitable for the possible addition of VHF sound transmissions later.

The Orkney station, which will carry both television and sound broadcasts on VHF, will serve some 30,000 people in the Orkney Islands and along the north coast of Caithness. The station will be on a site at Netherbutton, previously belonging to the Air Ministry, where an existing 250-foot tower will be used. The TV transmission will, it is proposed, be in Channel 5, as for Peterborough.

Variable Selectivity IF Stages in Communication Receivers

DESIGNS FOR THE HOME CONSTRUCTOR

J. B. DANCE, M.Sc.

This article will stimulate thought and discussion among all who are interested in improved selectivity for the amateur-band receiver. It is a subject which can be, and has been, approached in various ways. Here, the aim of our contributor is to show how an IF unit can be home-constructed to give a very high order of final selectivity.—Editor.

WHEN an amateur makes his own receiver, he encounters problems in connection with the dial and front end which it is almost impossible for him to solve to his complete satisfaction, even if he does require only amateur-band coverage. On the other hand, it should be possible for any enthusiast to construct an IF unit which would be as effective as those in good communication receivers. This article aims to show that it is a very easy matter to produce a cheap IF unit which will give as much selectivity as it is possible to use on 'phone and which could be added to an existing receiver. The method to be described for varying the selectivity is a very practical one, especially for the home constructor, no wobbulator or other apparatus having been used for the alignment.

The main purpose of the IF section of a receiver, apart from giving gain, is to remove unwanted signals and noise ; the latter may be divided into two main types. The first consists of " hash " or " sharsh," which covers a wide spectrum, but contains most of its energy in the high frequency regions and which can be largely removed together with QRM by using high-selectivity receivers. Receiver noise falls into this category. The second type consists of impulse noise of very large amplitude, but of a duration of only the order of a millisecond or so. This can be much more effectively dealt with fairly early in the IF unit, before it has been able to shock-excite high selectivity circuits, than in the audio section ; this aspect of the matter is, however, outside the scope of the present discussion.

If a crystal filter is not used, it is necessary to go in for a double-conversion receiver to get the desired selectivity with good image rejection. The usual 465 kc IF does not give satisfactory image rejection at 30 mc (without a rather complicated front end) or very good selectivity, but it is a good compromise for use in single-conversion receivers. Although it is commonly assumed that a double superheterodyne receiver will remove the second-channel bogey, the use of a high first IF and a very low second IF may lead to what can be called " second second-channel interference " (and, if the second oscillator is not crystal controlled, to the possibility of pulling).

Consider a double superhet with a first IF of 4 mc (about 80 metres) and a second IF of 50 kc. That part of the receiver after the first converter can be looked upon as a single superhet, fixed tuned at 4 mc, with an IF of 50 kc — a receiver with such a low IF will be subject to second-channel interference. This could be eliminated by increasing the selectivity of the first (4 mc) strip, or by adding a circuit to this strip to attenuate the unwanted frequency. The commonly adopted first IF of 1·6 mc is low enough completely to avoid this effect with any second IF which it is possible to use for phone reception and high enough to avoid any of the usual types of image interference. Except for actually deciding on the frequency, few design problems arise in connection with the first IF. In the work being described here, a normal 1·6 mc IF strip has been used ; two stages are employed, so that the receiver can also be operated as a single superhet, with adequate noise silencing voltages available.

Second IF Channel

One can always get a feeling of intense satisfaction from actually designing and making up one's own equipment from that design ; in the case of the second IF section, it was decided to wind some transformers for operation at about 85 kc and then to experiment by lowering their frequency. Some unwanted permeability - tuned transformers (6d. each " surplus ") were unwound so that the cans and formers could be used to make the required second IF transformers. The standard 1·45 inch square IF cans will fit over the chassis holes made for an IO valve holder, thus making an interchange of valve and transformer positions possible without further drilling — a very useful thing when experimenting.

Generally, for a given Q, the higher the

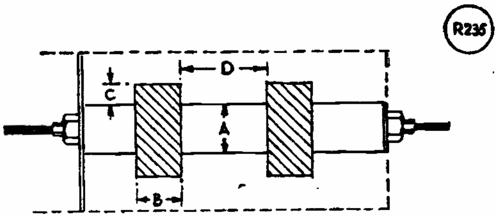

Fig. 1. Diagram of second IF transformers described in text. Approximate dimensions are: A, 0.5 in.; B, 0.4 in.; C, 0.2 in.; and D, 0.85 in. The dotted line represents the screening can.

L/C ratio of a tuned transformer circuit, the higher the gain, but with a very high L/C ratio a high Q cannot be obtained and the resonant frequency is made more sensitive to small capacity changes, *e.g.*, Miller effect when AGC is applied. As a practical compromise the required inductance for each tuned circuit was calculated for a parallel capacity of 220 $\mu\mu$F at 85 kc using one of the usual empirical formulæ given in radio design handbooks. (The dust-core was assumed to produce an inductance increase of 30% when in the half-way position.)

One thousand turns of wire were wound tightly on a ½-in. diameter former, between cardboard cheeks held in position by "sticky." As no wave-winding facilities were available, the wire was moved quickly from side to side between the cheeks whilst winding to get the closest possible approximation to wave-winding. When finished the cardboard cheeks were removed and the wire was held in position by a few spots of polystyrene cement. (Litz wire was not used for the coils because of its large diameter and the fact that the improvement is small below 100 kc.) Coils of 1,000 turns each were made up using 40, 38 and 36 SWG SSC enamelled. The coil wound with 38g. wire had a considerably higher Q factor than that using 40g., but it was found difficult to get the 36g. wire into a small enough space for two of the coils to be put into one can and the Q was only a little better than the 38g. coil; it fell from 90 to 75 when the 36g. coil was put into an earthed can. The Q was found to be greatest with the core fully in; the centre of the coil should be at earth potential with respect to the IF voltages.

It might have been possible to make a higher Q coil by using larger diameter wire with sectionalized windings. The coupling between all the coils could then have been varied at will, but it would only have been possible to use half the number of tuned circuits in a given space. It seemed that the most practical method of getting good skirt selectivity for 'phone reception without involving special magnetic materials would be to use two mutual inductively-coupled circuits per can. Several transformers of this type were made with two coils, each consisting of 1,000 turns of SSC wire; the dimensions are shown in Fig. 1. The Q of each coil in an earthed can was measured at various frequencies and the mean results are tabulated in Table I together with the necessary capacity to resonate at the frequency involved. The Q of a given coil is equal to $2\pi fL/R$ and hence increases with frequency until it reaches a maximum, after which the resistive losses increase more quickly than the frequency. Table I shows that whilst the Q has a maximum value at about 85 kc, the transformers would be quite effective below 48 kc.

For experimental purposes the transformer coils were tapped at 450 turns so that the loading on each resonant circuit could be reduced if desired, solely at the expense of gain, of course. The coupling between the windings was made as small as conveniently possible for the size of can used and seemed to be about the most desirable compromise; by connecting the output from a valve anode to a tapping on the coil, however, a smaller part of the valve anode resistance could be coupled into the resonant circuits, resulting in a higher effective Q. The capacity in parallel with the coil need only have a tolerance of about 10%. If it is not desired to construct the transformers, suitable 85 kc items can be purchased from Denco

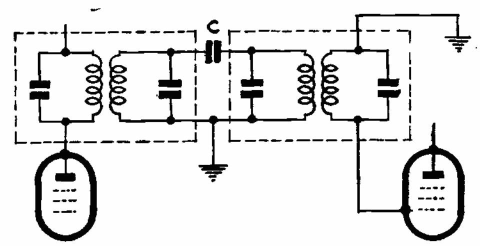

FIGURE 2 (A)

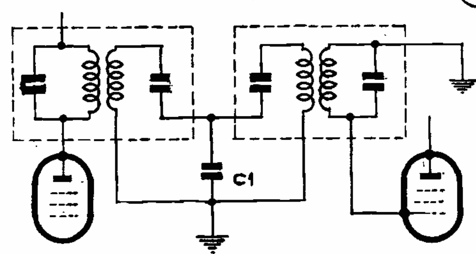

FIGURE 2 (B)

Fig. 2A. High impedance or "top coupling" between two IF transformers. Fig. 2B. Low impedance or "bottom" coupling between IF transformers.

or they may be obtained from "surplus" units.[1]

There is no point in using a high-gain low-noise second mixer and therefore injection of the oscillator voltage into the same grid as the signal voltage was not considered to have any advantages and might have caused pulling. Any multi-grid valves, *e.g.*, 6K8 or 6BE6, are suitable converters, but it is desirable to use a separate oscillator. A self-oscillating 6K8 has been used for experimental work and was found to be reasonably stable after an initial warming-up drift. A crystal oscillator is desirable, but if a crystal of about the correct frequency is not available, a Franklin is probably the next most stable oscillator.[2] Another suitable oscillator has been described by G3GKG.[1] Negative temperature coefficient condensers should be used for the correct fraction of the oscillator tuning capacity. It is not difficult to reduce second-oscillator drift far below that of an HF first oscillator, but drift in the latter can be corrected by the receiver tuning. It is well worth while building the second oscillator into a very rigid closed box with a coax lead to the mixer grid; with adequate decoupling of heater and HT leads, oscillator harmonics should then be completely eliminated from the receiver input. The oscillator feedback coupling should be as small as possible.

TABLE I

Freq. (kc.)	Parallel Capacity ($\mu\mu$F)	Q
141	75	59
135	82	62
125	100	66
114	120	68
103	150	70
86	220	71
71	330	68
60	470	63
55	570	60
51	670	58
48	720	56
41	1,000	—
33	1,500	—
29	2,000	—
24	3,000	—
20.5	4,000	—

Table showing the measured Q of coils consisting of one thousand turns of 38g. SSC wire. All measurements were made with the transformer can earthed.

Single Stage

A normal single IF stage was built using a 6K8 converter, two of the transformers already mentioned, a 6SK7 amplifier and a cathode follower detector; this type of detector (which can be any small triode or triode-connected pentode) is preferable for maximum selectivity because damping on the previous tuned circuits is very small. The decoupling condensers were 0·1 μF (impedance 32 ohms at 50 kc), but 0·25 μF to 0·5 μF condensers are more satisfactory. Suitable detector decoupling and filter components are shown in Fig. 3. The alignment of the single stage was carried out by accurately tuning the receiver to a local BBC station using the first (1·6 mc) IF only, setting the second oscillator to give a response at the end of the second IF unit and then adjusting all transformer cores for maximum response as measured on a 0 - 1 mA meter in the anode circuit of the cathode follower detector. Two tuned circuits could then be detuned slightly in opposite sense, to give a more level response, if desired. The final transformer of the first IF amplifier should also be realigned.

The results obtained with the single IF stage were extremely encouraging, especially considering the simplicity of the circuit. Many signals whose presence could not even be detected through extremely bad QRM when using a single superhet were brought out quite clearly when the second IF was added. Anyone not wishing to make up the more complicated unit with variable selectivity (to be described) could obtain reasonably satisfactory results from this very simple circuit; it involves only two additional valves, a suitable operating frequency being 35 to 100 kc. An amplifier having four tuned circuits has been described previously.[1]

The audio amplifier used by the writer had a very wide frequency response and it was found that speech intelligibility was vastly improved by cutting the bass to balance the top-cut of the second IF unit. A simple RC filter consisting of a series capacity 200 $\mu\mu$F to ·005 μF, followed by a 10K resistor to ground was found to be very effective, but a steep-cut filter [3] would probably have given better results. It has been found that if a signal made almost unintelligible by high selectivity is listened to for ten minutes or so, it gradually becomes more easy to read as one gets used to

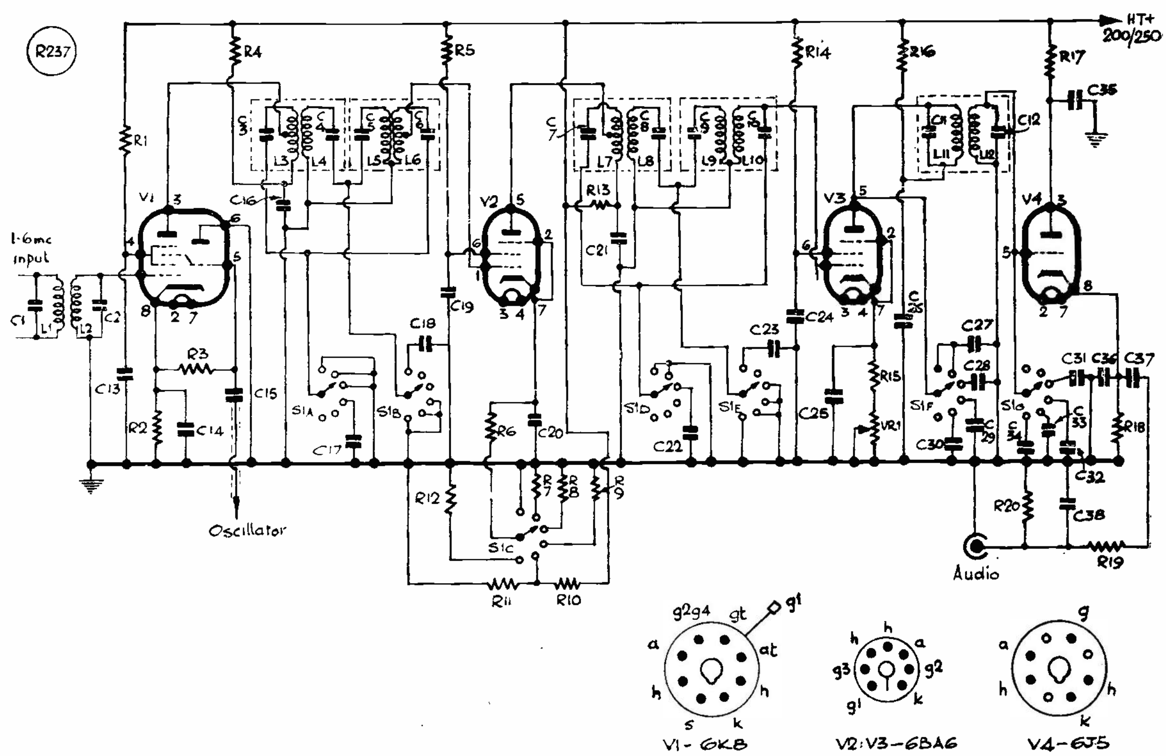

Fig. 3. Finalised circuit proposed for a high-selectivity IF amplifier, for operating at 1.6 mc. Variations on this basic design are possible, as explained in the text; six different bandwidths are given by the circuit shown here, for which all values are in the table.

Table of Values

Fig. 3. Circuit of the Variable Selectivity Unit

C3 to C12	680 μμF*, 10%, mica	R3	100,000 ohms
C13, C14, C16, C19, C20, C21, C24, C25, C26	0.1 μF to 0.5 μF	R4, R13, R16	2,200 ohms
C15	10 μμF*	R5, R14	47,000 ohms, 1w.
C17, C18, C22, C23	0.1 μF*	R6, R15	220 ohms
C27	82 μμF,* 2%	R7	820 ohms*
C28	75 μμF,* 2%	R8	18,000 ohms*
C29	56 μμF,* 5%	R9	82,000 ohms*
C30	33 μμF,* 5%	R10	330,000 ohms*
C31	7 μμF,* 20%	R11	47,000 ohms*
C32	26 μμF,* 10%	R12	27,000 ohms*
C33	49 μμF,* 5%	R17	6,800 ohms
C34	82 μμF,* 2%	R18	68,000 ohms
C35	0.5 μF	R19	20,000 ohms
C36	.0033 μF	R20	10,000 ohms*
C37	750 μμF*	VR1 (optional)	20,000 ohms preset
C38	.0015 μF	L1, C1, L2, C2	1.6 mc transformer
R1	27,000 ohms, 1½w.	L3 to L12	*See text*
R2	270 ohms	V1	6K8, or similar
		V2, V3	6BA6, or similar
		V4	6J5, or similar

S1 (Selectivity switch) = 4-wafer, 7-pole, 6-way, ceramic

S1a and S1b = 1st wafer	S1d and S1e = 3rd wafer
S1c = 2nd wafer	S1f and S1g = 4th wafer

**Values marked with an asterisk may be adjusted to obtain the desired performance.*

the absence of high frequencies. The ear begins to compensate for the deficiencies.

Coupling

The single stage was found to be quite useful at IF's down to 29 kc on 'phone, but the selectivity could be much improved by the use of more transformers. If it is desired to have more than two tuned circuits between valves, mutual inductance coupling alone cannot easily be used. Two other effective methods of coupling tuned circuits are shown in Fig. 2. Whilst C and C1 could be replaced by resistors or coils, resistors would damp the tuned circuits and inductances with their screening are not convenient. The low impedance or "bottom" coupling shown in Fig. 2(*b*) was preferred to the high impedance or "top" coupling shown in Fig. 2(*a*), because it is rather easier to switch the comparatively large capacities C1 with only a small fraction of the IF voltage on them than it is to vary the selectivity by switching the much smaller condensers C with the full IF voltage across them with respect to earth. If C1 were omitted from Fig. 2(*b*), the two coupled circuits become virtually one tuned circuit with twice the inductance and half the capacitance of a single one. Similarly C in Fig. 2(*a*) could be replaced by a piece of wire. The value of

C or of C1 considerably affects the gain and selectivity of the amplifier.

Variable Selectivity

The provision of variable selectivity giving at least three different bandwidths was regarded as essential for optimum results under varying conditions in a communications receiver. Most methods for reducing selectivity cause two "humps" to be formed in the response curve on either side of the IF by some of the tuned circuits, and the peak due to the other tuned circuits fills in the trough between the humps to give a fairly "square" response. When many tuned circuits are employed, however, it is not always easy to get such a result.

Looking back through past issues of *The Short Wave Magazine,* there is an article by G6HL[4] in which different second IF strips are used for CW and 'phone. This seemed rather space consuming, as did the second IF unit described by G8SI[5], using one tuned circuit per can for CW use only. The method of obtaining variable selectivity by tilting one of the coils in each of the IF transformers (as found in some Eddystone receivers) was not considered practical for the home constructor, especially with many transformers.

It seemed necessary to do something more than merely to alter the coupling if many tuned circuits are used. The possibility of altering the selectivity by changing the second IF had been considered, but rejected because of the complicated switching of tuned circuits (including the oscillator) which this would involve. Methods employing variable positive feedback were not considered to be ideal. Another way of changing the selectivity is to increase the tuning capacity of some of the tuned circuits and decrease that of others. This method is used on the final IF transformer of the circuit to be described (Fig. 3), but it was not considered very practical to extend it to all ten tuned circuits.

There are many ways in which satisfactory results could be obtained, the choice depending mainly on one's personal ideas and requirements. The circuit shown in Fig. 3 giving six positions of selectivity, has been found to be capable of excellent results, but is nevertheless very straightforward and within the scope of any competent amateur. This unit has been used mainly at about 50 kc (parallel tuning capacitors of 680 $\mu\mu$F), at which frequency the ten tuned circuits produce excellent selectivity (more than can be used on a double side-band signal), whilst in the broad selectivity positions quality is comparatively good.

Circuit Details

Only one transformer is used between the last IF valve and the detector because if two or more transformers are cascaded, the maximum output voltage to the detector will be severely limited. For the same reason the tappings on the last IF transformer were not used. This type of detector should be operated at a fairly high level, especially as the audio filters cause considerable attenuation. Two transformers were used between the other stages, as shown, with bottom coupling. In order to reduce the selectivity, it was considered desirable first to reduce the number of tuned circuits below ten. Let us consider the coupling between V1 and V2. If S1a is in an earthed position, there is no coupling between L3C3 and L6C6 and the coupling between L4C4 and L5C5 is determined by the position of S1b. The coupling is made a minimum and the selectivity a maximum by using a large coupling capacity, C18. When the junction of C4 and C5 is not connected to anything by S1b, L4C4 and L5C5 become one, so that there are three tuned circuits between the first two valves. The response curve shows two "humps" when overcoupled. If S1b is connected in an earthed position, there is no coupling between L4C4 and L5C5, leaving only the two circuits L3C3 and L6C6 to couple the valves. The coupling between these is determined by the position of S1a. When the junction of C3 and C6 is not connected to anything by S1a, there is virtually only one tuned circuit between the two valves. The coupling between the next two valves is varied in exactly the same way.

Any number of tuned circuits between four and ten may thus be employed in the unit by connecting the switch appropriately. It is essential in this design to use a switch having a low contact resistance or undesired coupling will be introduced. The unwanted coupling due to the resistance and inductance of the

TABLE II

Selectivity Switch Position	No. of tuned circuits	Final IF transformer detuning capacity ($\mu\mu$F)
1 (max.)	10	0
2	8	0
3	7	7
4	5	26
5	4	49
6 (min.)	4	82

switch parts and wiring common to each two tuned circuits was found to be absolutely negligible at 50 kc with the switch in an earthed position. This was ascertained by earthing both of the bottom couplings between two of the valves and showing that the output was negligible with the other stage at maximum gain. The process was repeated for the other valve coupling. The performance was made much more satisfactory in the broader selectivity positions by incorporating switched condensers across the final two tuned circuits. Providing the tuned circuits of the final transformer are detuned by the same amount in opposite directions (hence the use of fairly close tolerance items for C27 to C34), alteration of the selectivity by means of the switch does not affect the frequency of maximum response at all.

The resistors in the cathode circuit of V2 are switched by S1c so as to leave the gain unchanged as the selectivity is altered. The values of these resistors are shown, but it will be necessary for each constructor to find the exact values experimentally to keep the gain constant in his own particular unit. This is best done by tuning in a non-fading signal and using the meter in the detector anode circuit. If the carrier is thus left at a constant level, then as the selectivity is increased, the sound volume will decrease owing to side-band cutting. AGC was not applied to the second IF amplifier because, if applied to V2, it would have affected the constant gain obtained by the use of S1c, and, if applied to V3, it would have limited the output somewhat. It is necessary to take the AGC from the end of the second IF amplifier, as if taken from the first IF unit, it would have been operated by any more powerful carrier within the wide passband of this unit. A preset control or fixed resistor can be used for VR1. The gain of the amplifier, although not very great because of the attenuating effect of the cascaded transformers, is nevertheless quite appreciable. The frequency is only a little above audio frequencies and in no case has instability been found.

Any suitable variable-*mu* valves can be used for the two amplifiers, but it is preferable that they should be single-ended; 6BA6's and 6SK7's have both been tried satisfactorily. Large values of decoupling capacity are important because of the low frequency involved. Whichever type of oscillator is adopted, the 6K8 requires about five volts injection. Simple screening was used between each of the stages under the chassis; it also served as a support for the switch. The chassis space occupied by the Fig. 3 circuit was seven inches square, but additional space should be allowed for the second oscillator, the BFO and the AGC amplifier.

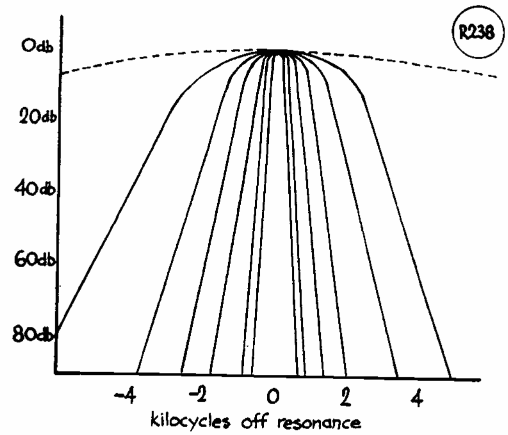

Fig. 4. Selectivity curves on the circuit shown in Fig. 3.

Alignment

The alignment was carried out with the switch in the maximum selectivity position. A signal from a generator (or a local BBC station) was tuned in accurately on the single superhet and the second oscillator tuned until a response was obtained at the end of the second IF unit, as measured on the 0-1 mA meter in the detector anode circuit. If no response can be found a condenser (·01 μF) may be temporarily connected between the anode of V2 and the grid of V3; it should then be possible to obtain a response. All transformers except those between V2 and V3 are then tuned for maximum response, the condenser (if used) removed, and all cores adjusted on to the peak. Altering the position of the selectivity switch should then give the desired effect and should not change the position of maximum response at all.

The selectivity curves obtained from the circuit of Fig. 3 are shown in Fig. 4, together with the broad selectivity curve obtained from the single superhet (*dotted*). They were plotted by connecting a germanium diode, a resistor, a very sensitive microammeter and a less sensitive microammeter in series between the detector grid and earth. The more sensitive meter was shorted out whilst measuring large outputs; a fairly linear scale over quite a large range was thus obtained. Signals were fed in from a wavemeter whose frequency could be varied by a small known amount.

The effective number of tuned circuits for each switch position of the Fig. 3 circuit is shown in Table II, together with the value of any detuning capacity across each coil of the final IF transformer. The connections and values shown in Fig. 3 have been found to be very satisfactory in practice, but could easily be varied to suit other constructors. The switch used was a 4-wafer, 7-pole, 6-way ceramic, but switching could be considerably simplified by having fewer selectivity positions, or by omitting both S1f and S1g.

Results obtained with this unit have been most satisfactory. In the broadest selectivity position speech quality is good, but even if the interference is very severe, it is usually possible to increase the selectivity just as far as is necessary almost completely to eliminate the interfering signal without making the speech unintelligible.

Speech could not be understood in the two highest selectivity positions when receiving a double side-band signal and could only be understood with difficulty in the third selectivity position. It was found possible, however, to make the signal perfectly intelligible whilst using maximum selectivity by carefully tuning to either sideband and adjusting the BFO. Single sideband signals could also be received using the BFO and maximum selectivity. The very high selectivity of the ten tuned circuits is, of course, also excellent for CW reception and could even have been increased slightly more for this purpose.

Unfortunately, no comparison has yet been made between the amplifier using the Ferroxcube pot cores described by Belrose [6] and the Fig. 3 circuit. Whether such a flat-topped response as that obtained by Belrose is necessary for amateur use is not known, but the Fig. 3 circuit appears to give better selectivity, except perhaps in the broadest position.

It is hoped that future constructors will incorporate many of their own ideas into variable-selectivity circuits, as there is ample opportunity for amateurs who enjoy experimenting to do some really useful work in this field.

The author would like to thank G3LLS for the loan of some apparatus and for many interesting discussions on the problems involved.

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TOUR OF SCANDINAVIA

ROUND TRIP TO LA, SM, OH AND OZ

J. N. Walker, G5JU

IN company with G6XJ, the writer recently made a tour of Scandinavian countries. Essentially the visits made in Oslo, Stockholm, Helsinki and Copenhagen were for business, but, as might be expected, a little time was found for some Amateur Radio activity in each centre.

The tour commenced on August 25 with a flight in a B.E.A. Viscount across the North Sea to Oslo. Many will remember that week-end for the high winds that were blowing all over the country, and it was certainly a little bumpy until " Sir Humphrey Gilbert " reached operational height at 23,000 ft., when all was smooth and very pleasant.

The remainder of that day was spent seeing the sights of Oslo—and there is a lot to see there. The original *Kon-Tiki* raft has a permanent home built specially for it, and seeing the actual " vessel " makes one realise what a fine achievement was the voyage made by Thor Heyerdahl and his companions. Then the little ship *Fram,* built of very solid timber and used so successfully by Nansen and Amundsen in their early Polar explorations, well before the days of radio communication as we know it now. The ship has been hauled out of the water on to dry land, and around and above it has been erected a tall timber building, a near copy of the actual " boat house " used in the day of the Vikings. Other interesting sights included the Viking ships dug up out of the mud of the fjord and in excellent condition ; and the mountain ski tower above Oslo and the Frogner Park with its astonishing array of statuary.

No individual visits to amateur stations were possible in Norway, but with some speedy cooperation from local amateurs at short notice (and this applied to other Scandinavian cities also), a meeting was held on the evening of August 26 in Oslo. A talk illustrated with coloured slides was given, and although, of course, the English language was used, it was evident the talk was well understood, since quite a number of questions were asked (also in English). Incidentally, it will generally be found that most foreign amateurs have some command of English and many can speak the language fluently.

In the Scandinavian countries it is traditional to include a supper with a meeting, so this one finished in a friendly atmosphere with beer and sandwiches (the famous open style of Scandinavian sandwich) all round, plus plenty of rag-chewing.

SM Experiences

Then on to Stockholm, where we were well looked after by Sven Frisk (SM5AWL), who initiated us into the ceremonies of "scawl." He owns a fine modern station, running some 300 watts (maximum allowed in Sweden after passing appropriate examinations is 500 watts), which, allied to a good site on one of the islands, and using a rotary beam, ensures a DX signal of good quality and strength. During a short session here on the morning of August 31, we were able to talk back to England, making good phone contacts with G5BJ, G3EGJ and G2JG on 14 mc. It is known others were waiting to follow on, and our apologies for having to "pull the big switch" all too soon. But we had to make tracks (and tracks is the right word!) to the site of the S.R.A. field-day — a journey neither the writer nor G6XJ will forget for a long time to come. The first ten miles or so were over normal tarmac roads; then we headed out into the wilds along a hard-surfaced lane. A few miles on was a notice, "No Road"—and, as we soon learnt, there *was* no road, only a bull-dozed track through the woods — but nevertheless, on we pressed regardless. All this time it was raining heavily, and soon we came to a stretch, some 30 ft. across, of thick mud, of unknown depth, probably with no hard surface below it. Now, there are two ways of getting through that kind of hazard: A slow crawl in bottom gear, with the hope the tyres will grip on something; and the other, to build up kinetic energy and slice through it. Which would you choose under the circumstances? SM5AWL, in his Mercedes, chose the second. A smart change-down, foot on the accelerator, and in we went at a rate of knots. The car bucked, slewed and skidded in all directions, but with Sven man-handling the wheel, miraculously we reached the far side!

The track continued, with sharp, slippery bends and another patch of mud, bigger than the first, to negotiate, and we were glad to reach our destination —a tourist centre at Okersberga.

It should be explained that S.S.A. is the Swedish national society and S.R.A. is the local one. The annual field-day organised by the latter is quite different from NFD—the only similar event in this country known to the writer is the field-day held each year by the Midland Amateur Radio Society, and even this is not on the scale of the Swedish effort.

The hostel at this tourist centre is quite a large building, with kitchens, dormitories, dining room and recreation rooms. AC mains are available and S.R.A. really go to town for the week-end. Several powerful transmitters are put on the air and can be used simultaneously under one call-sign (SM5XA). Aerials of different types are erected—to be seen were beams with power-operated rotators; long wires disappearing into the distance; Zepps, and all the rest—and activity is maintained at a high level. The writer had the pleasure of a fine QSO with SM5SI in Stockholm on two metres. Those not actually manning the station, numbering 30 or more, gathered to listen to a talk on receivers, illustrated again with slides, and followed by a demonstration of the Eddystone "888" receiver, which, unprotected in the boot of the Mercedes, had not been affected in the slightest by the rough journey and gave a good account of itself. Subsequently, the receiver was put into service at one of the operating positions, and was not switched off until activity ceased on the Sunday evening. But, with the rain still pouring down and our thoughts on the ordeal before us, we left after a few hours and tore back through the oceans of mud—without mishap, thanks to SM5AWL, who really ought to turn his attention to rally driving. Just as we reached the first large patch of mud, we met a group on their way up to the centre and busy with VHF walkie-talkies.

On the following day the weather improved and all the field-day participants had a pleasant time. It

During their Scandinavian tour, at an Amateur Radio meeting in Helsinki we see, left to right: OH2OJ, G5JU (Stratton & Co., Ltd.), G6XJ (Stratton & Co., Ltd.) and OH2TT, chairman of this particular meeting. G5JU and G6XJ were present at several such during a very interesting tour.

says much for their enthusiasm that, despite the weather and the appalling "road," many cars, with full loads, managed to reach the site.

Across to Finland

The Sunday morning saw us on our way to Helsinki, flying over the Archipelago—a fine sight below us. We were astonished at the number of islands, large and small, stretching for miles in all directions. Little is heard of the Archipelago in this country, but it is popular with Scandinavians on holiday, and we found ourselves wishing we had made this part of the journey by sea. And strange to think that, where ships could be seen below us, lorries travel over the ice in the depth of winter!

Without belittling the other countries, it can be said that enthusiasm for Amateur Radio undoubtedly reaches a high level in Finland, and the national society, S.R.A.L., does much helpful work in furthering the interests of its members. A "luncheon club" meets every working day in Helsinki, and the writer had the pleasure of joining some twelve members on one of these occasions. An interesting sidelight is that most of the committee members of S.R.A.L. are able to get along to these luncheons, and so official matters usually receive extremely prompt attention.

Again, and at short notice, a local meeting was arranged at the Hotel Helsinki—unofficial but very successful. Following a talk given by the writer, the usual beer and sandwiches were consumed, and the high "noise-level" (or conversational hum!) continued until the final, final "all-out" order had to be obeyed.

Although somewhat late, a visit was then made to the home of John Velamo (OH2YV), who combines with his many other activities the editorship of the S.R.A.L. *Journal*. A search was made on 7 and 3.5 mc for G stations, but, probably because of the late hour (after midnight BST), none was heard. CQ/G calls produced replies from YU, UA and DL, but none from G! Incidentally, it apeared to be in order to use the call G5JU/OH, so out this went! A look through John's certificates (he must surely be the world champion holder of these) and then a ride through the quiet streets in a taxi which arrived three minutes after a telephone call—and this at 1 a.m.—one of the benefits of the radio-control system which is extensively employed in all Scandinavian countries.

Up the following morning—actually, the same morning—at 5 a.m. to catch the plane to Copenhagen. A damp morning, with cloud very low, and after being airborne for about fifteen minutes, a return to Helsinki to correct a loose screw in an engine cowling. The excellent landing, with the "deck" invisible almost to the point of touchdown, spoke well for the skill of the pilot and the good use obviously made of radio-aids. Airborne again a little later and a smooth flight to Copenhagen—and, because of the clock difference, still only 9.30 a.m. when we landed.

Straight into business activities, intermixed with traditional Danish hospitality, largely in the shape of "smoer-brod" (open sandwiches and a satisfactory meal in themselves). The Wednesday evening was spent investigating the attractions of the famous Tivoli Gardens, which have something to offer to suit almost every taste. Quite a number of languages to be heard, and English (or should we say American?) freely spoken.

Meetings in OZ

On the Thursday evening, there was a goodly gathering, mostly of E.D.R. members, to see the slides and hear the talk centred around them. This time Bo Neilson (OZ7BO) gave a resumé in the native tongue, and the intelligent questions asked (mostly in English) showed that the session was well appreciated. On this occasion, a tape recording was made of the talk, for distribution around other Danish amateur groups. A number of photographs were taken by local experts, but no copies have yet been seen.

OZ7BO is a leading exponent in Europe of SSB, and he kindly invited us to pay a visit to his station on the following evening, when it was the intention to have an SSB session and possibly work into Britain. Unfortunately, by then, colds which had been showing signs of development reached a stage which put the visit out of the question, and we had to miss the party OZ7BO was laying on — our apologies again to him and his XYL.

Some sight-seeing was managed the following day —a visit to the "Little Mermaid" statue, famous in Hans Andersen's stories; to the Gardens of Remembrance, established in memory of the Danish Resistance Movement; and a tour around Zealand, which included Elsinore Castle, the home of Hamlet, Prince of Denmark.

Then into the plane and an uneventful flight across Denmark and Holland. With good visibility, there was no delay in landing and, despite some reports to the contrary, we found the arrangements at London Airport worked smoothly and speedily.

And so ended the tour, with all its fresh experiences, the interesting contacts made with people of other lands, and the memories of the friendliness and hospitality which are inseparable from the Scandinavian countries. Our only regret was that lack of time made it impossible to meet more of the LA, SM, OH and OZ amateurs and to get to know them better.

NEW G.E.C. INSTRUMENT TUBE

A new instrument cathode-ray tube, the 5BHP, which combines a high deflection-sensitivity with low distortion and uses a new, helical post-deflection accelerator system, has been developed by the M.O. Valve Co., Ltd., a subsidiary of the G.E.C. Intended, primarily, for use in wide-band measuring oscilloscopes, the 5in. diameter flat-face tube has a Y-plate deflection sensitivity of 1.5 mm. per volt under typical conditions. The high sensitivity is achieved with specially designed deflector plates, while the use of helical post-deflection acceleration and an aluminised screen enables a bright, fine trace to be obtained.

The Six-TA Special

NARROW BEAM FOR TEN

C. D. ABBOTT (G6TA)

That there is still scope for the derivation of specialised aerial systems is shown by this article — our contributor offers an interesting and original beam assembly which has some attractive features for those who want a compact directional array (either indoor or outside) for the 10-metre band, now wide open for world-wide DX.—Editor.

JUDGING from what one hears over the air, many amateurs are under the impression that a Yagi type of aerial gives very low-angle radiation.

Reference to any text book will confirm that this is *not* the case, and, in fact, an aerial consisting of a driven dipole *plus* one or more parasitic elements has its major lobes at the same vertical angle as a simple dipole which is a similar height above ground.

In the case of the beam assembly, the lower lobes are proportionately larger than the higher, but it is in the horizontal plane, where most of the energy is concentrated in one narrow "loop," that the advantage is gained.

By using an aerial with, say, two elements, both of which are directly energised—such as the "ZL Special"—an improvement in low-angle radiation is usually obtained, especially in built-up areas where the terrain under and near the aerial is far from being perfectly conducting ground.

Development

Soon after the war, when amateur licences were re-issued, the author used a two-element beam with 0·15 wavelength spacing and fed with two separate feeders cut to give a phase difference of 126°. In order to get reasonably low standing waves on the feeders the impedances at the feed points were stepped up considerably by using 1 in. diam. tube and folds made of 16 gauge wire. With 600-ohm lines this gave a good match and wide band coverage.

Forward gain and back-to-front ratio were good. Apparently, quite a satisfactory vertical pattern compared with a normal two-element parasitic beam had been accomplished, as reports at great distances were usually about one or more S points better, whereas at relative short ranges they were approximately the same.

In order to gain more experience with aerials and to save time and expense attention was turned to two metres. On that band, quite elaborate arrays could be constructed and tried out fairly easily. By using a suitable indicating device about 100 feet away, at the far end of the garden, quite accurate results could be tabulated.

It was found that stacking aerials resulted in a great improvement, but the preferred 0·6 wavelength spacing, whilst attainable on two metres, would present insuperable difficulties on ten metres if 360° rotation were required.

It was decided to compromise, and an aerial consisting of two two-element beams, each spaced 0·15 wavelength and fed 126° out of phase with 0·25 wavelength stacking, was tried. This proved very satisfactory.

On twenty metres the author had previously reduced the turning width of a beam by using 17ft. tops only, with additional pieces 8ft. long

FIG. 1

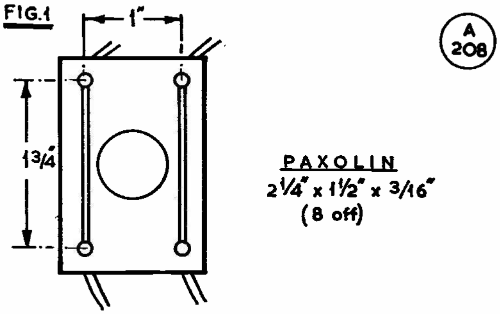
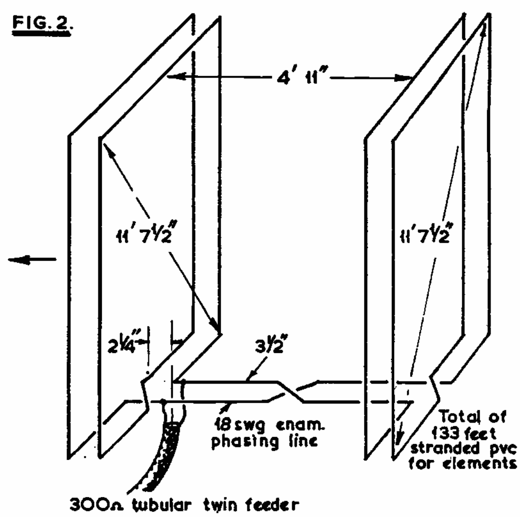


FIG. 2.



Layout and dimensions of the "Six-TA Special," of which further details are given in the text. The spacing between the elements for each section is one inch (as Fig. 1) secured by the use of the small paxolin corner strips, cut and drilled to the dimensions given in Fig. 1. As explained in the article, the beam is supported on bamboo spreaders fixed to distance-pieces to give a separation of 59 inches between sections. This design is giving very good results on 10 metres.

hanging down from each end. As nearly all the radiation takes place from that part of the aerial where the current is greatest, the bending at right angles of the end $\frac{1}{8}$th-wavelength had very little detrimental effect.

This same shortening method was applied to the two-metre aerial, and later, in order to improve the general appearance of the array, the lower four ends, instead of hanging down, were turned upwards and held by insulators attached to the upper elements.

It was soon realised that, theoretically, the ends of each pair of elements, where they were separated by the insulators, were at the same potential and therefore the use of insulators was superfluous. Also it was appreciated that by connecting the respective ends together it would become unnecessary to feed both the top and bottom components.

It must be remembered that the matching device of a high step-up obtained by uneven folds was still being used, and it became obvious that this would not fit in with the new idea mentioned in the previous paragraph.

The one-inch diam. tubing was discarded and two continuous loops of fairly thick enamelled wire were substituted. The spacing and stacking were kept the same, but instead of using two 600-ohm feeders, one 300-ohm line was used and connected to the front element; a phasing line of 600 ohms with a half-twist joined the front to the back loop.

Derived Design

It seemed that after all these experiments only a Cubical Quad had been produced—but a little reflection showed that this was not the case. The new design had the following advantages:

(1) There was no stub to adjust. This may not seem important at first glance, but anyone who has adjusted stubs at or near ground level will be aware that when the array gets well up in the air the results are seldom satisfactory. Unfortunately, few amateurs have towers with a platform to enable adjustments to be carried out *in situ!*

(2) In the case of a Quad, even if the stub is correct for, say, 28,100 kc, it will be far too long to work well at the HF end of the band. Not only will the forward gain and back-to-front ratio suffer, but the impedance at the feed-point will have changed considerably. Using 80 ohm co-ax (as is generally recommended for Quads), this mismatch caused by altered impedance will result in serious losses.

(3) As in the case of the "ZL Special" *vis-à-vis* a normal two-element beam, the aerial described here gives a better vertical pattern than a Quad.

Having completed the above experiments on two metres, a scaled-up copy was made for Ten.

Construction of 10-Metre Array

A boom consisting of 4ft. 11in. of 2in. x 2in. straight-grained knotless pine was fixed to the mast (a 2in. dural scaffold pole) by means of a builder's right-angled clamp. Four bamboos about 6ft. long were secured to each end of the boom with shelf-type angle brackets. A second boom of similar material, but only 1in. x 1in. cross-section was clamped 4ft. $1\frac{1}{2}$in. below the first. On each end of this were screwed pieces of paxolin $4\frac{1}{2}$in. x 2in. and 3/16in. thick. These formed horizontal T's and each had four small stand-off insulators on their underside to anchor and support the aerial wire and phasing line.

At the end of the lower boom nearest the feeder a piece of paxolin about 7in. x 1in. x 3/16in. was fixed by means of a small right-angle bracket so that it hung downwards. The feeder was tied to the lower few inches of this to prevent it being torn away from the aerial in a high wind.

To avoid possible splitting of the bamboos, instead of passing the aerial wire through holes drilled in them, eight pieces of paxolin $2\frac{1}{4}$in. x $1\frac{1}{2}$in. x 3/16in. were cut as shown in Fig. 1. The centre hole was a tight fit on the bamboo. The bamboos were bought slightly longer than required, and it was an easy matter to arrange, when cutting them to length, that the paxolin pieces rested against a knot to prevent them slipping towards the centre. A little Bostik compound on the bamboo before putting on the end pieces held the latter quite firmly.

The exact diagonal length from paxolin to paxolin was 11ft. $7\frac{1}{2}$in., and about 133 feet of plastic covered stranded wire was used for the complete aerial. In order to prevent relative movement altering the impedances a few very light spacers, with two holes drilled 1in. apart, were threaded on the element sections when they were assembled.

The phasing line was made of 18 gauge enamelled wire spaced $3\frac{1}{2}$in. to give approximately 600-ohm impedance. In order to clear the mast it was made slightly longer than 4ft. 11in. and held away at its centre by means of a bracket and insulators.

To allow for the longer phasing line and also its velocity factor the feeder was not attached directly to one loop, but $2\frac{1}{4}$in. along the line;

300-ohm tubular line was used as feeder.

Fig. 2 gives the electrical layout of the system, with main dimensions, and should make the general arrangement quite clear.

Finally, it should be emphasised that, as in the case of all horizontally-polarised aerial arrays, *height above ground is important.* The lower element must be at least one half wave-length above ground — double this height is advised for even better results.

Now that ten metres is open in such fine style it is well worth building a really good beam system just for that band. The author can confidently recommend his "6TA Special" as capable of giving an excellent performance, while being simple to construct and instal.

BOOK REVIEW

The Ham Register, 1958

FOR those who detest rubber-stamp QSO's and think that a contact should imply "contact" of some sort, the *Ham Register* comes as a completely new accessory to their hobby. With the ultimate aim of giving some personal details, to supplement the bare name and address in the *Call Book,* of as many of the world's amateurs as possible, this first edition proves its worth—but also spotlights the difficulty of the task.

Running to 512 pages, and keeping the information reasonably short in the vast majority of cases, this work contains references to between eight and nine thousand amateurs in most countries of the world.

The inveterate rag-chewer will find it invaluable, but for the one inevitable short-coming — that the station you work is probably not listed. Huge as the list is, it contains only a very small percentage of the world's amateurs, and we have found over some weeks that if we find one contact in ten contained therein, we are doing quite well.

Nevertheless, this is an excellent idea and one which can obviously expand, although the space difficulty does seem formidable.

Typical information for each entry is somewhat as follows: Call-sign, Christian name; name and address; year of licensing; occupations, past and present; Service record; family details; hobbies; and DX awards held.

Thus one may learn, at random, that W2NON plays the oboe and English horn; that W8IA goes in for stamp collecting and sail-boat racing; that WØDEB is an Associated Press correspondent and served 27 years in the USNR; that AP2CR was the first SSB station in Asia, in 1953; that OZ4FA has a little girl born April 11, 1956, and likes to work in the garden — and so on.

All the W entries are listed first (as in the *Call Book),* in alphabetical and numerical order; then follow the other countries in alphabetical order of prefixes. There is no difficulty in finding any entry almost immediately one hears the call-sign.

Between the W and Foreign sections is an up-to-the-minute list of prefixes and an official country list which gives the Zone and Continent for each country.

For the last eighty pages or so the entries are cross-referred by their countries, states and towns. Thus, if one wants to see whether a certain town is represented in the main list, one can turn up "Germany, Munich," and see instantly the calls of twelve Munich amateurs whose details appear in the appropriate places.

The production as a whole strikes us as excellent, and the only criticism we can make is that rather too many of the entries have been made twice as long as the average by the inclusion of some story about a fairly trivial incident—such as being the first "to hear the new broadcasting station in Texas when it opened in 1924, with a home-made receiver consisting of . . . " and so on. More entries and less of this detail would have resulted in a more useful work; but as it stands it will give a great amount of pleasure to the very many regular users of the bands.

Ham Register, 1958, is edited by Arthur E. Lewis, W3VKD, and published at 37 S. Sixth Street, Indiana, Pa., U.S.A.; it is obtainable at the price of Two Guineas from our Publications Department at 55 Victoria Street, London, S.W.1.

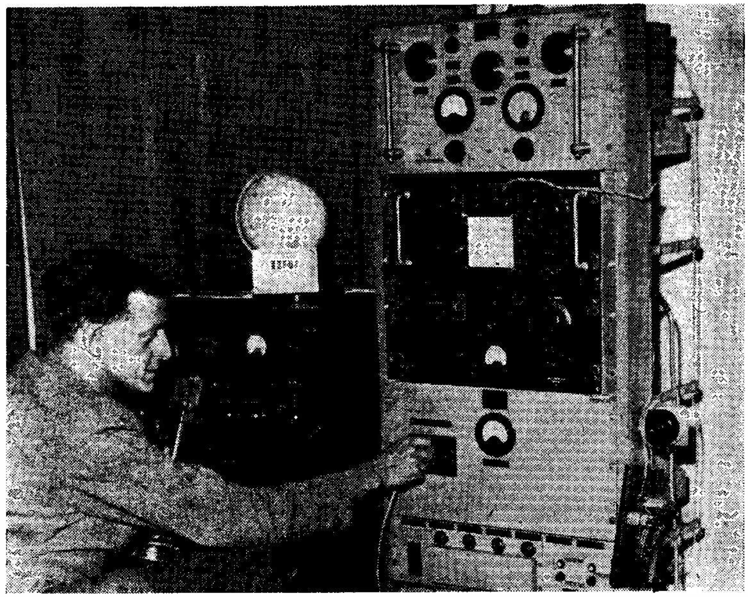
L.H.T.

WRIST-WATCH RADIO

Though one may smile at this notion, already exploited by the writers of science fiction, it is not as far-fetched as might be supposed. At the annual camp of 2 Press Comm. Sqdn., Royal Signals, Army Emergency Reserve, during October, a transistor transmitter was shown, built into a match box, complete with key and power supply; the transistor used was an American 30 mc type actually working on 5.5 mc, with an input of 3 mW from a midget 4.5v. battery, while the key was a miniature micro-switch actuated by the operator's thumb. With the transmitter alone, ranges up to 1,000 yards were obtained without any aerial.

Incidentally, 2 Press Communication Squadron is the new title of what used to be the Army Wireless Reserve Squadron (recruited almost entirely from among radio amateurs) which has now been assigned specific duties, indicated by the new name. The Squadron was embodied for the Suez affair, and in fact the Press link from Port Said was largely organised and manned by amateurs—a fine tribute to their efficiency, and a mark of the confidence of the authorities in this reserve unit. And true to radio amateur form the world over, while they were out there members of the Squadron took the opportunity of getting themselves issued with MD5 calls; some choice DX was worked while off-duty.

DX COMMENTARY



G3FUT

CALLS HEARD, WORKED and QSL'd

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

IF we start by describing this past month as slightly down on the previous period, that still implies that it has been very good indeed. The surprising thing is that it has been *so* good, not only for the DX-chasers, but also for the Top-Band specialists at the one end and the VHF types at the other. If ever we could write that a Good Time was had by All, this is it.

The *CQ* DX Contest was certainly well timed this year, and the week-end concerned could hardly have been better as far as conditions were concerned. But the QRM . . . practically everyone of interest was three layers deep, and most people were content with ploughing through the top layer and then the one under that.

Those 48 hours made your commentator seriously wonder whether these flat-out contests are really worth holding any more; to make a reasonable score you have simply got to work everything you hear for the entire period. Forty-eight hours of rubber-stamp contacts make a fine endurance test, but do they really prove anything else? That, however, is another story, which we might return to on some suitable occasion.

We still have not had a clear lead from correspondents as to whether they like this Commentary divided up into bands (as in the last two issues) or into individual contributions (as in the previous few). This time we are taking a middle course; where our reader spreads himself and his letter over all the bands we propose to do likewise; where he uses only one or two, say 28 mc and Top Band, we deal with them under separate headings. Your opinions will, as always, be appreciated.

Incidentally, may we say thanks for the many encouraging comments we have received, linked with Christmas wishes and Christmas cards? One would like to be able to reply to them all individually, but time presses, so we hope this note will be accepted as a grateful acknowledgment.

And now, first of all we are going to deal with all the miscellaneous items of DX news which come from individuals, from Clubs at home and overseas, and over the grape-vine, both material and etheric.

DX Gossip

Last month it was stated here that the PYØCV effort (Trinidad Is.) was due to start on November 18. It did, but all the radio gear appears to have ended up in the sea . . . so the expedition is postponed indefinitely, but by no means called off. *(See* "Late Flash.")

BV1US is a station that has given innumerable 'chasers a new country in his relatively short life out there in Formosa. Now we gather that he is to become a W4, and he may be off the air by the time you read this. Another one closing down (or probably closed by now) is KS6AF; but she may possibly be operating as a ZM6 for a while.

HV1CN is still active from that rare spot, but on phone only, and speaking practically no English . . . JT1AA has been inactive owing to the temperature of his shack, but was hoping to move the station into his home and to get warmed up again . . . VQ8AS, the promised station on Rodriguez Island, has been on a lot, but he has such a weak signal that only the boys with real receivers ever hear him.

XQ8AG, in case you thought it was an anagram or something, is said to be in Chile, to which the call letters in the "XQ" series do belong. Why they have suddenly blossomed out on our bands we wouldn't know . . . One of the reasons why CR8AC is hard to raise is his receiver. It is a strictly non-amateur type and we gather that the entire 14-mc band occupies about one eighth of an inch on the dial . . . ZD9AE has now departed from Gough Island, leaving no one there for our purposes.

W6AM (Long Beach) now stands at 274 confirmed (JT1AA's card did that!) We have described his fabulous aerial-farm before, but he tells us that the station is half-a-mile square, on a hilltop 1200 ft. above the Pacific Ocean, and that when he gets home to Long Beach, on a mere 105 ft. hill, the bands sound dead indeed. Combine a location like that with kW's and rhombics . . .

We would like to get to the bottom of the affair of the Mysterious Maldives. G3HLY (Godalming) reports that he worked VS1HJ, who confirmed that he was active from the Maldives and hopes to go back some time. On the other hand, a letter from VS1HU says "there is no definite news yet about the VS1HJ/VS1HX trip to the Maldives . . . one trip ended in failure due to Tx trouble."

Other items from VS1HU: they now manage to drive an ET-4336 from a VFO-exciter, and hope to wander into the phone bands shortly. VS1HD and VS2DB are *en route* for the U.K. GW3ITD is a recently-arrived Naval type, hoping for his VS1 call; U.K. stations are asked to try heading their beams on Asia if they are on around midnight and 0100 GMT . . . the VS1 boys often hear them at that time, but they seem to work nothing but W's.

VS1HU, the Club station, only wants JT1AA for WAZ. The score in the DX Contest was 285 QSO's, 29 Zones and 48 Countries, during a limited period of operation.

Finally, some good ones known to be there, but not reported by any of our correspondents: 14 mc Phone, UAØLA, HKØAI, ZS8I, AP2U, HZ1TA, ZS2MI (Marion Is.). 14 mc CW, KP6AL, HKØAI, FE8AH, KAØIJ, FL8AC, VR6TC, HS1WR, ZD3E, VR1A, HL2AJ. All known to be active and audible—and worth looking for?

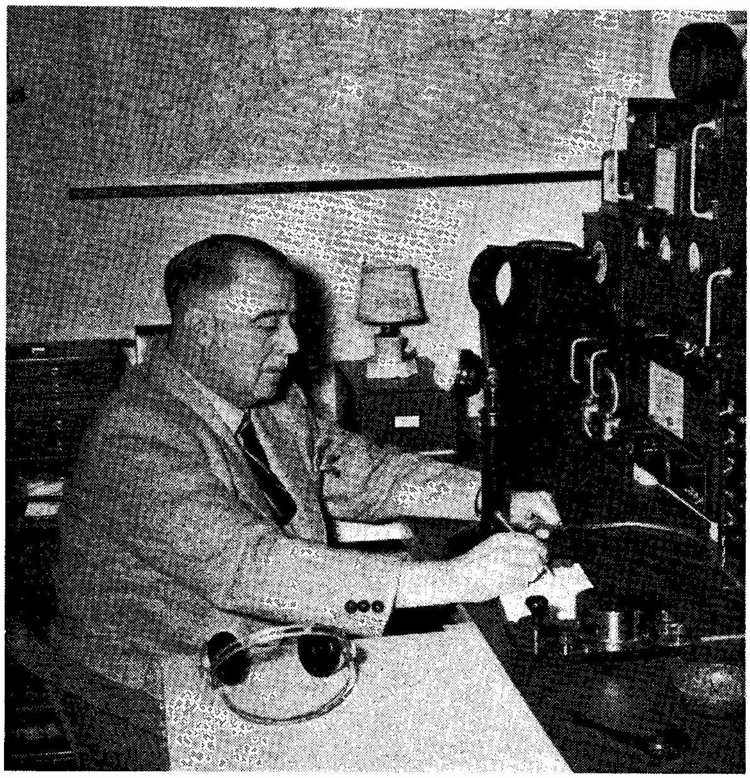
Contest Contacts

G3FXB (Southwick) made what he calls an "unofficial score" of 404,800 points, from 677 QSO's. Previously, in the 21-28 mc Contest, he had made 3510 points from 282 QSO's, and between the two events he added some quite nice ones to his Five-Band score. On 7 mc CW he worked OH2YV/Ø and UA9CM; 14 CW gave him DU7SV and FY7YF; 21 mc CW added F9QV/FC, VP5FH (Turks) and VP9CY; 21 mc phone brought in CO, CX, OA, VP5, YV, ZB2 and ZP; 28 mc CW collected OA4FA, UAØOM and VP5FH; finally, 28 mc Phone raised AP5T, CE, CX, KH6ZA, KL7PIV, OH2YV/Ø, VP5BL, VP7NM and XE1YD.

G2DC (Ringwood) made 311,344 points in the *CQ* Contest (22 Zones and 75 Countries); this, and the recent Phone Contest brought his marathon score for the year up to 38/150, despite the fact that he had four months of inactivity due to moving his QTH.

G2HPF (Chelmsford) records a total of 109,495—lower than it should have been because his main object was chasing the WAE I award. G3JVJ (London, S.E.22) finished up with 102,258, derived from 280 QSO's. He remarks that during the afternoons it seemed more like the ARRL Contest than the Worldwide affair!

Countless other readers mention the *CQ* Contest, of course, and their new scores in the Five-Band



In the June 1953 issue of the Magazine, we featured G5TV (Harrow Weald, Middx.) as "The Other Man's Station" for that month. Here is the equipment, still much as it was then, with the operator himself in position — note the home-constructed cut-out desk, with ample space for the oddments while providing a comfortable elbow-rest. G5TV apologises for having omitted to show a copy of "Short Wave Magazine" in this photograph. Why should he — we are always glad to hear from any Old Timer who has grown up with Amateur Radio!

table show how successful they were, but those given are the only ones who, having computed their scores, have sent them in.

Multi-Band Work

Very few of the keen 'chasers keep to one, or even two bands these days. In fact, it is one of the tantalising features of such good conditions that one always wonders what one is missing on one of the other bands! A lot of valuable time is wasted QSY'ing from 14 to 21 mc, and from 21 to 28 mc, followed by a wish that one had stayed put instead!

G2DC seldom fails to report on five bands—sometimes six—but he has not touched Top Band this month. On 3.5 mc he collected new Europeans such as UB5, UC2 and UR2, plus the inevitable W's and VE's. On 7 mc he raised all W districts, VE 1-4, PY, UA9, CN8 and two new ones in the shape of F9QV/FC and OH2YV/Ø. G2DC finds that the general *mêlée* of QRM that used to plague this band has almost departed; new rigs seem to be tested out on 14 mc these days!

On Twenty he is rather vitriolic concerning "1926 signals" and rank bad operating. After FB8XX had called CQ one evening, his frequency was "just a mass of blurps and howls for about five minutes," and at least four different stations thought they were in QSO with him—one of them gave his full QTH for QSL! By comparison, 21 mc is sheer heaven. New ones on this band for G2DC were VP7, KG6, KR6, YV, KL7, OQ5, VP9, CX, VQ3, FB8, CR5SP, ZS9G, ZP and a few more—on CW. "Sixty watts of undermodulated phone" raised KH6, YV, VE5-7, VP5 and 6, OA and ZP. XQ8AG (*see* previous paragraph) was called but not raised. The 28 mc band was erratic but yielded about ten new ones.

G5BZ (Croydon) worked the three main DX bands, and the principal event was the snagging of JT1AA. Other good ones on 14 mc were ZK1BG, ZK2AD, FB8XX and XW8AE, along with KR6, HH3L, ZP5HK, VKØAB, KG6's, OHØ's, VP8BY and masses of KL7, KH6 and the like. 21 mc gave him F9QV/FC, PJ2AV, ZP5JP, all W, VE5 and others, while 28 mc yielded CX9AJ, JA3AB, VQ4, CE, ZC4 and a UR2 for a new one.

G3FPK (London, E.10) added eight new ones with activity over four bands. His 28 mc phone netted MP4KAS, ZD4BV and 5A5TP, CW raising CR6, JA, VQ3 and 4. 21 mc CW brought in EA9AP, JA's, UO5, VP8AX (South Georgia), ZE and a long-awaited WØ in Iowa. On 14 mc G3FPK used CW only, bringing his score for the band up to 99 with KV4BO and UN1AN. He also heard the "3A1W" mentioned last month, who claimed to be in Monte Carlo, but signed "de LA . . . " once by mistake! Three new ones were added on 7 mc, despite the shocking rock-crusher around 6.9 mc. They were GD, OHØ and UR2. UA9's, ZC4, 4X and others were also there, and the PY's have been good at 2300 or thereabouts.

G2HPF reports on six bands, although the Top Band news is not concerning a QSO. On 28 mc phone he raised KG6AGS, HC1AGI, HK1DZ, MP4KAS, CX9AJ and LUØDAB; CW caught OHØ, IT, UC, UR and VQ2-4. On 21 mc phone he worked SVØ, PJ5CA, KG1BW, ZS3BC, CX3BH, VP5BL and 5CM, VP6, KL7, ZD4 and 6. During the Contest a state of "no joy" on this band was caused by the dog, who had chewed through the co-ax run in the garden, feeding the Cubical Quad. (There ought to be some crack there about "feeding a spherical dog.") 14 mc was only productive of KR6QW and a bunch of U's, but included one in Zone 19; 7 mc brought nothing but assorted U's and two OHØ's. 3.5 mc, to round off, contributed UA, UR2, IT, 4X and W1-4.

G5FA (London, N.11) has worked 100 countries (35 Zones) this year with 50 watts and an "indifferent" aerial. He has just received WASM-II, of which he is G holder No. 4, and says it is a nice-looking sheepskin. Recent contacts on 14 mc were DU7SV, KH6IJ, LX2GH, F9QV/FC, OD5, UD6, UF6 and the like; on 21 mc JA3BB, HE9LAC, KL7RZ and the OHØ's.

G3JZK, back at Cambridge, collected OHØ, CR7, CX and UR2 on 28 mc; on 14 mc he worked GD, VU, UAØKAR, UPOL7 and LA2JE/P; and on 7 mc he filled in a few gaps, with W5 and W9 for good measure.

G3ABG (Cannock) reports lots of DX on five bands, but tells us that his XYL was rushed to hospital and that a gale removed his aerials, so, what with being chief cook and all, he will be QRT for some time. But he is quite philosophical about it and says that his 2000 QSO's since July 1 will keep him going. Pick of the DX was: SVØ, OHØ and FC on 28 CW; VQ2-4, VP6, ZD6, ZD4 and MP4K on 28 phone; SVØ, KH6, PJ2 on 21 CW; KL7, VP5 and 6, OA and YV on 21 phone; CR6,

W A Z MARATHON, 1957
(Last Lap)
All Bands

Station	Zones	Countries
G3FKM	40	197
G3HLY	40	193
G5BZ	40	163
G3FXB	39	182
G3BHW	39	181
G3DO	39	179
G3BDQ	39	145
G3DC	38	150
G3JKF	38	117
GM3EOJ	37	122
G3FPK	37	110
G3LET	36	100
G3HCU (Phone)	36	98
G3GGS	35	106
G3KMA	35	105
G5FA	35	100
G3GZJ	34	112
G3JJG	34	98
G2BLA	34	96
GM2DBX (Phone)	33	91
G3HQX	32	99
G3JWZ	32	88
G6PJ	32	86
ZL3CP	27	64
G3DNR	26	78

KL7 and FQ8 on 14 CW; the fabulous HV1CN on 14 mc phone (!), and scores of W's on all five bands up to Eighty.

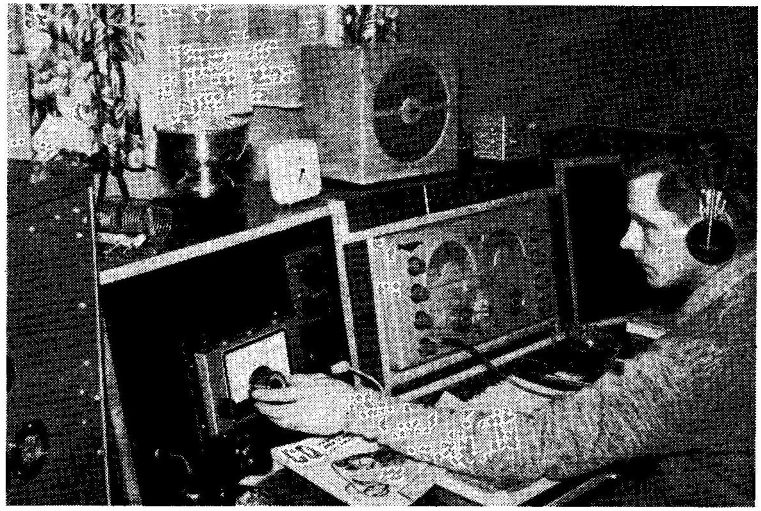
Six-Bander

G3JJG (Mitcham) also reports on six bands, and says that 7½ hours' operation during the Contest pushed his scores up very satisfactorily — largely due to Europeans on 21 and 28 mc. On 3.5 he added UC2AX, UA1DG and UA1DZ, and on 7 mc UA9CM, OHØ, ZC4 and W's. Best on 14 mc were KØLSJ/KG6, YK1AT and ZD8JP, and on 21 mc OD5LX, SVØWR, YV5DE, OHØ and stop-gaps. 28 mc gave him VP5FH (Turks), CN8IF, VQ4AQ and a host of Europeans. He now runs 150 watts to an 813 and a 132-ft. wire—CW only.

G6VC (Northfleet) cleaned up some new ones in the Contest, including CE3AG, VQ4AQ and IT1TAI on 28 mc, OHØ on 7 mc and YO on 3.5. Since then he thinks 21 mc the best band, and he finds mornings, 0900-1200 GMT, very interesting.

G3LET (Westcliff) says the Contest made it easier to work such stations as KH6, KL7's and West Coast W's, although he didn't raise much that was new. He was glad to find 28 mc full of CW for once, and raised some new ones thereon. 21 mc gave him KP4, VE8, ZC4, ZB1 and some new Europeans. Most activity was on 14 mc, and fetched in FB8XX, VQ3GC, UG6KAA, UPOL7 and a few more. On 7 mc he heard KR6AK and DU9WX (1500 and 2100), but they were blotted out by the hordes of UA's calling CQ; but he did work UA9, 4X, lots of W's, TI3DRK/MM and a strange ZD8LN — regarded as phoney until proved otherwise.

G3BHW (Margate) has a new Tx which looks like being TVI-proof on 21 mc, so he hopes for better things on that band from now on. The short-skip on 14 mc annoys him and, as he says, it doesn't seem as if it is going to leave us this cycle. Meanwhile he reports the following: 28 mc phone, AP5T, XE1YD, FB8BV, KH6's, HP2ON, HC, HH, HI, HK, PJ and W7



Anyone who may have enjoyed the snappy CW contact always given by VE6VK, Calgary, will be interested in this photograph — he runs a nice station, and invariably sends a QSL card.

(Nevada). 21 mc, FB8ZZ, PJ2AV, CR4 and VE8. 14 mc, all on CW—FK8AH, XZ2TH, FG7XC, ZK2AD, FL8AC, FB8BD, UPOL7, VKØAS, ZS3B and quite a few more. These were nearly all between 1830 and 2030, when G3BHW thinks Twenty is a DX-hunter's dream.

Forty Metres

Most of the all-banders having now been dealt with, we come to the two-band specialists and to our one and only 7 mc exclusive, who is G3BST (Bletchley). He found it a quiet month, remarkable for the terrific signal-strengths of the W's (and his own over there !) But conditions were poor for the Contest on 7 mc. QSO's of interest were VO1CL, OHØ, UAØAG and 9CM, CN8IF, F9QV/FC, 5A5TE; 4X, IT, YK and ZC4. G3BST wonders whether VO1CL (Bell Island) could possibly turn out to be a separate country ? Earlier in the year he worked HE1AB, but thinks all HE calls are issued with the figure 9, and wonders. (We imagine that HE1's are, or were, Swiss portables in Liechtenstein).

Two-Banders

21 and 28 mc were the two bands on which G3DO (Sutton Coldfield) found his new additions, having collected VP1OLY on 28, and ZS7C on 21, both phone. Others of interest were OHØ on 28, and HE, UR2 and ZD4BV on 21.

G3HLY pushes up to 193 with the help of FB8XX and VQ8AS (Rodriguez), and confirms our statement that you need a receiver for the latter, who only uses 15 watts.

Another 28/21 fancier was G2YS (Filey), with OHØ, VP5FH and sundry Europeans on 28; CX2CO, PJ2AV and Europeans on 21. G3JVJ mentions KR6QW and an OD5 on 14; JA, VP5FH, VP2LU, CX2CO and XE1PJ on 21; and VQ3SS and FQ8AF on 28. G3JVJ runs 50 watts and a 7 mc Windom for all bands.

G3DNR (Broadstairs) collected MP4KAS and ZD4BV on 28 mc phone, plus quite a lot of stuff such as VP6, VQ2-4, TF, ZD6 and ZE; KL7, PY and OZ were new phones for him on 21; 14 mc CW raised KP4, EA9 and SVØWB, the latter on the US Coast Guard Cutter *off* Rhodes (too bad !) G3DNR thought conditions better on 28 than on 21 mc . . . when the MUF is sufficiently high, they often will be.

Not so much news of cross-band (Six and Ten) work this month, but G3FXB does own up to a little of it, with all US districts except W6 and 7. They have been heard on Six, but were not listening on the other band.

GI3IVJ (Belfast) worked 28 mc only, where he collected VP5FH, VU2MD, OD5LX, VQ3GC, F9QV/FC, KL7, CR6 and CR7 (all CW), also HH2HH, PJ2CH, OQØDZ, ZS3BC, ZS9P, KG6AGO, CR9AK, XE1PY, AP5T and VS6DJ (all phone).

SWL Corner

J. W. Cave (Poole) remains the 28 mc specialist, and reports that band uniformly good, with no poor days and no sign of a mid-winter decline. Loggings he quotes are CR4AC (1415), CR9AH (1325), KR6SO (0950), KW6CA (0850) and OH2XK/Ø (0915).

M. J. Edwards (Carterton) reports on 21 mc phone only, with FY7YH, OA4AQ and 6M, VK6KL, VP9IVM, ZP5JP and 5KQ, as well as the curious XQ8AG . . . *see* earlier note on him (he's in Chile),

L. D. Strange (Sutton Coldfield) covers four bands with an 0-V-I—quite a rarity these days, and none the worse for that. On 14 mc he winkled out ZK1BS, FO8AG, SU and VE8 on phone, with UAØKAR, UO5, UN1 and UH8 on CW; Ten gave him CN2, KZ5WA and VQ6ST on phone; 21 mc brought in VP8CH, LUØEAB and K3CCJ/M4. On 7 mc he heard JA3ADX/MM, but is not quite sure of the middle letter; can anyone identify?

P. Day (Sheffield) covers five bands, including a long log of W's heard on Six (December 8). Best in the DX line were VP2AZ (Antigua) and PJ2CE (14 phone), HI8BE and FG7XC (14 CW), HE9LAC, FB8BX and FE8AH (21 phone), ZS3AG, KG6AGS, CR9AK, XE1YD and CR4AC (28 phone) and LU2ACH, UQ2 and UC2 on 7 mc. *He* tells us that this XQ8AG character is reputed to be a W in Northern Viet-Nam! Further gen.: that FU8AD is on 14045 kc CW every day, 0630-0700 GMT, and that VQ2AT has been hearing US police cars and TV programmes above 65 mc! P.D. uses an RF-26 into an Eddystone 358X, with an indoor 50-mc dipole, for his 6-metre searching.

Yasme II

Danny Weil, VP2VB, has decided to call his new boat *Yasme II*, as the one that blew up in Holyhead harbour was never officially re-named. *Yasme II* is 50 ft. long, 30 tons and fitted with a diesel engine capable of giving a maximum speed of six knots. Equipment already fitted includes SX-101 and S-53a receivers; HT-32 and HT-18 transmitters; and a 3 kW. generator. Further equipment will be added when she arrives in Miami—she is at present being fitted out at Poole, Dorset.

VP2VB wants us to make it clear that no one will be *asked* to make a payment for his QSL. Cards will normally be handled by KV4AA, but if anyone wants his card by direct airmail, then he is expected to include the necessary postage. (During the last voyage some 70,000 QSL's were involved!) *Voluntary* contributions towards the expenses of the expedition will be welcomed, but there is, of course, not the slightest obligation.

There have been delays in the target sailing date of December 15, and the main concern now is whether VP2VB will be able to get far enough South before spring gales and bad weather set in. We hope to keep readers informed, well in advance, of call-signs, frequencies and probable ports of call. Watch this space!

WAZ Marathon

We are not surprised to see those "40's" creep into the Zones column of our Marathon table at the last minute. G3FKM has now claimed top position on the ladder with 40 and 197—obviously bent on making the 200 before the end of the year—with G3HLY only four countries behind him.

Next month, of course, the final appearance of the Table will tell the full story. No bets accepted!

Top Band Topics

Seeing that this year, sunspot-wise (as they say) should be one of the poorest for the Top Band, it is nice to be able to say that such predictions have gone all wrong. The evening before writing this very paragraph we switched on at 2230 GMT and by 2300 we had heard DL1FF (599), DL2ZK/A, DL7AH, OK1VE, GM3IAA, GW3LEW and GW3LQP, all 579 or better.

DL1FF told us that he had worked four W's on November 24; that UB5FJ told him that UA9CM was active on the band;

FIVE BAND DX TABLE
(POST-WAR)

Station	Points	3.5 mc	7 mc	14 mc	21 mc	28 mc	Countries	Station	Points	3.5 mc	7 mc	14 mc	21 mc	28 mc	Countries
DL7AA	841	110	167	234	178	152	247	G6VC	361	34	47	138	81	61	153
W8KIA	745	68	148	265	151	113	265	W6AM (Phone)	350	13	32	245	39	21	245
G3FXB	730	72	130	208	183	137	232	JA1CR	348	19	49	174	70	36	176
G5BZ	712	64	118	243	170	117	249	G3GZJ	316	25	60	96	91	44	133
G3FPQ	647	66	91	194	175	121	215	G3IGW	282	42	65	83	64	28	116
G2DC	646	73	97	200	141	135	213	G6TC	274	17	63	121	42	31	136
G3DO	620	24	46	230	154	166	247	G3JZK	266	15	51	56	87	57	132
W6AM	505	30	58	274	86	57	274	G3JJG	250	37	43	92	48	30	109
G3ABG	471	45	84	170	92	80	186	G2BLA	242	26	45	62	59	50	102
G2YS	464	65	85	149	104	61	167	G3JVJ	241	23	63	65	53	37	97
G3WL	450	39	77	146	115	73	177	G3HQX	226	12	37	74	45	58	104
G3BHW	443	15	32	161	131	104	196	G3DNR	202	10	21	81	43	47	95
GM2DBX (Phone)	417	34	31	158	100	94	173	G3LET	174	11	42	92	22	7	100
G2HPF	406	38	65	157	74	62	172	G3IDG	100	11	15	22	22	30	42

(Failure to report for three months entails removal from this Table. New claims can be made at any time).

and that he had heard, but not worked, EL1C. The DL nationals have only a limited permit for One-Sixty, which expires on February 28; until then they will be in much demand.

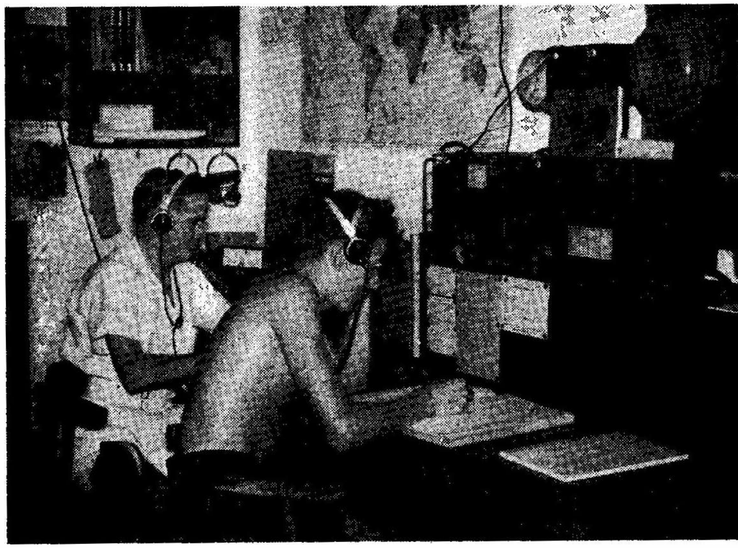
ZE3JO (Salisbury) writes to say that he is now on the band every Sunday from 0300 to 0500 GMT, looking for *any* station; his frequency is around 1802 kc, but VFO. He has already had two contacts with VQ2GR, over a very hilly path of about 700 miles, with 579 reports. ZE3JO is 5250 feet up, which helps, and the static is lowest at the times mentioned above; for much of the day it is S9 plus. VQ2GR and himself are both looking for DX or, in fact, for any signals except their own!

Two bulletins from W1BB include the following news items: ZL3RB is all set for DX with a new 813 rig . . . VP3AD checked in on October 13 with reports on W1BB and W3RGQ . . . W2QHH had a report from a UA1 SWL, 0955 GMT and apparently long path; W1BB was also heard there . . . PY7AN is expected to show up on 1829 kc . . . OA5G is off the air but building a new rig.

VP6RG promises activity on the band . . . G3GGN is now VE2AZI, and visited W1BB, W1PPN and W1SS. He chatted over the air with other W's, but was not there for an opening with G.

At the season's first opening, November 24, K2BWR seems to have made the earliest crossing, with W1BB, W1PPN, K2CHQ and W3RGQ also active. Europeans who worked across were G3PU, 5JU, 6BQ, 8JR and DL1FF. W1BB suggests that the effect of the sunspot activity will be to make the band more erratic, with unpredictable openings and poor stretches.

Coming back to more parochial news, we are told that GM3KHH is now in Buckie, Banffshire, and "dealing out QSL's right and left." During December he raised DL2ZK/A, DL3GZ and



On p. 417 of our October issue, we showed a photograph of the operators on VS1HU, Singapore. Here is their station, from which a lot of nice DX has been worked on the 7 and 14 mc bands — DXCC was achieved in 95 days, and by the end of October about 2,000 QSO's had been made, with "first VS1" given to many keen DX types. VS1HU does not operate at all on 21 mc (in spite of QSL cards received!) and would like to have SWL reports on their 40-metre transmissions.

YU3EU, for nice EDX on 160. G3GZJ (London, S.E.23) worked the same three, plus HB9IN and DL7AH, and he notes (as we did ourselves) that when they are coming in at really good strengths, most GM's and northerly stations are quite weak.

The scores on the WABC Ladder have not changed much since its last appearance, two months ago, but we do know of several near-sixties coming up.

Late Flash: G8GP (London, S.E.4) worked a UB5 on December 11, probably UB5FJ, as he is known to be on Top Band.

Miscellany

G3FPK, with his experience of operating 3A2BT, confirms the remarks from GC3HFE last month about the rat-race, the pile-up, the squawking-match, or whatever you prefer to call it. He tried the dodge of noting the sensible "two-by-two" callers, waiting for the long-winded types to finish their calls, and going back to one of the snappy ones with an equally snappy reply. However, Long-Winded Willie, hearing nothing but silence by the time he was listening once more, usually started up all over again.

G3FPK, in spite of his experiences, doesn't agree with the "unethical" aspect so much; he says "many operators carry L-plates, especially those unfortunates behind the Iron Curtain, whose equipment is poor by our standards, and they let their enthusiasm run away with them when they hear a rare one."

That QSL Bureau

We have often wondered what, if anything, they keep in the notorious Box 88, and G3ESP (Pontefract) now joins us. Since the ban was lifted on June 1, 1956, he has worked 28 Russians in various districts (for DXCC and WAE). He has sent QSL's for all of them, some to Box 88 and one direct to a UP2 who gave his full QTH. Number of returns — *nil!* As against this, G3ESP has two SWL reports from Moscow dated

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

TOP BAND COUNTIES LADDER

(Starting Jan. 1, 1952)

Station	Confirmed	Worked
G2NJ	98	98
GM3EFS	97	97
G3JEQ	96	96
G6VC	95	95
G3GGS	92	94
G3HEK	92	94
G3FNV	91	92
G3JHH	89	90
G3AKX	89	89
G2AYG	88	88
G2FTK	86	91
G2CZU	77	77
G3KOG	75	79
G3DO	75	75
GW3HFG	66	80
G3EJF	60	65
G5JM (Phone)	59	60
G2CZU (Phone)	57	58
G2AO	53	62
GM3COV	49	62
G3KEP (Phone)	49	60
G3HKF	47	61
G3LBQ	37	48
GW3HFG (Phone)	30	40
G3LEV (Phone)	30	39
G3LNO	23	41
G3LNR	17	26

back before the ban was lifted, and a QSL from a station whose CQ he answered (but did not work him). Is there a black list or something of the kind, or is this experience general? G3ESP, meanwhile, wonders what he has done to deserve such treatment.

Our own experience, for comparison—four Russians worked since the ban; four QSL's received, unasked for. Makes you think, doesn't it?

Parasite

Almost as bad as the parasitics are the parasites, and G3JZK complains of one who goes all round the Europeans who are calling rare DX, asking them to QSW for him if they work it! It's true that no one can work a rare one without finding something or other hopping up and down on the frequency, but a really hardened case just switches in his selective eardrums so that he literally copies the DX and shuts the rest out!

Another mystery from G3JZK —he worked UA4FC, who gave his QTH as Dickson Is., and the QSL confirmed it, complete with Arctic scenery. UAØKAR knew nothing about this and suggested that there might be another island of the same name; 'KAR also confirmed that there is no activity from Wrangel Is.

Late Flashes

G8GP worked PY7AN/Ø, 14 mc, on December 15 at 1945. We have since heard that PY7AN was "rumoured" to be working from an island which may count as a new one, starting December 15. This might be Trinidad Is. and a replacement for the unfortunate PYØCV, whose gear was dropped in the drink.

KG4AQ is now active on 21 and 14 mc, SSB . . . VS5AT is another one on SSB . . . VQ4EO is due to leave on his "SSB Safari" in January . . . CR8AC makes things difficult for 'chasers by working on 14 mc CW and listening for replies on 28 mc phone!

G2BLA (Morden) reports a good month of CW work, with the accent on 28 mc, where he found VP5FH (Turks), OHØ, IT, CN8, OA4FA, U's and several new ones for his Five-Band score. And in the Marathon he reached 96 and hopes to make the century by the end of the year.

Contests

Too late to remind you that the first week-end of this month carried the CW section of the WAE DX Contest, but we hope you did well therein. The next big event is, of course, BERU—during the last week-end, January 25-26. It starts at 0001 GMT on the Saturday and finishes at midnight on the Sunday—CW only, and the simplified scoring system introduced for the 1957 BERU.

Likewise Sunday mornings will be full of Top-Band activity from 0500 GMT onwards, with a considerable variety of stations active from across the Pond, and several European countries also in evidence.

Not a contest, but an "Activity Week-end" is announced from Malta, where all available ZB1 stations will make an effort to be on all bands, 28 to 3.5 mc, from 1200 GMT on February 1 until 1800 GMT on February 2. WAE-chasers are recommended to look out for them, five bands, CW and phone.

We should like to close this offering with a tribute to all our many helpers in preparing this Commentary. The West Gulf DX Club, that notable association of W5's, have been of tremendous assistance with their regular bulletins on world-wide DX and gossip; W1BB is, as always, the gen-man *par excellence* on Top-Band matters; W6YY also puts in invaluable pieces of information from time to time. There are many others, but it would be invidious to mention them, and we must include them in all the host of regular readers who keep their resolution to put pen to paper and get something in to us before the Fateful Friday each month.

It is *your* Commentary, not ours, and we hope to keep it that way. So we wish you all a Happy New Year, full of DX on all bands, with prosperity and success in that and all other spheres.

Next deadline will be **first post on Friday, January 17,** and don't be late! Address everything to "DX Commentary," *Short Wave Magazine*, 55 Victoria Street, London, S.W.1. And, from your Commentator, "HNY," 73 and BCNU.

R.A.F.-A.R.S. HF-Band Transmitter

NOTES ON GENERAL DESIGN

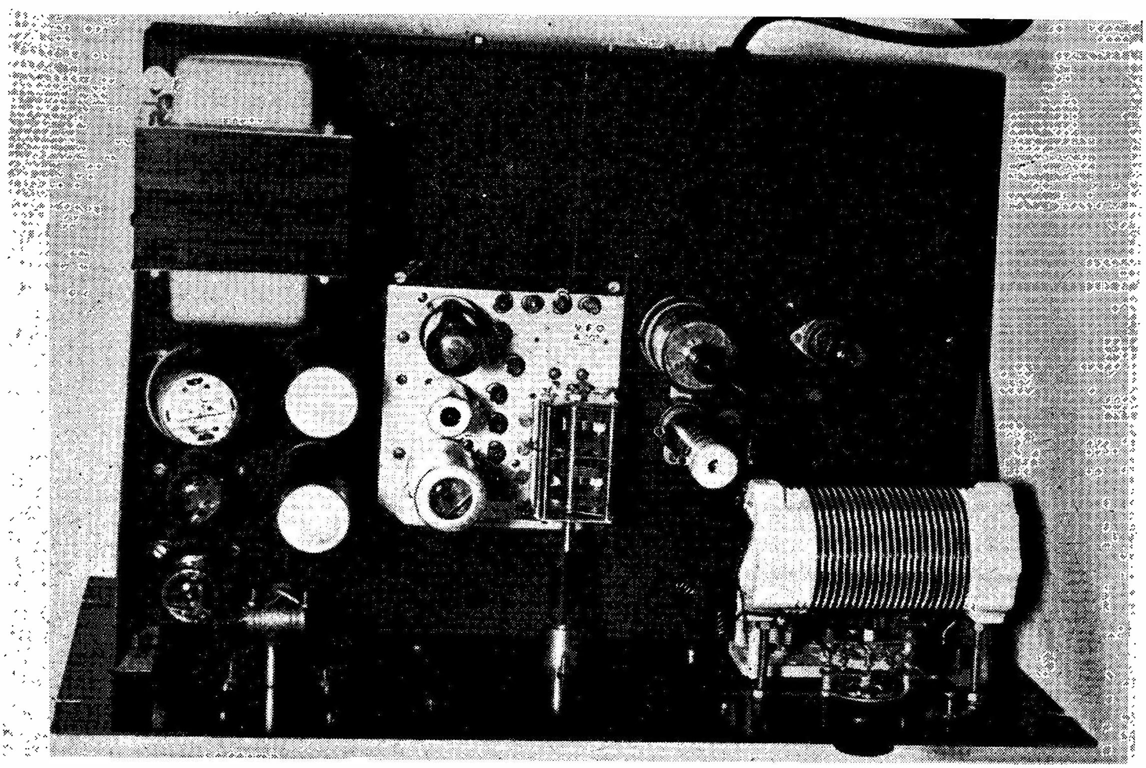
W/Cdr. A. R. GILDING, R.A.F. (G3KSH)

(Vice-President, R.A.F. Amateur Radio Society)

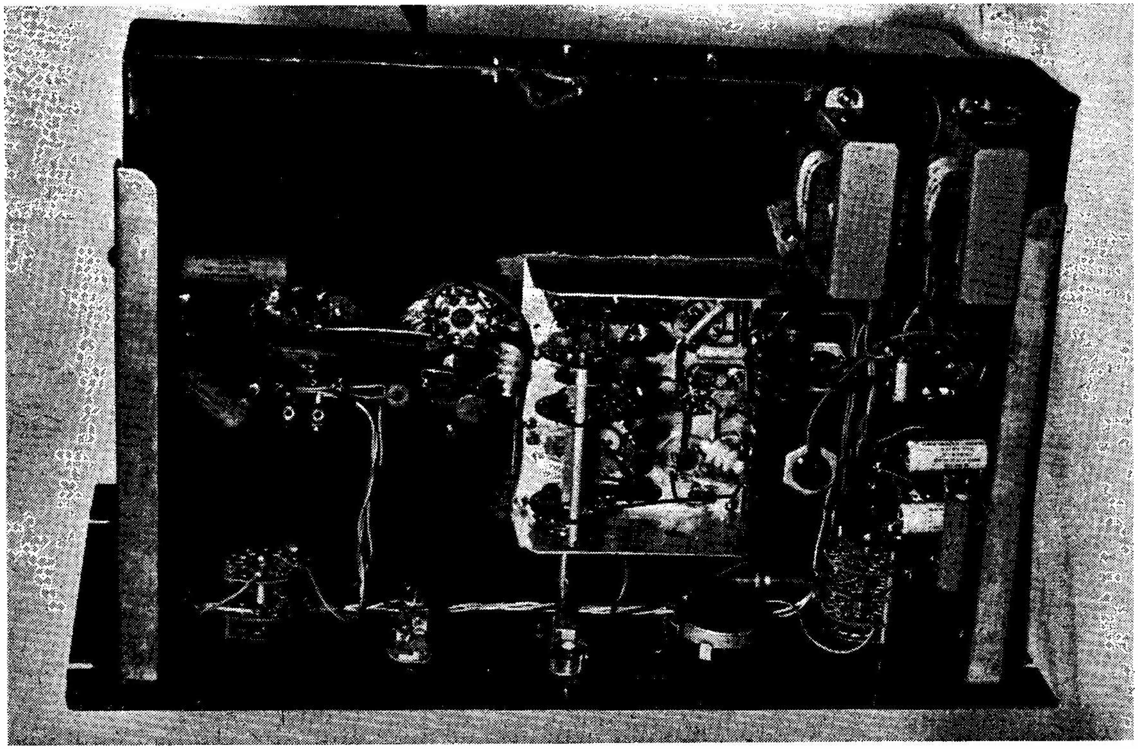
This is a brief description of an interesting all-band transmitter assembly produced, in kit form, for member-clubs of the R.A.F. Amateur Radio Society overseas—where it is difficult, if not impossible, to obtain apparatus suitable for amateur-band operation. Membership of the R.A.F. Amateur Radio Society—which is fortunate in having official recognition at Air Ministry level—is open to all past and present members of the Royal Air Force; the Hq. of the Society is at R.A.F. Station Locking, Weston-s-Mare, Somerset, where G8FC is located, keeping in contact, by Amateur Radio, with R.A.F.-A.R.S. groups in many parts of the world, including Antarctica.—Editor.

ONE of the problems to be faced when forming any Amateur Radio Club is the design and construction of an all-band HF transmitter. For Clubs located within easy reach of " the market," components are readily available—but for R.A.F. Club stations, particularly those overseas, this is not so easy. Also, there are difficulties for the Service man overseas in getting equipment out from home, because of the limitations on the amount of baggage he can take with him. In recent years, with the introduction of air trooping, this has been made even more difficult. With these factors in mind, the Royal Air Force Amateur Radio Society (on the initiative of the late vice-president, W/Cdr. W. E. Dunn, O.B.E., G2LR), decided to provide assistance to newly-formed Club stations by supplying them with an all-band HF transmitter in kit form. This is easily assembled and wired, and indeed one club had their first QSO within two hours of receiving the kit !

Visitors to this year's Radio Hobbies Exhibition may have seen, on the R.A.F.



Inside view of the R.A.F.-A.R.S. standard transmitter, as assembled from the kit of parts supplied to Club groups affiliated to the R.A.F. Amateur Radio Society. The driver is a Geloso VFO Unit (centre) giving output on the five bands 3.5 to 28 mc, the power supply section is at left, and the RF power amplifier to the right; the coil assembly L1, L2 (see circuit diagram) is fitted close to the panel, to keep the band-change switch leads as short as possible. The tank tuning condensers C7, C8 are immediately beneath the coil.



Under-chassis view of the R.A.F. Amateur Radio Society kit transmitter, as wired out ready to go on the air. The smoothing chokes are upper right, and the function switch S3 at lower right. The central assembly is the underside of the Geloso VFO Unit, with the QVO6-20 valveholder to its upper left. The switch below left is the meter change, S2.

Amateur Radio Society stand, an exploded kit, a completed transmitter, and aircraft apprentices from No. 1 Radio School, R.A.F. Locking (all members of G3IDZ, the Apprentices Club station) busy assembling these kit transmitters for R.A.F. groups overseas.

General Arrangement

A short description of the kit transmitter, with photographs and a diagram, is given here because of the great interest shown in it. The transmitter has recently been re-designed to incorporate the Geloso VFO unit. Since the preparation of kits is done voluntarily by G8FC club members at the Hq. station at Locking, this has reduced the amount of work involved, and at the same time, produced a very sound design. The PA stage has also been changed by the introduction of a QVO6-20 in place of the 807, with the Geloso design of pi-network output circuit.

The VFO is the Type 4/101, with a 6V6 output stage, which was fully described in the March, 1957, issue of *Short Wave Magazine.* It provides ample drive on all bands to the

Table of Values

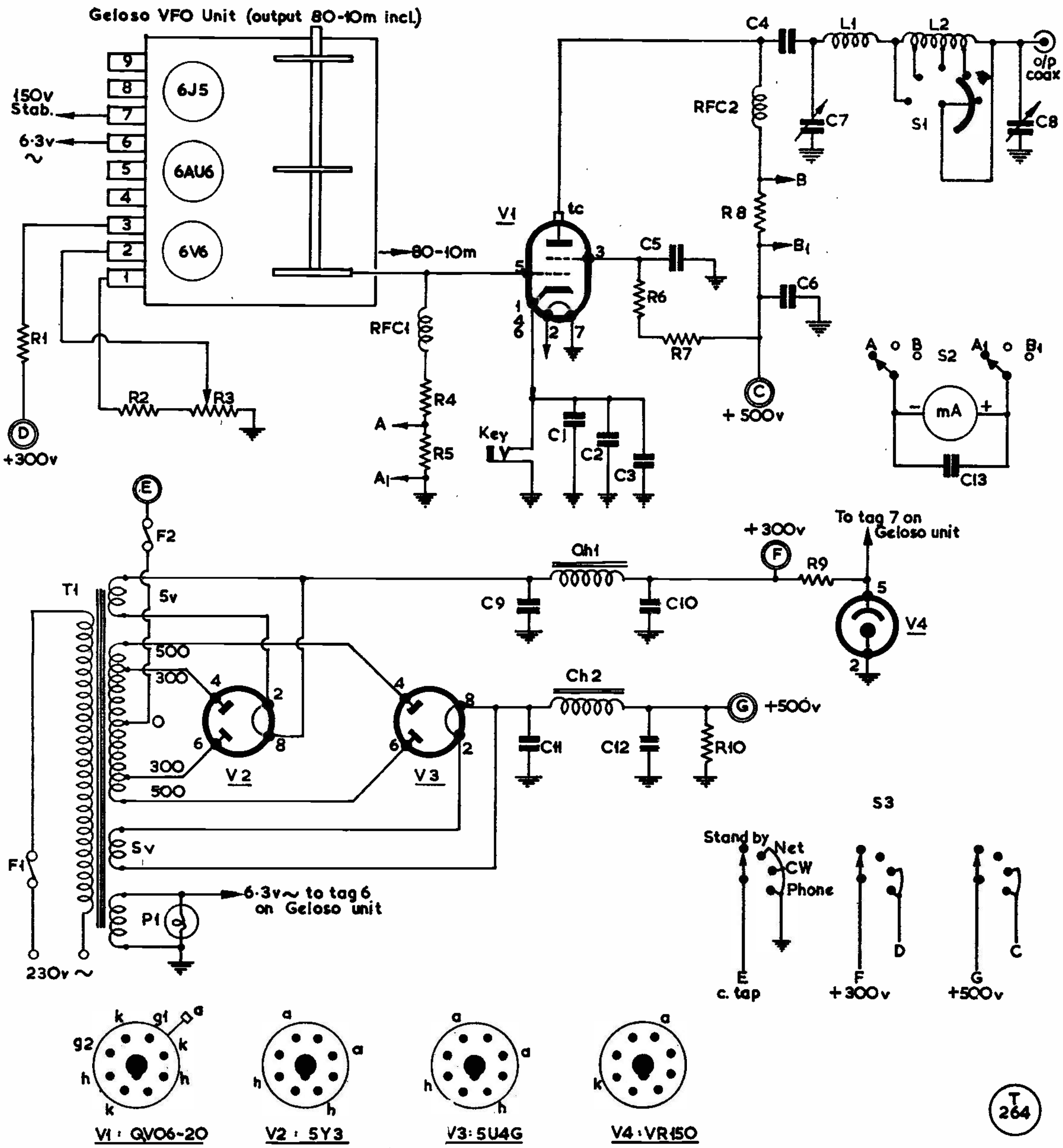
Circuit of the R.A.F.-A.R.S. 50-Watt Transmitter

C1, C2, C3	= .001 μF, disc ceramic	R9	= 5,000 ohms, 10-w.
C4, C6, C13	= .001 μF mica, hi-test	R10	= 500,000 ohms, bleeder, 1-w.
C5	= .001 μF, 500v.	S1	= Wave-change switch, Yaxley type progressive shorting
C7	= 175 $\mu\mu$F, tank tuning	S2	= Meter switch
C8	= .001 μF (500+500 $\mu\mu$F) output tuning	S3	= Function switch
C9, C10	= 8 μF, 500v. DC smoothing	Ch.1, Ch.2	= 10 Hy. at 150 mA
C11, C12	= 8 μF, 600v. DC smoothing	T1	= 500-0-500v./300-0-300v. at 250 mA
R1	= 10,000 ohms, 5-w.	F1	= 1 amp. mains fuse
R2	= 22,000 ohms, 5-w.	F2	= 250 mA HT fuse
R3	= 35,000 ohm pot'meter, drive control, 2-w.	RFC1	= Eddystone 2.5 mH
R4	= 27,000 ohms, 2-w.	RFC2	= Labgear heavy duty transmitting type
R5	= 10-ohm meter shunt (or as necessary)	P1	= Pilot lamp
R6, R7	= 15,000 ohms, 10-w.	V1	= QV06-20, Mullard
R8	= Meter shunt, to read 0-200 mA	V2	= 5Y3, Brimar
		V3	= 5U4G, Brimar
		V4	= VR-150/30 Brimar

COIL DATA

L1 5 turns air wound, 16 SWG enam., one-inch diameter winding, spaced to 1¼-ins., for 28 mc.

L2 26 turns 16 SWG enam. on 2½-in. diameter Eddystone frequentite coil former assembly Nos. 1090/1091/1092, tapped at 2 turns for 21 mc, at 5 turns for 14 mc, and at 10 turns for 7 mc — *or* Geloso standard pi-network PA unit.



Essential circuitry of the HF-band kit-type transmitter, on which notes are given in the article. A standard Geloso VFO Unit drives a band-switched PA, and the power supply capacity and control switching provides for either CW or phone working — though, as sent out to R.A.F. Amateur Radio Society club stations, a modulator is not included in the kit. A number of these transmitters are already on the air at the stations of overseas member-groups of the R.A.F.-A.R.S.

PA, which runs at about 50 watts. Care has to be taken to keep the lead to the PA grid as short as possible in order to prevent loss of drive. A single meter is used to measure PA grid and plate currents, a suitable multiplier being included in the "Amp" position of the meter switch. Incidentally, when using "surplus" meters, it is always necessary to verify that there is no shunt mounted inside the case, or much time may be wasted in looking elsewhere for the cause of apparent low drive, or insufficient plate current. As will be seen from the photograph, the Geloso unit has been modified slightly by removing the cord drive, and fitting an Eddystone full vision dial and drive, which is directly coupled to the tuning shaft. Some note vibration had been found when using the cord system, which now seems to have been eliminated. The PA stage is completely de-coupled and Ferrox beads are used on the grid and anode leads of the QVO6-20 to avoid parasitic oscillation. All cathode pins are separately by-passed. The tank input tuning condenser is 175 $\mu\mu$F whilst a twin-gang receiving type, 500 + 500 $\mu\mu$F, is used on the output side. The controls on the front panel are self-explanatory, and can be enumerated briefly as follows: below the meter, the function switch (marked "Stand-By," " Net," " CW " and " Phone ") the drive control potentiometer, the VFO wave-change switch, key jack, pi-output (PA band-change) switch, input and output tuning condensers and, in the bottom right hand corner, the meter switch.

Though a modulator is not provided with the kit, phone can be used if required, and the power unit and switching have been designed to provide for this facility. In addition to the heater supplies, it gives a stabilised 150v. to the VFO, 300v. to the buffer stage and 500v. for the PA and modulator (if used).

The whole transmitter is enclosed in a case of Eddystone 358X receiver pattern, and makes a very attractive " table-topper." Several of these kit transmitters are already on the air, both in this country and overseas, and those readers who have heard the very fine CW signal emanating from VS1GZ over the past twelve months will realise the capabilities of the equipment as described and illustrated here. Other " kit " stations are ZC4GT, VS9AD, ZB1LQ, ZC4AM, G3IRS, 3KHM, 3LHT and 3KQB—all R.A.F. Amateur Radio Society member groups. The material for this article was prepared by A. E. Seymour, G3GNS, of R.A.F. Locking.

Set-up in " Studio E," Lime Grove, when the BBC did an Amateur Radio broadcast on December 9. G3KEP is seen at the Eddystone 888A receiver, tuning in W3BIW on 10-metre phone — with G5CS (right) of the Science Museum, and Mr. Arthur Garratt (centre) of the National Physical Laboratory, looking on. The transmitter is a Labgear LG.300, with its associated modulator and power supply unit, and the aerial a Labgear Bi-Square beam for 10 metres. Our always-helpful G.P.O. co-operated by issuing the special (and most appropriate) callsign GB3LG. Though the programme was, of course, rehearsed in detail, as broadcast it was actuality, in that W3BIW was genuinely raised and worked while the BBC TV transmission was on the air — and anyone who has ever attempted to give a demonstration of a DX QSO will appreciate what that meant to the anxious participants ! " Short Wave Magazine " was glad to be able to assist in various ways in the mounting of this broadcast — which has been commented upon favourably from all parts of the country — one of the aids being a copy of our Great Circle DX Zone Map, seen pinned up on the wall to the left.

(Copyright photograph, courtesy BBC)

Straight PA for 70 Centimetres

USING THE MULLARD QQV02-6

J. A. PLOWMAN, A.M.Brit.I.R.E. (G3AST)

This is an original design for an RF amplifier on 430 mc, using a new double-tetrode. The unit as described here is suitable for either portable or fixed-station work.—Editor.

SINCE the introduction of the new Mullard QQV02-6 double tetrode, little has been heard of it in amateur circles. This is unfortunate, for not only is this valve of very modest dimensions, but it is exceedingly easy to drive as a straight-through PA stage, is very moderately priced, and exhibits excellent efficiency up to nearly 500 mc.

In view of these compelling characteristics, the writer was tempted to construct a transmitter power stage utilising one of these valves, and was delighted to find that it has proved itself a very worth-while addition to G3AST.

The unit was designed to be operated from the existing two-metre rig, which employs push-pull 6C4 valves in the final ; this was described in the April, 1952, issue of *Short Wave Magazine*, but almost any two-metre drive, above a watt or so, would be entirely adequate.

In order to utilise the QQV02-6 to its fullest capacity, it was decided to run "straight through." It was necessary, therefore, to employ a tripler stage between the exciter and this double-tetrode PA stage. As it was inconvenient, at G3AST, to modify the existing equipment, the tripler stage was mounted on the same chassis as the PA.

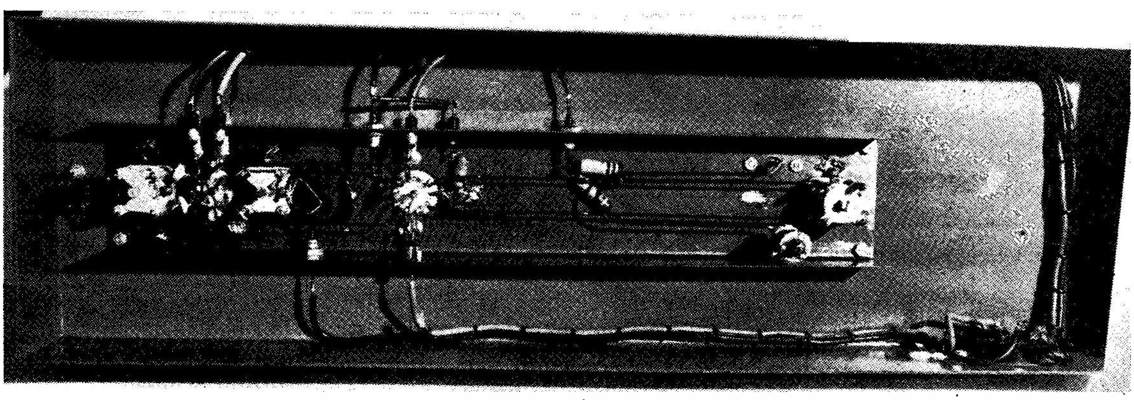
Owing to the low drive requirements, an ECC91 was more than adequate to drive the output stage, and this valve, acting as a push-pull tripler, was "unity coupled" to the PA grids. This method of coupling tends to be somewhat inefficient, but that was quite acceptable in this instance owing to the "spare" drive available. (It also has the advantage that the number of tuning coils is reduced.) Should sufficient drive not be available, an improvement could be effected by ensuring that the grid loop resonates with the input capacity of the QQV02-6.

Very low screen voltage is recommended for the PA valve, this being obtained from the HT rail *via* a dropping resistor, or from the modulated supply in the case of 'phone operation.

The final anodes of the PA are series tuned, as this provides greater efficiency. The output capacitance of the QQV02-6 is, however extremely low, and should the half-wavelength lines prove an embarrassment (by reason of their physical dimensions) a quarter-wave line would still be reasonably satisfactory.

Power take-off is obtained through a standard co-axial outlet on top of the chassis, utilising the usual hairpin loop. A series capacity is provided here, however, to cancel the reactance of the loop, and improve power transfer. Foam polythene TV co-axial is used at the writer's QTH, and a material reduction in cable losses can be effected.

Pilot lamps can be used as a dummy load, but care should be taken to terminate the co-axial correctly, if the lead is more than a few inches long. [Over



Under-side view of the 70 cm tripler-amplifier by G3AST, with the 430 mc half-wave PA section on the right; the elements for L5 (see Fig. 1) are 6 ins. long. The valves are ECC91/QQV02-6, and the internal chassis size for the unit is 12 ins. by 2 ins., with a 1-in. drop — see text.

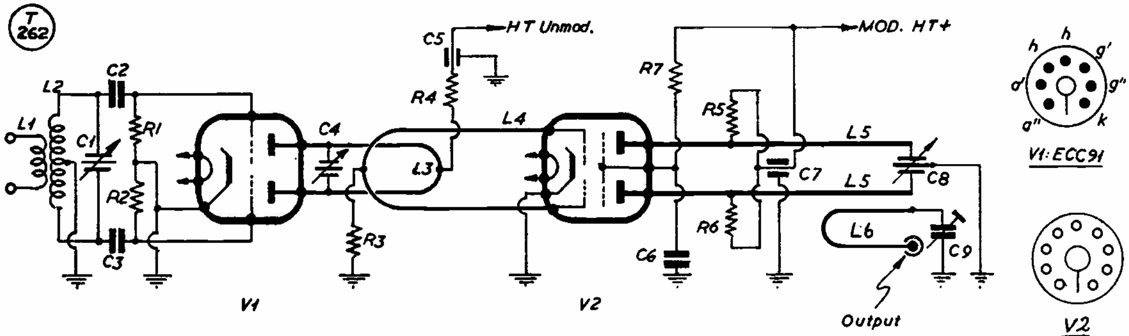


Fig. 1. Circuit of the 70-centimetre tripler-PA unit designed and described by G3AST. The RF output valve is a Mullard QQV02-6, and the general layout arrangement is shown in the under-view photograph. Dimensions for the loop inductances are given in Fig. 2, and all values in the table herewith.

Construction

The unit is actually constructed on a 24 g. brass sub-chassis, bent in the form of a "U" 12 in. by 2 in. with sides 1 in. high. The sub-chassis is contained inside a 5 in. x 17 in. standard chassis to provide an appearance match with the two-metre gear. (This actual method of construction has no significance!)

The whole unit was built, and in fact, all the development work was done, using the brass sub-chassis alone.

All connections to the unit are brought out through the sides of the "U" *via* feed-through insulators, except those which require by-passing, which are made with capacity bushes, the latter item being very effective owing to their low internal inductance. The brass sub-chassis was first drilled for the tuning condensers, and, using it as a template, corresponding holes made in the larger chassis. Using the tuning condensers as temporary bolts, the unit was assembled inside the large item and both the valve holes and attachments made in conjunction. This ensures that the items will mate at a later date. Only four bolts were required to attach the two chassis together, almost sufficient attachment being obtained from the various components.

The output of the existing two-metre transmitter was 300 ohms, and this was fed to the push-pull input coil through two P.T.F.E. feed-through bushes, and connected to the coupling coil of insulated wire inter-wound amongst turns of L2. Drive can be varied by adjusting the linkage of this coupling.

The input coil L2 is tuned by a split stator microdenser, and bias for this tripler stage is obtained from the grid leaks.

The anode circuit of this valve is a quarter-wave hairpin loop which, being very tightly coupled to the final grid, is rather broadly tuned. The tuning control for this stage is of similar pattern to C1, but most of the rotor and stator plates are removed (*see* above). The modified condenser covers the tuning range quite adequately. The grid circuit following, being well damped by grid current, is broadly tuned by the input capacity of the PA valve, and has no tuning control. Screen supply for this stage is obtained *via* a feed-through capacity and dropping resistor R7 from HT+, note being made of the low HT rail voltage that is permissible.

The anode circuit of the PA is series-tuned by another microdenser, C8, the capacity of which might seem somewhat large to those unfamiliar with this mode of operation. The stator vanes of this condenser are at HT potential, and care should be taken to avoid them taking up any metal swarf, otherwise the HT will be shorted to chassis; the rotor is of course at earth potential, and therefore quite

Table of Values

Fig. 1. Circuit of the 70 cm PA by G3AST

C1 =	Eddystone Type 551, 25 x 25 μμF	C8 =	Eddystone Type 552, 25 x 25 μμF
C2, C3 =	15 μμF disc Ceramicon	C9 =	Philips 2-8 μμF trimmer
C4 =	Modified Eddystone Type 551, 3-rotor 2-stator each section	R1, R2 =	33,000-ohm, ½-w.
		R3 =	22,000-ohm, ½-w.
		R4 =	1,500-ohm, ½-w.
C5 =	.001 μF feed-through bush	R5, R6 =	2,200-ohm, ½-w.
		R7 =	5,600-ohm, ½-w.
C6, C7 =	.001 μF sub-min. Ceramicon	V1 =	ECC91, Mullard
		V2 =	QQV02-6, Mullard

COIL DATA

L1 = 3 turns insulated flexible PVC, interwound with L2.
L2 = 4 turns 17g. "Lewmex M," on 3/8-in. diam. former, centre-tapped.
L3 = Hairpin loop, *see* sketch Fig. 2 for dimensions.
L4 = Hairpin loop, *see* sketch Fig. 2 for dimensions.
L5 = Half-wave line: 17g. "Lewmex M," spaced 5/8-in. centres, 6-in. long, toed in at V2 anode pins.
L6 = Suitable hairpin loop for L5, *see* sketch Fig. 2.

safe to handle from the top of the chassis.

The HT feed for series tuning is supplied at the voltage node and in this case the 2,200 ohm resistors R5, R6, are acting as voltage droppers and RF chokes. This is necessitated because the HT rail allowed for the QQV02-6 is only 175 volts, but has the advantage that the " chokes " are truly aperiodic, and will obviate any ringing troubles. They also act as safety resistors, should an abnormally heavy HT demand develop.

The coupling loop is short and stiff enough to be fitted *in situ* without any additional anchorage, this being accomplished by wiring the hairpin directly between the output receptacle and the series capacity, which is sweated to the side of the brass chassis, providing excellent rigidity. The output loop is adjusted in place such that it runs parallel with the half-wave lines, with a spacing of about a quarter inch.

Tuning and Setting Up

The unit was designed to be reasonably foolproof, as difficult or " fussy " adjustments are always a curse in the field.

Anyone in possession of a grid dip meter for both 70 cm and Two will experience no difficulty in setting up. The grid dip meter in the writer's possession extends to 180 mc only, and in consequence the 70 cm section lengths were arrived at by cut-and-try methods. However, having established suitable dimensions for the latter, no trouble should be experienced.

The input circuit was tuned right up " on the nose " using the grid dip meter. Check can be made using the grid current as an indication. The two grid leaks should be strapped together, and by-passed to earth, before being led away to a 0-5 mA meter, connected between the " cold " ends and chassis.

Using this method, connect heaters, and tune C1, for maximum grid current in V1. Open the bottom end of R3, and insert meter between bottom end and earth ; be sure to by-pass the " earthy " end with a ·001 μF Ceramicon or miniature mica condenser. Tune C4 to give maximum grid current to the PA with HT on V1 only.

Solder R5 and R6 approximately in position, and clean a good inch of wire either side the connection.

A 60 milliamp. pilot bulb may now be connected to the output socket, and reduced HT applied to the PA plate and screen. Tune C8 for maximum output, and having done so, carefully touch an insulated handle screw-driver along either line to establish a point where *no*

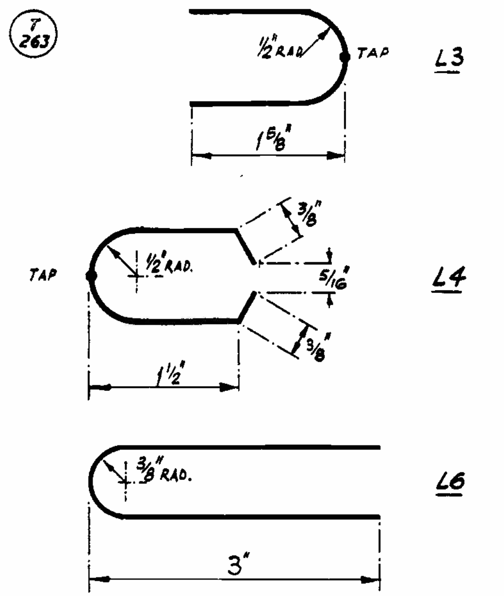


Fig. 2. Dimensions details for the hair-pin inductances in the G3AST 430 mc tripler-PA unit. The wire specified is 17g. Lewmex-M enamelled, which could be substituted by 16g. enamelled copper.

flickering of the lamp occurs. This point is the correct voltage node, and may vary from model to model. Once this is found, the HT should be taken off, the resistors R5 and R6 resoldered at this point, and the HT reapplied. Unless the tapping point happened to be right first time, slight readjustment of C8 may now be necessary for maximum output. Check back over the previous stages using the output lamp as indicator, to counteract any slight final trimming necessitated by removing the grid meters, and reinstating the grid leaks.

The 60 milliamp. bulb can now be replaced by a 6·3 volt pilot bulb, and full 175 volts applied to the PA. It should be noted that this figure is the actual plate voltage, checked at the RF end of R5 and R6. A much more usual HT rail voltage is employed, but account must be taken of the drop in these two resistors.

The dummy load of 6·3 volt pilot bulb will light quite brightly ; a further increase in brilliance can be effected by trimming out the pick-up loop inductance with C9. The transmitter is then ready for testing on aerial.

While no tests have been made on the air at G3AST with this gear, field strength checks show that the RF output is superior to much more ponderous gear consuming many times the current.

Will your Station pass an Insurance Inspection ?

VHF BANDS

A. J. DEVON

Some Tropospheric Openings—
Trans-Atlantic Two-Metre Schedule—
Restricted U.K. Permits for 52.5 mc—
Station Notes and News—

WHEN we left off last month, about November 27, it was during a spell of good conditions for tropospheric DX, which had been building up steadily since November 18. This trend continued right up to December 6, when the whole picture changed again, and the GDX went out. One of the good evenings during the period November 27 to December 6 was December 1, a Sunday, during which signals were loud and steady, over almost all England. Till the 14th, conditions were "winter" again—then, on December 15, when the glass had gone high once more and the north-easterly gales had died down, the north-south paths opened and some very good GDX contacts were heard in progress during the evening of the 15th. The general picture after that was average-to-poor, with not much activity, until Christmas Day, when your A.J.D. took a turn round the two-metre band and heard some greetings-QSO's going on, in the old tradition.

In spite of the rather dull impression that may be given by the foregoing, there is quite a lot to discuss. And even at that, it is probable that there were reports on the way to us while this was being written, because, by December 20, the mail (even across London) was running up to four days late.

Those who may be on regular schedule with, or who have been listening to, PE1PL will probably know by now that the station was closed on VHF with effect from December 19 — not "for re-decoration," nor to "reopen under new management," but because of internal reorganisation. The operators of PE1PL hope to have their very fine station on the air again by the end of January or the beginning of February, when they look forward to resuming their regular schedules, and opening new ones with U.K. stations. Some details regarding PE1PL were given in "VHF Bands" in the September issue, from which it will have been seen that the G stations on regular daily schedule with PE1PL were G2HCG, G2NY and G6FO. For G2NY (Preston) at extreme distance, contact one-way if not both ways was possible on about 50% of occasions. In the case of G2HCG and G6FO, however, both at 220 miles-plus, PE1PL was always worked and the path was 100% reliable, better signals both ways being obtained by G2HCG than by G6FO; for the latter, the schedule produced 67 contacts in a row, in the sense that whenever a QSO was due, it was made. This was certainly not because of some special cleverness at Maids Moreton, but because PE1PL runs plenty of power, a high-gain beam, and a very good receiver, so that any DX station attempting to work them gets all the assistance possible. The characteristics of the PE1PL signal at the G6FO end can be likened to any far-DX signal on the HF bands—echo, deep fading, flutter QSB, phone sometimes readable on a weak carrier and at other times hard to read on a strong carrier, due to phase distortion, but quite often loud and steady. Whatever the conditions were, however, an R5 contact was always possible on CW, even if at times it was a matter of scraping round in the noise.

Trans-Atlantic DX Watch

In the June 1957 issue, in this space, we mentioned the possibility of ex-MP4BCA being able to open up on two metres from a specially favourable site (for the UK) off the Newfoundland coast. This is now in train, and he is there at Ramea Is., 70 miles N/E of St. Pierre (FP8), listening, whenever conditions seem favourable, over 144-145 mc during 2200-0330 GMT, using a good converter into an SX-100, with a 16-ele beam. W's are being heard satisfactorily, and during Auroral displays "many unidentifiable signals" have been received. It is also very interesting to note that, on occasions, Prestwick aircraft control tower on 121.5 mc has been logged by ex-MP4BCA—so there should be a good chance of G signals being heard if we get the right conditions across the Atlantic.

As soon as the rather tedious and tiresome local licence formalities can be gone through, ex-MP4BCA will be on with a VO1 call-sign, and a 200-watt transmitter, all ready to go. Immediately the call is issued, he will be letting us know, and the idea is to establish a talking channel on one of the HF bands, so that schedules can be lined up, and reports exchanged, for the more effective U.K. VHF operators who may be interested. More of this very interesting prospect later. In the meantime, call "CQ DX Ramea" on a beam heading of about 300° whenever the band seems open to the west; in view of the listening schedule at the other end, it would be no bad thing if our better-placed DX operators did this at intervals during 2230-2330 *whenever* they are on. We shall get the news quite quickly from the other end if anything transpires — and you never know!

Notes and News

G2HDR (Stoke Bishop, Nr. Bristol, and not too well located) was naturally very pleased to get a CW contact—the record for his station—with G3CCH in Scun-

TWO METRES

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

Worked	Station
78	G5YV (787)
73	G6NB
71	G3CCH
70	G6XM
68	G3BW, G3GHO
66	EI2W (286), G3IUD (302), G5BD
65	G5MA
64	G3BLP
63	G2FJR (542)
62	G3KEQ
61	G3HBW
60	G2OI (402), G3DMU
59	G3EHY, G4SA
58	G3FAN (637), G3IOO, G8OU
57	G8SB
56	G3WW (770), G5DS (654)
55	G2HDZ (495), G2HIF, G5BM, GW5MQ
53	G2AJ (519), G4CI, GM3EGW (196)
52	G2NH, G6RH, G6XX, G8VZ, GW2ADZ
50	G3ABA, G3GSE (518)
49	G3HAZ (358)
48	G3FIH, G5ML, G6TA (487)
47	G3DKF, G3JWQ (357), G5WP
46	G2CIW (247), G3LHA, G4HT (476), G5BY, G6YU (205)
45	G2AHP (647)*, G2DVD (362), G2XC, G3BJQ, G5JU
44	G3BK, G8DA
43	G2DDD, G3BA, G3COJ, G3DLU,* G3HWJ, G3KHA (262), G4RO, G5DF
42	G2HOP, G3BNC, G6CI (220)
41	G2CZS (282), G2FQP, G3DO, G3WS (255)
40	G3CGQ, G3IER, G8KL
39	G2IQ, G3DVK (208), G3GBO (434), G3VM, G8IL (325)
38	G2FCL (234), G3APY, G3CKQ, G3HTY, G5MR (343), G8VN (190)
37	G2FNW, G2FZU (180), G3DLU, GC3EBK (260)
36	G2DC (155), G3CXD, G3DLU* G3IIT, G3KUH (169), G6CB (312), G8IP
35	G3FZL, G3FYY (235), G3HCU (224)
34	G3AEP, G3CKQ (162), G8IC
33	G3FUR, G3GFD, G3HHY(125)
32	G3HIL, G8QY, G8VR, GC2FZC
31	G3HXO, G3KPT (108), G3KQF G5RP, GM3DIQ
30	G2AHY, G3FRY, G3GOP (208), G3GSO (160), G3GVF (129), G3IRA, G3KEF (110), G5NF, GW8UH
29	G3AGS, G3AKU, G3FIJ (194)
28	G3ITF, G3KUH, G8DL, GM3BDA
27	G3CVO (231), G3DAH, G3ISA (160), G6GR, GI3GQB, GW3GWA
26	G2BRR, G3CFR (125), G3SM (211), G3YH, G4LX, G4MR (189)
25	G3JMA, G3JXN (220), G5SK, G6PJ
24	G3FD, G3FXG, G3FXR, G3JHM
23	G3CWW (260), G3HSD, G4JJ/A G5PY
22	G2DRA, G3AGR (135), G3ASG (150), G3BPM, G5AM, G8NM
21	G2AOL (110), G3DVQ, G3IOE, G3IWJ, G6XY
20	G3EYV
19	G3FEX (118), G3GCX, G5LQ (176)
18	G3DBP, G3JGY, GC2CNC
17	G3EGG
16	G3FRE
15	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 accrue.*

*** New QTH**

thorpe on November 30. Also on that same evening, G3IOE (Newcastle) was worked by G6NB, G5MA and G3KEQ, in that order, solid phone both ways; these contacts are noteworthy because G3IOE is "right down in a hole," and can only be heard or worked at GDX when conditions really are good. Another nice contact for G5MA (Gt. Bookham, Sy.) was with EI6A. Wicklow—it gave a great deal of pleasure at both ends.

G3KPT, who used to be one of the Bristol VHF group, is now installed at West Bromwich, and sends a first report from the new QTH; he is running 20-25w. to a QQVO3-20A, with a 3-ele flat top, and the results of one week's work appear in the Activity Report.

G2CIW (Cambridge)—to whom your A.J.D. owes an apology for having missed Jack's report for the November issue—says that for him the highlight of the period is the apparent increase in 70-cm activity—on December 1st he worked five stations off the cuff and heard four others, including PAØWAR. On the 15th, G2HCG was raised on 430 mc for a new contact, and another county on that band.

Another to report success on 70 cm is G3HBW (Bushey Heath) who found G3FAN, G3HAZ, G3LGJ and G3LHA all workable on November 30, with G2FNW and G3JZG heard, at very good strength. On the 24th, Arnold did get G3GZM for Worcs., as suggested in our last, and also G3IRA, of Swindon, for Wilts. On December 16, when conditions were again good, G3HBW had "unplanned" contacts with G3HAZ and G3LHA, the latter using a new 48-ele stack and being S6-7 on phone.

G3LHA (Coventry) himself reporting says that on 70 cm he now has a QQVO6-40A as a straight PA on 434.68 mc and is looking round the band almost every evening during 7.00-8.30; he says that activity in the Midlands area is quite good, with some six stations on regularly. Good GDX worked by G3LHA on 430 mc includes G3FAN, G3IRA and G8AL, 9 counties now being accounted for on that band. G8VZ (Princes Risborough), on two metres nearly every evening, has found conditions varying from poor to very good, and was glad to work a number of stations new to him in the north and west, at distances of 100-150 miles.

G2AHY (Crowthorne, Berks.) worked 29 stations during the period, making his total 193S in 2½ years on the two-metre band: but for 185 cards sent out, only 54 have come back—he would like enough to be able to claim his VHFCC, so hopes some of the outstanding ones will turn up! G3DLU (Sheffield), temporarily inactive due to a domestic upheaval, is putting in his time on constructional work. G3KQF (Derby) is very pleased with results since improving his "view" to the south; F3LP has been worked for a new country, making only one more to get for entry into the Countries Worked table.

From G3KEQ (Sanderstead) comes claims to bring him up-to-date in the tables; among interesting stations he mentions as worked during the tropospheric openings are DL3NQ, G3IOE, GI5AJ, GW3FKO/P (Cardigan), GW3GWA, PAØOV and PAØRG.

SWL Woodhouse (Storrington) got his share of GDX during the good openings in the early part of the month, giving the week-end November 30/December 1st as the most fruitful period; a particularly interesting signal for him was G3JGY/M, from near Malvern. SWL Winters (Melton Mowbray) is doing very well with the new beam and reports plenty of activity "locally and up and down the country" during the fine spell; he has now heard four countries and 30 counties. SWL Karlsson (Malsryd, Sweden) writes as a regular follower of this piece, reporting for the first time; he has heard 7 countries on two metres, using a CC converter and 16-ele stack, and also listens on 50 mc—on that band he has logged 306 different W's in 28 states, with an RF-26 unit and a 3-ele flat top. Nice going!

EI2W (Dublin) is still hard at it on six metres—he reports his totals as 159 contacts with 119 different stations in 28 states for the period October 26 to December 8, with TG9JW heard, and EI2W heard by PZ1AE, as best DX—and what DX!

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 strict alphabetical and numerical order.

G3KQF, Derby.

WORKED: F3LP, G2AHY, 2CRL, 2FNW, 2MV, 3BEX, 3BFP/A, 3CGQ, 3DBM, 3DJJ, 3FAN, 3FD, 3GFD, 3GSO, 3GZM, 3HBW, 3HXN, 3HYH, 3HZK, 3IJB, 3IUK, 3JXN, 3KAG, 3LGJ, 3LHW, 3LOK, 3LTF, 3MA, 4DC, 4IB, 5JU, 5MA, 6YU. (*November* 20-*December* 15).

G2HDR, Bristol, 9.

WORKED: G3CCH, 3FIH, 3HHY, 3HXN, 3IER, 3IRS, 3KHA, 5BM, 5DW.

HEARD: G3BA, 3EJO, 3FAN, 3GTN, 3GUX, 3HBW, 3HWC, 3IWJ, 3JWQ, 3JXN, 3JZG, 3KEQ, 3KMT, 3KQF, 3LAY, 3LHA, 3MA, 5MA, 8VZ. (*November* 24-*December* 16).

G3KPT, West Bromwich, Staffs.

WORKED: G2NY, 3BA, 3EJO, 3ENY, 3GGR, 3HAZ, 3IRS, 3JZG, 3KEQ, 3KMT, 3LDW, 5MA, 6SN. (*December* 8-*December* 15).

G2AHY, Crowthorne, Berks.

WORKED: F3LP, G2FNW, 2HCG, 2NY, 2YM, 3BEX, 3BII, 3CO, 3FIH, 3FMI, 3FQS, 3GFD, 3HA, 3HZK, 3IBI, 3IIT, 3IWJ, 3JZN, 3KEQ, 3KQF, 3LOK, 4DC, 5DW, 5HN, 6AG, 6XX, 8AL, 8SK, 8VZ. (*November* 18-*December* 14).

SWL Tomlin, Malvern, Worcs.

HEARD: F3LP, G2AHY, 2ANS, 2ANT, 2ATK, 2AUD, 2DCI, 2FKZ, 2FMO, 2FNW, 2HCG, 2HGR, 2JZ, 2MV, 2NY, 2YM, 3AGS, 3ANB, 3APY/M, 3ARK, 3BA, 3CBU, 3DF, 3DJJ, 3EJO, 3ENY, 3EYV, 3FAN, 3FEX, 3FIH, 3FIJ, 3FTN, 3GFD, 3GHO, 3GSO, 3GTN, 3GZM, 3HAZ, 3HBW, 3HWC, 3HXN, 3HXS, 3HZF, 3HZK, 3IER, 3IIT, 3IOO, 3IWJ, 3JNI, 3JQN, 3JWQ, 3JYZ/A, 3JZG, 3JZN, 3KEQ, 3KFD, 3KHA, 3KQF, 3KUH, 3LAY, 3LDW, 3LHA, 3LOK, 3LTF, 3LZP, 3MA, 3MAX, 4DC, 4MK, 4PS, 5BM, 5CP/A, 5DW, 5MA, 5YV, 6AG, 6JK, 6LL, 6NB, 6SN, 6WF, 6XT, 8AL, 8SK, 8VZ, GB2RS, GW8UH. (*November* 1-30, *week-ends only*.)

G8VZ, Princes Risborough, Bucks.

WORKED: G2BMZ, 2FNW, 3DJJ, 3DKF, 3EJO, 3FIJ, 3FKO, 3FMI, 3GFD, 3GSO, 3HA, 3HAN, 3HHY, 3IER, 3IOO, 3IRS, 3JWQ, 3JXN, 3JZG, 3JZN, 3KHA, 3LHP, 3MA, 3MAX, 4MK, 5BM, 5YV, 6WF, GW8UH.

HEARD: GI5AJ, ON4DW, PAØGER. (*November* 17-*December* 15. *All over* 50 *miles only*).

SWL Winters, Melton Mowbray, Leics.

HEARD, PHONE: G2BVW, 2CDB, 2CRL, 2FKZ, 2FMO, 2FNW, 2HCG, 2HGR, 2NY, 3APY/M, 3BA, 3BEX, 3BU, 3CGQ, 3DBM, 3DJJ, 3EVV, 3FAN, 3FIH, 3FMI, 3GGJ, 3GHI, 3GHO, 3GSO, 3HAN, 3HBW, 3HMH, 3HXS, 3HYH, 3HZK, 3IOO, 3IRA, 3IRW, 3IWJ, 3JWQ, 3JWQ/A, 3JXN, 3JZG, 3KEQ, 3KKV, 3KQF, 3KUH, 3LHA, 3LHW, 3LTF, 3WW, 4MK, 5CP/A, 5DW, 5KG, 5MA, 5YV, 6AG, 6NB, 6OO, 6XT, 6XX, 6YU, 8AL, 8VZ, GB2RS, GW3GWA, PE1PL.

HEARD CW: G2CIW, 2FKZ, 2NY, 3BEX, 3CCH, 3GSO, 3HBW, 3IOO, 3JWQ, 3JXN, 3JZG, 4MK, 5MA, 5YV, 6XX, 6YU, GB3IGY. (*November* 13-*December* 8).

SWL Woodhouse, Storrington, West Sussex.

HEARD: G2ABD, 2AHP, 2AHY, 2AIH, 2ANS, 2ANT, 2AUD, 2BDP, 2BMZ, 2DDD, 2DSP, 2DVD, 2FM, 2FNW, 2GG, 2HCG, 2HGR, 2HOP, 2JM, 2MV, 2NM, 2NY, 3ANB, 3BA, 3BBR, 3BEX, 3BII, 3CBU, 3CGE, 3CNF, 3CO, 3DJJ, 3DKF, 3EFP, 3EJO, 3FAN, 3FEX, 3FIH, 3FKO, 3FP, 3FQS, 3FTN, 3GDR, 3GHO, 3GJJ, 3GSO, 3HAZ, 3HBW, 3HCU, 3HHY, 3HLH, 3HXS, 3HZJ, 3HZK, 3IAM, 3IBI, 3IGS, 3IIT, 3IOO, 3IRS, 3IUL, 3IWJ, 3IYX, 3IZD, 3JGY/M (Hereford), 3JHM, 3JR, 3JWQ, 3JXN, 3JZN, 3JZG, 3KHA, 3KQC, 3KQF, 3LAY, 3LGJ, 3LHA, 3LHW, 3LOK, 3LTF, 3LVO, 3WW, 4DC, 4MK, 4PS, 5DS, 5DW, 5MA, 5NF, 5UM, 5US, 5WW, 5YV, 6AG, 6AG/M, 6FO, 6JK, 6LL, 6NB, 6OX, 6WF, 6YU, 8AL, 8OS, 8VZ, GB2RS, GW8UH, ON4BZ, PE1PL. (*November* 19-*December* 15).

U.K. 6-Metre Permits

Just as this issue was going down, we got it that the G.P.O. will allow, *on application individually*, operation on 52.5 mc for a limited period of six months during (for most people) the hours between 0100 and 0930 GMT only. Unfortunately, this agreeable concession is of very limited practical value, because for one thing 52.5 mc is an awkward frequency for W/VE stations, and for another Trans-Atlantic DX openings are known to occur only between about noon and the early evening hours — say, 1200-1700 GMT. However, those operators in Glam., Mon. and Northumbs. (and the Western Highlands of Scotland!) whose applications may be accepted are *not* restricted to the 0100-0930 period.

There could, of course, be full daylight paths at DX distances to the *east* between about 0700 and 0930 GMT—but note that to work VK/ZL you must be able to receive on 56 mc, our old band, while they have to listen on 52.5 mc, a frequency they do not now use, having recently been turned off the 50 mc band. (Uncomplicated, or isn't it!). Though we fear that, like 70 mc, 52.5 mc will attract only the temporary attention of a few enthusiasts, let us not fail to acknowledge that the Post Office authorities are doing their best to be helpful under conditions which are also difficult for them.

Happy New Year!

This issue should reach you when that greeting still really means something — your old A.J.D., who slogged this piece out over Christmas, is glad to be able once again to send his good wishes to all who follow "VHF Bands," and to thank the many readers who thought of sending him cards and good wishes for the season. They were greatly appreciated.

Dead-line for the February issue will be **Wednesday, January 22**—addressed to: A. J. Devon, "VHF Bands," *Short Wave Magazine*, 55 Victoria Street, London, S.W.1. With you again on February 7, all being well.

Phase and Frequency Modulation

DISCUSSING THE FUNDAMENTALS, AND A CIRCUIT FOR PHASE MODULATION

N. SHIRES (G3BTM)

This article deals in a general way with the mechanics of some of the less-used methods of modulation, in particular phase modulation — not well understood in Amateur Radio circles, but nevertheless of considerable technical interest, because it could in many instances be the answer to the problem of phone operation during TV hours.—Editor.

AS the character of an alternating current is governed by its amplitude, frequency, and phase, the " distortion " of one or more of these factors will enable intelligence to be transmitted if the frequency used is suitable. When the distortion is caused to vary the original form in accordance with either telegraphy or speech waveforms it is generally referred to as " modulation." We can therefore have amplitude modulation (AM), frequency modulation (FM), and phase modulation (PM) or a combination of two or more. When more than one system occurs simultaneously the second is usually an undesirable by-product, a notable exception being the use of either FM or PM tone modulation to prevent selective fading on an AM telegraphy signal.

A short note on amplitude modulation is necessary here to permit the establishment of terms of reference for all three systems. For AM, the amplitude of the carrier envelope varies by an amount dependent on the amplitude of the modulating signal; its frequency affects only the rate at which the variations occur.

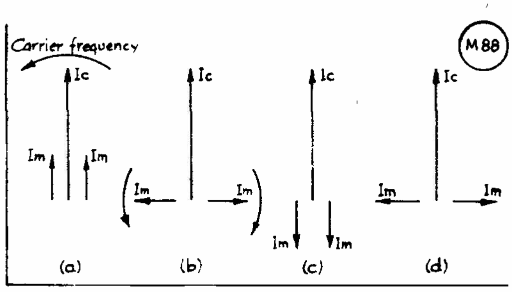


Fig. 1. Showing relative positions of sideband and carrier phases during one cycle of audio frequency with amplitude modulation. Ic is the carrier amplitude, and Im the sideband

Since with AM, only the carrier level varies (Fig. 1) and the frequency is constant, a relationship between the carrier and modulating frequencies can be stated. Assuming a carrier frequency F of 1 mc is modulated by an audio frequency of 1 kc, three frequencies will occur in the output of the modulated stage; they will be the carrier frequency of 1 mc, with a sideband on either side spaced in frequency by 1 kc. The upper sideband will be higher in frequency, 1·001 mc, and the lower will be 0·999 mc.

The amplitude of the sidebands have no lower limit of power, but the upper limit is governed by the carrier amplitude, since if the original modulating frequency is to maintain its character the variation about the mean cannot exceed the original amplitude. When this value is equalled, the output will be zero at the negative peak and as there are two sidebands, it follows that each must have an amplitude one half that of the carrier. On the positive peak all the powers will be added and the peak output will be proportional to the square of the respective amplitudes, with the modulating energy entirely in the sidebands.

Fig. 1 illustrates the case mentioned above in which Ic is the amplitude of the carrier with a constant frequency of 1 mc and Im is the amplitude of the associated sidebands. As the frequencies of these sidebands are above and below the carrier frequency they will appear to revolve in opposite directions with respect to the carrier and the complete diagrams must be considered to rotate at 1 mc, as shown by the arrow marked " carrier frequency." The vertical axis of the graph represents amplitude, and the horizontal axis equals time, showing the modulation in this instance to vary in phase quadrature (or at right angles) to the time axis. Fig. 1a shows

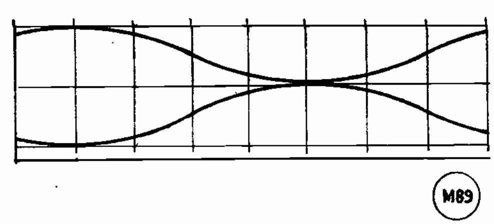


Fig. 2. Carrier and sideband envelope arising from the conditions shown in Fig. 1.

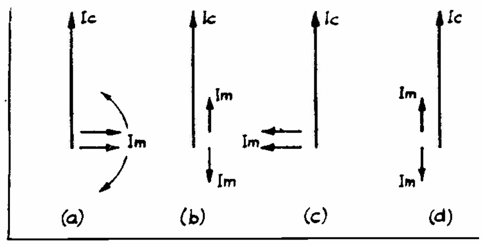


FIGURE 3

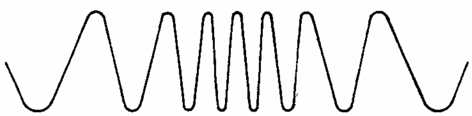


FIGURE 4

Fig. 3 and Fig. 4. The interpretation of these sketches is given in the text.

the condition when both sidebands are in phase with the carrier, their power being added to the total radiated. Fig. 1b illustrates the condition one quarter-cycle of the modulating frequency later, the phase of the sidebands now being such that they are in opposition to each other and in quadrature to the carrier, entirely cancelling their effect on the carrier amplitude. A further quarter of a cycle later the sidebands will again be in phase with each other, but in anti-phase to the carrier ; this will cancel the carrier frequency power as in Fig. 1c. The condition as in Fig. 1b will exist again after the next quarter-cycle (Fig. 1d) and with the completed cycle the condition returns to Fig. 1a. The shape of the envelope shown in Fig. 2 is that which will occur as a result of the modulation described if the frequencies are sine-wave in character.

Frequency Modulation

When frequency modulation is used the sidebands at any instant are changed by 90° with respect to the carrier when compared to the AM condition. By reference to Fig. 3 the importance of this can be seen. Fig. 3a shows the sidebands in phase with each other and lagging on the carrier by 90° ; this means that they are effective only along the *time* axis and cannot alter the *amplitude* of the carrier. Fig. 3b shows the condition one quarter of a cycle later when the sidebands are in anti-phase and in phase quadrature to the time axis. This condition can be compared with that of Fig. 1b in as much as the modulating frequency having no effect on the carrier, the fact that a phase difference of 90° exists between the two illustrations can be ignored. A further quarter-cycle of the modulating frequency later in time will produce the condition shown in Fig. 3c, in which the sidebands are once more in phase and in this case leading the carrier by 90°. The effect, as shown on the envelope of Fig. 4, is that when the sidebands are lagging on the carrier it is reduced in frequency at a rate dependent upon the modulating frequency ; when the sidebands are leading the carrier, the frequency is increased at a similar rate. It is important to realise at this point that it is the *rate* of variation which is determined by the modulating frequency. The degree of frequency variation is dependent solely upon the amplitude of the modulating signal and is known as the "frequency deviation"; this quantity can be assumed as being equivalent to the amplitude of an AM signal.

If a carrier signal at a frequency of 2 mc is required to be frequency-modulated at 1 kc, it would appear in order to transmit the signal by varying the carrier between the limits of, say, 2·0001 mc and 1·99990 mc (or even less) one thousand times a second. This condition would also suggest that a frequency-modulated signal could be transmitted over a very narrow band width — in the case stated, the limits are separated by only 200 c/s. The assumption is, however, incorrect for two reasons.

In the first place the carrier frequency when modulated cannot be sinusoidal as the length of time required for the completion of adjacent sections of a cycle are constantly varying at a rate equal to the modulating frequency. A study of relevant literature will show that the distortion of an alternating frequency will cause harmonics of the original frequencies to appear. An analysis of a frequency modulated wave (the proof of which is inappropriate to this article) shows an infinite number of sidebands appearing on either side of the carrier and

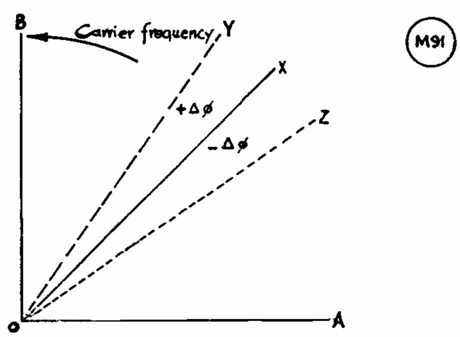


Fig. 5. Showing the variation of phase with the application of phase modulation.

spaced from it in frequency by multiples of the modulating frequency. With the 2 mc signal modulated by a 1 kc tone, upper side-bands will appear at 2·001, 2·002, 2·003 mc, and so on, and the lower at 1·999, 1·998, 1·997 mc, etc. The relative amplitudes of these side-bands are a function of the ratio of the modulating frequency and the frequency deviation, known as the "modulation index."

The second reason is that the receiver would have difficulty in demodulating a carrier with such a small shift in frequency. This can, for comparison, be likened to an amplitude-modulated signal with an extremely low level of modulation — so low, in fact, that the carrier noise would mask the intelligence.

From the foregoing, similarities between AM and FM become apparent. The rate of change is determined by the modulating frequency, the degree of change by the amplitude of the modulation for both systems. In addition, the rate of variation has no lower limit and wave-forms suitable for telegraphy can be applied to either system if desired, the resultant outputs being A1 and F1 respectively.

Phase Modulation. When phase modulation is used the frequency and amplitude of the carrier remain constant and Fig. 5 illustrates the condition occurring. The line OX represents the position of the phase in an unmodulated carrier in respect to the co-ordinate system AOB, which should be considered as revolving in an anti-clockwise direction at a rate equal to the carrier frequency. When phase modulation occurs the line OX will oscillate about the mean position between the extremes indicated by the lines OY and OZ. When variations occur, the line OX (usually termed a vector) will move toward the position OY at a rate determined by the modulating frequency, and at the extreme position OY the vector must stand still, at least for an instant. The vector will then reverse its phase and move clockwise with respect to the motion of the co-ordinate system. The vector OX will move over the original position and finally reach the opposite extreme OZ, at which point it must again reverse its motion, and again for an instant stand still. At the extreme positions OY and OX the phase is stationary and a true carrier frequency prevails as no phase-shift is occurring. The fastest change in the speed of the vector will therefore occur at the position OX, which would be the correct position of the phase if no modulation existed.

It is this *variation in speed* which accounts for the equivalent instantaneous carrier frequency change. Frequency maxima and minima will occur alternately at the position OX. The positions OZ and OY are determined by the amplitude of the modulating signal, and the maximum rate of change (equivalent instantaneous frequency change) is governed by the frequency of the modulating signal. Therefore, phase modulation is dependent upon both the amplitude *and* the frequency of the modulating signal. It can be seen, therefore, that two major differences exist between this method of modulation and the other systems previously discussed.

(1) The degree of modulation is dependent upon both the amplitude and frequency of the modulating signal,

(2) The equivalent frequency change is reduced as the modulating frequency is lowered, and therefore at zero frequency no modulation occurs. Due to this fact, telegraphy cannot be achieved as in the case of AM and FM.

The sidebands generated in phase modulation will be similar to those stated for frequency modulation when an equivalent modulation index exists.

Depth of Modulation. The limiting factors for depth of modulation which are applicable to AM have no counterpart for PM or FM. The limit to which the phase or frequency can be varied is governed simply by the ability of any associated circuits to handle the frequency spectrum required and the permitted bandwidth for the particular frequency or type of service.

Modulation Index. The modulation index of a frequency modulated signal is the measure of carrier frequency deviation divided by the modulating frequency. This can be considered as being equivalent to the depth of modulation in the AM condition. For FM the modulation index will vary with the frequency of the modulating signal as follows: If the maximum frequency deviation in an FM transmitter is 6,000 cycles, and the modulating frequency is 1,000 cycles, then the modulation index will be equal to one half the deviation divided by 1,000, *i.e.*, 3. If the modulating frequency is 100 cycles the index would be 30. For PM the modulation index will remain constant for any modulating frequency due to the relationship between the amplitude and frequency of the modulating signals and the carrier, as stated earlier. This modulation index when discussed mathematically can be shown to equal the phase shift of the carrier in radians.

So far, the general case of FM and PM has been considered. In amateur service, a very limited bandwidth is permitted and the resultant emission is termed narrow-band frequency modulation. The usual operating condition achieved is where the first sidebands are one half the amplitude of the carrier. This condition will arise when the modulation index is arranged to be 0·6 radians, *i.e.*, the distance between OX and OZ in Fig. 5 will be 34·38°. When the above requirements are met, the carrier-to-sideband relationship roughly equals that for a 100% modulated AM signal. The additional sidebands occurring in FM or PM with a modulation index of 0·6 radians are quite small in amplitude; for instance, the second sideband will only be about 1% of the carrier amplitude, and the third considerably lower. Obviously, such low levels can be ignored for all practical purposes, but it must be remembered that any increased amplitude of the modulating signal will cause an increase in these sideband levels. This increase could result in severe splatter on the signal due to increased bandwidth, and possibly distortion of the modulating signal.

Advantages and Disadvantages of FM and PM

The main advantage of either system for the amateur is the simplicity of the modulating section of the transmitter. A single stage audio amplifier will give sufficient voltage output for satisfactory modulation from any type of microphone. In the case of FM, a second valve is all that is required for the modulating stage and any transmitter, irrespective of power output, *if VFO controlled,* can operate on phone with the aid of two small valves such as the 6AM6. For PM two valves at least are required for the modulator, but an advantage is gained due to the increased frequency stability obtained whether it be with a VFO or a crystal controlled oscillator.

Interference to television reception often results from the use of AM when the unmodulated carrier does not show any trace. In a case of this nature the use of either FM or PM will permit telephony operation during TV hours — an enormous advantage from the amateur point of view. If AM telegraphy causes trouble and a steady carrier is clear the use of frequency shift keying will permit telegraphy also.

As there is no variation of amplitude with FM or PM, Class-C stages can be used to amplify the signal and frequency multiplication is permissible whenever necessary. It should be noted, however, that the modulation index is increased by an amount equal to the number of times the modulated signal is multiplied in frequency. If multi-band operation is desired, provision should be made to vary the audio level applied to the modulator when the band is changed, *e.g.*, approximately half the level would be required at twice the frequency.

(To Be Continued)

Simple Absorption Wavemeter

FOR THE AMATEUR BANDS

R. H. WRIGHT (G3IBX)

UNDOUBTEDLY one of the most useful accessories to have about the station is an absorption-type wavemeter. Actually it is debatable whether such an instrument should be classed as an accessory, or whether it comes under the heading of essential equipment—particularly as the operator must be sure of what he is doing when selecting the correct harmonics in his transmitter.

Such a piece of equipment is both easy and cheap to construct and the circuit shows a particularly suitable instrument costing but a few shillings to make.

The coils used are the Denco octal-based plug-in types, " Blue Range," and by suitably connecting the aerial coupling winding, an auto-transformer effect is obtained which gives a greater meter reading and so increases the effective sensitivity of the instrument. These commercial coils are used in preference to home-constructed types in view of their great efficiency. The numbering of the coil connections in the diagram refers to the pin connections on an international octal valveholder.

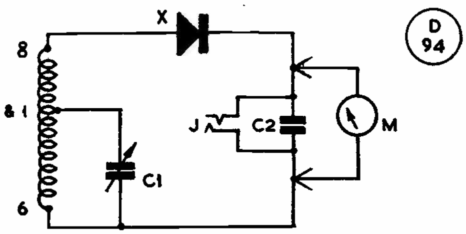
A number of different germanium crystals were tried in the original but there appeared to be no noticeable difference in performance. Final sensitivity will, of course, depend very much upon the meter being used as a resonance indicator. A meter having a full scale deflection current of 50 or 100 microamps would be ideal, but failing that an 0 to 1 milliamp meter will function satisfactorily.

The whole instrument can easily be accommodated in a large Oxo tin—such a container, or something like it, can usually be obtained from the local grocer — and with the octal base mounted on one side, or at the end, the coil will plug in externally. When all cutting and drilling is finished the tin can be given a coat of paint.

To use the wavemeter it is only necessary to plug in the appropriate coil and then approach the transmitter, adjusting the variable capacity, C1, for maximum meter reading; this indicates resonance between the transmitter and the wavemeter tuned circuit. Beware of placing the wavemeter too near the transmitter—the microammeter can easily be overloaded and damaged. If the milliammeter is replaced by a pair of high resistance phones, the wavemeter can be used as a phone monitor when on telephony.

Calibration

While the specified coils will have a stated frequency coverage, a more accurate calibration can be put on the instrument, relating frequency to dial reading. This can be done in several ways, of which probably the two simplest are: (1) By working against a VFO, itself calibrated from the receiver; or (2) By coupling the wavemeter to the receiver. In method (1) the variation of VFO note is heard on the receiver when the wavemeter is brought into resonance with the VFO oscillatory circuit, *or* just enough coupling is used to obtain a deflection on the indicating meter. For method (2) the receiver aerial lead is looped two or three turns round the bottom, or earthy end, of the wavemeter coil former; then, as C1 is swung through resonance, a change in receiver background noise will be heard; this is the tune point, the frequency being as indicated by the receiver



Circuit of the Absorption Wavemeter, using standard Denco plug-in coils. If the indicating microammeter is removed, a headset can be plugged into the jack for telephony monitoring. A piece of apparatus of this sort—costing very little and easier to build than a crystal set—is one of the basic items of test gear in the amateur station.

dial. A number of such points can then be plotted for each coil.

In both methods—or any method of calibrating an absorption wavemeter—the coupling should be kept as loose as possible, so that resonance tune is only just detectable. This ensures that the calibration being put on is reasonably accurate, and that the wavemeter tuning is not being "pulled" too much by the coupling into the secondary circuit. In any event, the calibration of an amateur-built absorption wavemeter can never be made better than "near-enough for practical purposes"—but that is quite good enough for the purpose intended.

For the circuit shown, coils are Denco Blue: Range 3, 1.8-3.5 mc bands; Range 4, 7-14 mc bands; Range 5, 21-28 mc bands. C1 is 300 $\mu\mu$F variable, or 500 $\mu\mu$F with .001 μF in series to reduce the effective capacity; C2, .01 μF; the detector is a germanium crystal diode, mounted in the wiring; and M is a moving-coil meter, 0-1 mA, or 0-100 or 0-200 μA for better sensitivity (*see* above).

DECEMBER DELIVERY LATE

The tragic occurrence at Lewisham on December 4 was the direct cause of the delay in the delivery, throughout the country, of the December issue of SHORT WAVE MAGAZINE. With the normal Charing Cross outlet blocked to the Post Office and our printers on the south side of London, it was not until Saturday, December 7, that all deliveries could be cleared, and December 11 before normal Post Office routeing was restored.

DECEMBER — AMENDMENTS AND CORRECTIONS

In the circuit on p.538 of our December issue, a fixed capacity of 50-100 $\mu\mu$F should have been shown between the second anode of V2 and the cathode of V3. The circuit will give a result without this condenser, but G6LX explains that it is advisable to include it to keep HT off the cathode of V3, and the apparent current draw of V2 within reasonable limits.

For his article on the Cubical Quad in the same issue, GM3BQA omitted to give the spacing of the tuning stubs as 4 ins.; he also points out that the photograph is of an early test model of the array, when stubs were being tried in the top sections of the reflector elements; these have since been removed, all tuning being done with the stubs fitted as in Fig. 4, p.524. In the diagram on p.523, Fig. 3, a *radial* scale of 0-50 dB should have been shown across the lower part of the drawing.

And in the caption to the graph on p.526, it could have been mentioned that the S-meter scale chosen was purely arbitrary, simply to accommodate the receiver and its S-meter to the enormous signal at first being radiated by S.I on 40 mc.

NEW YEAR HONOURS

A few days before this appears, Her Majesty's New Year Honours List will have been published. We shall be very glad to hear from any reader holding a call-sign whose name appears in the List, with a note of the distinction conferred.

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.

EI7AC, T. H. Perrott, 5 Glenview Terrace, Spa Walk, Mallow, Co. Cork.

G3KNK, P. Lancaster, The Vicarage, St. John's Chapel, Bishop Auckland, Co. Durham.

G3KOV, G. J. A. Bird, 87 Combe Street, Chard, Somerset.

G3KQI, J. L. Howard, 78 Northcote Road, Knighton, Leicester, Leics.

G3LDK, Mrs. D. Anthony, 53 Stafford Road, Ruislip, Middlesex.

G3LDM, E. B. Mason, 158 Lower Richmond Road, Putney, London, S.W.15.

G3LEQ, G. L. Adams, 5 Byng Road, Tunbridge Wells, Kent.

GW3LFM, M. F. Taylor, 20 North Drive, Rhyl, Flintshire.

G3LMK, G. V. L. Johnson, 83 Victoria Street, Narborough, Leics. *(Tel.: Narborough 2016).*

G3LRP, P. N. Ackley, 89 Mulberry Place, Ryhill, Wakefield, Yorkshire.

G3LUO, C. H. Evans, 39 Nevern Square, London, S.W.5.

G3LVK, N. A. Lambert, 22 Sunderland Terrace, Bayswater, London, W.2.

G3LWL, J. Morgan, 1 Shrapnel Road, Well Hall, London, S.E.9.

G3LWP, R. L. Cutler, Barn Cottage, Walberton, Arundel, Sussex.

G3LYO, J. H. Cox, 161 Newborough Road, Hall Green, Birmingham, 28.

G3LZE, M. Henry, America Lodge, Higher Lincombe Road, Torquay, Devon.

G3LZF, E. Gittins, Green Hirst Hey, Todmorden, Lancs.

G3MAG, W. E. G. Allwright, 12 Ashington Gardens, Peacehaven, Sussex.

G3MAM, Dr. D. B. Sugden, 5 Church Street, Alfreton, Derbyshire.

G3MAX, F. Nicholls, 29 Rectory Road, Abbey Hey, Manchester, 18.

G3MAY, H. F. Stenhouse, 28 Pearl Road, Walthamstow, London, E.17.

G3MAZ, H. V. Bell, 19 Pelham Crescent, The Park, Nottingham, Notts.

G3MAZ/A, H. V. Bell, 152 Kingsway, Widnes, Lancs.

GI3MBB, A. McMurtry, 13 Upper Canning Street, Belfast.

GM3MBC, J. H. Churchill, 46 Dalziel Drive, Glasgow, S.1. *(Tel.: Ibrox 2418).*

G3MBL, A. G. Edwards, 244 Ballards Lane, North Finchley, London, N.12.

G3MBP, P. Masters, 110 Station Road, Drayton, Portsmouth, Hants. *(Tel.: Cosham 77596).*

G3MBS, S. Gibbs, St. Mary's Lodge, Cottage Place, Chelmsford, Essex.

G3MBT, P. Watson, Brooklands, London Road, Chelmsford, Essex.

G3MBT/A, P. Watson, Coppice Farm, Penn, Bucks.

G3MBW, J. E. Collins, 16 Woodlea Grove, Westfield, Yeadon, Nr. Leeds, Yorkshire.

G3MBX, M. G. Stoot, 9 Aerial Road, Lovedean, Portsmouth, Hants.

G3MCF, J. Wilson, 11 Applegarth Lane, Bridlington, E. Yorkshire.

GM3MCH, N. Stewart, 16 King's Road, Forfar, Angus.

G3MCJ, H. M. Hayfield, 113 Hamline Lane, Exeter, Devon.

G3MCK, G. P. Stancey, Ivy Cottages, Hoyland Common, Barnsley, Yorkshire.

G3MCP, P. G. Goadby, 535 Welford Road, Leicester, Leics. *(Tel.: Leicester 77344).*

CHANGE OF ADDRESS

G2ATM, S. Read, 42 China Street, Bulwell, Nottingham, Notts.

G2AYG, J. G. Openshaw, 516 The Mount, Walmersley Road, Bury, Lancs.

G2CKQ, R. S. Trevelyan, 103 Barnfield Avenue, Kingston-upon-Thames, Surrey.

G2QY, G. P. Anderson, A.M.I.E.E., 16 Warrender Way, Ruislip, Middlesex.

G3ACQ, H. J. Harmsworth, 27 Thanet Road, Bilton Grange, Hull, Yorkshire.

G3DGY, E. H. L. Cooper, Glenbrook, Gynsill Lane, Anstey, Nr. Leicester, Leics.

GM3HQN, A. Rennie, Carnach, Redding, Falkirk, Stirlingshire.

GW3IHX, N. J. Bond *(ex-G3IHX),* 31 Elgar Crescent, Llanrumney, Cardiff, Glam.

G3ISQ, R. C. White, 43 Hinton Parva, Nr. Wimborne, Dorset.

G3JDT, B. J. Read, 61 Salisbury Grove, Mytchett, Nr. Aldershot, Hants.

G3KCC, C. J. Carroll, 9 The Oval, Brough, E. Yorkshire.

G3KFF, M. A. Perry, 7 Mitchell Road, College of Aeronautics, Cranfield, Bletchley, Bucks.

G3KQK, T. A. Dugdale, The Cottage, Egerton Green, Malpas, Cheshire.

G3KYU, J. Ashford, A.R.I.C.S., 9 Well Meadow Gardens, Copthorne, Shrewsbury, Shropshire. *(Tel.: Shrewsbury 5666).*

G3LHJ, D. Webber, 14a Keyberry Park, Newton Abbot, Devon.

G3NB, D. G. Sutton, 36 Montpelier, Weston-super-Mare, Somerset. *(Tel.: Weston-super-Mare 5182).*

G6GG, G. Golding, 40 Cagefield Road, Stambridge, Nr. Rochford, Essex.

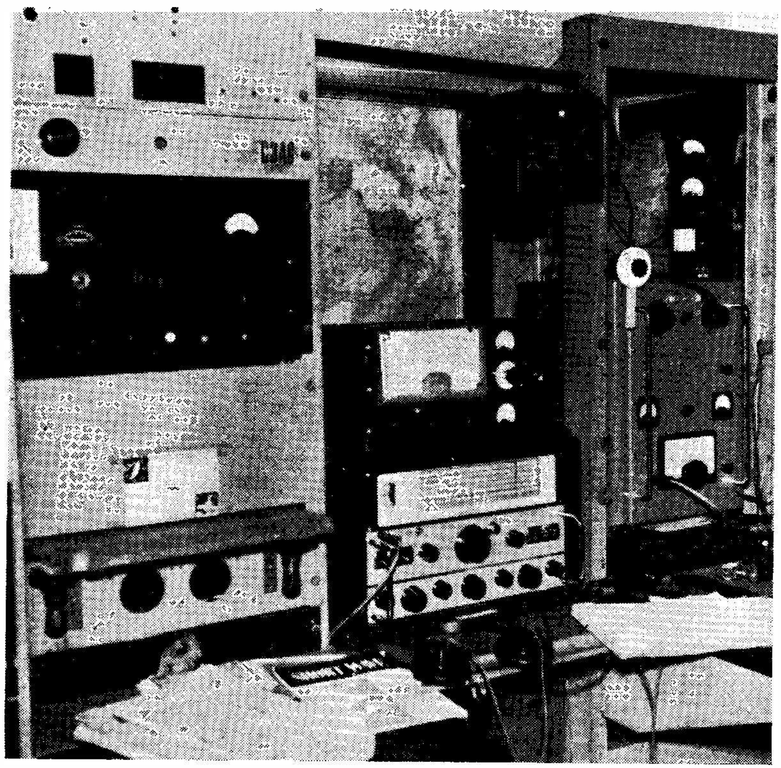
CORRECTION

GM3EFS, W. H. Borland, 79 Bank Street, Alexandria, Dumbartonshire.

G3LYU, D. T. Price, 29 Pytchley Road, Southfields Estate, Rugby, Warks.

THE OTHER MAN'S STATION

G3AG



THOUGH the station of G3AG was actually licensed in the mid-thirties, the operator — F. Inchley, 11 Carnwath Road, Sutton Coldfield, Warwickshire — started much earlier than that; he was "AA" 2AXI in 1926, and became G6IN in 1927. This call was relinquished owing to pressure of business preventing any amateur activity. As G3AG, prior to the outbreak of war he was Midlands controller for the old C.W.R. (Civilian Wireless Reserve), the members of which did such outstanding work when the call came in September, 1939—G3AG himself was i/c No. 8 W/T Emergency Fitting Party at Barnwell.

Post-war activity as G3AG did not commence until 1955, with the completely re-built station pictured here. The receiver is a G.E.C. BRT-400, and the transmitter runs an 813 in the PA, the latest acquisition being a Labgear LG.300 (which, of course, also has an 813 PA). The power pack, speech amplifier and modulator sections are in the rack at the extreme left of the photograph. Above the BRT-400 can be seen a Class-D wavemeter, to the right of which is the aerial coupling unit. And G3AG remarks that "after many experiments" his most successful aerial for 21 and 28 mc is an end-on long wire, which "puts a signal into most parts of the world."

On this equipment, since 1955 a phone WAC has been achieved, with WAS and enough countries for DXCC also worked on phone, though some urgently-needed QSL's are still outstanding.

G3AG started life as a sea-going operator with Elder Dempster, his first ship being the m.s. *Aba,* and after service in the R.A.F. during the war he became technical representative for a big electronics concern. He says that, after all this time, Amateur Radio is to him still as thrilling and enjoyable a hobby as it was when he first started, more than 30 years ago.

THE TWELFTH MCC

• The Magazine Top-Band Club Contest •

NOVEMBER 16-17 : 23-24, 1957

WHEN the Annual Battle, which is now old enough to have become a tradition, was resumed on November 16 last, it was obvious that the entry was better than ever. On the dot of 1600 GMT on Saturday, November 16, the rash of "CQ MCC's" broke out once more, and the Twelfth MCC was under way. We are pleased to announce the record-breaking entry of 39 logs received, with 44 Clubs actually competing.

Stourbridge, last year's winners, got away to a flying start which they never lost, and they top the Roll of Honour once again with the highest-ever score of 486.

Coventry, who have appeared on the Roll six times in the past, winning the event in 1946 and 1951, made a come-back after five years of comparative obscurity; they scored a very close second with a total of 478.

Aldershot, with their fine score of 467, made third place, thus figuring in the top bracket for the first time. They beat **Harlow** (last year's third) by only three points for this position.

The fast-and-furious nature of this year's Contest is obvious from the fact that the scores of the first four Clubs — for twelve hours' operation — are all higher than the 1955 winner's score, the year when sixteen hours were allowed. This year's winning score, by Stourbridge, beats their own aggregate for 1956 by 55 points, and their 1955 score by over 100.

Facts and Figures

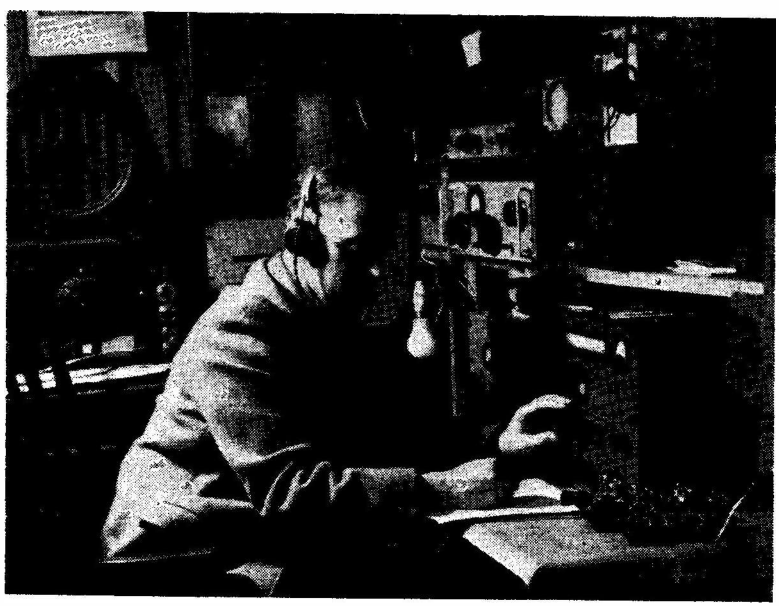
Table I shows the positions and scores of all 39 Clubs whose logs were received by the due date. **Medway** (G2FJA/P) suffered a lot of trouble and therefore sent in a check log only—which was a pity, as their score, despite time off the air, was a good one.

Close behind **Harlow,** who held fourth place with 464, came **Grafton, Salisbury, Bailleul, Slade** and **Sheffield** with 445, 441, 439, 433 and 411 points respectively. Last year only the first three topped the 400 mark.

Apart from those listed in the table, other Clubs participating were **Rugby** (G3BXF), **Stoke,** (G3GPU), **U.L.R.S.** (G3KMX/A). **Welwyn** (G8LM/A) and the afore-mentioned **Medway** (G2FJA/P).

Various ambiguous stations cropped up from time to time, and most contestants had their scores slightly reduced by the judges for claiming, most optimistically, their three points for a "Club" contact which was certainly nothing of the kind. **Aldershot** were the only Club to have their score actually increased by the scrutineers, having claimed only single points for one or two *bona fide* Club contacts! **Harlow's** score suffered a cut of ten points as a result of claiming "Club" status for G3GKQ, 3KRC, 3GTG, 3GRQ and 3LVW.

1st:	**Stourbridge & District Amateur Radio Society, G3BMY**	**(486)**
2nd:	**Coventry Amateur Radio Society, G2ASF**	**(478)**
3rd:	**Aldershot & District Amateur Radio Society, G3IQE**	**(467)**



Again placed first in MCC, this was the Stourbridge & District Amateur Radio Society station, operated by G3BMY and G8GF (shown). Between them, they put up a magnificent performance to win for the second year running. An important element in their success was the fact that the receiver (CR-100) main tuning control is ganged to the transmitter VFO, making frequency control automatic. They used a half-wave end-on aerial.

Further losses of points were incurred in many cases by incorrect logging of QTH and QRA, by non-agreement of RST reports, and by the attempted squeezing-in of QSO's which actually began at 1903 hrs.—or before the start time. Another reason for illegitimate points (promptly struck down by the judges) was the working of the same Club twice during one period—no doubt accidentally. But a good logging system is essential in a Contest like this, and it might be a good plan if we altered the rules so that, another time, such claims would actually penalise the claimant.

It might also be mentioned here—if only for the peace of mind of those Clubs who have mentioned "irregularities"—that this Contest is always closely invigilated throughout all four periods. That is to say, a careful listening-watch is kept by experienced operators who know what they are looking for, especially just before and a few minutes after the official Contest periods ! And let it be said, also, that over the years very few infringements of the rules have been noted; such as have occurred could always be put down to nothing more than over-enthusiasm.

Scoring

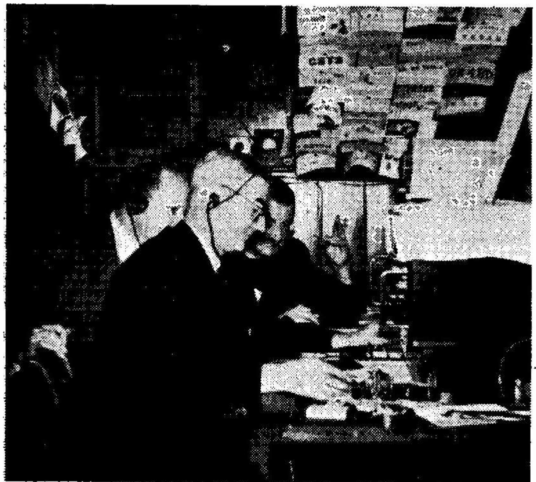
Obviously, the whole intention of the Contest is to make it essential for the winning Club to work nearly all the others at each session; and, if this is to be done, there cannot be any waste of time looking for "single-pointers." This year the number of single-point contacts is substantially down once more; note, however, that it was eight such contacts over and above Coventry's score that made Stourbridge the winners. Both Clubs worked the same number of other Clubs, scoring 441 in the process, but the Stars winkled out 45 other stations, whereas the Cars found only 37—and these Clubs are quite close together, thinking geographically.

TABLE I

POSITIONS AND SCORES

	CLUB	CALL	Club Contacts	Non-Club Contacts	TOTAL POINTS
1.	Stourbridge	G3BMY	441	45	486
2.	Coventry	G2ASF	441	37	478
3.	Aldershot	G3IQE	429	38	467
4.	Harlow	G3ERN	426	38	464
5.	Grafton	G3AFT	402	43	445
6.	Salisbury	G3FKF	414	27	441
7.	Bailleul (REME)	G3IHH	408	31	439
8.	Slade	G3JBN	402	31	433
9.	Sheffield	G4JW	387	24	411
10.	Clifton	G3GHN	354	42	396
11.	Gravesend	G3GRS	357	30	387
12.	Sutton & Cheam	G2BOF	342	30	372
13.	Liverpool	G3AHD/A	330	39	369
14.	Cheltenham	G3GPW	303	31	334
15.	Port Talbot	GW5VX	318	14	332
16.	Mitcham	G3KKZ	300	31	331
17.	Crystal Palace	G3IIR	297	26	323
18.	Wirral	G3CSG	285	33	318
19.	Thanet	G3DOE	285	20	305
20.	Bradford G.S.	G3KEP	285	16	301
21.	Stroud	G3EKD	288	11	299
22.	Edgware	G3ASR	273	10	283
23.	Catterick	G3CIO	261	10	271
24.	Grimsby	G3IYT/A	246	20	266
25.	North Kent	G3ENT/A	234	17	251
26.	Leicester	G3LRS	234	16	250
27.	Surrey (Croydon)	G3EUE	219	26	245
28.	Torbay	G3LHJ	231	13	244
29.	South Shields	G3DDI	231	9	240
30.	Wellingborough	G3KSX/A	225	13	238
31.	Northern Polytechnic	G3LPU	177	23	200
32.	Stevenage	G3JLA	177	5	182
33.	Bury	G3BRS	165	7	172
34.	Southport	G2DQX	156	13	169
	East Kent	G3LTY/A	162	7	169
36.	Southampton University	G3KMI	156	5	161
37.	RAF Kinloss	GM3HRZ	114	11	125
38.	Plymouth	G3KFN	117	6	123
39.	Ravensbourne	G3HEV/A	54	2	56

It has been suggested by some Clubs that a racket is developing, whereby local members are briefed to come on the air and work their own Club station but no one else. We should be very sorry if this were so, and, in fact, there seems to be little suggestion of it in the log sheets. Those Clubs situated in large towns and centres of industry probably have far more local stations available, but with so many Club stations as there were this year, it would be a dangerous procedure to waste a lot of time collecting



It is some years since Coventry Amateur Radio Society have appeared among the leaders (see Table II), but here they are again, placed 2nd in the Twelfth MCC. Above is the operating position at G2ASF, with G3FOH (left) and G3HDB (behind) watching old-timer G2LU (foreground) paddling the bug. The scene below is of the separate monitoring position, manned by (left to right) SWL Hann, G3RF, G2FTK, G3LJR, and SWL Clements. Note the black-board in the background, to keep operators up-to-date with the immediate position.

single points from locals.

It is interesting to note, on this subject, that the highest score for single-point contacts was 96 in 1954, 63 in 1955, 50 last year and 45 this year. Next year — who knows ? — we might rule them out altogether. We only allowed them in, in the first instance, under the mistaken impression that lots of Clubs would all score full marks on the other Club stations, so that the single-pointers would be necessary to decide the final result.

Comments

Some Clubs considered the operating standard pretty low this year, with a few outstanding exceptions (once again, the novices were, quite rightly, being let loose on the keys !) **Stourbridge** think the time has come to increase the sessions to four hours again . . . **Coventry,** with an almost identical score, suggest that it be reduced to two hours !

"Most clocks seemed to stick at 1859 hrs. . . . **(Aldershot)**; "Encouraging to find an increase in numbers **(Harlow)**; "Only two operators, both newly licensed and having very little CW experience, making G3LPU the most inexperienced station in the Contest !" . . . **(Northern Polytechnic)**; "Very enjoyable, and no criticisms" . . . **(Stroud).**

"Stations still persist in congregating round one frequency when the rest of the band is clear" . . . **(Edgware)**; "Though we have not gained many points, we have gathered a wealth of experience on our first attempt" . . . **(East Kent)**; "Best MCC yet, with more activity and excellent conditions" . . . **(Cheltenham).**

Contradictions

Several northern stations, including Liverpool and Wirral, suggest that the times should be an hour later, as it is difficult to work southern stations so early. On the other hand, Bury report that on both Saturdays they made half of their score in the first hour, because fish-fone was not so troublesome then.

Port Talbot, Plymouth and other outlying stations also press for a later start or for some form of loading for DX contacts. Crystal Palace criticise the bunching of stations and also wonder whether it should be necessary to transmit the name of the Club after the first contact, as the others only have to look up the call-sign, anyway.

Catterick were sadly handicapped because they found the Club locked up on the last day, the NCO i/c having gone for a walk with the key in his pocket ! North Kent say "Strange how signal-strengths seemed to increase when there was a GM on !" And they thought the Top Band was 200 kc wide, not twenty . . .

Bradford Grammar School had five operators ;

TABLE II

ROLL OF HONOUR, 1946 - 1957

Year	1st	2nd	3rd	Total Entries
1946	Coventry	Cheltenham	Grafton	20
1947	West Cornwall	Warrington	Coventry	14
1948	Rhigos	Coventry	Wirral	28
1949	Rhigos	Neath	Coventry	25
1950	Rhigos	Neath	Coventry	36
1951	Coventry	West Cornwall	Surrey	28
1952	{ Chester { Neath	—	Clifton	28
1953	Neath	Chester	{ Surrey { Salisbury	28
1954	Neath	Clifton	Surrey	28
1955	Surrey	Sheffield	Nottingham	34
1956	Stourbridge	Bailleul	Harlow	36
1957	Stourbridge	Coventry	Aldershot	39

Southampton University one operator and three log-keepers . . . South Shields and Grimsby had lots of trouble from Cullercoats (GCC) . . . Clifton organised things in a big way, with large blackboards giving the latest information and "state of the parties"; no less than twelve members played their various parts, not to mention the running of the canteen service.

Bailleul were down to 5 watts for some of the time; they think some recognition should be made of the private station giving the most points to competing Clubs . . . This is an idea. Slade was one of the many Clubs that moved away from noisy town sites into rural areas. This year they were on a member's farm . . . Salisbury worked with only one operator, and suggest a phone section in future Contests—but we do not think that this would find general support; MCC is essentially a CW affair.

For the very first time, Aldershot & District Amateur Radio Society, G3IQE, appear in a lead position in MCC, a very creditable performance in a hard-fought Contest. Operators shown here (left to right) are: G3KMO, G3IQE, G3FMN and SWL Howes; also assisting was SWL Halfacre, who is sightless and who will soon have his own licence. For the Contest, Aldershot used a modified TCS-12 transmitter, a half-wave aerial, and two receivers — a BC-348 and an HRO.

Suggestions

Among the many suggestions put forward comes the perennial one that we should publish a list of competing Clubs beforehand. We know all about that one! The first one or two Contests were run under those conditions and we found that the entry was extremely small, because so many Clubs did not notify their intentions by the due date, and then, finding the date passed, decided not to enter at all—or sent their entry in late, which meant that they were not in the published list and so were not "recognised" by the others when the Contest was on. This year's large entry is very greatly due to the informality and the fact that no prior notification is necessary.

Another idea put forward is that as everyone seems determined, at present, to stick in the 1800-1850 kc sector, points should be doubled for contacts made above 1850 kc. That, as we see it, would merely crowd everyone above 1850 kc all the time! And as for the bright spark who says "the four contacts with each Club should all take place in different quarters of the band—one in 1800-1850 kc, one in 1850-1900 kc, and so on . . ." Work out the mathematics of that one for yourself, and decide whether it would be possible at all!

Rises and Falls

Congratulations to these Clubs, who have climbed considerably since last year: **Coventry** (16th to 2nd); **Aldershot** (23rd to 3rd); **Salisbury** (19th to 6th); **Gravesend** (17th to 11th). Commiserations to those who fell from high positions to not-so-high, generally on account of not being able to be on for the whole period, or being without experienced operators.

Thanks to GM3HRZ (Kinloss) and GW5VX (Port Talbot) for putting two more countries on the map; they both had a rather hard time of it. Welcome to newcomers from Northern Poly., East Kent, Bradford Grammar School and Southampton University.

Thanks also for valuable Check Logs from Medway (G2FJA/P), G3JHH and G3MCB, which were much appreciated.

Finally, bouquets from the judges to the following Clubs for their really excellent logs, which were a pleasure to scrutinise: Slade, Stevenage, Sutton, Wirral, Liverpool, Crystal Palace, Gravesend, Stroud, Coventry and Stourbridge. There were only one or two *bad* logs; twenty-five or so good ones—and the above, outstanding. But in no case did the state of the log influence the judging, which was strictly impartial and impersonal!

So another MCC passes, and "normal working will be resumed" until roughly the same time this year. Many thanks to all contestants for their co-operation in making possible such a successful event.

Club secretaries are now asked to note that the next deadline for routine Club notes will be **Friday, January 17.** They should be addressed to "Club Secretary," *Short Wave Magazine*, 55 Victoria Street, London, S.W.1. And from ourselves, a Happy New Year to all Club members, officers, and secretaries in particular. We hope to be hearing from them regularly in 1958.

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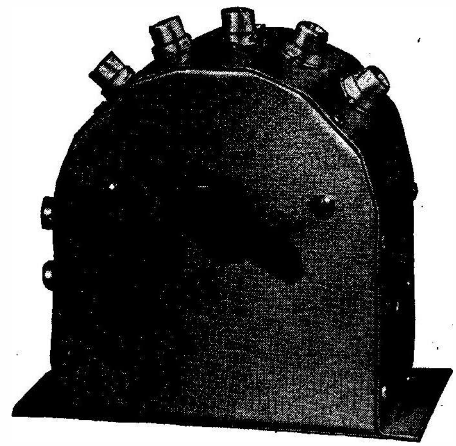

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1613.25	1815	2196	3920	10,545	11,751
1650	1870	2261	3960	10,557	11,788
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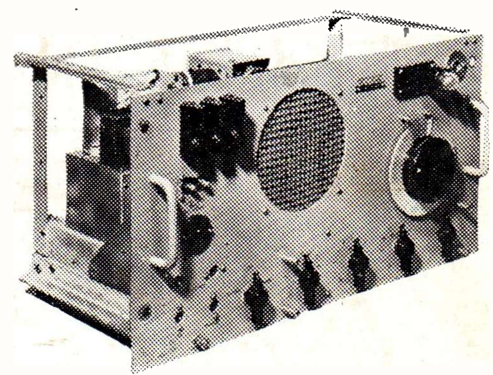

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