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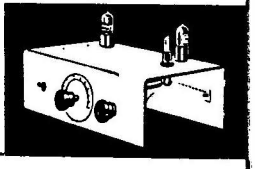

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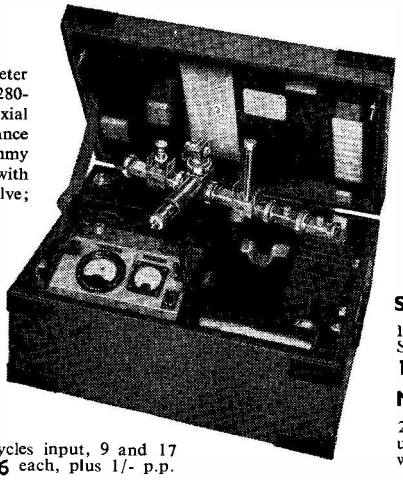

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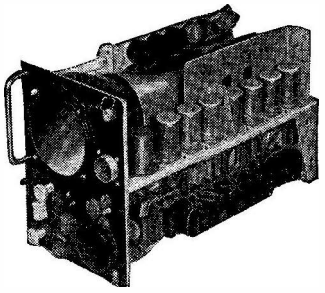

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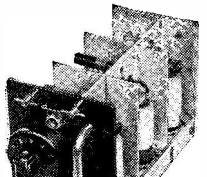

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The SHORT-WAVE Magazine

EDITORIAL

Prospects *One of the most encouraging phenomena in the world of radionics at the present time is the rising tide of " young interest " in Amateur Radio. From our general correspondence, it is easy to gauge these tendencies, and it is evident that a great many schoolboy-beginners are taking the Radio Amateurs' Examination in their stride, so to speak, with no immediate intention of coming on the air—this is something to be kept for " later on," which usually means when they have learnt enough Morse to pass that test!*

In the main, however, it is still from our army of SWL's (many of whom are very experienced on the receiving side) that newcomers are recruited to the ranks of radio amateurs, and it is these SWL's who need guidance and encouragement. It is here that local Club groups can do so much to help, advise and enthuse beginners—and it is to the credit of many Clubs, up and down the country, that they make special arrangements to cater for the needs of their SWL members.

The coming year, with all the interesting and exciting prospects that it holds for radio amateurs—the greatly improved DX conditions; the rise in the MUF; the availability of ten, six and four metres for inter-Continental and cross-band working; and the launching of the earth satellites—means that 1957 will be outstanding in the memory of those fortunate enough to be able to join in all these activities.

Austin Forbes G6FO.

End-On Aerial Tuner

AND SIMPLE THREE-BAND SYSTEM FOR 10, 15 AND 20 METRES

WITH the DX openings now occurring on the HF bands, and the high level of activity on them, especially during contest periods, one obvious requirement is a quick-change aerial system. A band-switching transmitter, by itself, becomes only half the answer to rapid moving if it takes half-an-hour to set up the aerial side every time the band is changed. Under present-day conditions, one needs to be able to get from band to band wihout wasting precious operating time.

End-On Aerial

The tuner described here was evolved to accommodate an aerial which is in itself simple but efficient, and has been found to give very satisfactory DX results on the 14, 21 and 28 mc bands — it is only on these bands that the system has been thoroughly tested.

It consists of no more than a 33-foot wire, with the end-on connection to the aerial coupling coil — *see* Fig. 1. By reason of its length this wire is, obviously, half-wave on 20 metres (voltage feed), three-quarter-wave on 15 metres (current feed) and full-wave on 10 metres (voltage feed). The correct feed condition is obtained automatically — provided the coil/condenser values are right for the band — and either the "A" or "B" tapping points can be used to get the same result.

Apart from the multi-band characteristic, the particular merit of this beautifully simple arrangement is that the aerial itself can usually be put up vertically, or nearly so, with all the advantages of low-angle radiation. In the test case, the 33-ft. wire is slung up in such a way that it drops down, at an angle of about 80°, straight to the lead-in point in the window, from where the connection is made to the ATU. Note that the aerial length is calculated not from the lead-in point, but right from the tap on the coil to the far-end insulator.

ATU Circuit

The L1, C1, C2, combination tunes the band in use, the coil being made plug-in, with its link coupling. The condenser settings can be determined beforehand for each band, so that band-changing becomes simply a matter of plugging in the appropriate coil and turning the condenser dials to the previously established readings. The aerial itself does not need to be touched; metaphorically speaking, it "works the same" on all three bands.

Tuning Procedure

With C1, C2, at minimum capacity, resonate the PA tank circuit. Then "draw" on C1 and "resonate" (minimum PA plate current) on C2. Continue until the normal PA loading is attained and then re-touch on the PA tank condenser and C1, C2 for resonance all through, as indicated by the PA plate meter. As maximum loading is approached, C1, C2 will react more and more on the PA tank setting; this effect will also be governed to some extent by the degree of link coupling, which should not be too tight. If the link can be made variable, so much the better, but if the values given in the Table are used, they will be found to give good transfer efficiency.

This process will produce, for each band, three dial readings—PA plate condenser in the transmitter, and C1, C2, on the ATU; these should be noted. The whole idea is to get together a set of repeatable dial readings—so that, merely by plugging the appropriate coil into the ATU, and setting up the dial readings, you are radiating on the selected band.

Significance of the RF Meter

Earlier, it was stated that on the three DX bands the 33-ft. aerial is voltage-fed on 14 mc, current-fed on 21 mc, and again voltage-fed on 28 mc. This means that on 15 metres the RF

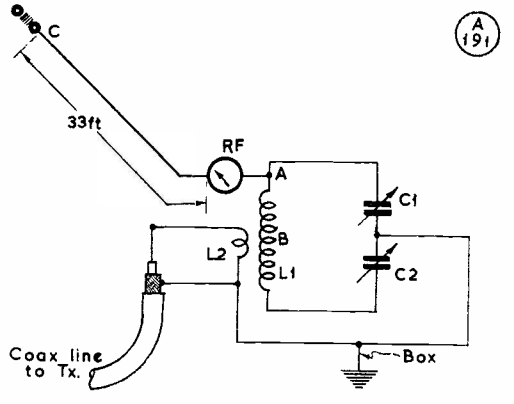


Fig. 1. Circuit of the tuner unit described in the article, the general arrangement being to accommodate a 33 ft. wire which is used half-wave on 14 mc, three-quarter-wave on 21 mc and full-wave on 28 mc. It can be tapped on at either point A or B, with the network L1, C1, C2 resonated at the mid-frequency of the band area, CW or phone, to be covered. For a 100-watt transmitter, the RF meter will need to read 0-1 amp. for safe working on 15 metres.

current indication should be a maximum—for example, if the DC input is 100 watts, and 70% efficiency is being attained in the PA (which it should be if the tank circuit is anything like adequate), from I^2R the indicated RF current should be about 1 amp.

This will (or should) happen only on 21 mc, because on that band the system is being fed at current. On the other bands, the feed is at voltage, and in theory there should be *no* noticeable current indication on an 0-1 amp. RF meter. But, in fact, the whole system will always have enough capacity to ground at the feed end to show *some* current reading. In the tuning-up procedure, therefore, the trick is simply to work for maximum deflection on the RF meter (for the appropriate settings of C1, C2, and the PA tank) whatever the band in use. On the two voltage-feed bands, the readings will be 0.1 to 0.2 amps. at most.

Construction of the ATU

The sketch at Fig 2 shows the form of construction adopted for the model. There are, of course, other layouts possible, which will be dictated largely by the size of the condensers used.

An insulating strip is mounted on the rear edge of the box by drilling, or punching, oversize holes through which the coil sockets project into the interior, well clear of metal. The strip on which the plug-in coils are mounted has banana-prongs fitted to register with the sockets. When making these mounting strips, it is advisable to get everything accurately in line, and to use the proper banana plugs and sockets, otherwise the coil becomes a force or jam fit, instead of sliding in and out easily while maintaining good electrical contact. (This may seem a small point to emphasise, but if one coil mount is badly made, and can only be forced in, it will have to be prised off with a screwdriver when it is changed, and this takes time if one is not to damage the coil in the process—we know; one of our coils is not at all a good fit!)

As the coils are relatively small, they can easily be air-wound and made almost self-supporting—in fact, they were produced by the method described in detail on p.434 of the October 1955 issue of SHORT WAVE MAGAZINE. The link winding is made of thicker, insulated wire, wound over the outside of the coil and placed at its centre.

Inside the box, all inter-connection is by copper braiding stripped from odd, unwanted lengths of coax—and the box is *not* relied upon as the ground return for the condensers. The aerial is connected to the stand-off insulator, and the box sits near the transmitter with about five feet of coax feed line across to the PA output.

As described and illustrated here, this little ATU will handle the RF output from a 150-watt band-switched transmitter without any sign of heating, and with the box itself absolutely dead to RF on all three bands. Changing bands is a matter of seconds only. The C1, C2, settings will hold over all normal VFO sweeps if the preliminary adjustment is made for the mid-frequency of the band area,

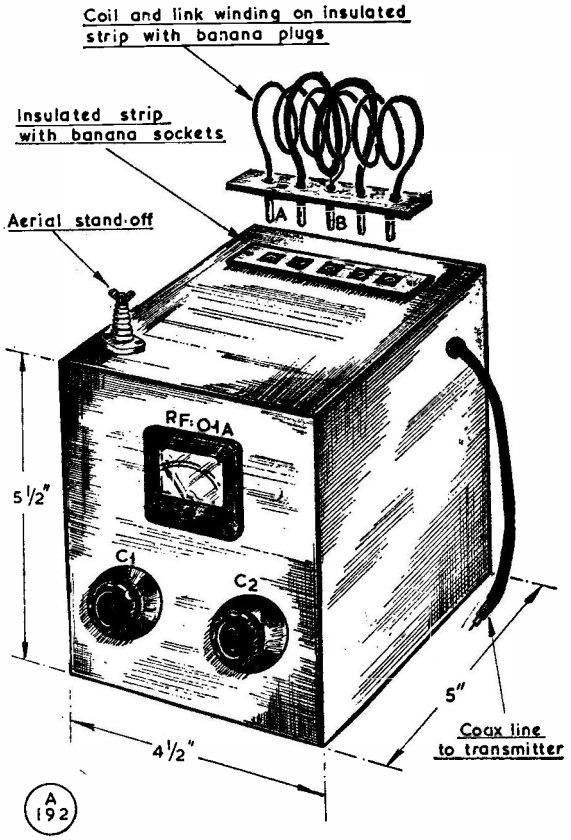


Fig. 2. General impression of the tuner unit as constructed for experimental purposes. The box is of aluminium, and plug-in coils are used to cover the three working bands.

Table of Values

Fig. 1. The End-on Aerial Tuner

C1, C2 = 38 $\mu\mu$F Jackson Bros. small transmitting type C604/SI/10

L1, 14 mc = 14 turns 16 SWG enam., 2 ins. diameter by 2¼ ins. long. L2, two turns PVC-covered wound over centre.

L1, 21 mc = 10 turns, as for 14 mc, 1½ ins. long. L2, one turn wound over centre.

L1, 28 mc = 6 turns as for 14/21 mc, 1 in. long. L2, one turn wound over centre.

RF = Thermo-couple RF ammeter, reading 0-1 amp. for inputs up to 100 watts.

either CW or phone, which it is desired to cover. It is probably a good thing to calculate the total aerial length for the mid-frequency of the 21 mc band; this will give a satisfactory average result on all three bands.

Receiver Application and Change-Over

This ATU is, of course, used with the receiver as well as the transmitter. Isolation on "send" is obtained by two open-circuiting relays in series, and a third giving a dead short across the receiver aerial-earth terminals. These precautions are dictated by the fact that full power is used in the transmitter—and it is a good receiver! So as not to upset the operation of the ATU on "transmit," one of the relays is mounted right inside the ATU box; this keeps the effective length of the receiver aerial connection down to a couple of inches, and has very little effect on the ATU tuning when the relay is open. The second "series opening," on the other relay at the receiver, is provided for safety, to make sure no RF can get to the aerial terminal, which is further protected by the dead-short on "send."

An interesting effect observed on "receive" is that incoming signals can actually be peaked on C1, C2; and on, say, 10 metres, the "sharsh" (or noise) peak as given by their reading is also that for maximum strength of the received signal *and* maximum RF into the aerial on "send."

40-Metre Application

A 33-ft. wire is quarter-wave on 40 metres and, just for the fun of it, a certain amount of transmitting has been done on the 7 mc band, to see how the system works out. Loading and feeding are, of course, as for 21 mc, and the radiating efficiency is no better nor no worse than one would expect from any other sort of quarter-wave vertical, or near vertical, aerial.

Though the set-up does work quite well on Forty—good enough, anyway, for loud talking round the U.K. and Europe—it is not here offered as being a particularly effective system for this band. For one thing, if the condenser capacities are made right for 40 metres, they will be too large for Ten, while the value for C1, C2, as used in the model, is such as to demand rather a large tuning coil for Forty. The capacities specified for C1, C2, ensure adequate coverage on each band 14-28 mc without excessively sharp tuning — yet, on Twenty, the ATU can be peaked on noise.

Conclusion

This quite simple multi-band aerial system and its associated tuning network has been discussed in some detail because of its interest and practical application from the point of view of the beginner, who may not have much space for aerials, anyway. The whole point is that, as described, it will give a good DX result on three bands with the minimum of complication. The ideas put forward (based upon practical tests) will not suggest anything very new to the experienced operator, nor to those who already have more elaborate systems, or are thinking in terms of beams. But even at that, a single-wire vertical aerial is always well worth serious consideration.

REAL AERIAL FARM

Reading an article recently on W6AM, well-known DX operator with a world-high score in Countries Worked, it was interesting to see that his aerial system consists of 12 rhombics, aimed to cover all parts of the world, and involving a total of 45 *miles* of wire! The 120 acres of land covered by this installation are planted with another "paying crop"—beans. W6AM has been actively interested in Amateur Radio since schooldays in 1912 and now goes only for DX.

FISH-PHONER FINED

It was reported in the *Times* of November 21 that one Arnold Burwood, skipper of the Lowestoft trawler *John Willment* was fined £2, with £10 3s. costs, for improper use of his radio transmitter. The case was that he was using his equipment for direct communication with his home, whereas such messages should have been routed through the appropriate Coast station. It was said in court that the G.P.O. monitoring check had disclosed that "quite 50% of the conversation on the trawler frequencies was frivolous and unnecessary chatter, causing serious congestion and hampering legitimate users in their business." Trawler operators estimate the "frivolous traffic" at nearer 80%. We can only hope that the same critical attention will not be turned to the phone areas of some of the amateur bands.

UNLICENSED BROADCASTING

The cult of "freedom radio" has spread to, of all places, Scotland. The Scottish National Party — a small but vociferous minority like the Welsh nationalists—is to support officially the clandestine activities of "Radio Free Scotland," according to a four-page newspaper called the *Scots Independent* dated December 15. What the Scots want to be freed from is not quite clear, but apparently it is all something to do with the right of free speech. Thus, "Radio Free Scotland" is an unlicensed broadcast station operating to give vent to Scottish nationalist aspirations, with the BBC as the main target.

25 Watts of Audio Power

DESIGN FOR A SPEECH AMPLIFIER / MODULATOR

IN the design of this modulator, efficiency combined with economy were the major considerations. The audio output requirement for the particular application envisaged—bench-testing small transmitters on artificial load — was a full 25 watts. This happens to be sufficient, also, to modulate a 50-watt carrier on our HF bands. For VHF working, however, the output would not be enough for fully modulating a PA running more than about 30 watts input. (The reason for this is that on two metres, and upwards in frequency, it is found that an audio power to PA input ratio nearer 1 : 1 is desirable, *e.g.* for a 50-watt carrier, one needs something like 40-45 watts of audio for full modulation.)

Circuit Considerations

With a crystal microphone, always necessitating a high-gain first stage in the speech amplifier, one of the common difficulties in amateur band working is RF finding its way on to the grid of this first valve, giving rise to all sorts of undesirable effects. These tend to increase as the frequency goes up, *e.g.* there may be no trouble on 80 metres, but a lot of it on 15 metres.

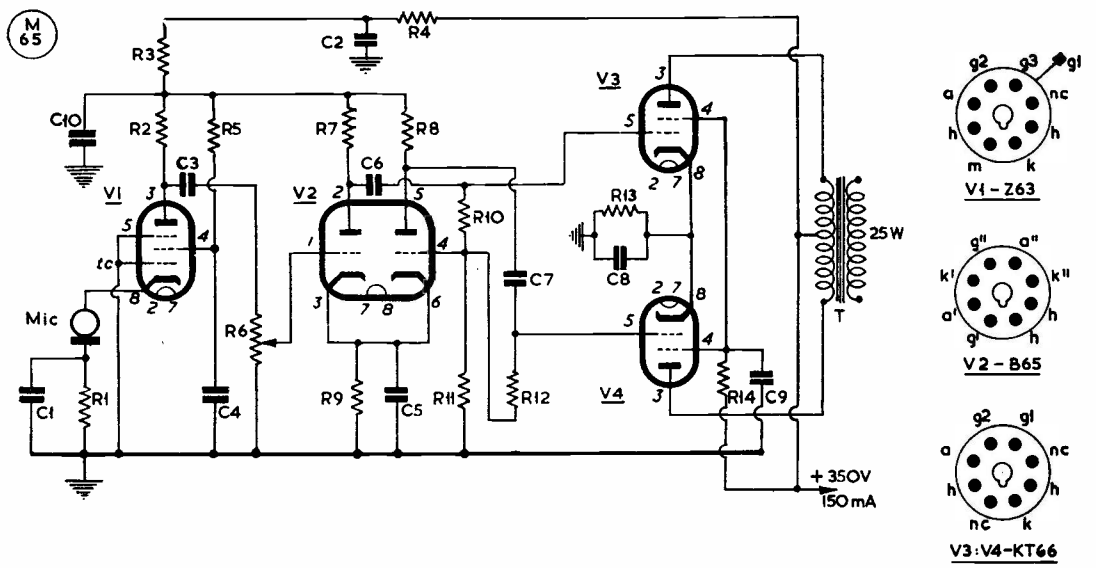
Hence, by using a microphone which gives plenty of output, these possible complications can be reduced, if not eliminated entirely. Since good carbon microphones, such as the excellent G.P.O. handset type, are available, it was decided to use one of these, thus simplifying the whole speech amplifier design in the manner shown in the circuit diagram. This also eliminates the usual microphone transformer, there being only one transformer (a Woden UM1 for output matching) in the whole modulator.

The first stage (G.E.C. Z63) is operated with grounded grid, which is thus common to both input and output circuits. The microphone (G.P.O. carbon) is connected in series with the cathode bias resistor, the cathode current of the

Table of Values

Circuit of the 25-Watt Modulator

C1	= 12 μF	R7, R8, R11	= 100,000 ohms, ½-w.
C2, C9, C10	= 8 μF	R9	= 3,000 ohms, 1-w.
C3, C4	= 0.1 μF	R12	= 220,000 ohms, ½-w.
C6, C7	= .05 μF	R13	= 250 ohms, 3-w.
C5, C8	= 25 μF	R14	= 10,000 ohms, 2-w.
R1	= 1,000 ohms, 1-w.		
R2, R10	= 200,000 ohms, ½-w.	T	= Woden UM1 matching transformer
R3	= 50,000 ohms, 2-w.		
R4	= 30,000 ohms, 3-w.	V1	= G.E.C. Z63, or 6J7
R5	= 1 megohm	V2	= G.E.C. B65, or 6N7
R6	= ¼-megohm, gain control	V3, V4	= G.E.C. KT66, or 6L6



Circuit of the 25-watt modulator. It is intended for a high-output microphone, such as a G.P.O. carbon type, and it will be noted that excitation is by cathode current of the first stage. As it stands, the speech amplifier can be used only with a carbon microphone. For a crystal type, an additional voltage-amplifying stage would be necessary, with a re-arrangement of the V1 circuit. If the power pack will give a good 350v./150 mA, 25 watts of audio should easily be obtained.

Z63 being sufficient to energise the microphone.

Remainder of the circuit follows conventional lines; a G.E.C. B65 is used as a phase-inverter, with one triode section feeding one KT66. Part of the drive voltage is fed back through R10 to the grid of the second half of the B65, the plate of which drives the other KT66. R10, R12 are intentionally made about 10% different in value in order to counteract the slight unbalance that would otherwise occur. C6, C7, can be anything from .02 to 0.1 μF, so long as they are equal in value; .05 μF gives a good result in this circuit.

Constructional Notes

This is the sort of speech amplifier-modulator that can be built up in a variety of ways—either open chassis, rack-panel, or in a cabinet. The only precaution necessary is to use screened microphone cable (outer conductor between insert and C1, R1) which should not be of a length likely to resonate at any working frequency in the RF sense. Five feet is a safe length on all bands.

It is always desirable, in any speech amplifier, to box in the first stage, so that the Z63 should be mounted in the sub-space if an open chassis is used, or in a compartment of its own with other forms of construction.

Using 350 volts HT and a pack that is capable of supplying a good 150 mA, results are excellent. The output is clean, with a total absence of hum, and none of the troubles often encountered with a carbon microphone—"frying" or "blasting" noises, with irregular speech level. Reports over the air have confirmed the side-tone check: That quality compares very favourably with that to be heard from many stations using a crystal microphone.

One other point of interest: Though the model has been constructed with the G.E.C. valve types specified here, they could be replaced by a 6J7 for V1, a 6N7 for V2, and a pair of 6L6's for V3, V4.

TWO MILLION VOLT TEST GEAR

In order to investigate the special properties of irradiated dielectric materials the research organisation of British Insulated Callender's Cables Limited have for several months been operating a two-million-volt Van de Graaff accelerator at their Wood Lane laboratories. This equipment was specially chosen for its flexibility in that it can act variously as a source of electrons, positive ions, gamma rays and neutrons.

In particular, however, the high-energy radiation thus produced is being used to modify the structure and properties of conventional polythenes. An exhaustive programme of study has been started on the physical and electrical properties of such materials after irradiation, with special emphasis on their uses as cable insulants.

The Irradiation Laboratory comprises a central generator block of two storeys, with the target room on the ground floor immediately under the generator room, flanked on each side by cable handling and control laboratories. The concrete walls of the target room are 3 feet thick to prevent the radiation in the laboratories from rising above the tolerance level, while those of the generator room in which the radiation intensity is lower, are 2 feet thick. Cable under radiation traverses the target room through two slits in the concrete walls, and is handled by conventional take-up and haul-off cable machinery.

The leakage of dangerous amounts of X-radiation and of electrons into the laboratories is prevented by covering the slits on the outside with 6 inches of lead bricks and on the inside with rubber snuggers and aluminium doors. The electron beam from the accelerator tube in the generator is scanned electromagnetically so that it emerges from the aluminium window of the scanning bucket as a beam having its longer axis parallel to that of the cable.

With these arrangements it has been found possible to process continuously polythene insulated cables. First investigations into the properties of such cables, after irradiation, have indicated that amongst other advantages, a substantially raised softening temperature results. The plant is the first in Great Britain to process plastic insulated cables in this way, and will greatly assist in the assessment of irradiated materials for general use in the cable industry.

ARRL DX CONTEST

This takes place in two sections, Phone and CW, over two week-ends for each section. Dates are: CW, February 22-24, March 22-24; Phone, February 8-10, March 8-10. *See* "DX Commentary" this issue for rules and other essential details.

THE E.M.I. ANNUAL REPORT

At the 25th annual general meeting of the E.M.I. Group, held recently, the chairman (Mr. J. F. Lockwood) reported that total sales at £53m. were £11m. up on the previous year. The trading profit was £2,417,000, representing an increase of half-a-million pounds over the year before. The chairman also said that E.M.I research and development resources in the field of radionics are now being extensively used by the Government and other large industrial organisations.

LONDON MORSE CLASS

We are asked to announce that a Morse class for candidates for the G.P.O. Test is being started at Brentford Evening Institute on January 8, at 7.00 p.m. Application to join should be made to: Mr. G. V. Mills, Brentford Evening Institute, Clifden Road, Brentford, Middlesex. The fee for the full course is only ten shillings.

Multi-Range Test Meter

AC MEASUREMENTS, FULL CIRCUIT AND CALIBRATION

PART II

The first part of this article, in our December issue, dealt with some general theoretical considerations in the design of an amateur-constructed multi-range test meter.—Editor

When selecting a wire for shunt winding, it must be such that there is no question of overheating, which would result in changing values and consequent errors. Generally 36 SWG up to 50 mA, 30 SWG to 250 mA, and 22 SWG beyond is satisfactory.

Quite often, both types of wire are used—Eureka wire for shunts between 1-10 ohms and copper wire for shunts less than one ohm. With its smaller resistance-per-inch it will be easier to use copper wire for the very low value shunts; be careful not to stretch the wire in handling as this will increase its resistance due to the lowering of the cross-sectional area.

With the wire tables and shunt formula the necessary resistances can be wound. But owing to small mathematical errors and other factors the shunts may not be of exactly the right value when actually placed in position. This can be easily remedied.

Rig up a battery and potentiometer in series with the meter—they can be any convenient value, but care should be taken not to overload the meter. With 1½ or 2 volts do not use a potentiometer of less than 5,000 ohms. With the potentiometer at *maximum resistance*, connect up and adjust until the meter registers *exactly* full scale deflection, *i.e.*, 1 mA. Then, without disturbing the setting of the potentiometer, connect the shunt—*very short* pieces of copper wire can be used to make the connection.

If the shunt is for the ten times (0-10 mA) range, the meter should read one-tenth the scale—0.1 mA. The shunt can then be adjusted until the pointer is exactly on the correct setting. Note that the resistance of Eureka wire can be altered by the simple process of running solder along it until the right value is obtained.

When the 0-10 mA range shunt has been adjusted, leave it in position and adjust the potentiometer until full scale reading is obtained. Then connect up the 0-100 mA (or hundred-times) shunt. Since the meter already has a 0-10 mA shunt across it, it is reading full scale at 10 mA; with the 0-100 mA shunt also connected it follows that 10 mA will be indicated at one-tenth FSD. On the original meter scale (marked 0-1 mA) this will appear at 0·1 mA.

This process continues until all the shunts are adjusted. It is useful to check the shunts by comparison with a meter of known accuracy but the system described is a good substitute method. On the other hand, much trial-and-error work can be avoided if the constructor has access to an accurate resistance bridge.

Measuring Resistance

No instrument of this kind is complete without at least one resistance range. Such an ohmmeter is actually a current reading meter. The movement is placed in series with a resistance (part of which is made variable) and a small battery, the values being such that with the test prods shorted out the resistance can be adjusted to enable a full scale reading to be obtained.

If, however, instead of shorting the test probes, a test resistance is placed across them the meter will register something less than full scale due to the current flow being restricted by the extra resistance in circuit. As an example:

Using the 1 mA meter and a 1·5v. battery, a resistance of 1,500 ohms would enable a full scale reading to be obtained with the probes shorted. If, instead, a test resistor of 1,500 ohms is inserted the total circuit resistance would be 3,000 ohms and the current flowing would be 0·5 mA. In such a case the scale reading of 0·5 mA means "1,500 ohms." By working out a few such simple examples the ohms range scale can be calibrated. For instance, still using Ohm's Law ($I = V/R$), if a 4,500 ohms test resistor is used the total circuit resistance would be 6,000 ohms and the current would be 0·25 mA so that this reading on the scale also indicates "4,500 ohms."

This system can be used quite satisfactorily for normal (medium) resistance measurements and many commercial multi-meters provide only one resistance range—giving readings up to 100,000 ohms on a 1·5v. battery. To provide readings above this, a higher voltage external battery and higher value series resistor is required. It is always useful to be able to measure higher and very low resistances. On

the standard range discussed accurate readings of low resistance is not possible and it is also difficult to obtain accurate readings at the high resistance end due to the cramped calibration scale.

The system mentioned is not practicable for low resistance measurements due to the fact that the voltage drop (or change in current) is so small as to be practically indiscernible. It is possible, however, to obtain a larger voltage drop across low value resistances by passing more current through the test circuit. This is done by fitting suitable shunts in parallel with the movement and series resistor —shown as Ro1, Ro2, Ro3 and RL in the full circuit opposite.

The application of the principle is simple. In the previous examples a 1,500 ohms series resistor, with 1·5 volts, gave us 1 mA full scale deflection. If a ÷ 10 range is wanted, this resistance must be reduced from 1,500 to 150 ohms (a shunt of 166·6 ohms); for a ÷ 100 range the resistance should be 15 ohms (a shunt of 15·15 ohms). To obtain higher resistance readings the series resistor and the voltage are increased in direct proportion; thus to obtain a " × 10 " scale both must be increased ten times—15,000 ohms and 15v. This is about the practical limit since a " × 100 " range would need a 150v. battery; in any case, the " × 10 " range gives readings as high as most constructors will require.

When making these calculations, the meter resistance must be taken into account. Note also that part of the limiting resistance must be variable; dry batteries drop in voltage through use and age and so some adjustment must be available. Also, a new battery may be slightly higher than the rated value and a little extra resistance is then available to allow for this. When the battery ages, the setting of the variable resistor can be adjusted to enable the correct current to flow. Since it is generally recognised that 1·2v. is the lowest at which a 1·5v. battery can be used with any degree of reliability, the circuit resistance can be arranged so that when the battery falls to this level it is impossible to get FSD on the meter, thus providing a hint that the battery needs replacing.

The potentiometer Rp is of low value to avoid the danger of meter damage due to excessive current flow. It will also be clear that the potentiometer should be adjusted each time resistance measurements are made; this by shorting the test probes and adjusting until FSD is registering. The resistance is thus called the Zero Adjuster.

Although often used in home built (and some commercial) test sets the series-type zero adjuster has one disadvantage. When the battery is delivering its full 1·5 volts, the total circuit resistance will be 1,500 ohms for full scale reading. With a 1,500 ohm test resistor (giving 3,000 ohms total in circuit) the meter will read half scale (0·5 mA). Now when the battery runs down less resistance is needed to obtain a similar deflection. For instance, if the battery is down to 1·25 volts, half scale is obtained with a total resistance of 2,500 ohms in circuit. As the limiting resistance total must be 1,250 ohms to obtain FSD at 1·25 volts, it is obvious that half scale deflection will be obtained with a test resistance of 1,250 ohms (2,500-1,250) applied. In other words, the midway point on the meter scale could be calibrated as " 1,500 ohms " or " 1,250 ohms " according to the condition of the battery.

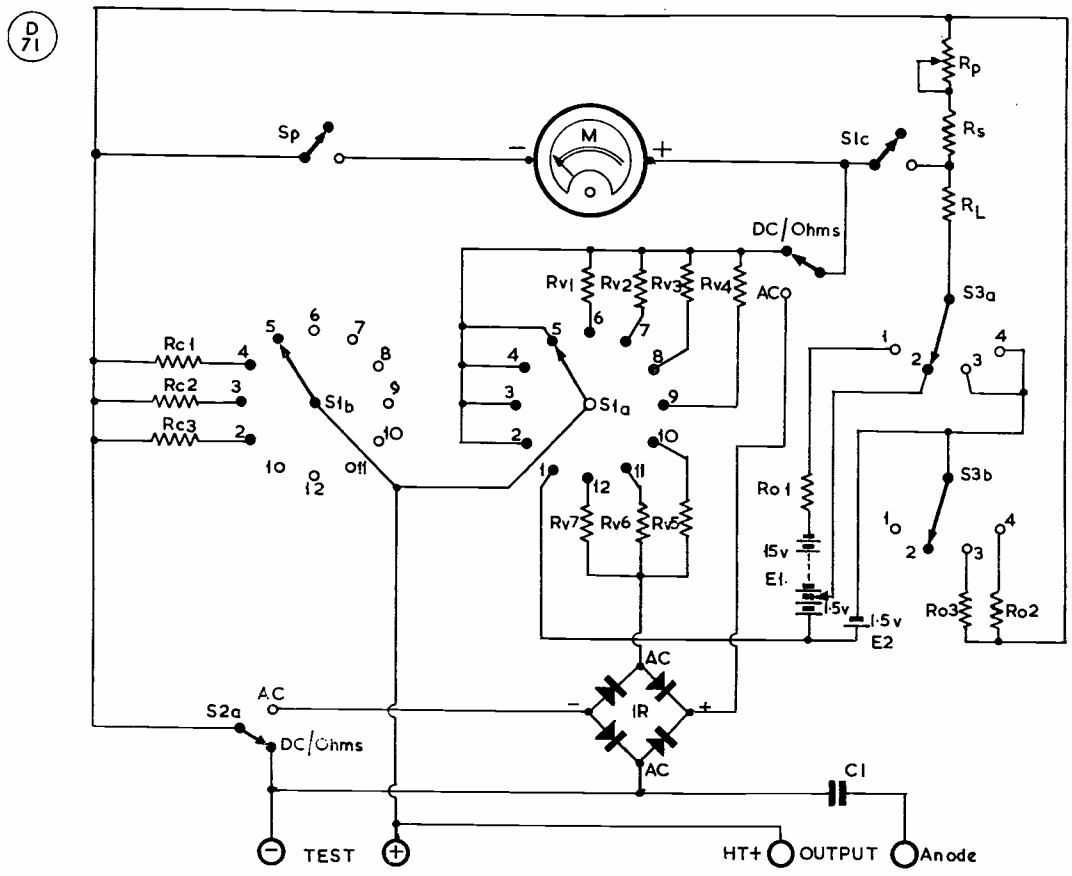
Greater accuracy can be obtained by using the shunt-type zero adjuster, consisting of a fixed and variable resistor in series, put in parallel with the meter.

The zero adjuster should be of the wire-wound type, preferably with the Ohms On/Off switch combined, if this is part of the system (*see* later). If low resistance ranges are used, the shunts must be capable of carrying heavy current without overheating, and so they should not be of less than 30 SWG wire. These shunts can be made in the same manner as described for the current-range shunts.

Owing to the heavy currents flowing when the shunts are in position, the battery should be of a type designed to withstand such current drain.

To check the accuracy of the resistance range shunts, it is necessary to obtain a resistor of known value which will give a reading somewhere about mid-scale on the respective ranges. In the instrument shown in the circuit, mid-scale on the fundamental range is 1,000 ohms, so that the ÷ 10 range has a mid-scale point of 100 ohms. With the shunt in circuit, the probes are shorted and zero adjustment carried out. Then the known 100 ohms test resistor is inserted—if the reading is not mid-scale the shunt must be adjusted, noting that each time the shunt is altered in value the meter *must* be re-adjusted for zero setting.

On the ÷ 100 range, if used, the central reading would be 10 ohms, and the same process is repeated, except that a 10-ohm test resistor is used. Incidentally, the test resistors (in this case 100 and 10 ohms) can be made



Circuit complete of the Multi-Range Test Meter built up from the detailed information given in the article. It is a very versatile instrument giving both A.C. and D.C. readings over a wide range, with resistance scales; it can also be used as an output meter With an 0-1 mA FSD low resistance moving-coil instrument, and taking the resistor values given in the table, calibration would be near-enough for most practical purposes. For final accuracy, the various ranges must be checked against either a standard test meter or known sources of voltage and current, and values of resistance. *(The switch below S1c in this diagram should be marked S2b).*

Table of Values

Circuit of the Multi-Range Test Meter

Current Shunts

Rc1 = 11.11 ohms
Rc2 = 1.01 ohms
Rc3 = 0.1 ohms

Voltage multipliers

Rv1 = 900 ohms
Rv2 = 9,900 ohms
Rv3 = 100,000 ohms
Rv4 = 1 Megohm
Rv5 = 8,250 ohms
Rv6 = 90,000 ohms
Rv7 = 450,000 ohms

Ohms range resistors

Ro1 = 9,000 ohms
Ro2 = 111.1 ohms
Ro3 = 10.1 ohms
RL = 925 ohms
Rp = 300 ohms, wirewound
Rs = 200 ohms

Switch positions

(S1) : 1, ohms ; 2, 0-1000 mA ; 3, 0-100 mA ; 4, 0-10 mA ; 5, 0-1 mA (normal scale, no shunt) ; 6, 0-1 V DC ; 7, 0-10 V DC ; 8, 0-100 V DC ; 9, 0-1000 V DC ; 10, 0-10 V AC ; 11, 0-100 V AC ; 12, 0-500 V AC.
(S3) : 1, high ohms (x 10) ; 2, normal ohms range ; 3, low ohms ; 4, very low ohms.

NOTE : When making tests, S2 must be at appropriate position (AC or DC/Ohms).

Switches

S1 Twelve-way, two-pole (if S1C is included, this should be twelve-way, three-pole).
S2 Two-pole, two-way
S3 Four-way, two-pole
Sp Meter on/off. Can be of the press-button type or standard low resistance make and break type.

Miscellaneous

M = Moving coil movement 1 mA FSD, 100 ohms internal resistance
IR = 1 mA instrument rectifier.
E1 = 15 volt grid bias block
E2 = 1.5 volt cell, high current type
C1 = 4 μF (only needed if Output Meter facilities are required).

up from 30 SWG Eureka wire and measured on the basic and ÷ 10 ranges respectively.

AC Voltage Ranges

If required, AC measurements can be made available. Here the requirements are less exacting. A low voltage range (say 0-10v.) is desirable for measuring heater voltages ; a high range (say 0-500v.) is useful for checking

mains voltages and rectifier input voltages ; an intermediate range (say 0-100v.) will be useful where the constructor needs accurate measurement of heater circuits in AC/DC equipment.

The measurement of current in AC circuits is seldom required, since continuity tests are all that are necessary — used in conjunction with voltage checks. This is just as well, because on the higher current ranges it is necessary to use a current transformer, shunts being quite unsuitable. Such transformers are difficult to obtain and are not an easy proposition for the home constructor.

The AC voltmeter is essentially the same as the DC voltmeter already described, except that a small instrument rectifier is necessary. On the higher ranges, the existing meter scale can be used, as the AC scales will be substantially linear. On the low AC voltage range, however, the scale shape will be distorted owing to the forward resistance of the rectifier, which becomes an appreciable fraction of the total meter resistance. Thus, the resistance of the rectifier varies according to the current flowing through it. This can be overcome by the use of a potential transformer to step up the test voltage to a higher value, so that it can be applied to a meter range which has adequate swamp resistance. In this way, a satisfactory scale shape and low temperature errors are obtained. The construction of a suitable transformer is, however, not for the inexperienced.

The average constructor will find it convenient to calibrate the low AC range on the existing scale plate. There are several methods of so doing, but the easiest is by tape measure! You will need a source of AC somewhere above 10 volts (such as two 6·3 volt windings on a power transformer connected in series), a heavy duty wire-wound potentiometer (of between 50-100 ohms), a length of Eureka wire, a knife edge (a razor blade is suitable) and a long tape measure. The potentiometer is across the AC supply, with the slider taken to one side of the meter. The other side of the meter goes to the razor blade slider, which runs on the Eureka wire stretched along the tape measure ; the ends of the Eureka wire are between the potentiometer slider and one side of the AC supply.

The actual resistance of the Eureka wire is of little importance, but 34 SWG (3·6 inches per ohm) is satisfactory. The knife-edge is arranged so that the full length of the wire is across the meter. The wire is cut to a specific length of not less than five feet.

Having set up the bits and pieces, apply the AC voltage and adjust the potentiometer until the meter reads full scale (the range-switch, of course, must be set to the 0-10v. range). The rest is simple arithmetic ; if the length of wire is 5 feet (60 inches) and equals 10 volts, then 9 volts will be obtained when the knife edge is connected to 9/10ths of five feet (54 inches), 8 volts at 4-5ths (48 inches), 7 volts at 7/10ths (42 inches), and so on. Put in another way, the tape measure calibration provides an equivalent comparison of six inches per volt.

As each adjustment is made, not the relevant scale reading on the existing scale so that it can later be calibrated for the 0-10v. AC range. It will be noted that the scale becomes progressively more cramped as the lower voltages are applied.

Practical Instrument

It should now be possible for the reader to piece together a simple multi-meter using the current, voltage and resistance circuits described.

The actual selection of ranges can be made by switching or by plug and socket. The former is more convenient, but both systems are used commercially. Some users prefer plug and socket selection on the grounds that one is less liable to make mistakes in range selection and so reduces the risk of damaging the meter. One disadvantage with the plug and socket method is that, on the current ranges, as soon as the plug is withdrawn from the range socket, the shunt is out of circuit and the meter will be destroyed, due to the heavy current flowing through it. This, of course, could only occur when range-changing is attempted with the test circuit connected—a practice not recommended on *any* instrument —but it does show that a moment's thoughtlessness could ruin the movement.

This also applies to simple switching systems where there will be no shunt in circuit between the make-and-break of successive switch positions. It is possible to arrange the switching so that the rotor of the switch makes contact with the following position before it disconnects with the previous position. Switches for range selection must be of the low contact resistance rotary type, this being particularly important with the current ranges. Simple on/off switches must also have low contact resistance. All these meter switches could be of the types specially made for the purpose, but failing this, an efficient self-cleaning type of

the Yaxley pattern is usually satisfactory. Standard toggle switches are *not* recommended for the simple make-and-break positions, as any resistance in the contacts will cause erratic readings and general inaccuracy.

As a useful refinement, a press-button switch can be incorporated ; if it is of the type which is pressed and rotated, it is necessary to rotate in the opposite direction to release it. One advantage is that no reading is possible until the switch is depressed—the time lag necessary to perform this operation enables one to re-check that the range selection is correct. If such a switch is incorporated, it should be placed in the positions marked " Sp " in the main circuit diagram.

We now come to a practical application of the preceding notes. The circuit shows a complete AC/DC Test Meter designed on the foregoing principles. It provides four DC current ranges, four DC voltage ranges, three AC voltage ranges and four resistance ranges.

Selection is by switching throughout, the main selector being S1, which is a 12-way, two-pole rotary type, and carries all ranges except those for ohms. Current shunts are assembled on one section and the voltage multipliers on the other ; the functions and values for all resistors are given with the circuit diagram.

Switch S2 is to bring the rectifier into circuit for the measurement of AC voltages. Switch S3 is a four-way two-pole rotary for selection of the resistance ranges. It should be noted that switch S1c must be closed when using the ohms ranges, but open when using the voltage and current ranges. It can be conveniently ganged to the S1 assembly or, alternatively, S1 can be a three-pole unit using the additional wafer for S1c. This switch could be separate, but ganging to S1 is recommended, as this will prevent accidentally leaving S1c set with the zero adjustment shunt in circuit when measuring voltage or current. Sp can be of the push-button type already mentioned, or may be a low resistance on/off type. The two additional test terminals marked " Output " are optional, but may be useful when the AC voltage section is employed as an output meter in lining up sets, checking frequency response, and so forth.

Output Tester

If, when making output tests of this kind, it is considered better to disconnect the loudspeaker, then a dummy load must be provided across the voltmeter terminals, *i.e.*, across the " Test " terminals—the probes being across the " Output " terminals. As most sets use tetrodes or pentodes as single-ended output valves, it is generally satisfactory to use a 10,000 ohm resistor for the load ; if in doubt about load impedance, consult the data on the output valve being used. Under these conditions, the 100v. AC range at FSD will equal an LF output of 1 watt and the 500v. AC range will give a full-scale reading corresponding to 25 watts AF. There is little point in calibrating a " watts " scale, since for most purposes one needs only a relative reading for comparison checks.

As regards construction, this will depend on personal taste, and it is not critical by any means. A suggested layout would be a sloping panel with the meter centred, and the control switches disposed symmetrically round it, with the terminals mounted along the bottom edge.

TABLE OF WIRE DATA

Copper Wire Data

Gauge	*Length per Ohm*	*Ohm per Yard*	*Safe Current*
40 swg	27.15 inches	1.326	70 mA
36 swg	68.04 inches	0.529	150 mA
32 swg	137.52 inches	0.262	400 mA
30 swg	181.08 inches	0.199	500 mA
26 swg	381.6 inches	0.094	1 Amp
22 swg	921.6 inches	0.039	2.5 Amps
18 swg	2714.4 inches	0.01327	7 Amps

Eureka Wire Data

Gauge	*Length per Ohm*	*Ohms per Yard*	*Ohms per Pound*
40 swg	0.98 inches	37.18	177,744
36 swg	2.4 inches	14.84	28.308
32 swg	4.9 inches	7.25	6,950
30 swg	6.5 inches	5.57	4.000
26 swg	13.7 inches	2.64	900
22 swg	33 inches	1.10	153.6
18 swg	97 inches	0.37	17.8

TA-12D FREQUENCY COVERAGE

Following on from the conversion details given on the TA-12*B* in the October-November, 1956, issues of SHORT WAVE MAGAZINE, there has been a lot of discussion and some correspondence as to what bands other " marks " of TA-12 cover. If you are lucky enough to have a TA-12, of any mark from A to H, the coverage can easily be checked by getting the VFO section into operation and tracking the band against the receiver calibration. For instance, by this test, it has been established that the TA-12*D* covers: Channel 2, 1.95-3.60 mc ; Channel 3, 3.0-5.0 mc ; Channel 4, 4.3 to 7.0 mc (just). In all TA12's, Channel 1 is the MW range 300-600 kc. In all unmodified TA12's, the VFO section can be got going by connecting one side of the (12-volt) LT supply to pin 1 on the supply panel ; earth, other side of LT and HT neg. to pin 2 ; and 250-300v. HT to pin 11. The switching on the transmitter will then bring in the four VFO units in turn.

Beam for Four Metres

LOW-COST YAGI—DESIGN AND CONSTRUCTION

J. A. BRATBY (G3GVA)

Here is a well-designed beam for the 70 mc band, easy and cheap to construct, and capable of giving good results if put together exactly as described. Indeed, to get the full gain from it, the design should be followed in detail. The author also makes an ingenious suggestion for the provision of stand-off insulators to mount the elements.—Editor.

WITH the introduction of the new 4-metre band, it is safe to assume that it is going to be widely used. One snag is the fact that the band is only available for two years. Consequently, in thinking about the aerial to be used, the average operator is not going to countenance any considerable cash outlay. Obviously, some will be in a position to put up beautifully fabricated arrays, but the vast majority will want the cheapest aerial possible. This article is written with the financial aspect is mind, and it can be said that the design as given here can be duplicated for about 10-15 shillings. It is the result of experiments carried out with similar aerials in Band II (87.5 - 100 mc).

In view of the frequency to be used, and in order to keep the construction as simple as possible, the design chosen is a three-element wide-spaced Yagi. The advantages of using a four-element type are (1) About 3 dB actual gain over the three-element type, and (2) Sharper directivity. In many respects, the three-element beam is simpler than the four-element, so it was decided to forego the advantages offered by the extra element.

In choosing the materials to be used in the construction, the main idea was to keep the cost as low as possible. Dural tubing being comparatively expensive, an alternative was called for; copper-plated tubes, one foot in length, are available for as little as half-a-crown a dozen, and are ideal for the job. A little over five shillings will bring sufficient rods to make all the elements required. The boom and element supports are formed from one-inch square timber (at about twopence a foot). Roughly twenty feet will be needed, and this can be obtained ready planed at the local builders' merchant. The cost of ceramic stand-offs and Terry clips is saved by using odd lengths of half-inch diameter coax cable. A small quantity of aluminium paint will protect the whole assembly against the effects of the weather. Construction of the folded dipole element is shown in Fig. 2, with the correct dimensions for obtaining 300-ohms impedance at the feed point.

Putting It Together

At this QTH, the first thing to be tackled was the construction of the boom. Two pieces of 1 in. x 1 in. cut to 68 inches are laid side by side, with their inner surfaces exactly 10 inches apart—*see* Fig. 1. A piece of half-inch thick five-ply, twelve inches square, with a one-inch diameter hole at the dead centre, is screwed to the two pieces of one-by-one, as shown in the diagram. Next, three pieces of one-by-one are cut to exactly three feet in length, and screwed to the two parallel lengths on the opposite side to the piece of five-ply, one at each end and one exactly half-way along. A quarter-inch hole is bored at each of the points marked "X" for mounting the element stand-off insulators. Two more pieces of one-by-one are cut to 12 inches and mounted on the same side as the element supports, as shown on the diagram. (These are the securing pieces for the one-inch diameter broomstick used for rotating the beam head.)

This completes the construction of the boom, and it can now be given a coat of aluminium paint. Whilst this is drying, the element stand-offs can be made. A total of eleven of these is required, and the construction is made clear in the diagram—Fig. 3. When the paint on the boom is dry, these can be inserted in the holes drilled in the element supports. These holes are purposely drilled undersize, and then filed out, using a rat-tail file, until it is just possible to force the polythene stand-offs in and obtain a really tight grip.

If copperised steel tubes or rods are used,

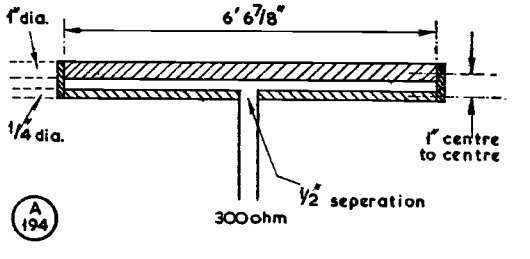


Fig. 2. Dimensions for the folded dipole element. Dissimilar diameters are only necessary if a 4-to-1 ratio is required to match in 300-ohm line (see text).

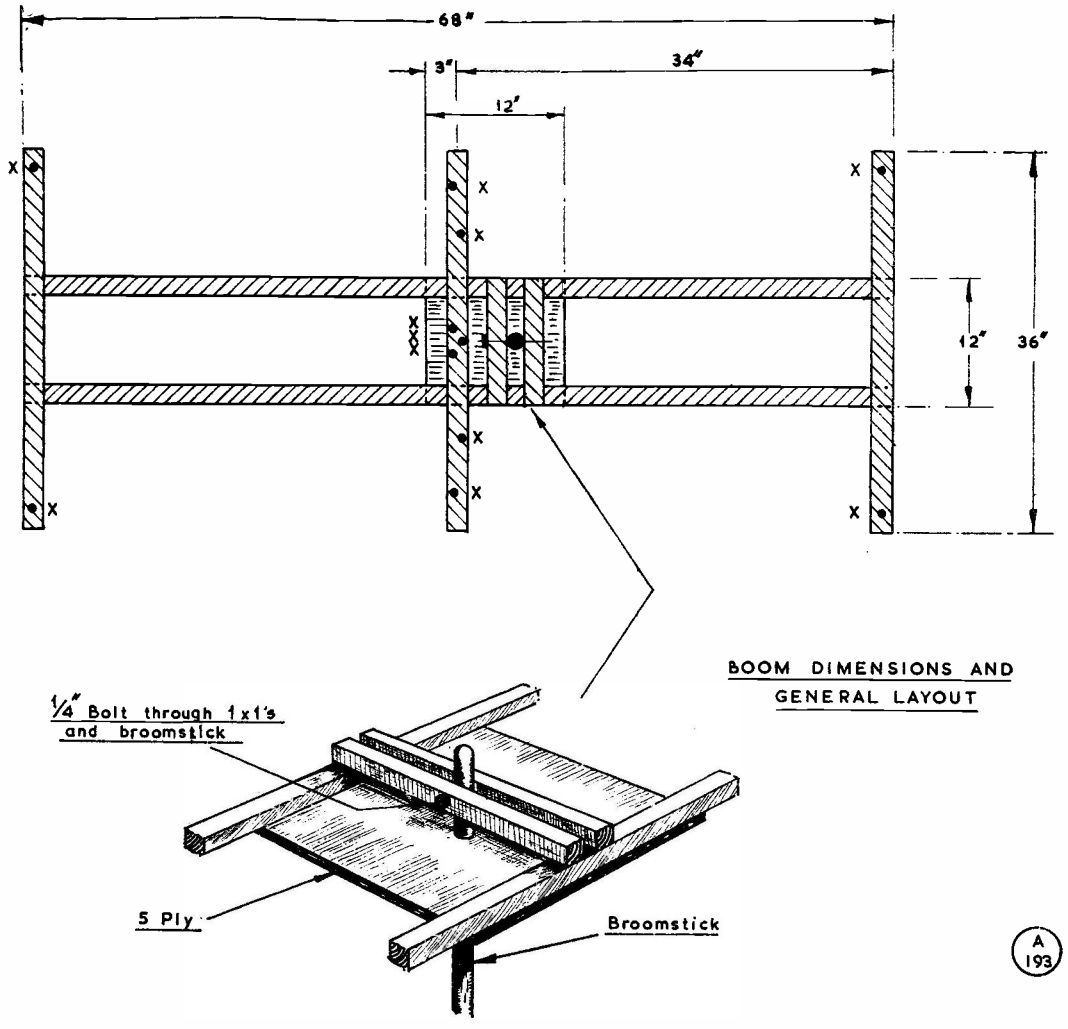


Fig. 1. General layout for the mechanical assembly of the three-element beam for 4 metres, with all necessary dimensions. Points "X" are the element mounting positions. The timber is "one-by-one" and the cradle is mounted on a rotatable pole at its point of balance.

the next job is the making up of the elements—*see* Fig. 4. This is commenced by cleaning the rods (if used) with emery cloth, taking care not to remove *all* the copper plating! Then the rods are plugged together to make up the following lengths: One at 7′ 1″; one at 6′ $6\frac{7}{8}$″; one at 6′ $4\frac{3}{4}$″; and two at 3′ 3-3/16″. (It will be necessary, of course, to cut some of the rods down in size to arrive at the correct dimensions.) Then all joints are well and truly soldered, using a reasonably large iron. Make sure that, in joining tubes together, the seam on each is in line with its neighbour, since the intention is that the seam should lie on the underside of the element, and so prevent water getting inside the tube.

Having made the elements, they can be fitted in the element stand-offs and soldered in position. To ensure accurate alignment of the elements, it is best to put a pencil mark at the exact centre of both element and element support. Then it is merely a matter of sliding the elements through the stand-offs until the two marks coincide. The two short elements are the broken part of the driven section, and should be spaced exactly half-an-inch apart at the centre. The ends of the folded element are strapped with short lengths of braiding removed from heavy coax, which has been flattened and tinned. The whole of the assembly can now be given a further coat of aluminium paint, and the first coat applied to

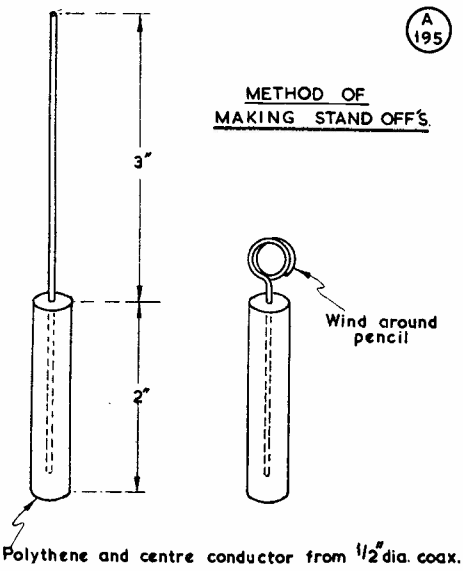


Fig. 3. Construction of the home-made stand-off insulator, from odd pieces of coax. The centre conductor makes the grip for the element.

the elements (taking care to leave sufficient of the driven element unpainted to permit soldering on the feeder line). Fig. 5 shows how the elements can be mounted. From the foregoing, and the drawings, it will be seen that the construction of the beam is very simple, and that no special tools or materials are required. The elements themselves can, of course, be dural tube, if that is preferred, or the copperised rod elements cannot be obtained. Another possibility is the telescopic whip-type tank aerial sold as "surplus" for a few shillings. In

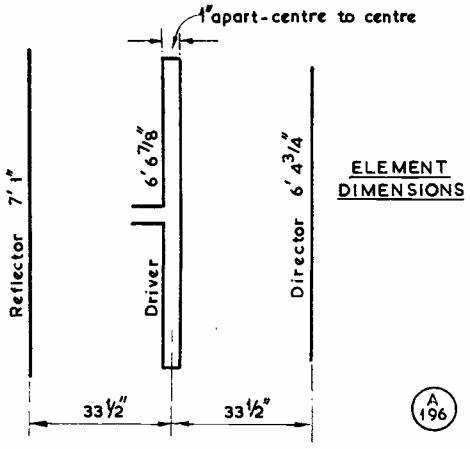


Fig. 4. Dimensions and spacing layout for the elements of the four-metre beam. Lengths are for 70.3 mc and spacing is 0.2 wavelength.

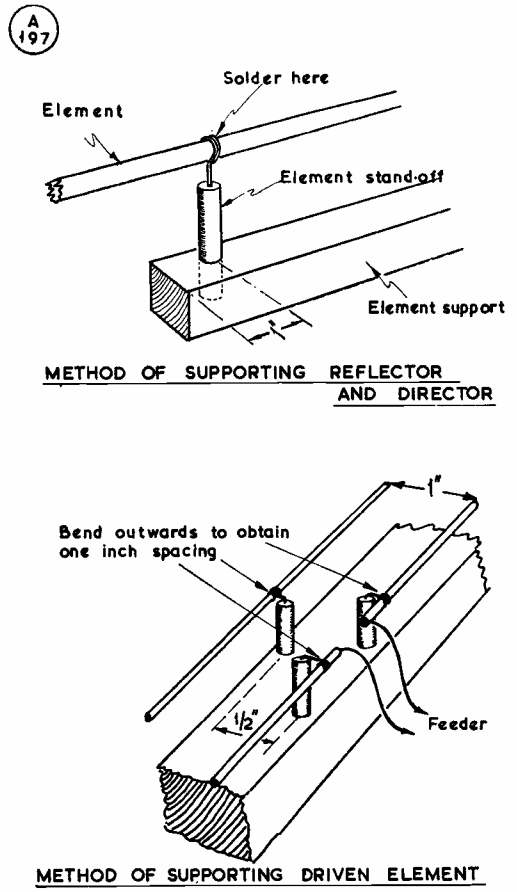


Fig. 5. Detail of the mounting of the elements for the four-metre beam, using the simplified stand-off insulators suggested by G3GVA.

writing this article it was felt that a description of the construction should come first, since after reading a lot of technical "gen" about decibels gain and feed impedances, some of us are too mentally exhausted to read on!

Feeding

The beam itself is a three-element Yagi, with the elements spaced 0.2 of a wavelength apart, as shown in Fig. 4. With this arrangement, the radiation resistance becomes 18 ohms, and it is immediately obvious that an impedance step-up of 4 will give 72 ohms. This is easily achieved by using a folded element as the driven one, so enabling 70-80 ohm twin feeder to be connected direct, or coaxial cable of the same impedance to be connected through a simple matching transformer ("bazooka"). For those wishing to feed with 300-ohm line, a step-up of 16.6 is required, and a very close approximation to this can be obtained by using a folded element

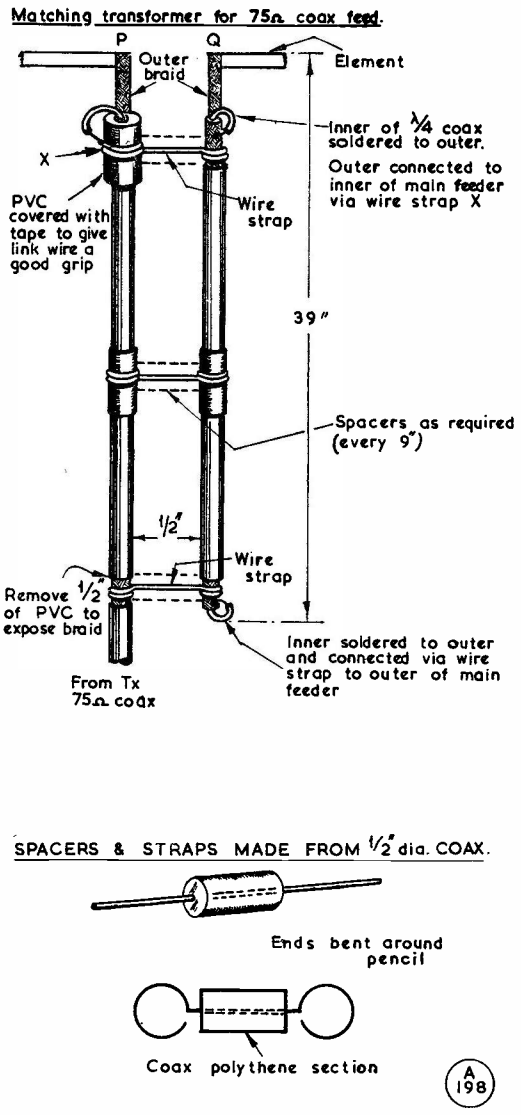


Fig. 6. Matching device for 75-ohm coax feed, balance-to-unbalance converter. The alternative is direct feed at points P-Q using 300-ohm ribbon (or tubular line), with the folded dipole dimensions given in Fig. 2.

with the dimensions given in Fig. 2. This will give a step-up of 16-1, and an exact match can be obtained by altering the spacing slightly —though it is felt that the improvement obtained by doing so would be negligible. Note that the dissimilar diameter elements are required only in the case of a 300-ohm feed line.

The gain over a simple dipole is claimed to be 9 dB for a three-element beam of this type. Reducing the spacing to 0.1 of a wavelength, and altering the lengths of the reflector and director to suit the closer spacing, will reduce the gain by 2 dB, and the radiation resistance will become 5 ohms. Despite the greater simplicity in constructing a close-spaced beam, it was felt that the difficulty experienced in matching, and the large changes in radiation resistance for slight changes in element positions and lengths, make the wide-spaced job the easier to tackle.

Some may argue that the diameter of the elements used is too small, but the point is that a large ratio of diameter to length is only required if the beam is to be used over a fairly wide band of frequencies. Since the four-metre bandwidth is only 200 kc, it is felt that the larger diameter elements would prove no better than the small diameter rods used in this design.

No pruning or alterations made to a beam of the type described will improve its performance. This is another point in favour of the design—meaning that it can be put up, the feeder connected and the transmitter loaded without fuss or quibble.

The dimensions given are for 70.3 mc, and no difficulty should be experienced in covering the whole of the band, since the use of the folded driven element will give the array a reasonably wide response. If it is intended to use *coax* for feeding, it will be necessary to make up the simple matching device, as already mentioned, since the array is balanced and the coax is not. Made in the manner indicated in the diagram, the " bazooka " should present no constructional difficulties.

No details are given of the method of rotation, since individuals will have their own ideas about this. At G3GVA a broomstick is driven by a small electric motor mounted well up the mast. Those intending building this array are advised to give considerable thought to the problem of rotation. Jerking the thing round by pieces of cord tied to each end of the boom has its limitations. A beam can only be used really successfully if it can be rotated from the operating position.

LECTURES ON TRANSISTORY

A course of eight lectures on Transistor Physics and Transistor Applications has been arranged for Thursday evenings, 7.00-9.00 p.m., commencing on February 7, at the South-East London Technical College, Lewisham Way, S.E.4. The fee for the course is £1, and personal application to join it can be made any evening, 6.30-7.00 p.m., after January 6, at the College, or by post enclosing the fee and the name and address of the applicant's employer. Nearest station for the College is St. John's, S.R., or buses 21, 36, 149, 192, 704, 705.

Single-Valve Crystal VFO Mixer

EXPERIMENTAL OSCILLATOR CIRCUIT

THE crystal-VFO mixer type of circuit for generating the transmitter drive frequency is quite well known, but is not used as much as it might be. For one thing, the principle ensures high-stability output with very simple construction, and, for another, it is a practical and useful way of employing those odd-frequency crystals, outside any band, which so many of us seem to have acquired over the years. Thirdly, and probably most important, the LF oscillator, which is the variable element, can be accurately calibrated over a wide frequency range.

For those interested in a full constructional design based upon this principle, it might be mentioned that an article in the February 1954 issue of SHORT WAVE MAGAZINE deals with the subject in detail. The purpose of the present note is to discuss a simple one-valve type of crystal-VFO drive oscillator, which will be of interest to the experimenter looking for something new to try on the bench. He might well emerge with the best VFO unit he has yet possessed.

By using a multi-electrode valve—a G.E.C. X61M, which could be substituted by a 6K8—both oscillator circuits are combined in one envelope, so to speak, as the circuit diagram shows. In the model, a 5905 kc crystal is used in Section A, and an LF oscillator tuning 1000-1500 kc in section B. The "A plus B" result is thus 6905-7405 kc, which is selected in the 7 mc output circuit tuned by C5; drive to the succeeding buffer amplifier stage is taken through C6.

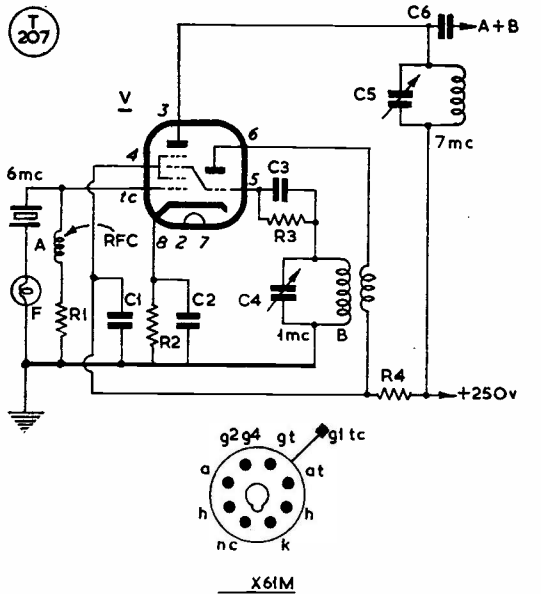
The section B circuit can either be coils wound for the purpose or a commercial product of the appropriate range having the usual "grid-reaction" or "grid-aerial coupling" windings. If the oscillator tends to squeg, HT should be reduced by increasing the value of R4. This can be checked by listening over the B-range on the receiver; the beat should be clean, strong and absolutely T9x.

Some Practical Points

The crystal oscillator, A-section, is mounted, together with the valve, above chassis; the 7 mc output tuned circuit is on the same level. The section-B oscillator, with its calibrated variable condenser C4, is sub-chassis, with a slow-motion driving head on the condenser.

The low anode-grid capacity in section A permits the valve to be run with fairly high screen voltage, thus increasing the CO output. The crystal fuse F should be included, because it will prevent that item being blown by over-excitation.

To get going, procedure is as follows: Cut the B-section HT supply, and tune the crystal oscillator side in the normal way. Then switch in the LF oscillator and adjust for minimum dip. Listen on the receiver, and find the setting on C5 that gives output in the 7 mc range. The readings of C4 and C5 will react, in that a wide change on C4 will necessitate a readjustment on C5 for minimum plate current, and hence maximum output at the A-plus-B frequency. These points amount to the "feel of the circuit" and are best established by careful checking of the output against the receiver (for



Circuit of the experimental Crystal-VFO mixer circuit, in which the A (crystal) and B (tunable) frequencies are combined to produce the required output frequency for driving the succeeding stage. The whole advantage of this arrangement is that the variable oscillator works over a relatively low frequency range, which greatly simplifies the problem of stability.

Table of Values

Crystal-VFO Mixing Circuit

C1 = .005 μF
C2 = .005 μF
C3 = .0005 μF
C4 = 250-300 μμF tuning
C5 = 50-100 μμF tuning
C6 = 50 μμF
R1 = 50,000 ohms
R2 = 500 ohms
R3 = 50,000 ohms
R4 = 25,000 ohms
A = 6 mc crystal (*see text*)
B = To tune 1,000-1,500 kc (*see text*)
F = 100mA bulb fuse
V = G.E.C. X61M, or 6K8

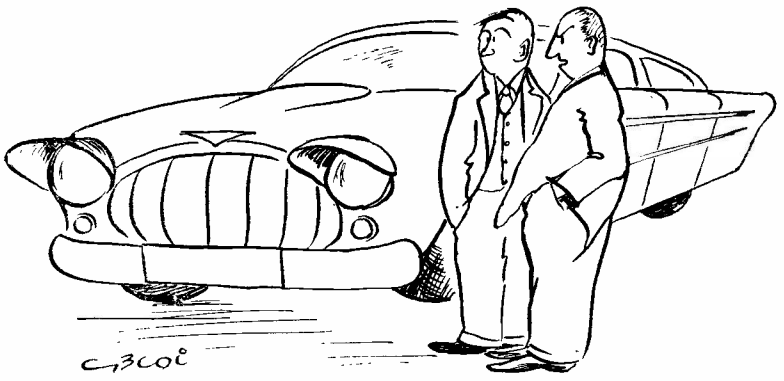
calibration) and in terms of grid drive into the following stage (for output).

Since the A-frequency will be present in the output circuit, there are two particular points to watch: If coupling into the buffer is too tight, both frequencies (A and A+B) may be drawn if the output tuning is too near the A-frequency. "Too near" cannot be defined in precise terms, because it depends very much on the *Q* of the circuit tuned by C5. But, obviously, if the crystal frequency is well outside the band, it is not likely that the output circuit would ever be tuned near enough to the fundamental (crystal) frequency to draw both.

With the model, it was found that RF output over the whole 7 mc range was ample to drive a 6AQ5 doubler to 14 mc for an 807 PA running at 25 watts.

As regards stability—which was the object of the whole experiment—the drift on the 7 mc output, checked against a BC-221 and also one of the BC stations HF in the band, was only a matter of a few cycles over a four-hour test run. Clearly, the stability depends upon the quality of the B-section of the circuit. But this is not difficult to achieve over 1000-1500 kc.

The actual choice of crystal frequency and LF range to tune on the oscillator will, at first, appear to depend mainly upon what is available. But, in fact, one has to be a bit careful to make sure that neither harmonics of the crystal fundamental *nor* of the LF oscillator fall within the amateur bands. The system can still be made to work even if they do, but it makes VFO setting under operating conditions rather difficult, not to say confusing, and some stage in the transmitter chain may pick up the wrong frequency; there is, in any event, obviously a limit to how close the wanted output frequency can be brought to the crystal frequency. You *can* make the whole circuit sound like an Egyptian bagpipe band!



". . . . No, I think a centre-loaded whip would be a bit ostentatious . . . ."

COLLINS RADIO COMPANY

The famous American firm, of Cedar Rapids, Iowa, has an English subsidiary, the new managing director of which is Mr. J. R. Pernice, who until recently has been in charge of electronics in one of the divisions of N.A.T.O. In Europe and the U.K., the Collins Radio Company of England, Ltd., 242 London Road, Staines, Middlesex, have a large maintenance commitment for their equipment used by international air carriers, the American services, and other commercial customers. It is an interesting fact that Collins, now a big concern in the international field, started in the mid-1930's as suppliers of custom-built equipment for the purely amateur market, in which, of course, they still operate. Much of their success has undoubtedly been due to the original connection with so many professional radio engineers who hold amateur operating licences. This is a point quite lost sight of by some British radio manufacturers, who too often fail to realise that many of the influential professional people in the world of electronics and radio communication are, or have been, radio amateur operators by inclination. The Americans, on the other hand, have always appreciated this, and firms like Hallicrafters, National and Barker Williamson—to mention only a few now doing big business in the commercial field—are in the same bracket as Collins. Whatever else they do, they still pay close attention to the amateur market and maintain a high level of advertising in their national Amateur Radio periodicals.

QSL BUREAU NOTE

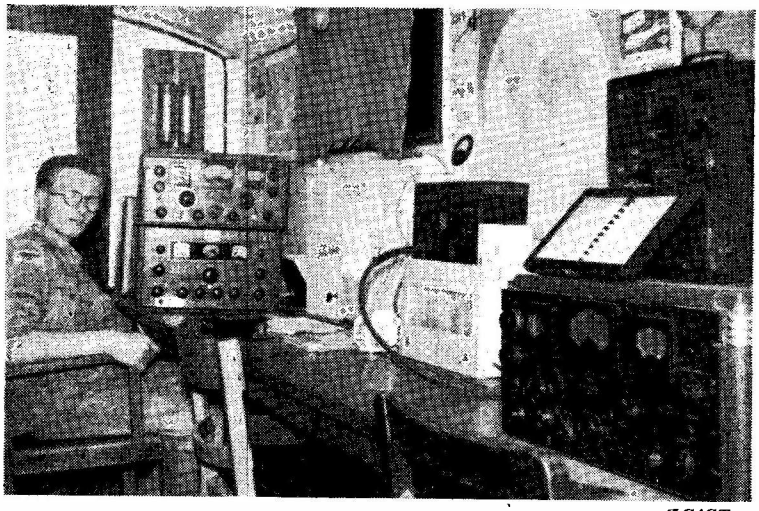
Readers using BCM/QSL are reminded that if they expect their cards back through our Bureau, their own cards as sent out should, naturally, bear the imprint "Pse QSL via BCM/QSL, London, W.C.1." At the present time, we are handling a great many more cards outwards than inwards simply because the return routeing is not clearly stated. *We* don't mind this, but it is the obvious answer to those who say they only get a small proportion of their return-QSL's *via* our Bureau.

JANUARY SSB CONTEST

Dates January 12-13, January 19-20. Rules p.539 December issue. Note that stations can be worked once on each band to score, but only once on anyone band during the two week-ends. Be sure to call "CQ SSB Contest."

DX COMMENTARY

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



ZC4GT

LET us start by wishing all our readers a Happy New Year, and a prosperous one for their private affairs as well as for their strivings after DX. If all the other good things in life were going to be as plentiful as the DX will be this year, we should indeed be well off!

January issues are always a little short of news — just before Christmas correspondents have other things to do than to sit down and write letters concerning the DX they have worked. For that reason your commentator generally attempts to carry out a short review of something or other, and this time one finds it rather interesting to review and comment on — previous January issues of "DX Commentary."

Just to follow our fortunes and link them up with the sunspot cycle, let us consider the last five years. In January 1952 it was written here: "May it prove a better year than 1951 from the point of view of conditions. Even Shakespeare had a thought for our present-day Amateur Radio when he wrote, 'Now is the winter of our discontent.' It certainly has been pretty grim at times."

A year later, in January 1953, we opened thus: "A year ago we had to report that November and December 1951 were about the worst DX months experienced since the war. Now we may as well cancel that statement, for the last two months of 1952 have surely touched a new low. But look on the bright side — DX can't get much worse...."

Apparently we were right, and it didn't — but in January 1954 it could only be said that the DX Contest, the previous November, was marked by a spell of fairly good conditions, and that December 1953 was terrible.

CALLS HEARD, WORKED and QSL'd

January 1955 carried the first note of real optimism, with the proviso that "the promise of October and November has been well and truly broken, not to say shattered."

A year ago, in January 1956, we described 1955 as "a momentous year in Amateur Radio . . . one that has shown us the shape of things to come." And now here we are in January 1957, after an autumn of superlative DX conditions, though slightly down in the winter doldrums for the time being. However, it is obvious that the coming Spring is going to show up the bands in the best form that most of us have ever experienced, with the most signals, the most QRM, and the most of everything.

When will it start? Well — we put our money on the period round about mid-February for some real openings on the HF bands. And by "openings" we mean spells of literally worldwide DX on all bands from *Ten* to *Forty*.

Meanwhile, they are far from dull, so we will report on them in terms of correspondence received this month, starting off with a Big Surprise for our regular readers.

Six Metres

For some years past the 50 mc (six-metre) band has been just another channel on our TV receivers. As an amateur band, it has been of purely academic interest to us — a band which was closed for good (as far as we were concerned) several years ago after the first Trans-Atlantic contacts were made by a handful of G's who were allowed to work the band by special permit.

Nowadays the MUF has been doing such startling things that the six-metre band is again a potential vehicle for worldwide DX — but not for us any more. However, *cross-band* contacts have solved a good many difficulties in the past, and here they come again, with W's and VE's (in particular) calling CQ DX on *Six*, and listening for replies on *Ten*. Our colleague A.J.D. has decided that 50 mc now comes in the DX category and has asked us to sort out this cross-band business for reporting in these columns.

Cross-Band, Six and Ten

One of the keen exponents of cross-band DX is Old-Timer G5BD

(Mablethorpe), who had *eighty* Six/Ten contacts between December 1 and 11. He worked W1, 2, 3, 4, 5 and 8, VE1, and heard a VE3. The best times, he says, are between 1330 and 1730 GMT, during which period many W's are on Six and tuning for replies on Ten.

G3FXB (Southwick) made cross-banders on December 9 with W1, 2, 3 and two VE1's. These were the first six-metre signals heard by him, largely because of lack of time. His receiver was an RF26/SX24 combination, and the receiving aerial was the Channel 3 TV array, beamed west.

EI2W (Dublin) made a cross-band " First " on December 1, when he worked W1FOS at 1537 GMT; on December 9 he made a similar " First " with VE1WL. In the two sessions he worked about a dozen W's in the East Coast States, plus the VE. With him, the band opens around 1400 and fades out about 1600.

Other stations known to be in on this are G3CAZ, G3COJ, G5JU, G6DH, GD3ELH, GD3FOC, GD3GMH, F3CT and PAØFB.

As it is so easy to fix up a receiver for 50 mc (an RF 26 converter is ideal) and quite a few people have suitable TV aerials up (Channels 2 or 3), it seems advisable to get in on this while the going is good. It may only be possible for short periods, but when the 50-mc band is open, the signals are really strong. W1HDQ has been heard on many TV receivers in this country!

A late comment regarding December 15-16 is that over that weekend conditions were poor — G5JU managed two W1's and a VE1 and heard three other W's. The 50 mc band was only open for a short time, with violent fading.

We hope for more reports next month, openings permitting, although we feel that the big time will come in the early Spring.

Ten Metres

DX on *Ten* has continued pretty well throughout the period, and recent Contests have stepped up the activity on the band. G3DO (Sutton Coldfield) tells us that he scored 49,622 points in the *CQ* DX Contest, using Ten Phone only. He worked 27 Zones and 59 countries. A new one for the band was OA4FA.

G3HCU (Chiddingfold) collected three new ones — SP5AM, ZD1DR and IT1ZZM. He also worked ZL, VS6, VK, OA, PY, VE7 and VE5 — all on phone — during normal activity. In the November 21-28 mc contest he put up a fine score and his log shows QSO's with ZL, JA, VK, ZD4, VS6, MP4, CR9, VQ4, VK1, VP6, ZD6, ZD8, ZE, TG9 and, of course, stacks of W, VE, ZS, South American and European countries. All on phone, as usual.

DL7AA (Berlin) worked several new ones, including ZD3A on CW, and HP3DA, FK8AO, VP2LU, CT2AH and CO8JK on phone.

G2DC (Bulford) was running only 22 watts of phone, but it fetched in ZD4BR, CR7DS, HC1FS, MP4KAC and 4BBL, and CN2BN. CW raised PJ2AK/P and new Europeans.

G3BHW (Margate) comments that the eastern and southern paths both appear to be wide open on some days (the former between 1030 and 1400, and the latter between 1530 and 1730), while on other days there is hardly anything doing from either direction. On phone he worked HK5ER, CR9AH and 9AL, MP4KAC, VP2JC and ZD6RM, as well as VU, ZS, ZE, CX, VS6, VQ4 and LU. G3BHW mentions the lack of CW activity on this band.

G3CMH (the Yeovil Club station) stuck to phone and worked CR9AK and 9AL, KP4's, LU's, ST2DB, TG9AD, VP6WR, VP7RV, W1SXN/Mobile, ZD6RM, ZE's and ZS's.

G3IOR (Norwich) collected lots of new States towards his WAS, and worked all W call areas regularly on phone. Others raised were VS6AE, ZD8SC, ZD6RM, VK's, OQ5, YS, ZD4, but had a " miss " on M1B.

G3GZJ (London, S.E.23) rounded up a few new ones including CR6, FA,UC2 and ET2US,as well as working VU, VS6, UB5 and a few more.

G5BZ (Croydon) reports a good month, with FK8AO, KL7BJV, CX and W's on CW, as well as TG9AD, ZD4 and 6, VP6, VQ4, YV and KP4 on phone.

G3KHE (Birmingham) says " Ten can be so baffiing — one minute wide open and the next dead silence .... *Eleven* (27 mc) can be intriguing especially if one is able to work duplex, and W1AHX is always on the look out for cross-band G contacts." G3KHE adds that " recent difficulties " have increased

". . . . And when you're reporting to Control, you can cut out all this 73 and best DX stuff . . . ."

his working week from 56 to 84 hours, so he has not much DX to report.

GM3BCL (Aberdeen) worked CR9AL, CO, HC, KT1, KZ5, LU, MP4, OQ, PJ2AF, TF, VK, VP4KL, VQ2 and 4, VP6WR, VS6, ZD4 and 6, ZD8SC, ZP5CF, YV1BE and ZS's. VP2JC got away. (All this on phone). 'BCL missed a few late openings, when KL7 and KH6 were around at 2300 GMT. He is now beamless, recent gales having removed a reflector — but we hope it will soon be back. Meanwhile he tells us that there are eight Aberdeen stations on ten-metre phone.

Fifteen Metres

Here we still have the best DX band of the lot, where practically anything can happen, and usually does. It is open for some hours longer than *Ten*, and is also useful on days when Ten seems to be just about closed down.

G3DO reports ZD8SC for a new one. G3BHW has been working phone only, at lunch times as well as between 1800 and 1900, and raised ZD8SC, ZS9G, HH4MV, VK9AMZ, and also OQ5, ZE, ZL, VK, ZS, VS6, VP6 and the like. He thinks the band has now become "quite reliable."

G3HCU's contest log shows QSO's with ZD4, JA, ZL's and ZS's, ZD6, CO, VP6 and 7, ZD8SC, ZP5CF, HC1ES, CE3DY, VP8BP, CR5SP, VS4NW, VQ5GC and a number of lesser lights which still scored points.

G2DC resorted to phone in an endeavour to find a few new ones (yes, there *are* still a few stray CW enthusiasts left!), and emerged from the battle with ZD8SC, 5A2TB, MP4KAC (new ones) and VK, VP6 and 7, KH6 and VS6 — all with that 22 watts of phone.

G3CMH had contacts with EA9EE, OY1R, TF3WBG, VP4JL, 6GT and 6WR, ZD4CF, ZD8SC, PY's, VK's and ZL's. Gotaways were interesting, and included DU7SV, HR1LW, SVØWE, VP8BR, YN1HF, ZK1BS and some KH6's. All the foregoing was phone work. CW raised LZ1KNB and those missed were UC2AA and VR3AA (1210).

G3IOR rolled in all districts W, VK's and ZL's, KL7, VS6, VP8, VQ 2 and 4, ZE, ZS and HZ on phone. On CW he raised VS6, ZE, ZS, VP8, FS7 and KW6CA.

G3HQX (Mitcham) sends in his latest for the Five-Band Table and mentions 5A2CO and ZD8SC as new ones on Fifteen.

G3GZJ added to his score with IS, KL7, CE and UA9, as well as working JA1, 4, 7 and 8, LU. ZL, ZS, CR6, TF, VS6 and others.

GM3BCL raised ZD8SC for his only contact of note; G3KHE says it is the best DX band, but oh! the noises . . . G5BZ thinks much the same, although he raised KL7, ZD8SC, PY4, VQ4 and VP6 on phone, plus JA3FT and W's on the key. He finds the all-covering W QRM a bit trying, and when they are in full cry it doesn't seem worth trying to find anything else, so he concentrates on working W5, 6, 7 and Ø. As 'BZ says, the dirty noises around this band affect the CW man more than the phone enthusiast.

Twenty Metres

This used to be "good old Twenty, the reliable stand-by," but it's now becoming a neglected band owing to the rival attractions of Ten and Fifteen, and also to the collection of nasty noises rapidly piling up on Twenty itself. Short-skip is a never-ending trouble, and the colossal carriers that sit around the LF end don't make things easy at the best of times.

The DX is there all right, but most people prefer to work it on the other bands. Those who stick to Twenty don't come off so badly, but their numbers dwindle each month.

G3IOR has had some fun on CW, collecting the new Russian prefixes, of which he has now totalled UP2, UB5, UC2, UA1 and UF6. He has heard nothing from UL7, UJ8, UM8 and the like, as yet. Phone fetched in PJ2, YV5, AP2 and the occasional PY, LU, VE and W.

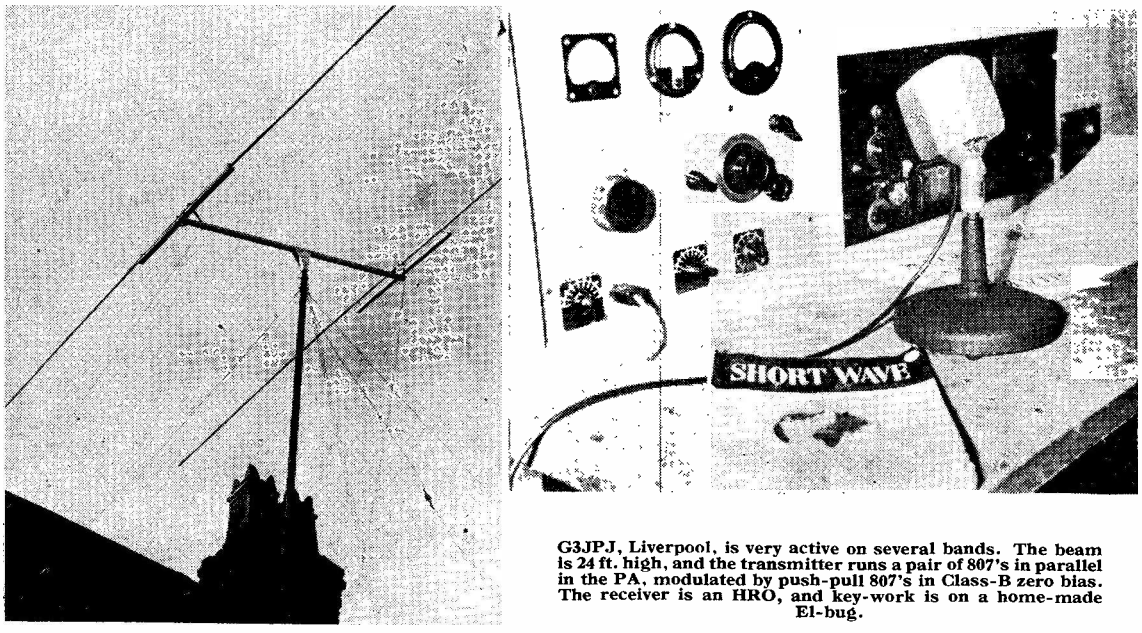
DL7AA even found a new one for Twenty, when he worked KAØIJ (Iwo Jima). G3CMH raised YV3BD and a few W's on phone.

G3GGS (Preston) found two all-time new ones — EA6AM and LA9LF/P (Jan Mayen). Referring to the possibility of a Tannu-Tuva expedition, he tried asking a UB5 about UAØKTT, and received the reply "Hr call no UAØKTT 73 VA" which, as he says, wasn't exactly helpful. He has also heard UPOL4 a few times, usually causing quite a stir among the UA's. He seems to be in the Northern Polar regions, rather than Antarctica, since when UA1KAE (Antarctica)

FIVE BAND DX TABLE
(POST-WAR)

Station	Points	3.5 mc	7 mc	14 mc	21 mc	28 mc	Countries
DL7AA	791	105	167	223	161	135	234
G5BZ	672	64	117	239	146	106	245
W8KIA	657	61	145	258	84	109	258
G3FXB	622	67	124	193	153	85	212
G3DO	564	24	46	218	128	148	236
G3FPQ	564	60	76	183	151	94	201
W6AM	499	30	58	269	85	57	269
ZB1AJX	457	6	56	119	143	133	189
G2YS	439	65	83	145	93	53	162
GM2DBX (Phone)	398	34	31	158	84	87	171
W6AM (Phone)	338	13	32	233	39	21	233
JA1CR	304	15	49	167	63	10	168
G3INR	303	44	53	119	58	29	129
G6VC	301	30	40	134	61	36	139
G2HPF	293	28	48	140	45	32	155

Station	Points	3.5 mc	7 mc	14 mc	21 mc	28 mc	Countries
G3GZJ	227	18	43	65	66	35	103
G3JLB	220	36	37	57	50	40	94
G3JWZ	220	47	56	59	34	24	90
G3IUW	216	31	38	66	59	22	101
MP4BBW (Phone)	207	1	5	54	89	58	112
ZB1HKO	200	18	29	73	53	27	88
G3JVJ	190	23	60	53	37	17	84
G2DHV	182	19	26	115	10	12	117
DL2ZO	172	2	42	96	31	1	105
G3JZK	148	14	28	34	57	15	78
G3HQX	126	9	35	32	31	19	61
DL2ZS	117	2	31	72	11	1	82
G3DNR	111	10	21	61	13	6	66
G3HEV	69	10	20	17	18	2	42
G3IDG	60	11	14	9	6	20	29



G3JPJ, Liverpool, is very active on several bands. The beam is 24 ft. high, and the transmitter runs a pair of 807's in parallel in the PA, modulated by push-pull 807's in Class-B zero bias. The receiver is an HRO, and key-work is on a home-made El-bug.

was a watery 559, UPOL4 was a solid S7/8.

G2DC worked FB8BE, VP8BK, VK7CH, VS1GY, UO5AA and UF6KAF. G3BHW had a short burst on phone, which brought in VP9CZ. CW accounted for ZD3A, ET2US, KZ5, VP6, FF8 and CR6. He heard VP8BO several times but couldn't raise him, the pile-up being pretty bad each time. 'BHW wonders what it must sound like down there!

G5BZ collected VQ5, ST, CR6, YV, FB8BD, KH6, VP8BK, PJ2ME, FK8AS and plenty of W, VK, PY, ZL and the like, but missed KM6AX and VP8BO (all CW). He finds Twenty very interesting round about 1900, but you have to be quick off the mark to raise the exotics. 'BZ also comments on the apparent shortage of VK's and ZL's this season.

G3LEQ (Tunbridge Wells) raised ZB2U, OX3CP, HC5PW and EA8CC, all on phone with 25 watts—including S9 plus from the last two stations.

Forty and Eighty

As usual, there is very little comment on these two bands, which simply are not used for DX purposes these days. There's plenty of activity on them, but not of our sort!

However, DL7AA worked VP2LU on Eighty CW, while Forty brought in W4EMF/KS4, UL7GL, 3W8AA, UD6DD and UH8AA on CW to give Rudi a score of 167 countries on the band. He has now worked 82 countries on 5 bands, and a further 39 on four bands. For individual band scores he is, of course, well over the century on all five—*see* table.

G3IOR went on Forty CW for a while and collected LU-Z, YI, UB5, UC2, UQ and UR. The commercial noise frightened him off Eighty altogether! He suggests that it might be a good thing to erect a parabolic, or some similar beam with a good back-to-front ratio, on the West Coast of Ireland.

New ones on Forty for G3HQX were CN2, FA, UB5, UC2 and UQ. G5BZ worked a few W's on Forty and some Europeans on Eighty, just to confirm that the rig still worked. G3JHH (Hounslow) heard FA9IO, on Eighty, giving 559 reports to 100-watt G stations, so was not surprised that his QRP didn't make it.

Top-Band Topics

First we will deal with the DX on the Top Band. Two week-ends of Trans-Atlantic tests have passed, neither of them very exciting, but by no means a washout.

On December 2 G5JU (Birmingham) made what is believed to have been the first crossing this season by working W1BB at 0540 GMT. Two hours later he also worked W2EQS. The second crossing seems to have been made by G3ERN, who worked W1BB at 0707; GM2BUD worked W1BB at 0715.

W1BB's report says that G5JU's signals were outstanding and stayed in at good strength until 0730 or after. He looks on this as very encouraging for the season, which should by rights be a *bad* one on account of the state of the sunspot cycle.

It should be mentioned here that certain U.K. operators are not observing the agreed frequency areas for these tests. To come up right on top of W1BB guarantees no QSO with him, because W1BB only listens in the European frequency area. Apart from that, much unnecessary QRM is caused to G's who can work W1BB.

CP5EQ was formerly W1HQM and has for years now been communications engineer for a Bolivian Oil Pipe Line Company. When he visited the USA last Spring he heard that the Top Band was open in a southerly direction, and showed some interest in that fact. This was resolved in a practical way when, last July, he worked W1BB for the first recorded CP/W QSO on the

band. CP5EQ used 50 watts, a long wire, and a 75A3 receiver.

Talking of long wires, KØHEM hopes to be using his *half-mile-per-leg* rhombic by now. He and WØCWZ have been at work installing it on the latter's farm. What a job!

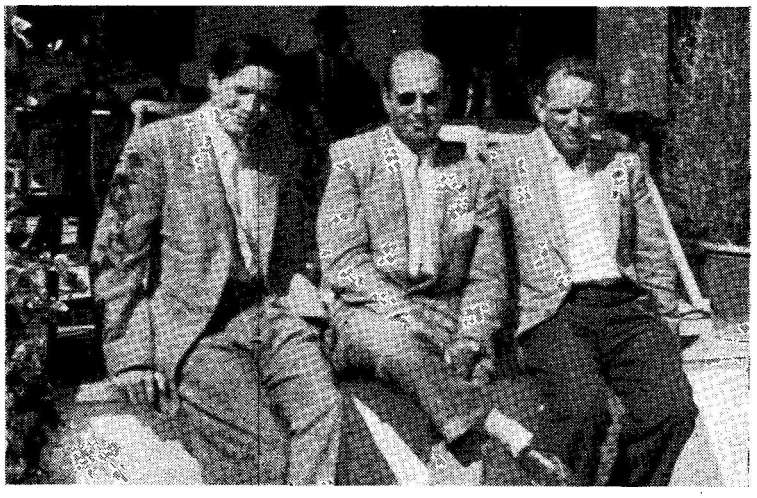
A new signal on the band was W1BB/1, from Stewart Perry's summer place, " Villa Mon Repos " in Maine, about 300 miles NE of Boston. The spot is quiet and ideal for the purpose, and two 50-ft. masts have now been installed to support a 260-ft. doublet. On preliminary tests during October, signals were heard and correctly reported by PY2AJK. The transmitter was running at 75 watts. A real QSO was only missed by faulty synchronisation of clocks.

Late Flash: G3ERN heard W1BB W2GGL and W3RGQ on the morning of December 16, but doesn't report any QSO's. G5JU worked W1BB, W1DTW, W3RGQ and, very interesting, EL1C (459/459) who is believed to be genuine—if he is, G3PU made the G/EL " First ".

Turning from DX to semi-DX, we find the most interesting topic is the activity of the DL2's on the band. G3GGS reports contacts with DL2UY and DL2ZO, also with HB9IN. He mentions conditions on the night of December 12 as particularly good, with the HB and OK's coming in at S8-9.

G3KHT (Bury St. Edmunds) reports for the first time. His station was on the air for MCC, representing the Club at RAF Honington, and since then he has worked about fourteen counties as well as OK1KKR, DL2UY and DL2ZO. He hopes to remain active for about four evening sessions per week in the New Year—if he doesn't get posted elsewhere! GD3UB has been strong down there in Suffolk, but the GM's are often down in the mush, and fish-phone makes things particularly difficult.

G2FTK (Coventry) worked DL2UY, DL2ZO and DJ2HW, the latter being cross-band from Eighty. He also raised Anglesey (GW6TK/A) Aberdeen (GM6IZ) and Lanark (GM3LGN). Contacts with Stirling, Dumfries and Kincardine will fill all his gaps for England, Scotland and Wales.



When G3IUL (left) and G3IUW (right) were in Majorca recently—see " DX Commentary," December—they met EA6AF (centre in this photograph) at the airport. G's on 80-metre phone are often heard in Majorca.

G3AKX (Sale) raised DL2ZO, and hopes for W1BB before long.

G3JHH thinks conditions are steadily improving, though the GM's are not yet strong. He particularly wants Berwick and Sutherland. No new counties, but he did raise DL2UY and DL2ZO—also GD3UB. On November 25, HB9T heard G2NJ at *1410* GMT; his report checks with the G contact Nick was making at the time.

DX Gossip

We are informed by the chairman of the YI2AM Amateur Radio Club, who is ex-GI3KEV, that the recent report we published (November " DX Commentary ") was not in accordance with the facts. The information given here was quoted from a letter from Habbaniya which stated categorically that YI2AM had been closed down because of interference to Service traffic which was actually caused by unlicensed YI stations. The new information is that YI2AM went QRT because the Iraqi Posts and Telegraphs Department refused to re-issue the existing licence. We are glad to have the facts. The Club is still open for constructional work, with a membership of twelve, including G3JNU, G3LEZ and GI3KEV.

Activities by stations signing YI2DF, 2OT, 2RM, 2CA, 2DX and 2BN are described as " operating under cover, as in some other countries, in this case providing a YI contact for the DX enthusiast." We take it, therefore, that they are genuine, if unlicensed. There are no Amateur Radio licences issued in Iraq.

W6AM (Long Beach) now clocks up 269 countries, with YVØAA, UM8KAA and ZC3AC cards having arrived (incidentally, all his scores are for *confirmed* QSO's.) On phone he now stands at 233, thanks to YVØAA, UM8KAA, YA1AM and UP2AS. He also received a card from UAØKFD—over *seven years* after the QSO was made!

For the benefit of innocents who may not know what W6 QRM can be like, may we quote W6AM's statement that there are 800 other amateurs in Long Beach? When you consider that most of them are keen DX chasers. . . .

ZB2Q (Gibraltar) has been running 5 watts to a dipole, on which he managed to work some W's and one DL. He would like to raise a few G's—on Twenty. ZB2Q also mentions that ZB2V is running 8 watts on the Top Band, but will be away on leave until January 11. Look for him after that.

The Tannu-Tuva operation, if it comes off, will be handled by UP2AS and UA1KAI, under Government auspices, and they hope to operate for a month. If you can break through the UA QRM it may be a chance for a new one and Zone 23 at the same time. We still prophesy the biggest pile-up in history . . .

W6ITH is said to be about to take off again, but won't say where to (*see* "Letters to the Editor," this issue) . . . HS1WR is back on the air from Thailand, 14 mc CW . . . Activity from Mauritius includes VQ8AB, 8AD and 8AP on CW, with VQ8AR on phone.

YJ1DL is now in VK-land, but expects to return in March . . . a "VU4AB" has been worked on Twenty CW, saying he was in the Laccadive Islands . . . XW8AB is on 14165 kc phone . . . CEØAC occasionally puts Easter Island on 14058 kc CW.

If you ever hear a ZL5, don't rush to the nearest psychiatrist. We understand that the New Zealand IGY station in Antarctica will use such a call in the New Year . . . VK9AJ is ex-VK1RW, operating from Direction Island (Cocos. Is. group); now on phone . . . ZC5JM is keeping British North Borneo on the map.

"CQ" DX Contest

Here are a few scores in the recent Contest, passed on by CO2BL *via* W6YY: CO2BL 332,000; G3AWZ 300,000; DL4MW 250,000; CT1PK 172,000; ZS5OA 85,000; ZK1BS 76,000; all the foregoing are all-band, phone. On CW K2GL is reported as scoring over 700,000, with 629 contacts, including 42 countries on 7 mc!

As a flashback we hear that *CQ* have finally made arrangements for getting out the certificates to winners in the *1954* Contest . . . . !

More DX Shorts

The Japanese station in Antarctica will sign JA1JG . . . The raft *Tahiti-Nui* is on the way, but FO8AP/MM has been using 14330 kc instead of the previously-stated 14103 kc; he apparently runs 50 watts CW or 30 watts phone, not the 2 watts as first stated by the R.E.F. . . FW8AA will be on Wallis Island again, working both phone and CW. FW8AB is in France, on vacation.

Some of the classier DX known to be on the bands:— BV1US (14160), KAØIJ (14120), FB8BC (14145), CR5SP (14150), YN4CB (14150), VR2BC (21185), CEØAC (21195), VP8BP and 8BT (21200), F9YP/FC (21260). All the foregoing on phone. And now a few CW prizes:— VP8BK (14002), VK9AJ (14090), TG9MR (14090), ZK2AB (14080), ZS2MI (14033), ZC3AC (14090), ZD9AF (14077), 3W8AA (14063), ZS9R (21065), VP2LU (21025), EL12C (21095), OY1R (21040), HZ1AB (21070), IS1CXF (21080).

ZA1AB has been heard by many and worked by a few, both phone and CW. He is not believed to be genuine . . . New details on the Tannu-Tuva project suggest that the call might be UAØKTI, not ØKTT. Also we have seen it stated that December and January might be the time. Nothing yet heard except a few obvious pirates trying to be funny.

More for the Wall

Wallpaper experts (or, as they call them over the Pond, "sheepskin hunters") will probably be interested in three more ways of covering up that blank space. We cannot possibly give full details, owing to the profusion of these things, which would fill this "Commentary" month by month, but here are the dry bones.

WOSA/HOSA Award: For "Worked All Antwerp" and "Heard All Antwerp." Contacts since January 1954 count; QSL's to be sent; a minimum of 6 Antwerp stations (5 for outside Europe). Five IRC's to WOSA, P.O. Box 331, Antwerp.

WAGM Award: For "Worked All Scotland." Contacts with one GM2, 15 GM3, one GM4, 5, 6 and 8 stations, all since October 1946. The twenty QSL's, with 10 IRC's or 2s. 6d., to go to GM3BCL.

WAYUR Award: For "Worked All Yugoslav Republics." For Europeans, three each of YU1, 2, 3, 4, 5 and 6 contacts (out of Europe, two each). QSL's and 5 IRC's to SRJ/WAYUR, Post Box 48, Belgrade, Yugoslavia.

Miscellany

G2DC was very happy to receive three brand-new QSL's during the month, from VQ1JO, FS7RT and YVØAA, the latter with quite an attractive pennant. On a card from CE3ZO, Jim (G6ZO) said that he had now got up a better aerial for 21 mc and hoped to put a good signal into Europe.

G3KAD (Doncaster) notifies us that a pirate is using his call on the 40-metre band.

160-Metre DX Tests, 1956-57 Season

The U.S.A. stations have decided this year that they prefer special "Test" days to the principle of working every week-end, and have suggested the following dates for Organised Tests:

January 13 and 27;
February 10 and 24.

Special attempts will be made to contact Europeans between 0500 and 0800 on these mornings. EU stations should call at 5, 15, 25 minutes past the hour, and so on, with the W's on the hour and every ten minutes thereafter.

All EU stations are asked to operate **between 1820 and 1835 kc;** the W's will be mostly in the 1800-1825 kc segment, and Loran causes trouble around 1850 kc. West Coast stations will be in the 1900-1925 kc area.

Synchronise your clocks with WWV just before each Test begins, and stick to the five-minute calling and listening periods (unless a QSO results, when the routine must be broken). Reports to "DX Commentary" by the usual dead-line dates.

21-28mc MARATHON, 1956

Station	21 mc	28 mc	Total
	Phone Only		
G2CDI	151	108	158
G3HCU	125	86	136
G3KHE	93	35	102
MP4BBW	81	58	97
GM2DBX	63	37	71
GM3BCL	19	91	93
	Phone and CW		
G2DC	110	65	122
G5BZ	86	59	102
VQ4RF	74	80	111
G3GZJ	66	35	68
G3GGS	47	58	82
ZB1HKO	39	19	42
G3JVJ	37	17	39
G3JWZ	34	23	40

JANUARY SSB CONTEST

Dates January 12-13, January 19-20. Rules p.539 December issue. Note that stations can be worked once on each band to score, but only once on any one band during the two week-ends. Be sure to call "CQ SSB Contest."

The recent FOC Marathon Contest was won by G3HCL, with F3AT and G3IEW in second and third places. Results of their DX Marathon are not yet available, owing to the longer time necessary for receiving and checking logs.

ARRL DX Competition, 1957

This annual event follows the same lines as last year, with American stations sending an abbreviated version of their State or Province after the RST report, and foreign stations sending a three-figure group representing their power input.

For overseas amateurs, the scoring is as ever—three points per completed contact, multiplier for the number of W/K and VE Call Areas (*not* States) worked on each band. Dates are:

***Phone*, February 8-10 and March 8-10; *CW*, February 22-24 and March 22-24**

This contest offers a special opportunity to overseas stations to qualify for the WAS and WAVE Awards. All the 48 States and the 10 Canadian Provinces, plus Yukon and North-West Territory, will undoubtedly be on the air.

With the best conditions for several years predicted, this Contest should raise considerable activity on the bands.

1956 Marathon

The final placings in the 1956 21-28 mc Marathon will be given next month, so let us have your scores up to the end of December. It seems unlikely that anyone will be able to catch up on G2CDI! Also (*see* last month's "Commentary") do not forget the 1957 Marathon for Zones and Countries Worked, irrespective of bands. Simply send your score with the two columns, Zones and Countries worked from January 1 onwards. Keep it topped up each month . . . three months' silence will ensure removal from list.

That brings us to the end of the news and well into the throes of another year. We look forward to a steady increase in the level of correspondence during 1957—and please see that the WAZ Marathon gets plenty of support. Deadline for next issue is **first post on Friday, January 18.** (Overseas readers please note that the following one will be *Friday, February* 15.) Address everything, as always, to "DX Commentary," *Short Wave Magazine*, 55 Victoria Street, London, S.W.1. Until next month, Good Hunting on all bands, 73—and all the best for 1957.

SIX METRES OPENS AGAIN

On December 24, the American 50 mc (6-metre) band was again wide open for Trans-Atlantic working, between about 1430 and 1700 GMT. Stations in the New England States were numerous and loud, an outstanding signal being W1CLS (Weston, Mass.) on SSB with only 6 watts input. W1HDQ (Canton, Conn.) was again heard on Channel II TV receivers! A number of G's were in on all this, cross-banding Ten/Six, and G5JU (Birmingham) reports that he was able to make 14 contacts with East Coast W's. On December 26, W6NLZ was calling (on 10-metre CW) for a cross-band 50 mc test with the U.K. At the moment of writing, it is not known whether his 6-metre signal was heard over here; he was certainly very strong on ten metres.

For those who have wished to know, the American 6-metre band is 50.0-54.0 mc, with most of the activity between 50 and 52 mc. The quickest and easiest approach on the receiver side is an RF-26 Unit with a Channel II TV aerial, into a receiver tuning around 8 mc. An ordinary BC set will do as the IF/AF amplifier.

EXTENSION OF TV HOURS

The amateur radio operator who happens also to be a keen TV viewer must have heard with somewhat mixed feelings of the PMG's new dispensation with regard to that hitherto quiet-hour between 6.0 and 7.0 p.m., when one could be on the HF bands without having to worry about TVI. It is now left to the discretion of the BBC and the ITA as to how this hour should be used. In view of the very heavy losses of the CTV companies and their urgent need to raise the advertising wind during what might be a profitable viewing period, it is certain that the hour will be filled—with some vapid tripe or other.

"ELECTRONICS MADE EASY"

This is an interesting and very well produced book which is also practical, for it is written for the benefit and from the point of view of the keen constructor who wants to build working apparatus—from a breadboard crystal set to a home-intercom. system, and including amplifiers, record players, converters and simple short wave receivers. There is also a useful chapter on modifying existing equipment for other purposes—such as using a BC receiver as an inter-room telephone, and a car radio as a PA amplifier.

At its price, *Electronics Made Easy* is outstanding value in books of its kind. Produced by the American publishers of "Popular Mechanics Magazine," which itself has a large circulation in this country, the material is of unquestionable technical reliability in the build-it-yourself context. The specification of preferred manufacturers' parts has been kept to a minimum, and where items of American make are quoted, they can be substituted by similar British products; in the main, however, values only are given, with full constructional data and wiring plans.

Electronics Made Easy, 192 pages, fully illustrated, price 6s. 6d. (in paper) or 21s. 6d. (cloth bound), from Popular Mechanics, Eagle House, 109 Jermyn Street, London, S.W.1. Orders can be filled from stock.

TOP BAND DX-PEDITION

HB9CM/HE IN LIECHTENSTEIN

S. S. PERRY (W1BB) *and* **L. H. THOMAS, M.B.E. (G6QB)**

MUCH is heard these days about DX-peditions to places of obscurity in order to provide new countries for all the keen chasers on the DX bands. We should, however, remember that a great deal of hard work has gone on at various times in order to bring a "new" country (though perhaps not a rare one) on to the Top Band.

Such an effort took place last season, when Philo Gander, HB9CM, went to a lot of trouble to put Liechtenstein on the 160-metre map.

Liechtenstein is a very small Principality with a single valley almost surrounded by mountains, and completely blanked off by them on the southern and eastern sides. HB9CM, a 39-year-old chemist who joined the ranks of radio amateurs in 1936, decided that he would put HE-land on the air, for his own personal pleasure and recreation, by staging a DX-pedition on his own.

Transport was not too good, neither were power facilities, so some light and compact equipment was specially built. The receiver was a battery-operated 1-V-1, and the transmitter was crystal controlled but with one stage only. It was an ingenious arrangement of an oscillator using two 1619's in parallel, with an input of about 90 watts, "locked" by a crystal in much the manner of the old Goyder-lock circuits; crystal burn-out was prevented by grid neutralisation and careful feed-back control. The total weight of the equipment, receiver and transmitter, was 25 lbs.

The first trip was made in January, 1956, and nothing in the way of DX was achieved. But on February 12, almost on the spur of the moment, a second trip was organised, and this turned out to be highly successful. HB1CM/HE was set up in a small hotel, and Philo got to work on a 60-ft. fir tree with some small rockets. In bitter cold (15° below zero F.) the successful placing of the nylon thread was marked with a "Boom!" and a burst of coloured stars.

This happened at the third attempt (a stock of spare rockets is always desirable), and this time the aerial could not have been placed an inch higher — it was absolutely on the top. A 270-ft. wire was hauled up, the home end being attached to the hotel building.

DX Results

The first real DX heard was W1BB, rolling in at RST 559 and 549 for a solid hour. They were the best signals heard from W1BB the whole winter, even from the home QTH at HB9CM in Berne. There was no trouble from QRM or QRN. During the evening the hotel room was heated, but by the early morning DX time the water pipes were frozen and the operator was wearing ski gloves! However, the QSO with W1BB, the main object of the trip, was the reward. Conditions did not allow any other W contacts, but during the two trips Top Band QSO's were made with 166 G's, 12 OK's, 9 DL's, 3 HB's and the one W. This, incidentally, is an interesting sidelight on the level of European activity on 160 metres.

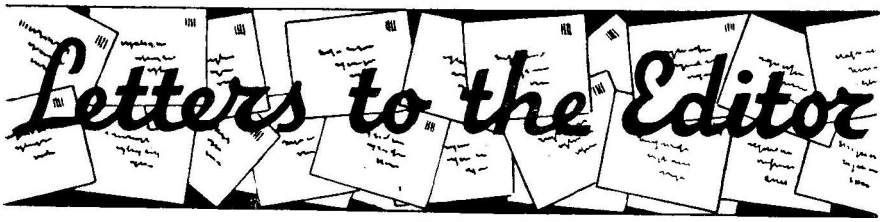
From W1BB's end it was an unusual contact, since band conditions (contrary to the usual run of things) seemed to peak at just the right time. DL stations were getting through, and there was HB1CM/HE's weak signal just alongside them. At 0605 GMT he was RST 239 to 359, making the first HE/W contact on the band possible.

Philo became the first recipient of W1BB's special 160-metre DX Award—his "king-size" QSL—as a small reward for his strenuous efforts to get over the mountains of Liechtenstein. Such successful DX contacts are interesting and rewarding for their own sake, and certainly give the participants a real feeling of accomplishment. May we have many more of them.

HB1CM/HE when he operated on Top Band from the little Principality of Liechtenstein, on Switzerland's frontier with Austria. Stations operating from Liechtenstein use the suffix HE, which is popular with those HB's who want to make a local expedition to put a new country on the air. HB1CM did just this, and on a one-night stand signing HB1CM/HE, worked W1BB on 160 metres—a resounding "First" if ever there was one.

MULLARD, Ltd. — CHANGS OF ADDRESS

The head office departments of the Mullard Organisation are now installed at Mullard House, Torrington Place, London, W.C.1 *(LANgham 6633)*, to which all correspondence should be addressed.



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

SMALL IRON-CORED COMPONENTS

Sir,—*I have become very conscious of the lack of lower rating modulation transformers of compact size; this arises mainly from an interest in Top Band mobile. To my knowledge, there is only one firm marketing modulation transformers, and their smallest product is too big for transmitters of 10-watt rating. Considering the number of different transformers, both mains and audio types, which are produced at "popular" prices, it seems to me that a long-felt want would be filled if a small modulation transformer could be offered with, say, three or four ratios to cover the generally-used types of modulator and PA valves.*

At present, most published circuits talk about transformers taken from various ex-Government equipments (the SCR-522 in particular), but unless one happens to have one of these to hand, it is necessary to buy the complete unit to get the one item.

I have put this point of view to quite a number of amateurs in various parts of the country; all agree that the lack of this component is a problem; in desperation, many have had to resort to choke control modulation.

Hence, I am sure that a small 10-watt modulation transformer would find a ready market. Perhaps you would care to test the response by publishing this letter.

S. D. Hoff, G3AWM, 51 Gwencole Crescent, Braunstone, Leicester.

MORE ABOUT THE ETHICS

Sir,—*The controversy over the "Yasme" has perhaps raged long enough—but one thing that has interested me about the correspondence on the subject has been the absence of the old amateur spirit of "Live and let live."*

Although we in the U.K. are not allowed phone-patch operation and the kilowatt, we do not protest against those who are. Why should we protest because someone has had the initiative to get to some rock graced with "country status" and does not wish to lose money on the project? If the DX fraternity are satisfied with saying "hullo-goodbye" to someone sitting on that rock, then why should they object to paying for what they feel is a praiseworthy achievement, if by so doing they help him to get there? This does not in any way detract from the merit of the other heroes who can afford to do it solely for its own interest and the honour of Amateur Radio.

After all, nobody is forced to work the DX if they do not like it, or even to listen to the wolf-pack in full cry. Another point about DX working: I feel that my time has been better spent if I can lighten the day of some District Officer in the jungle with the latest news and views. The atmosphere on the DX bands might on occasion be pleasanter if it were recognised that what some rare-station operators are really interested in is a little companionship over the air—not always just in saying "hullo-goodbye," providing the new-country contact, and then shouldering the burden of the QSL's.

J. S. Bennett, G3KLC, 4 Broad Street, Stamford, Lincs.

PROBATION ON CW

Sir,—*I am very glad to see* (SHORT WAVE MAGAZINE *Editorial, October, 1956) that you have decided to champion the idea of the CW "probationary" period for new operators. It is my opinion that unless an operator is forced, by a period of CW working, to achieve a T9x note, he may not be able to produce a phone carrier good enough to be modulated. Also, there is a distinct possibility that Morse operation may become something of a lost art. This would be a step backwards, and not "progress," as some confirmed phone operators would have us believe! Furthermore, are operators who have never worked on CW going to observe the band planning as punctiliously as they should? I think not.*

For all these reasons, I oppose this so-called concession and welcome any move to decline acceptance of it. I hope others who may feel likewise will write in to indicate their support, so that the authorities will know the extent of the opposition to this change.

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

TTX ON FORTY

Sir,—*I think you might be interested to hear that in recent weeks I have been operating TTX on the 7 mc band. My opportunities of working during the early afternoon, which appears to be the best time, are limited, but the contacts I have been able to make show what is possible.*

With an input of 250 milliwatts, some of the stations worked are: G2RF (75 miles, 459); G3AZY (180m., 569); and G3KSL (200m., 559). The transmitter is the Top Band TTX with a 7 mc coil and crystal substituted, running either four or five home-made transistors in parallel. G2RF was worked on a "G8PG-type" Top Band aerial 255 ft. long, and the others on a 132 ft. end-fed wire, all on 7010 kc. The contact with G3KSL was held for more than an hour, during part of which he was trying to get a Continental station to listen for me.

On Top Band, my TTX score stands at 27 counties confirmed with 30 worked.

C. Hubbard, G3CSZ/TTX, 104 Highfield South, Rock Ferry, Birkenhead, Cheshire.

MAGAZINE EXCHANGE

Sir,—*Recently, I had a letter from OK1HI (Josef Hyska, Cechova 31, Praha XIX, Czechoslovakia) asking if I could put him in touch with anyone in the U.K. who would be interested in exchanging magazine subscriptions. The OK's are unable to subscribe direct, due to currency restriction, but OK1HI is very keen to receive* SHORT WAVE MAGAZINE *each month. He suggests a "straight swap"—a Magazine subscription for one to their "Amaterske Radio."*

F. A. Herridge, G3IDG, 95 Ramsden Road, London, S.W.12.

DXPEDITIONS—REAL AND IMAGINARY

Sir,—*In the hope that a new country may emerge, some very DX-minded amateurs send in for publication in the Amateur Radio press as "fact" what can only be classified as rumour, hearsay, guess-work or just plain scuttlebut. They fail to make it clear that their report is based not on fact, but on rumour.*

As an example, I merely asked VK6MK over the air what transportation would be available from Western Australia to ZC3 (Christmas Is. in the Indian Ocean). Next thing, it was in print that I was going there. Then it was in print that I was actually on my way there. Then stations were heard talking about my being there, and one operator said Yes, he'd heard me on from there. As a result of all this, I fully expect to get requests for QSL cards. In fact, nothing has been done by me about going to ZC3.

Such rumours, published as fact without qualification—with only about a dozen out of, perhaps, 100 such proposed DXpeditions ever materialising—has led to numerous DX operators doubting news of such trips when they are authentic. It is probably true that some of these expeditions were planned in good faith, but never came off for a variety of reasons—such as inability to get a licence, inability to get there even if they got the licence, failure to secure suitable equipment, not enough time on vacation when it came to the point and (if the truth were known) just plain inability to afford the cost of the undertaking when it was realised what was actually involved.

In this context, it has recently become known that call-sign DUØRT has been issued to me. Now it appears in print that "W6ITH is planning to work from Spratley Island." In order to set the record straight, and before anybody claims a QSL card, I am pleased to be able to give the facts to date:

In May 1956, one Tomas Cloma of Manila visited the Spratley Is. He found them uninhabited and claimed them by reason of this non-occupancy. Cloma also renamed the Islands "Freedomland" and declared them a protectorate of the Philippines. The Spratleys (the Chinese call them the Nansha Is.) are in the South China Sea about equi-distant from Viet-Nam and the south-westerly Philippine island of Palawan. In the past, the Islands have been claimed by both France and China. However, nobody really pressed the matter, because they are of little economic value. During the last war they were occupied by the Japanese.

In June 1956, I obtained permission, by invitation, to go to Cloma's "Freedomland" to put a station on the air from there. At his request, the Philippine Ministry of Communications issued me with call-sign DUØRT. Since then, Cloma has asked for United Nations trusteeship, allegedly to keep Communist China out.

That is the story to date (November 24, 1956) and how the matter stands at present. No decision has yet been made for operating DUØRT from this location.

D. R. Tibbetts, W6ITH, 1 Camino Pablo, Moraga, California, U.S.A.

FAILURE TO QSL

Sir,—*Some time ago I worked my 100th country and started meeting the mail carrier looking for the QSL's. As most amateurs will, I counted cards sent against those received, and, upon completion of my little survey, sat down To Write* QST *A Letter. Then I realised that most of my unanswered QSL's were due from British Commonwealth countries—so you get the letter instead!*

I thought you might like to see some results, six months having been allowed for transit through the various bureaux. In many cases, IRC's have been sent, and some stations have been QSL'd several times. Sample figures are: England, 113 cards sent, 7 QSL's received; South Africa, 52 sent, 3 received; France, 22 sent, 18 received; Australia, 16 sent, 3 received; Argentina, 33 sent, 30 received; Brazil, 15 sent, 12 received (the PY result is particularly interesting because all cards must be sent through L.A.B.R.E.).

I don't know what these figures prove; one cannot say "British stations don't QSL," because the rare prefixes (MP4, VP, ZS9, etc.) do come through 100%, as do GC, GD, GM and GW.

A QSL card doesn't have to be fancy, or expensive, or even mailed direct. Those card-chasers who need their cards don't mind as long as they get them. Failure to QSL can be a bitter disappointment, especially to a novice. One such on this side has waited over six months for a card from his first and only DX worked—a G station.

W. T. Clarke, W3RPG, Frances Drive, Greenwood Hills, Harrisburg, Penna., U.S.A.

BBC SIGNAL IN THE 15-METRE BAND

Sir,—*A number of amateurs in the Midlands have complained of a strong BBC station which can be heard at considerable strength in the region of 21.24 mc. Those living in the Daventry area may get a number of other interfering beats, but the one mentioned is probably the most prominent. As it occurs at a frequency which is not the image of any strong signal, it has often been described as a parasitic radiation from the BBC's transmitter. The writer suggests that is is* not *the fault of the BBC, and thinks the following explanation is more likely to be the correct one:*

There is a very strong BBC broadcaster on a fundamental of 21.47 mc (outside our band). If one is using a receiver such as an HRO—which has an IF of 0.456

mc, with the mixer-oscillator working on the HF side — what can occur is that when the receiver is tuned to 21.242 mc (the oscillator, of course, being on 21.698 mc) the transmission on 21.47 mc is so powerful that it breaks through the RF signal circuits and mixes with the oscillator to give a difference-frequency of 0.228 mc; this gets doubled, either by the mixer or by over-loading of other valves, to give 0.456 mc, the IF of the receiver.

A reduction of the 21.47 mc signal is possible by means of a wave-trap tuned to that frequency, and has been found to eliminate the beat on 21.242 mc, thus proving the argument. But in the writer's experience a great deal of sensitivity is then lost (in the HRO) over the whole of the 21 mc amateur band.

J. B. Kaye, G5BG, Wappenham, Towcester, Northants.

BBC VHF/FM TRANSMITTING STATION

THE NEW INSTALLATION AT HOLME MOSS

Courtesy **Engineering Information Dept.,**
BRITISH BROADCASTING CORPORATION

THE BBC's VHF sound broadcasting service was brought within reach of a further 14,000,000 people when the Holme Moss VHF/FM transmitting station was brought into regular programme operation on December 10.

Holme Moss is the first of the new high-power VHF stations to be opened in its permanent form with a full three-programme service. It is built on the same 150-acre site as the BBC's Holme Moss television station, and is situated 1,750 ft. a.s.l., adjoining the Holmfirth-Woodhead road (B.6024) some 8 miles south of Huddersfield.

The VHF transmitters are housed in an extension to the television station building. The new building is of similar construction and appearance to the original one, being stone faced and having double windows throughout in order to conserve heat during cold weather. The transmissions will be horizontally polarized and will be on the following frequencies: North of England Home Service, 93.7 mc; Light Programme, 89.3 mc; Third Programme, 91.5 mc. The effective radiated power on each programme service will be 120 kW.

Transmitters

There are six 10-kW VHF transmitters, two for each programme service. They use the "FMQ" frequency modulation system, and duplicate drive units fed simultaneously with the appropriate programme are provided for each programme service. Automatic change-over arrangements ensure that either drive may be selected with the other acting as spare.

The "FMQ" system of frequency modulation consists essentially of a quartz crystal oscillator connected through a quarter-wave network to a balanced modulator, the susceptance of which is varied by the modulating signal, and this in turn varies the frequency generated by the crystal oscillator. The crystal is specially cut to avoid the generation of spurious frequencies within the operating range. The chief advantage claimed for this system of frequency modulation is that the circuits are simpler than those of other systems, and are therefore more reliable and easier to maintain. The output of the crystal oscillator is multiplied by three stages of frequency doubling and one tripling stage to produce the required carrier frequency.

The transmitters follow closely the design of the latest transmitters used at the BBC's VHF station at Wrotham in Kent. There are five stages of carrier frequency amplification, the first two being of the conventional push-pull type, while the remaining three stages are single-ended grounded-grid stages, with coaxial line tuning elements. The final stage uses two BR.191B valves operating in parallel. All valves are air-cooled and employ AC for filament heating.

In common with the other BBC VHF stations under construction, the Holme Moss installation is equipped with specially designed monitoring equipment. Housed in a cabinet some 7 ft. high and 2 ft. square, this can give a continuous indication of the centre frequency of any of the three transmissions. It also includes high-precision low-frequency oscillators for accurate measurements of frequency deviation, noise and distortion.

Cooling air for the transmitter valves and other components is taken from an air duct running below the units. The air-blower is situated in this duct. The warm air is exhausted through trunking running along the tops of the cabinets. Dampers are provided to enable this air to be re-circulated within the building for heating in cold weather.

The outputs of one Home Service transmitter, one Light Programme transmitter and one Third Programme transmitter are combined and connected to one half of the slot aerial. Similarly, the outputs of the other three transmitters are combined and fed to the other half of the aerial *via* a separate feeder. Thus, all three programmes are radiated by both halves of the aerial, thereby ensuring continuity of service in the event of failure of either half of the feeder/aerial system. This arrangement of transmitters also enables continuity of service to be maintained, at reduced power, should either transmitter in any or all of the three pairs of transmitters cease to operate.

Automatic control ensures that the outputs of the two transmitters on any one programme are correctly phased. As the VHF equipment is designed to run virtually unattended, the transmitters are switched on and off by time-switches, and automatic monitoring equipment is provided. The associated fault-indicator panel and alarm system have been designed to call attention to any faults which develop during trans-

mission, and also to give warning if the equipment is not in a suitable condition for automatic operation.

Mast and Aerial

The VHF aerial system is carried on the same mast as the television aerials. The mast is 750 ft. high and has a total weight of 140 tons. The maximum downward thrust on the base pedestal, under the most severe conditions, is 350 tons. The base is located by a two-inch diameter steel ball in a socket, which forms a pivot to allow angular movement of the mast in high winds. Up to the 610-ft. level the cross-section is triangular, each face being 9 feet wide. Between the 610 ft. and 710 ft. levels the cylindrical VHF aerial is placed. This consists of a hollow galvanized steel cylinder 6 ft. 6 ins. in diameter and 100 ft. long, in which there are 32 slots arranged in eight tiers of four, giving a net power gain factor of 6:1. Thus, the 20-kW output from each pair of transmitters become 120 kW effective radiated power.

The aerial feeding arrangements and distribution feeders were designed, installed and matched by the BBC's own Planning and Installation Department. Specially designed notch filters are included between the transmitter outputs and the combining units to reduce the possibility of spurious radiation caused by intermodulation between the Home, Light and Third programme transmitter outputs.

The mast is supported by four sets of stays. The stay ropes are of fully locked-coil construction in steel, and have a breaking stress of 120 tons per square inch. There is a safety factor of "times four" under the most severe conditions, which includes an overall coating of ice ½-inch thick simultaneously with a wind pressure of 65 lb. per square foot at the mast head. This corresponds to a wind velocity of 125 m.p.h. Under these most exceptional conditions the lateral displacement of the mast head would be about 7 ft. 6 ins.

". . . . But if it's got 14 mc IF's, my wife won't have it . . . ."

THE RISE IN THE MUF

For the next 18 months or so, the maximum usable frequency (MUF) will be of intense interest not only to radio amateurs throughout the world, but also to physicists and engineers professionally concerned with radio communication. Sir Edward Appleton, the eminent authority on the subject, has forecast February 1957 as a peak period—there will probably be considerable interference on TV screens from long-distance transmissions, and European VHF stations in the FM band will be strong signals in this country. We live in stirring times!

CONCLUDING VOLUME XIV

The next issue, dated February, of SHORT WAVE MAGAZINE will conclude Volume 14. A complete Index to the year's work, with many cross references, will be included as a free loose supplement in the March issue, which will be No. 1 of Vol. XV.

FILM ON TELEVISION DEVELOPMENT

We are informed by RCA Great Britain Ltd. that they now have available for public distribution a 16 mm. film, with sound, tracing the development of television from its infancy right through to compatible colour. It is a half-hour documentary, going back to the mid-1920's and culminating in the appearance of colour television. Prints of the film, called *The Story of Television*, can be hired on application to: RCA Great Britain Ltd., Lincoln Way, Windmill Road, Sunbury-on-Thames, Middlesex.

ARRL's "RADIO AMATEUR'S HANDBOOK"

The 1957 edition of the world-famous *Radio Amateur's Handbook* will be available from us about the end of February or the beginning of March. Orders, at 34s. a copy post free, can be taken now for delivery immediately copies are received.

We still have a few copies of the 1956 printing, which are now offered at 30s. post free. The *Radio Amateur's Handbook* has for more than 30 years been recognised as the standard guide to the subject.

"WRITTEN IN ENGLISH"

One of the most graceful compliments ever paid us—and one which we have long hoped someone might some day bestow—came in just before Christmas from a reader who, in sending in his subscription renewal, remarked simply: "One of the reasons why I like the *Magazine* is because it is written in English."

WORD OF THANKS

As always at this time of year, we would like to take this space to thank so many readers and friends in the radionics industry who were good enough to send greetings for the season. All were very much appreciated, needless to say.

Checking Over-Modulation

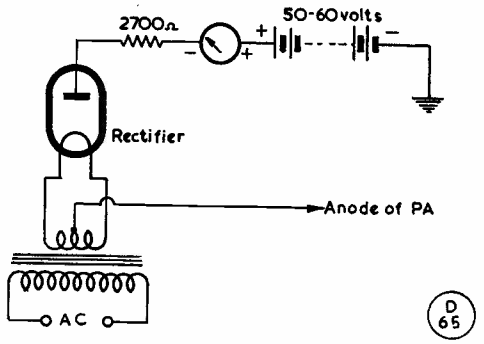
AUTOMATIC INDICATING DEVICE

IT may not be appreciated by newcomers to telephony operation on the amateur bands that there are fairly simple ways of providing an indication that over - modulation is occurring.

But first some comments on the effects of over-modulation will not be out of place. A picture of what happens in the electrical sense when a carrier is modulated beyond the 100% level is given in the article by A. A. Mawse in the January 1956 SHORT WAVE MAGAZINE. The effect is illustrated in Fig. 1(D) on page 585 and it will be observed that the carrier is reduced to zero and stays there for an appreciable fraction of the time occupied by a cycle of the audio frequency wave form—the fraction varies, of course, with both frequency and degree of modulation beyond 100%. This means that radiation starts and stops abruptly at audio frequency and transients are produced, resulting in the creation of frequencies well outside the band occupied by the carrier and its normal sidebands. In a moderate case, the effect is severe sideband splash, but often spurious frequencies are audible 30 to 50 kc away from the carrier frequency. These can cause unnecessary interference to others and are a prolific source of BCI and TVI troubles. And increasing the selectivity of the afflicted receiver will not help at all towards eliminating the interference.

Modulation Checker

The simple device made up to the accompanying circuit will do two things—indicate when over-modulation is occurring, and prevent most of the ill-effects of such over-modulation. It is a rectifier valve connected the " wrong way round," so to speak, and only conducting when the voltage at the anode drops to a very low value. The value used must have a high peak inverse voltage rating, so that it will withstand the positive anode peaks without breaking down, and it should also have a low internal voltage drop. Generally, a mercury vapour type is to be preferred and the filament transformer must have the usual high insulation, as in normal rectifier service. Both 866A and RG240A valves have been



This simple circuit gives visual indication of over-modulation.

tested and found satisfactory.

A source of bias is required to ensure that the valve conducts before the PA anode actually reaches zero volts and to counteract the inherent 15 volts or so internal voltage drop in the rectifier valve. This bias can be, say, 50 or 60 volts and may be derived from a battery (of the type used in portable receivers), or from a potentiometer across one of the low voltage HT supplies. The latter is preferable as otherwise a small reverse current flows through any bleeder resistor fitted to the main HT supply during periods when the transmitter is off.

Operation

In effect, the valve becomes a relay, closing when the PA anode volts drop to nearly zero and impressing a small positive voltage so that the carrier is not actually interrupted. The system means also that limiting is introduced but, providing it is not carried to excess, no harm should ensue.

The meter shown as forming part of the circuit is essential when a hard rectifier valve is employed, to indicate the degree of over-modulation and to permit correct adjustment. A meter with a full-scale deflection of 5 mA is suitable as generally the current flowing will be much less than this. With a mercury vapour valve, the usual glow can be seen during conduction and the meter can then be dispensed with if desired. The resistor R1 is included to limit the peak current flowing through the rectifier valve.

For convenience, the unit can be built into, or added on to, an existing modulator so that it is energised only when the modulating equipment is switched on and in use. The lead marked " anode " is taken to a point where no RF voltage exists but which carries the modulating voltage.

J.N.W.

VHF BANDS

A. J. DEVON

The Activity Factor—

Locating Jodrell Bank—

Proper Use of Four Metres—

Station Reports and News—

THERE have been spells of quite good conditions during the period since mid-November—notably when the weather changed to mild-with-fog from cold—but the level of activity was never such as to make the most of the openings.

In truth, it is the low activity on two metres which is now the main worry to those who continue to use the band regularly. Our best listener report this time (in terms of stations heard on) is from SWL Stokes, of Ruislip, Middlesex, who shows a total of 35 different stations logged, mainly in the London and Home Counties area, in three weeks' listening. From Diss in Norfolk, SWL Smith heard only nine stations in about the same period. The report from G3KHA (Bristol) shows that he worked 15S and logged 16 more stations in the month to December 15.

These rather disappointing figures are in spite of good openings round December 6 and 10. On the 6th, GD3UB was on, and working stations round the northern counties—from the south, G5MA (Gt. Bookham, Sy.) raised him for an RST-569 report that evening. On the 10th, G3KHA found conditions good west-east, but activity in the London area was so low that he only got two QSO's, though both were excellent in terms of signal level.

Undoubtedly, there has been something of a migration to 70 centimetres, as well as to four metres and 25 cm. But this does not by any means account for all those who might otherwise have made an appearance on two metres. The winter season always shows the same tendency, but the December activity this year certainly seems to be lower than usual. It is not that people have abandoned the band altogether—it is just that many of them are giving VHF a rest while DX is so good on the HF bands, particulary 10 metres. Their VHF gear is still in being, and will be dusted off when the urge again makes itself felt.

Locating Jodrell Bank

Arising from the notes in this space last month (*see* p.540), we are indebted to Professor Lovell himself for the exact pin-point of his great Radio Observatory. The position is: Lat. 53° 14′ 11″ N., and Long. 2° 18′ 22″ W. The NGR is 795711. This position is 3¼ miles 045° magnetic from Holmes Chapel railway station.

Looked at on the Ordnance Survey sheet for the area, run your finger up the railway line (towards Manchester) from Holmes Chapel; the next station is Goostrey. About 1½ miles further up, a road crosses the railway. The site is 200 yards or so east of this point—and that is as near as we can locate it for you. The Lat. Long. or NGR already given should plot to this same point.

We are also grateful to G3LX (Stockport, Ches.), who quotes the same data and the *Air Pilot List of Navigation Obstructions* as his source; he took the trouble to plot the position for us on Sheet 110 of the Ordnance Survey, which is the correct map to use for the purpose.

In the course of his letter, Professor Lovell writes as follows: "The restriction of 50 miles imposed by the Post Office at our request is, of course, less important than the requirement that any amateur operations should not interfere with our apparatus, which is itself carrying out systematic programmes for the IGY in this waveband. If there were any urgent cases on the fringe area, we would be quite prepared to engage in tests with the amateur concerned, but there is naturally a limit to the amount of time we could spend on them. If you hear of any hardship cases in this connection, perhaps you will get into touch with me."

So there you are—and a very fair statement, too. Those operators genuinely interested in 70 mc transmission who are in the fringe area and can transmit on the band are asked (if they have any doubts as to whether they might cause QRM) to let us know, and we shall be glad to put them in touch with Professor Lovell's experimental station for tests to be arranged.

Touching further on plans for the International Geophysical Year, we now have it that the transmitting frequency of the earth satellite to be launched by the Americans will be 108 mc; its orbit is to be, approximately, rather north of the equator. The Russian satellite is expected to circle the earth at "right angles" to this, *i.e.* from pole to pole. There is a project, on which we hope to be able to give further information shortly, officially to enlist amateur aid in making

BRITISH ISLES TWO-METRE ZONE PLAN

(This is reproduced here for the attention of all concerned).

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

TWO METRES

ALL-TIME COUNTIES WORKED LIST

Starting Figure, 14

From Fixed QTH Only

Worked	Station
75	G5YV
70	G6NB, G6XM
68	G3BW
66	EI2W (286), G3IUD (302)
65	G3CCH
64	G3GHO, G5BD (435)
62	G3BLP (630)
60	G2FJR (427), G2OI (402), G3DMU
59	G3EHY, G4SA
58	G3IOO, G8OU
57	G8SB
56	G3WW (770), G5DS (654)
55	G2HDZ (495), G2HIF, G5BM, GW5MQ
54	G5MA
53	G2AJ (519), G3FAN, G4CI
52	G2NH, G6RH, G6XX, GW2ADZ
50	G3ABA, G3GSE (518)
49	G3HAZ (358)
48	G3FIH, G5ML, G6TA (487)
47	G3HBW, G5WP
46	G4HT (476), G5BY, G6YU (205)
45	G2DVD (362), G2XC, G3BJQ, G3KEQ, G5JU
44	G2CIW (192)*, G3BK, G8DA
43	G2AHP (500), G3BA, G3COJ, G3HWJ, G4RO, G5DF
42	G2HOP, G3BNC, G3DLU*, G6CI (220), GM3EGW (146)
41	G2FQP, G3DO, G3WS (255)
40	G2DDD, G3CGQ, G3IER, G3JWQ (256), G8KL
39	G2CZS (275), G2IQ, G3DKF, G3DVK (208), G3GBO (434), G3VM, G8IL (325)
38	G2FCL (234), G3APY, G3CKQ, G3HTY, G5MR (336), G8VN (190)
37	G2FNW, G2FZU (180), G3DLU
36	G2DCI (155), G3CXD, G3IIT, G3KHA (195), G6CB (312), G8IP
35	G3FZL, G3FYY (235), G3HCU (224)
34	G3AEP, G3BKQ, G8IC, GC3EBK
33	G3HHY (125), G3LHA (113)
32	G3HIL, G8QY, G8VR, GC2FZC

observations on these satellites. It would be a good idea to have a converter and a beam ready for this frequency.

Noise from the Sun

Still on the IGY theme (almost), we have an extremely interesting report from G3CGQ (Luton), who spent most of the day on December 23 watching his S-meter with his beam headed in the direction of the sun. From an arbitrary zero, he was getting up to eight S-points of noise during a period from 1040 to 1540 GMT. Note that this was on *two metres*. Between 1040 and 1230, the noise was observed as sharp flicks, or pulses, above a mean level which itself varied somewhat. Peak intensity was at 1230, with upward flicks corresponding to bursts of noise. Between 1430 and 1500 GMT, the noise effect was erratic, with a general fading down of the mean level, until by 1530 the noise was down to one S-point; from 1540 onwards, all was quiet. The maximum observed on the meter was S8, corresponding (on G3CQG's S-meter) to a strong two-metre signal. Variations were from S2 to S7.

The noise was sharp on the beam, 10° either side of maximum being sufficient to lose it almost entirely, and to keep up the maximum intensity the beam had to be moved to follow the path of the sun.

While all this was happening, conditions on the two-metre band itself were very poor, even below the "normal low" for the season; it would seem almost as if there was a degree of absorption taking place.

Sun noise can often be heard on a southerly beam heading, but this is the first report we have seen of it having been followed round for so long at such a high level of intensity on two metres.

Owing to the time factor, it has not at the moment of writing been possible to check with official sources as to what the sun was doing on December 23, nor have we been able to get an evaluation of DX results on the HF bands. Allowing the usual 48-hour interval, it would have been on Christmas Day and Boxing Day that the HF bands might have been affected by what appears to have been a solar flare of exceptional intensity. And, of course, the level of amateur DX activity on the HF bands would, in the nature of things, have been at about its lowest on Christmas Day, in any event.

More About Activity

We have mentioned before the statistical activities of SWL Drybrough (Coventry), who spends a good deal of time listening and makes some interesting log analyses as a result.

Briefly, he shows that for the

Worked	Station
31	G3HXO, G3KPT (108), G5RP
30	G3FRY, G3GOP (208), G3GVF (129), G3IRA, G3KEF (110), G5NF, GM3DIQ, 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), G4LX, G4MR (189)
25	G3JMA, G3JXN (220), G5SK, G6PJ
24	G3DLU*, G3FD, G3FXG, G3FXR, G3JHM
23	G2AHY, G3CWW (260), G3HSD, G3YH, G4JJ/A, G5PY
22	G2DRA, G3AGR (135), G3ASG (150), G3BPM, G3GSO, G5AM, G8NM
21	G2AOL (110), G3DVQ, G3IWJ, G6XY
20	G3EYV, G3IOE
19	G3FEX (118), G3GCX, G5LQ (176)
18	G3DBP, G3JGY, GC2CNC
17	G3EGG
16	G3FRE, GM3DIQ*
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 are worked.

* New QTH

TWO METRES

COUNTRIES WORKED

Starting Figure, 8

16	ON4BZ (DL, EI, F, G, GC, GI, GM, GW, HB, LA, LX, ON, OZ, PA, SM, 9S4)
15	G3GHO, G4MW, G5YV, G6NB (DL, EI, F, G, GC, GD, GI, GM, GW, HB, LA, ON, OZ, PA, SM)
14	G2FJR, G2HDZ, G3IOO, G5BD, G8OU
13	G2XV, G3BLP, G3CCH, G3DMU, G3GPT, G5DS, G6XM, G6XX
12	G2HIF, G3WW, G5MA, G6LI, G6RH
11	EI2W, G2AJ, G3ABA, G3DVK, G3HAZ, G4RO, G4SA, G5UD
10	G2FQP, G2HOP, G3BK, G3BNC, G3EHY, G3FAN, G3GHI, G3GSE, G3WS, G5MR, G8IC, GM3EGW, GW5MQ
9	G2AHP, G2CZS, G2DVD, G3FIJ, G3IUD, G5ML, GC3EBK, PAØFB
8	G2CIW, G2DDD, G2XC, G3AEP, G3DKF, G3GBO, G3HCU, G3HWJ, G3JWQ, G3VM, G5BM, G5BY, G8SB, GC2FZC

three months Sep.-Nov. inclusive, only 11 stations outside his local area (Warwickshire and the eight surrounding counties) came on at some time in each of the three months. They were: G3FAN, G3GPT, G3HXS, G3KEQ, G3WW, G5KG, G5KW, G5MA, G5YV, G6NB and G8VZ. Taking two months, the number increases to 13, and for one month only the total is 30, including quite a number of GDX and EDX call-signs.

Then, ignoring DX altogether, he shows that another 22S in his local area (Warwickshire and surrounding counties) came on at some time during each of the three months; 15 others were on during two months only; and 16 more for one month.

His totals for the three months Sep.-Nov. 1956 are thus 107 different stations in 30 counties and 5 countries—which, from near the middle of England, is good going on the receiving side, even if it is disappointing in terms of activity. However, the fact remains that from the neighbourhood of Coventry, more than 100 different two-metre stations were workable at some time in the three months.

The practical value of this statistical data is obvious, because it establishes exactly what the level of activity was and, within useful limits, where it lay. Since, during the dead periods, there would have been other areas of activity which were not (owing to conditions) within receiving range of Coventry, it follows that the over-all level of activity was higher—during the three months September to November—than it would have seemed to anyone just listening round the band. This is a point we have frequently made when discussing the activity factor. It is, of course, also only too true that while the figures may prove one thing, what one decides in one's own mind is based upon what can be heard when one goes on the air to look for somebody to work!

Four-Metre Possibilities

As one of our correspondents this month says, the new 4-metre band should be looked upon not as another local (meaning U.K.) talking channel, but as a potential DX band. What this means is that in the same way as the W's and VE's would like us to put in 50 mc receivers so that we can cross-band them Six/Ten, we would like them to get fixed up with good 70 mc receivers so that they can cross-band us Four/Six.

It is this that should be our objective with the new band—Four/Six Trans-Atlantic working. Such a result would be a great deal more interesting (and valuable) than 50/28 mc cross-banding, which has all been done before, anyway, and is not itself in the field of VHF DX.

This coming 12-18 months may well see the only opportunity there will be in the lifetime of many of us to achieve a Trans-Atlantic contact cross-banding Four/Six—and what an achievement will be the G/W "First" on this theme! If the predictions are reliable, it should be possible, and from QTH-to-QTH at that, without the necessity for organising an expedition anywhere. If the MUF does go high enough in these latitudes for our 70 mc signals to cross the Atlantic, they will be just as strong and as easily workable as the W's are now on 50 mc.

There are plenty of U.K. stations well able to cope with the problem, and it is very much to be hoped that the W's will co-operate to the extent of providing themselves with 4-metre receivers—as, indeed, we are sure they will. The dedicated VHF types in the States are just as keen as anyone on this side when it comes to grasping an opportunity to break new ground.

And, for the record, your A.J.D. would predict that the right time to start trying for this Trans-At. is any afternoon around 1500-1600 GMT from February onwards, when W/VE stations can be heard coming in well on their 50 mc band.

On 25 Centimetres

Whatever recommendations may be made as regards working frequency areas in the 1250 mc band, the only thing that is certain is that they won't suit everybody! Our own firm contribution to this

TWO METRES

COUNTIES WORKED SINCE SEPTEMBER 1, 1956

Starting Figure, 14

From Home QTH only

Worked	Station
47	G3GPT
42	G5MA
41	G3KEQ
35	G3GHO, G5ML
33	G3DKF, G3JWQ, G3LHA
32	G2DVD
31	G2CIW
30	GC3EBK
29	G3IOO
26	G3KHA, G3WW
25	G3CKQ
24	G3KUH
23	G3KEF, G3KPT
19	G3FIH
18	G5MR
15	G3IER

This Annual Counties Worked Table opened on September 1st, 1956, and will run till August 31st, 1957. All operators who work 14 or more Counties on Two Metres in the year are eligible for entry in the Table. The first claim should show a list of counties with stations, which can be added to thereafter as more counties are worked.

discussion is that it is the LF area that should be used, because of the markedly higher efficiencies obtainable as between 1200 and 1300 mc. On the other hand, we would agree that the prime requirement is to have everyone *together*. The worst thing that could happen in the development of the 25 cm band would be to have "private parties" camped in groups across it from the LF to the HF end. There would be just no chance of contact being made.

Also to be considered are the interests of those already on the band, who have provided themselves with equipment and are now fully operational. One such group consists of: G3GDR, Abbots Langley, Herts., 1297.83 mc; G3HBW, Bushey Heath, Herts., 1297.05 mc; G5CD, Hendon, Middx., 1297.53 mc; and G5DT, Wallington, Sy., 1298.05 mc. As G3HBW says, "I do not think there is any question of our working anywhere else in the band."

Station News

G3KHA has rebuilt his two-metre transmitter on the lines of the G3GPT design described in the June 1956 issue of SHORT WAVE MAGAZINE—he says it "certainly gives the watts," and estimates the RF output to be over 60 watts. G3KHA discusses the band plan in the light of the comments in this space last month, and gives instances to show that some stations, and in particular Continentals, do not tune to the high end of the band at all—his opinion is that those above about 145.25 mc are at a definite disadvantage.

There can be no question that if the two-metre band plan is to succeed, everybody must tune the whole band—the proper procedure to use is QLM, QMH, QHM and so on.

G3DLU (Sheffield) is altering his two-metre converter to the YU1AD design (*see* SHORT WAVE MAGAZINE, December 1956), in which several other correspondents are also very interested.

G3MA (Gt. Bookham) is maintaining his five-nights weekly schedule with G3ALC (Rutland) and also keeps in touch with the

SEVENTY CENTIMETRES

ALL-TIME COUNTIES WORKED

Starting Figure, 4

Worked	Station
28	G2XV
26	GW2ADZ
23	G3BKQ, G6NB
20	G3HBW
19	G3KEQ
18	G3IOO
16	G6NF
15	G4RO, G5YV
14	G2HDZ
13	G2CIW
10	G2OI, G3IRW
9	G5DS
7	G2DDD, G2HDY
6	G3FAN, G3JHM, G3JMA, G3KHA, G3WW
5	G3FUL, G3IRA, G3IUD, G5ML
4	G3JGY

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

Derbyshire stations G3JWQ and G5CP. Bob is now at 42C in Annual Counties. G5BD (Mablethorpe) has a new 70 cm converter on which he can "hear G3HBW most nights," and G3GSO, of Derby, writes in for the first time with a claim for the All-Time; for his 112 stations worked he has a total of 77 QSL's. G3GSO remarks that he has been on two metres since 1951 and has found that the quality one must cultivate is that of patience!

What G3WW (Wimblington) calls "just casual operation since Sept. 1st" has brought him in 26 counties for the Annual, though he was out of it for the October openings, due to illness. Nothing has been heard from his neighbouring counties of Norfolk and Suffolk. On the evening of December 8, G3WW had hopes of working GI, as he could hear G3HWS (Southport) getting a QSO as early as 1830.

G3KPT (Kingswood, Bristol) reports that he is on every evening "for at least an hour," and can often hear the carriers of London stations with their beams in the wrong direction. However, he works G3KEQ and G5MA on two metres, and on 70 cm has heard G5KW and G6NB. G3HHY, on 70.26 mc, has been worked cross-band, also GW4CG on 70.23 mc. G3KPT remarks that though he has been able to work "over the 100 stations within a year of getting his licence," his score in terms of QSL cards is still less than 50% of those sent.

Note from Kenya

VQ4EV (G3GBO) writes from Nairobi with a list of nine VQ4's who are fully equipped for two metres. Of the nine, all in and around Nairobi, VQ4GB has the best location, nearly 2,000 ft. above the town. Several of the VQ4's run to good beam assemblies and they are certainly very keen and active amongst themselves. Unfortunately, however, as Don says, "Africa is too big for the few VHF types in it." The greatest separation between any of the Nairobi group is only 25 miles.

If conditions do develop for true long-distance working on VHF, the most likely part of the world for the first such openings to occur will be in the equatorial belt. Thus, the VQ4's will be well placed, and we may yet see a new world record for VHF established by one of the Nairobi stations.

This thought leads on to the idea of international DX tests on two metres, for which the best period should be about July to September this year. While the first thought is an organised series of tests, in fact the best answer is probably a high level of activity with careful listening for DX, and watching for unusual phenomena on the band.

In Conclusion

For next month, we hope to hear from many more of the followers of this piece, for which the closing date will be **Wednesday, January 23,** addressed A. J. Devon, "VHF Bands," *Short Wave Magazine*, 55 Victoria Street, London, S.W.1. And a very Happy New Year to you.

RADIO EQUIPMENT IN THE "QUEENSHIPS"

I.M.R.C. INSTALLATIONS IN R.M.S. "QUEEN MARY" AND "QUEEN ELIZABETH"

N. P. SPOONER (G2NS)

The material for this article—which will be of interest to many readers who have wondered what sort of gear is fitted in a big passenger ship—was provided by courtesy of the Cunard Company, owners of the "Queens," and the International Marine Radio Company, contractors for the radio equipment. A later article will discuss the frequency bands and operating procedures used in ship-shore working.—Editor.

THOSE who live in or near the great liner ports are often envied for the unrivalled opportunities thus afforded them of making a close-quarters inspection of the big ships using these ports. Unless nautically-minded, or with an interest in the engine room, the one part of a ship of which the average reader of SHORT WAVE MAGAZINE would like to know more will, of course, be the radio office.

In the case of ships like the "Queens," their majestic bearing forbids the vulgar approach, and neither a claim to long local residence nor the waving of a personal QSL card will of themselves gain access to the radio room, or liberate any technical information about the gear. If, on the other hand, one applies through the "correct channels," then nothing but courtesy and friendly co-operation will be forthcoming from the publicity department of the Cunard Company and the technical people at the International Marine Radio Company, who operate the radio gear they have supplied and installed in the *Queen Mary* and the *Queen Elizabeth*. To them the writer's thanks and acknowledgments are due for making available to him the official and up-to-date information given in this article.

The structural details of these magnificent ships need not concern us here—except, perhaps, to emphasise that they are by far the largest passenger ships afloat, and that they are British! We might take advantage of the wide circulation overseas of SHORT WAVE MAGAZINE to mention these points for the information of those W's and others who, having been brought over to Europe as GI's during the war, thought they were being carried in some mighty new product of an American shipyard! *(The flag-wagging is forgiven!*—Editor.)

General Layout

Let us now put to sea in the *Queen Mary* and hand in a message for transmission at the acceptance office on the promenade deck, where a pneumatic tube delivers it to the receiving room. This is also the control room and is copper-screened to minimise pick-up from the normally unattended, remotely-controlled transmitters situated some 420 feet away, and from any stray QRM generated by ship fan motors, vacuum cleaners, cabin fans and other electrical gear.

A feature of the control system is the rapid wave-change that can be carried out in less than five seconds on the three remote HF transmitters and, depending on the channel sequence, between five and ten seconds on the Medium/Long wave Tx used for CW contact with ship and shore stations. Normal traffic is dealt with by two of the HF transmitters on telephony (also available for CW) and the other HF transmitter on CW (also available for phone). The HF telephony terminating equipment includes send-and-receive path monitor and line amplifiers, volume indicators and speech inverters. Two-wire extensions are made to the ship's private branch exchange and thence to the 700-odd telephones on board, the two-wire system working into a "four-wire" radio path (and the inland telephone trunk system) *via* hybrid coils. Signal-to-noise ratio on the "receive" path is improved by volume expanders; hybrid coil losses and degrading are avoided by using a four-wire booth when ship-shore telephony conditions deteriorate.

Of the two receivers at each operating position, one is extensively used for monitoring; this allows rapid QSY to be effected if conditions require asking the shore station to try another channel. Multiplex operation at peak periods gives a rapid and smooth clearance of CW and telephony traffic. A Creed automatic running in excess of 100 w.p.m. will swallow Wheatstone slip fed into it from a keyboard perforator, and a magnetic tape recorder will take Morse press bulletins for play-back in quieter moments. To comply with safety regulations, a complete emergency station, with accumulators and charging equipment, is always ready to go on the air from the receiving room; in this is also kept one AM and one FM telephony VHF transmitter, with their receivers. Silenced typewriters are used to take down incoming aural signals, and a desk connected by lines to all receivers and by direct telephone to the bridge, transmitting room, exchange and the deck office gives the supervisor on duty a full picture of the work in progress.

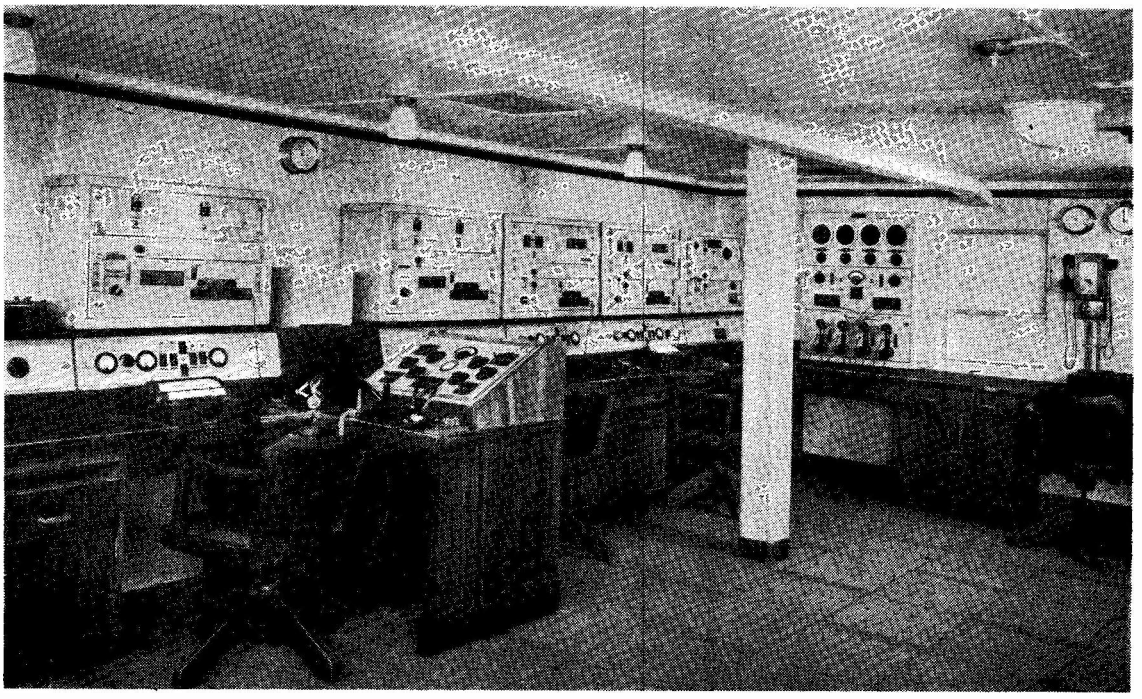
The Transmitting Equipment

Turning now to the transmitting room, we find there, in addition to the four main transmitters, the controls for the 35 KVA 3-phase motor alternators, housed several decks below, that supply power to the entire station. Transmitter No. 1, normally associated with R/T position 1, is a five-stage crystal-controlled modified Type ES4A, a suppressor-grid-modulated transmitter covering 4-20 mc with 24 pre-set frequencies. Its CW aerial power is 800-1300 watts, with a 250-watt carrier for telephony. The remote control arrangements comprise press-button operation for LT and HT on-off, selection of Channels 1-6 and frequencies A, B, C, D. CW or Phone working is selected by switch lever. The crystal oscillator, one half of a 4074A double triode, is capacity-coupled to the second half, which acts as a doubler; in the

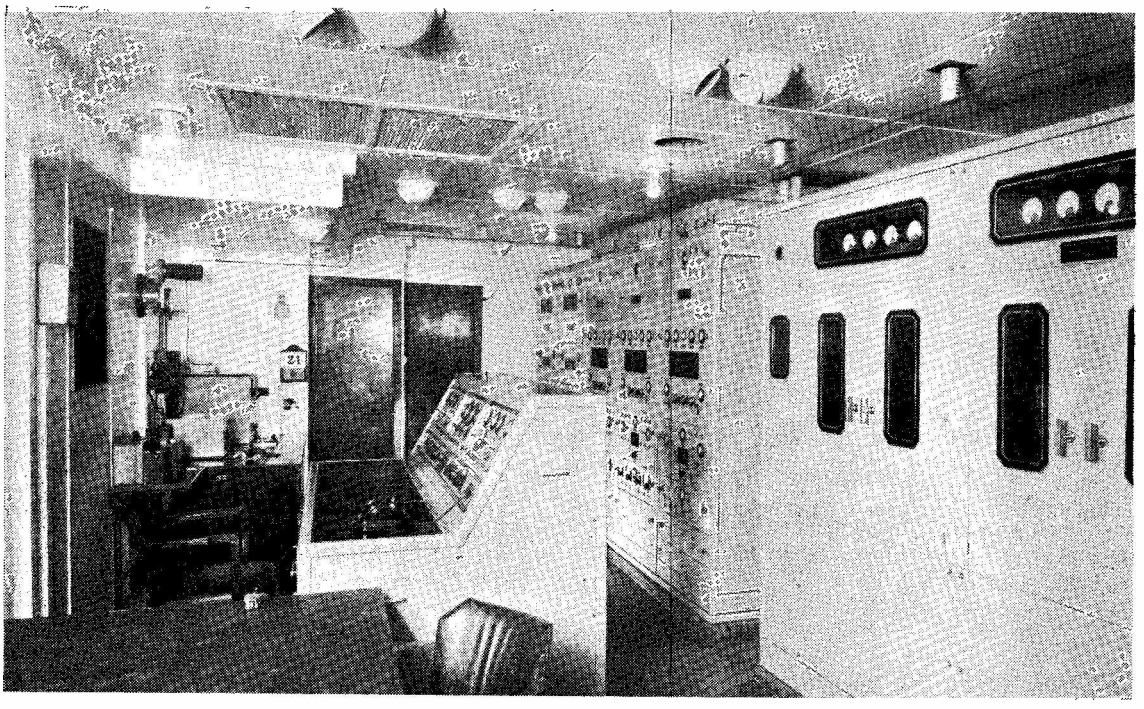
tuned anode circuit of this stage is a channel selecting relay for feeding the RF output to the next stage in the chain and also for completing the cathode circuit of the 4074A. With the relay open, the cathode circuit is made through a high resistance to prevent undue build-up of heater-cathode voltage. The drive from the oscillator-doubler stage is taken to the grid of an 807, *via* a tapped RF transformer, which then acts as a buffer or doubler as required. The grid leak of the 807 is in series with the load resistance of an electronic keying unit, the valve being negatively biassed to cut-off when the key is on "space." Electrically-operated contactors select any one of six pre-tuned rotatable coils in the anode circuit, and the output is capacity-coupled to the grid of the next buffer-doubler stage, which is an 813. This stage has combined grid and cathode bias and its anode circuit, capacity-coupled to the final, employs six similar coils. The PA consists of two paralleled 5D/100A valves in Class-C, and normal 80% modulation is effected on their suppressor grids; these are made positive with respect to the cathodes for CW and negative for phone. Separate tuning coils are used for each channel, and the speech amplifier incorporates a voice-operated gain adjustment device.

Transmitter No. 2, normally in R/T position 2, is a five-stage crystal-controlled Type 14C, covering 2-18.1 mc with 10 pre-set frequencies. Its aerial power is 800 watts CW and 400 watts phone, modulation being applied to the anode and screen of a pentode 282A penultimate stage. The remote facilities comprise telephone dialling control for HT on-off and selection of Channels 1-10, with CW/Phone selection by switch lever. Crystals for the 307A pentode oscillator stage are selected from a bank of ten by push-rods actuated by the dialling mechanism. The oscillator anode is close-coupled to the grid of a 282A pentode stage located immediately above it. In the anode of this first stage are channel-selecting push-rods for picking any one of ten pre-set rotating inductors. Close-coupling is again employed into a second 282A pentode stage, of which the anode is tuned to the fundamental or to double that of the first stage. Capacity-coupling then connects into the grid of a 282A pentode modulating amplifier tuned always to the frequency of the second stage. The PA is a neutralised 251A triode, and its anode is tuned by any one of ten pre-set coils that are also duplicated in the aerial tuning arrangements.

The third transmitter, covering 1.76 to 22 mc, is an ES4B and similar in many ways to the ES4A, with the exception that plug-in output valves are used and the PA anodes have photo-cell protection against over-heating. This Tx has an aerial power of 1 kW, with 300 watts on phone, and the remote facilities comprise LT and HT on-off control by press-button, CW/Phone by switch key and Channel 1-6/Frequency A, B, C, D selection by rotary switch. The fourth transmitter, a 3-kilowatt MO-PA Type M20A, covers 515-365 kc and 100-160 kc, CW and MCW, with ten pre-set frequencies, for ship, coast and distress frequency working. MCW at 700 c.p.s. is effected on the anodes, the remote facilities of this



Radio receiving and control room of the R.M.S. "Queen Elizabeth." The transmitter installation is entirely separate and the receiving office is fully screened against interference from the ship's extensive electrical equipment.



An impression of the remote-controlled transmitter equipment in the R.M.S. "Queen Elizabeth." The transmitters are normally unattended. In the far left-hand corner is the entirely separate battery-operated installation for emergency operation on the 600-metre band. The whole of the radio apparatus in the "Queen Elizabeth" and her famous sister the "Queen Mary" was supplied and installed by The International Marine Radio Company, Ltd.

transmitter comprising CW/MCW and HT on-off control by switch key lever with Channel 1-10 selection by telephone dial. The MO is a 4279A triode in a Colpitts circuit, tuned by selection of the required inductance tap with shorting out of unused turns, an operation carried out by a motor-driven selector switch and the dialling system. Keying is in the grid of the MO, a metal rectifier back-biassing the valve during spacing. The PA consists of three paralleled 4279A triodes. The aerial circuit is magnetically coupled to the closed circuit, the degree being pre-selected by the main switch contacts and taps on the coupling coil. For long-wave working, the inductance of the loading coil was permanently set during installation.

"Queen Elizabeth" Installation

The radio gear supplied, installed and operated aboard the elder "Queen" by the International Marine Radio Company so thoroughly fulfilled all requirements that they were commissioned to fit the younger *Queen Elizabeth*. This installation consists of three modified ES4's and one M20A, the former being for HF telephony and CW traffic and the latter for CW/MCW contact with ship and coast stations. The separating distance of 400 feet between receiving and transmitting rooms permits satisfactory multiplex working, the receiving room being copper-screened with power supplies led in *via* an internally shielded 1:1 transformer.

The four normally unattended transmitters are remotely controlled from the receiving position, with rapid wave-change in less than five seconds in the case of the three HF sets, and between five and ten seconds for the one medium/long wave transmitter. The terminating equipment of the telephony circuits includes privacy, monitor and line amplifiers, voice-operated gain adjustment, weighting amplifiers, hybrid coils, volume indicators and level measuring equipment. Volume expanders are fitted in the "receive" path. A telephone dial and four press-buttons remotely control the HF transmitters, the dialling giving a selection of quarter, half or full power, CW/Phone and any one of six different channels, while the press-button unit will select any one of four spot frequencies in the channel dialled, the total available being 24 spot frequencies. A channel and frequency intergrating device homes on an indicator at the control position and gives a visual check of the frequency actually set up at the transmitter. By means of a probe, a portion of rectified RF is fed to a carrier indicator and side-tone monitor unit. Field strength and modulation readings are remotely indicated during telephony working, and on CW rectified RF triggers an audio oscillator for the output to be fed to the CW receiver in use. The level of keyed side-tone is adjustable from the receiving position.

The medium/long wave transmitter is remotely controlled by telephone dial, and an indication of the

frequency actually set up is given by a latching relay with a pointer. Five HF Phone/CW receivers, two MF/LF and one LF receiver are available at the operating position, with another HF/MF/LF receiver in a " silent room " and a magnetic tape recorder for feeding received news bulletins into the public address system. A Morse perforator and transmitter for high-speed CW and an AM and an FM transmitter/receiver complete the receiving side.

Turning now to the actual transmitting room on the *Queen Elizabeth*, in addition to the four transmitters already mentioned, this also houses a crystal-controlled battery-operated medium-frequency emergency set, having an aerial power of 50 watts. Its associated HF/MF receiver is mains operated with entirely automatic change-over to battery when needed. A keying unit provides automatic transmission of auto-alarm and distress signals. A fully-equipped workshop, a plan table and the control desk for the two 35 KVA three-phase motor alternators, completes the transmitting side. With slight variations, the modified ES4's and the M20A tally with the descriptions already given for the *Queen Mary*.

On any Atlantic passage, a heavy volume of passenger traffic is handled through the radio office in both ships, on CW and telephony, and the radio staff is kept fully occupied.

The generosity shown by the management of the International Marine Radio Company in giving the foregoing information concerning the radio equipment of these two very famous liners is gratefully acknowledged by the author.

NEW " SAVBIT " SOLDER ALLOY

The new " Savbit " alloy introduced by Multicore Solders is claimed to prevent the absorption into the solder alloy of copper from soldering bits. It is said to prolong the life of copper bits by as much as ten times. This special alloy, which actually contains a small percentage of copper, can be supplied in diameters of 14, 16 and 18 SWG, incorporating extra fast, non-corrosive Type 366 Ersin Flux. There is no appreciable difference in the melting points of " Savbit " Type 1 Alloy and the higher tin content alloys generally in use. Ersin Multicore Type 1 " Savbit " Alloy is available in two entirely new retail packs : A 1lb. reel containing approximately 170ft. of 18 SWG costs 15s., and a new popular pack, with 53ft., is 5s.

THE W6AM STORY

Arising from the item on p.479 of the November 1956 issue of SHORT WAVE MAGAZINE (" Careful with Reporters "), W6AM of Rolling Hills, Calif., sends us a cutting of the description of his station as treated in the local paper out there. W6AM explains that the article was produced by careful collaboration between all concerned — the newspaper editor, the reporter who " covered the story," and W6AM himself. The result is a good, readable article, written in such a way as to interest the lay public without causing irritation or amusement (or giving offence) to the knowledgeable reader with an understanding of Amateur Radio. There is absolutely nothing about " hams " or " best 73's."

Members of the N.A.T.O. Valve Standardisation Group recently visited the Hammersmith factory of the M.O. Valve Co., Ltd. The chairman of the Group is Mr. H. G. Hughes, here discussing the new G.E.C. hydrogen thyratron, E.2503, with his colleagues. They have an extremely important function to perform, in that the Valve Standardisation Group recommends specific types for use in all the electronic equipment operated by the N.A.T.O. forces. The M.O. Valve Co. is now a wholly-owned subsidiary of the General Electric Co., Ltd.

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.

DL2ZU, Sgt. C. R. Barrett. c/o Sgts' Mess, R.A.F. Station, Gatow, B.F.P.O. 45.

EI9BD, S. Naughton. Crannagh, Ballina, Co. Mayo.

G3CCR, H. Porter, 5 Queen's Road. Sedgley, nr. Dudley, Worcs.

G3KPU. E. Prince, 12 Lidget Lane, Retford, Notts.

GM3KXM, J. Anderson, 33 Millbeg Crescent, Barlanark, Glasgow, E.3.

G3KWW, Dr. R. W. Wilkinson *(ex-ZC1AF),* Flat 3. 298 Goldhawk Road, London, W.12.

G3KXR, A. J. G. Keiller, 7 Meddowcroft Road. Wallasey, Cheshire. *(Tel.: NEW 4685).*

G3LES, S. Smith, 20 Dunkirk Road. Hillside, Southport. Lancs.

G3LFZ, G. G. Ellis, Little Croft, Beresford Road. Newhaven, Sussex.

G3LGD, G. W. Denby, 104 Rooley Lane, Bankfoot, Bradford, 5. Yorkshire.

G3LGH, J. H. Sunderland. 11 Clement Street, Rochdale, Lancs.

G3LHC, B. L. Bonehill. Brumar, West Farm Close, Ashtead, Surrey. *(Tel.: Ashtead 4299).*

G3LHG, E. W. Smith. Shelcliffe Kennels, Shelford, nr. Radcliffe, Nottingham.

G3LHM, A. Whetstone, 32 Spencer Road, North Wembley, Middlesex. *(Tel.: ARN 7231).*

G3LHP, D. Earnshaw, Gerharden, Alkington Road, Whitchurch, Shropshire.

G3LHQ, B. Crisp, 5 Granny Hall Park, Lightcliffe Road, Brighouse. Yorkshire. *(Tel.: Brighouse 1923).*

G3LIA, R. J. Rogers, 25 Ridgeway, Berkhamsted, Herts.

G3LIN, D. Wright, 42 Malvern Crescent, Spring View, nr. Wigan, Lancs.

G3LIR, M. A. Harrison, 15 Brookhouse Avenue, Leicester, Leics.

G3LJT, J. W. Hayter, 4 Chesterford Gardens, Basildon, Essex.

G3LJU, A. G. Bennett, A.M.I.Mech.E., Assoc.M.C.T.. 13 Benomley Drive, Almondbury, Huddersfield, Yorkshire. *(Tel.: Huddersfield 5743).*

G3LKB, Dr. L. C. Bousfield. Church Gate, Billingshurst, Sussex. *(Tel.: Billingshurst 142).*

G3LKD, A. Dunscombe, 14 Upper Station Road, Radlett, Herts.

CHANGE OF ADDRESS

G2BCX, F. C. Judd, 1 Canterbury Avenue, Ilford, Essex. *(Tel.: Valentine 1783).*

GM2BD, W. D. Ingle, 33 Craiglockhart Gardens, Edinburgh, 11.

G2CNN, P. M. Branton, The Mount, Studland Bay, Dorset. *(Tel.: Studland 221).*

G2HNO, L. J. J. Morgan, 52 Seafield Road, Southbourne, Bournemouth, Hants. *(Tel.: Southbourne 47182).*

G3AGO, A. M. Bryant, 56 Mount Crescent, Brentwood, Essex.

G3BGY, G. A. Bryan, Beehive Lane, Ferring, Sussex.

G3BYY, E. W. Elliott, High Curley, Staines Road, Wraysbury, Bucks.

G3BZF, H. Goldthorp, 115 Great Stone Road, Firswood, Manchester, 16.

G3CHN, R. V. Thorn, Decca Navigator Transmitting Station, Bolberry Down, nr. Kingsbridge, S. Devon.

GM3EDZ, T. Hughes, 53 Ancroft Street, Glasgow, N.W.

G3EHE, K. J. Mather, 7 Normanhurst Road, Walton-on-Thames, Surrey. *(Tel.: Walton 5637).*

G3EKP, J. E. Whittle, 59 Belthorn Road, Belthorn, nr. Blackburn, Lancs.

G3FCQ, L. J. Dumble, Righi, Pilmer Road, Crowborough, Sussex.

G3FDV, S. Ledbrooke, West Walla Bungalow, Heathfield, nr. Tavistock, S. Devon.

GM3FFQ, W. Donaldson, 11 Broomhall Place, Edinburgh, 12.

G3GUL, N. Cash, 38 Mountview Court, Green Lanes, London, N.8.

G3GXX, W. S. Horsfall, Skerryvore, Holmefield Avenue, Cleveleys, Lancs.

G3HC, V. Delnevo, 27 Oxford Hill, Witney, Oxon.

G3HQU, J. G. Jackson, 243 Rawlinson Street, Barrow-in-Furness, Lancs.

G3HRW, H. Hunt, 3 Richmond Street, Cheriton, Folkestone, Kent.

G3HSW, J. Cassidy, 40 Trevethick Street, Gateshead, 8, Co. Durham.

G3HZM, M. Barnsley, 11 Cemetery Road, Denton, Lancs.

G3IGZ, D. W. Bruce, 13 Southwood Road, New Eltham, London, S.E.9.

G3IKW, K. W. Ireland, 41 Portway, Baughurst, nr. Basingstoke, Hants.

G3IVB, L. R. Beeson, 17 Lumley Avenue, Skegness, Lincs.

G3JPP, Sgt. E. H. Price, Westways, Pulley Lane, Salwarpe, Droitwich, Worcs.

GW3KGR, R. W. Lupton, Sgts' Mess, R.A.F. Station, Pembroke Dock, Pembs.

G3KLM, P. J. LeMoine, 72 Manor Road, Selsey, Chichester, Sussex.

G3KME, P. G. Pennell, 32 Stricklan Road, Cheltenham, Glos.

G3KSU, A. R. Williams, 24 Marlborough Road, Ipswich Suffolk. *(Station at Chelmsford, Essex.)*

G3LCG, G. P. Bateman, 131 Parklands Drive, Loughborough, Leics.

G4GR, J. McK. Archer, 6 Friars Road, Newport, Mon.

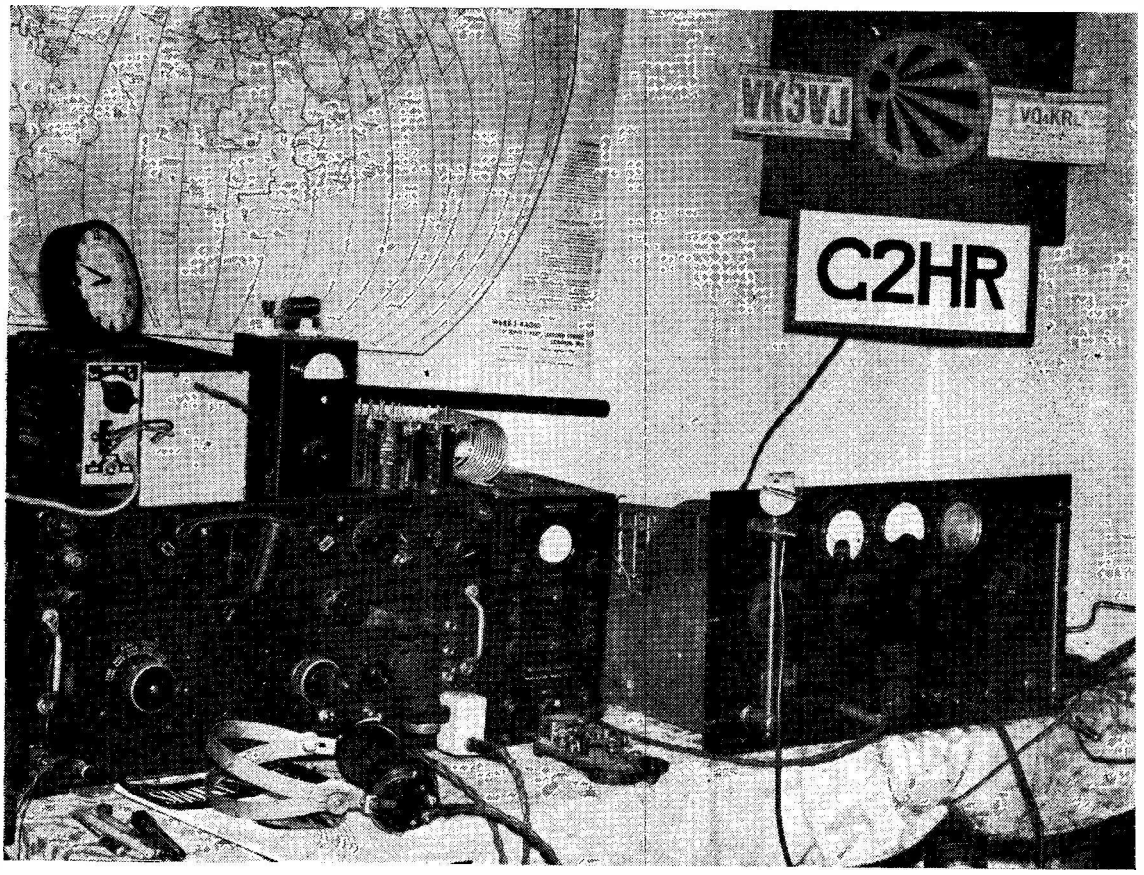
G4HQ, F. D. Roberts, 33 Albion Hill, Loughton, Essex.

G5GJ, F/Lt. F. W. Benson, A.M.Brit.I.R.E., Far View, Bledlow Ridge, nr. High Wycombe, Bucks.

G8RY, F. E. Wyer, 21 Tredington Road, Glenfield, Leicester, Leics.

The Other Man's Station

G2HR



WITH the exception of the 1939-45 war period, scarcely a week has gone by during the past 27 years without a signal being radiated under call-sign G2HR — owned and operated by E. Johnson, 35a Woodland Road, Chingford, London, E.4.

The station was first licensed AA ("artificial aerial") as 2ADC in 1928, the full radiating permit under the present call-sign being obtained a year later. As no mains were then available, a start was made with ultra-QRP, using but half-a-watt from batteries to a "one-lung" self-excited oscillator. Despite the limitations, *plus* a not-so-stable home-cooked 0-V-1, some 30 countries were worked and several Trans-Atlantic contacts were even made—in those days, band occupancy and therefore QRM were not what they are now, and DX with such QRP was quite feasible.

Nowadays, occupation of a small flat (with garden, luckily) has necessitated compromise and the crowding of the equipment into limited space. The transmitter, on the extreme right, is a converted ex-RAF driver unit covering 1.8, 3.5, 7 and 14 mc. With a switched power supply, inputs of from 10 watts (on Top Band) to 50 watts on the HF ranges can be obtained. Despite the simplicity of the line up, which is no more than 6V6-807, a clean signal emerges on all bands, the doubts of the sceptics notwithstanding. A small modulator for Top Band phone, using 6AC7-6L6, has been incorporated for plate-screen control of the 807; this has also been used for screen modulation on the 7 and 14 mc bands, with the 807 run at full input.

The receiver is a BC-342, to which many modifications have been applied. To the right of the receiver can be seen a small 'scope, used for general monitoring. Also available is that very necessary adjunct to any "surplus" receiver used on the amateur bands — a crystal calibrator giving 1000-100-10 kc check points.

At G2HR, interest is on the theoretical rather than the operating or constructional side, and in the course of the years several articles have been con-

tributed to the Amateur Radio press. Most of the practical work is done on aerials, in which interest has never flagged. Results have been achieved on most of the popular types, as well as on those lesser-known, such as the "VS1AA."

As regards operating, the first choice has always been CW on 14 mc, with occasional appearances on 3.5 and 7 mc. DX worked has been world-wide, and though nothing sensational can be claimed in terms of zones, countries, states or what-have-you worked and/or confirmed, the fact is that there are few parts of the world into which the G2HR signal has not penetrated during the last quarter-century. Top Band is used in the main as a "relaxation band," and operation on it is confined mostly to local phone.

G2HR is not a contest station; under modern conditions, this is considered to be more a test of endurance and good operating than skill in construction. Preferred is the easier atmosphere of rag-chewing, DX or local — but G2HR still gets a thrill from winkling out the more difficult ones when the opportunity presents itself.

NEW UHF TRIODE BY G.E.C.

The G.E.C. A.2521 is an indirectly heated, high slope, low noise triode specially suitable as an RF amplifier for frequencies from 500 to 1000 mc. The A.2521 has a slope of 12 mA/V and an anode dissipation of 2½ watts. In normal receiver applications it is free from microphony. The noise factors are 9 at 500 mc and 12 dB at 900 mc. The valve can be used GGT, when the gain and the bandwidth are adjustable by altering the coupling between the anode line and the output loop. At 900 mc, for a power gain of 16 dB, the attainable bandwidth is 4 mc; for a gain of 6 dB this becomes 80 mc.

ULTRASONIC SOLDERING OF ALUMINIUM

As is well known, there are many difficulties associated with the self-soldering of aluminium. An interesting application of aluminium wire is its use as a speech coil in high-quality loudspeakers. The main advantage is its lightness, which reduces the mass of the vibrating system, thus widening the response into the high frequency audio range.

Mullard Equipment Division have pioneered a method of soldering aluminium which has made this practicable. Ultrasonic energy is fed to a bath of molten solder, which causes cavitation to occur. When the aluminium wire is dipped in the solder the cavitation effect removes the oxide film normally present on the aluminium and tinning takes place. On removal, the layer of solder thus fixed to the aluminium enables it to be soldered in the ordinary way.

It is usual to use a 90%/10% tin-zinc solder in the bath with no flux, and the only restriction on the soldering afterwards is that no *chemically* active flux should be present. It is recommended that 60%/40% tin-lead resin core solder be used.

This method, which has had great success in many fields where soldering of aluminium is necessary, has been of particular use to loudspeaker manufacturers. The perfection of the method—which has only recently been achieved by the Mullard Company after some years—has come about by very close co-operation between Wharfedale Wireless Works and Mullard Limited. Wharfedale Wireless have for some time employed the Mullard method of soldering their aluminium speech coils.

Since this modification was installed at Wharfedale Wireless Works three months ago, there has not been one failure on aluminium speech coil windings due to faulty soldering.

THE VQ3/VQ4/VQ5 POPULATION

According to the well-produced "Circular Letter" of the Radio Society of East Africa, there are now 10 licensed VQ3's, 43 VQ4's and 8 VQ5's who are full members. In addition, the Society has 22 SWL members. Production of the "Circular Letter" is the responsibility of Inspector D. T. Bradford, VQ4EV (G3GBO of Denham, Bucks., when he's in the U.K.), who will be well remembered as a keen VHF operator ever since his SWL days. VQ4EV makes a very good job of the "Circular Letter," which runs to 12 duplicated foolscap pages, clearly and accurately typed and neatly bound. It puts to shame some of the "blotched impressions," dignified by far more grandiloquent titles, that we get from certain club groups! This is not meant unkindly, but only to emphasise that production of a clean job *is* eye-catching and no more difficult than doing a messy one.

TRIBUTE TO RADIO AMATEURS

For 1956, the BBC's series of Reith lectures—always one of the most important scientific contributions of the year — was delivered by Sir Edward Appleton, G.B.E., K.C.B., F.R.S., of Edinburgh University. Sir Edward is famous throughout the world as a physicist, with radio as his special subject. In the course of his third lecture, "Science for Its Own Sake," given on November 25, it was interesting to hear him pay proper tribute to the work of amateurs: "It is a fact," said Sir Edward, "that most sciences have profited substantially from the work of amateurs — and the subject of radio is, notably, one of them." The lecture was reprinted in full in the BBC's *Listener* dated November 29.

TRANSISTOR RECORD PLAYER

The AG.9121 Record Player/Amplifier by Philips Ltd. Electrical utilises four transistors, in the sequence OC71-OC71-p/p OC72's which, running only from four 1½v. cells in series, will give about 600 mW audio output, with a battery life of approximately 100 hours. The 6v. battery also runs the turn-table motor, which is governed to maintain the correct speed throughout the life of the battery. The AG.9121 plays 7-, 10- or 12-in. records, standard or microgroove, and gives the necessary three-speed settings of 33⅓, 45 or 78 r.p.m. The total weight of the Player is only 10½ lbs., and it is completely portable.

THE ELEVENTH MCC

• The Magazine Top-Band Club Contest •

NOVEMBER 17-18 : 24-25, 1956

THIS year's MCC was no disappointment for all those Clubs who have been looking forward to it keenly since the end of the previous battle, twelve months back. The entry list of 36 was as good as it has ever been, topping last year's by two and equalling the record of 1950; the new shortened operating periods made things even more lively; and new names come up into the Roll of Honour for the first time.

Stourbridge scored a resounding win, a clear 21 points ahead of **Bailleul,** the runners-up. They, however, were only one single point ahead of **Harlow,** who take third place.

Grafton, Mitcham and **Sheffield** were fourth, fifth and sixth in a very close bunch, with only three points between them.

A very interesting fact is that, despite the clipping of four whole hours off the total operating time, compared with the last few years, the scores have not fallen off by more than a few points. (Last year's winner, with sixteen hours of operation, scored 453 points; this year's victor managed to aggregate 431 in only twelve hours.)

1st: Stourbridge & District Amateur Radio Society, G3BMY (431)

2nd: Bailleul Radio Society, G3IHH (410)

3rd: Harlow & District Radio Club, G3ERN (409)

The Participants

We show the positions and scores in Table I, and 36 Clubs are listed therein. Other alleged "Club" stations appeared from time to time and caused the eager scorers to claim three points, but they have had to be discounted by the adjudicators.

Leicester, G3AWM/A, and Plymouth, G3GRA/A, appear to have operated somewhat sporadically; and Leicester sent a log so late that it could only be accepted for check purposes. Ravensbourne, G3HEV, worked seven or eight stations but clearly marked their entry "Check Log," so they were not treated as being in the Contest. Points for contacts with such Clubs have been down-graded to one only, this being the fairest means of settling matters. Thus, nearly all contestants have had their scores slightly reduced by the judges, but it is important to note that this has not, in any instance, affected their position. (For example, the top three claimed 435, 418 and 413 respectively, but finish up in the same order with 431, 410 and 409.)

Among the highly doubtful "club" stations claimed were Mill Hill, Littlehampton, Rhigos, Aylesbury and Northants. The latter turned out to be G4KS, a single-operator station on throughout, who sent in a check log but was definitely not a club. Had there been any unanimity in the claiming

Out in front by the handsome margin of 21 points, Stourbridge & District Amateur Radio Society came first in the Eleventh MCC with a total of 431 points. Operating was by G3BMY (shown here) assisted by G8GF; each took one week-end. Their equipment consisted of a CR-100 receiver and a specially designed transmitter, coupled together and working on a common half-wave end-on aerial, the whole installation being arranged for full electronic break-in. The transmitter was crystal-VFO mixer, the variable oscillator section covering only the 200 kc of the 160-metre band; the arrangement was two EF50's with wide-band couplers into an 807 PA. Stourbridge are to be congratulated on a very fine performance in a hard-fought Contest.

of some of these contacts as being worth three points, we should have had to hold an inquest—but in most cases only one Club tried it on, all the others listing the same station as a one point contact !

The Scoring

For the first time, we have broken down the scores as shown in Table I into Club Contacts and Non-Club Contacts. If one takes the actual Club entrants as 36, then the maximum theoretical score for Club contacts would, of course, be four sessions of 35 each, giving 140 contacts or 420 points.

The two leading stations obviously did extremely well to collect 127 and 128 Club QSO's respectively, and it was **Stourbridge's** 50 non-Club contacts that finally won the battle for them. This again shows the vital importance of the single-point QSO's. To be in the first three, everything on the band has to be worked.

The numbers of single-pointer stations worked are substantially down on last year, which was to be expected. The cutting of the operating hours made it an important matter to round up all possible Clubs during the period, without spending too much time on other contacts. We can visualise, at last, a future MCC based on Club contacts only. (The only reason this has not been tried before is because it was feared that several Clubs might each score the "possible" and end up with the same total—though this does not appear at all likely in the light of this year's experience.)

Checks on the logs showed discrepancies in RST reports, as logged by the two ends of the same QSO ; other faults were incorrect logging of QTH or QRA, including some clever guesswork that didn't always come off! Closing-down at 1900 GMT sharp was not all it might have been, but points were duly deducted for all contacts heard going on after closing time. One of these was initiated as late as 1907, but entered as 1859 GMT — by the operator's watch, of course, it might have been!

On the whole, however, the event was very tidy ; the "to Club or not to Club" ambiguity was reduced to the lowest level possible, and there has been very little indeed in the way of criticism, either of the rules or the general conduct of the Contest.

Comments

Judging by the observations of the invigilators and the many comments on the subject, operating was of the usual high standard. Such instances as deserve criticism were not due to wilfully bad behaviour of the "hogging" type, but rather were they small incidents such as might always occur when two inexperienced operators meet.

[over

TABLE I

POSITIONS AND SCORES

	CLUB	CALL	Club Contacts	Non-Club Contacts	TOTAL POINTS
1.	Stourbridge	G3BMY	127	50	431
2.	Bailleul	G3IHH	128	26	410
3.	Harlow	G3ERN	121	46	409
4.	Grafton	G3AFT	111	60	393
5.	Mitcham	G3KKZ	116	43	391
6.	Sheffield	G4JW	117	39	390
7.	Clifton	G3GHN	113	28	367
8.	Chester	G3GIZ	113	27	366
9.	Slade	G3JBN	109	29	356
10.	Sutton and Cheam	G2BOF/A	108	29	353
11.	Neath	GW3KSQ	109	17	344
12.	Liverpool	G3AHD/A	102	32	338
	Wirral	G3CSZ	103	29	338
14.	Rugby	G3BXF	101	24	327
15.	Nottingham	G3EKW	94	32	314
16.	Coventry	G2ASF	92	33	309
17.	Gravesend	G3GRS	83	35	284
18.	Crystal Palace	G3IIR	84	26	278
19.	Salisbury	G3FKF/A	87	11	272
	Stoke-on-Trent	G3GBU	88	8	272
21.	Grimsby	G3IYT	76	36	264
22.	Stevenage	G3JLA	76	13	241
23.	Aldershot	G8TS/A	76	12	240
24.	Thanet	G3DOE	73	18	237
25.	Bury	G3BRS	71	19	232
	Harrow	G3EFX/A	71	19	232
27.	Derby	G3EEO	67	20	221
	Medway	G2FJA/A	66	23	221
29.	Wrexham	GW3IHL	68	6	210
30.	Edgware	G3ASR/A	59	23	200
31.	Southport	G2DQX	59	19	196
32.	Torbay	G3GDW	58	8	182
33.	Walsall	G2FPR	48	9	153
34.	Honington	G3KHT	43	2	131
35.	Compton Bassett	G3HXZ	38	9	123
36.	Wellingborough	G3KSX	26	14	92

Bailleul Radio Society, G3IHH, rang the 2nd bell in the Eleventh MCC, their first appearance among the leaders in this annual inter-Club contest. Here is the team: Upper left, G3HDD; lower left, G3DXJ; lower right, G3IVH; upper right, G3LKP. They ran 10 watts to an EF50-EF50-TT11 transmitter, with an AR88 receiver, and the aerial was 290 ft., end on. Though R.E.M.E. personnel, members of Bailleul are not necessarily Army Signals types, which is to mean that all four operators shown here are strictly radio amateurs who have learnt it in the ordinary way, and not as professional operators.

Not all Clubs treat this Contest with the deadly earnestness that makes them work their crack operator until he falls dead . . . . many of them regard the event as a fine opportunity for giving their less experienced brass-pounders a chance of operation under real Contest conditions.

Thus, occasionally, we heard G3XYZ call G3UVW; the latter replied to someone else, but G3XYZ went back just the same and thanked him for his report! There was often plenty of QRM around Club stations—sufficient to confuse even a veteran of Contests—and the novices might well be excused for grasping the wrong end of the stick on occasion. There was a certain amount of what we might call "pedestrian operating," but this as it should be, and showed that the less experienced members were being given a chance on the key.

Individual Club comments confirm this, but in general they emphasise only the enjoyment of their members. **Wellingborough,** apologising for their low score, say that their QTH is over shops in the centre of the town, with fluorescent lighting going full belt immediately beneath them . . . . and only recently installed, at that, so probably not yet properly treated against QRM. Nevertheless, "the operators, log-keepers and general assistants enjoyed the Contest and look forward to participating again—perhaps from a quieter QTH."

Honington were "still in the throes of getting organised . . . . a single-handed effort . . . . a very enjoyable contest, and we hope for a 'maximum effort' entry next year." **Torbay** say "very tough working from this part of the country." True—the geography was against them.

Wrexham say "Very pleased to get North Wales into the Contest for the second year, and look forward to next year's . . . . suggest 1700-2000 GMT, as only locals can be worked in the first hour."

Medway "used this year's MCC to give several younger members practice. Thoroughly enjoyed by all—roll on next year." **Stevenage** is a very recently-formed Club, and their entry is, they hope, the first of many. But "why was it that all the activity seemed to be in the first 50 kc of the band, from 1800 upwards? Calling CQ in the wide open spaces higher up the band produced only a stony silence."

Thanet report "considerable gaps of operating time lost, due to blocking of receiver by GNF, North Foreland Radio . . . . Contest appeared to be supported in greater strength on the second week-end." **Grimsby** thought "conditions on first week-end were not too good, and found the going very hard." They feel that all Clubs should use a club entry and several operators . . . . "to allow one man to go right through the Contest on his own rig gives him an advantage, and is not quite in the spirit

TABLE II

ROLL OF HONOUR, 1946 - 1956

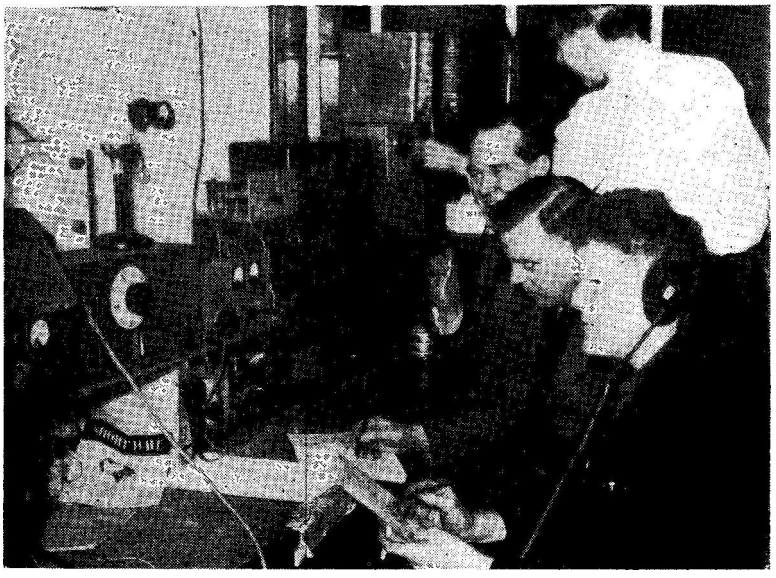
Year	1st	2nd	3rd	Total Entries
1946	Coventry	Cheltenham	Grafton	20
1947	West Cornwall	Warrington	Coventry	14
1948	Rhigos	Coventry	Wirral	28
1949	Rhigos	Neath	Coventry	25
1950	Rhigos	Neath	Coventry	36
1951	Coventry	West Cornwall	Surrey	28
1952	Chester / Neath	—	Clifton	28
1953	Neath	Chester	Surrey / Salisbury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

of the Contest."

Shorts

"Our effort not so good as in previous years, but it stimulated the same interest" . . . **(Salisbury).** "Why do all Clubs stack themselves ten deep in about 40 kc and QRM one another to pieces?" . . . **(Crystal Palace).** "Receiver trouble was coupled with the loss of a major portion of the aerial at crucial times—we apologise to others who may have called us without results" . . . **(Coventry).**

"Aerial re-arranged on fourth day—from 266-ft. dipole to 600-ft. 'random-fed.'" . . . **(Nottingham).** "Enjoyed the Contest and look forward to an improved position" . . . **(Liverpool).** They did improve, too — from 27th last year to 12th this year!



Harlow & District Radio Society came third in MCC, only one point behind Bailleul. G3ERN (nearest camera) was supported by, from front to rear, G3GWE and G3JVI, who is sightless. The log-keeper was SWL Pamplin (white shirt). It is also Harlow's first appearance in a lead position.

At **Wirral** G3CSG was unable to take part because of illness, and the substitute was G3CSZ, of TTX fame. He found it difficult to persuade some stations that he was *not* G3CSG!

Sutton had a lower score on the second day through a slip-up — the aerial tuning unit was not removed to the "/A" address, twelve miles away, on that occasion!

"Activity unfortunately only in the lower part of the band" . . . **(Slade)**; "Contest was enjoyed by all who took any part in it at all" . . . **(Chester)**; "No complaints — most of the operating from the other competitors was of a very high standard, borne out by the very small number of 'repeats' necessary" . . . **(Harrow).**

"Only our second attempt, but enjoyed it immensely — standard of operating excellent" . . . . **(Mitcham)**; "Single-point stations were hard to find, and generally cost valuable minutes, due to slower operating technique . . . **(Bailleul).**

Suggestions

In general, everyone seemed quite happy about the rules. **Grafton** consider the three-hour sessions a great improvement on the previous four-hour arrangement, but would like to see the number of sessions cut down to two.

Clifton feel that three hours represents the absolute minimum, and that members travelling long distances would not spend time and money turning up for a shorter session. (There is no suggestion that they will be cut shorter than three hours.)

Edgware suggests that it would help, in future, if non-Club stations would agree to operate above 1875 kc; at least Clubs could probably come to a "gentleman's agreement" with local stations on these lines.

Finally, several Clubs suggest 1500-1800 GMT as the future operating session. At the moment we are doubtful about the wisdom of this, in view of the popularity of Sunday evening TV. The advantage might be that GDX conditions would be better, with more single-point stations to work.

Some Figures

Taking this year's leading three stations, **Stourbridge** jumped from 14th, last year, to the top; the other two, **Bailleul** and **Harlow,** appeared "from nowhere," not having figured at all in previous lists.

Still comparing with last year, **Grafton** improved their position from 22nd to 4th, and **Mitcham** from 17th to 5th. Other notable climbers were **Neath** (31st to 11th), **Liverpool** (27th to 12th).

Newcomers to the Contest included, in addition to the second and third scorers, **Crystal Palace, Stevenage, Honington** and **Compton Bassett. Grafton** and **Coventry** are among those who have appeared in every MCC since the beginning.

The judges would like to thank all log-keepers for the way in which the final figures were turned in. This made their task relatively simple. In particular, congratulations on the high logging standard shown by **Sutton and Cheam, Nottingham, Edgware, Derby, Stevenage, Grimsby, Crystal Palace, Rugby, Liverpool, Wirral** and **Mitcham.**

Club Secretaries are asked to note that the deadline for next month's reports is **Friday, January 18.** They should be addressed to "Club Secretary," *Short Wave Magazine,* 55 Victoria Street, London, S.W.1. And now, a happy New Year to all Club members, and in particular to their hard-working honorary secretaries.

SMALL ADVERTISEMENTS

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

TRADE

CONVERTERS for 14, 21, 28 mc bands, from £4 10s.; s.a.e. details. High pass filters for TV receivers, 18/6 (and post.).—G3FXB, 86 Cross Road, Southwick, Sussex.

NO. 19, Mk. II, Transmitter/Receiver, brand-new, complete with power supply; no hand sets; £6 10s., carr. paid.—Sound Television Ltd., Elms Road, Aldershot.

TELEVISION Interference: Receiver Filters—High-pass E.5037, 30/-; Low-pass E.5031, 30/-; Composite Band I/III, 49/6; Transmitter Filter E.5034, 80 dB, 1 kW., £6. — Labgear (Cambridge), Ltd., Willow Place, Cambridge.

QSL CARDS AND LOG BOOKS, G.P.O. APPROVED. CHEAPEST, BEST. PROMPT DELIVERY. SAMPLES. — ATKINSON BROS., PRINTERS, LOOE, CORNWALL.

WANTED: BC-610 Hallicrafter, ET-4336 Transmitters and spare parts for same. Best prices. —P.C.A. Radio, Beavor Lane, Hammersmith, W.6.

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

READERS' ADVERTISEMENTS

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

70 CM and 2m, 4-over-4 array on 40-foot pole, mounted prop-pitch motors, £10. ZC1, Mk. I, phones and mic., Vy FB, £8. Philips merc. rect. Charger, 6/52v. x 18 amps., £15. Buyer collects.—G4OT, Ranworth, Woodham Walter, Essex.

HALLICRAFTER S38, 550 kc - 32 mc, 110/230-volt transformer, £10. — G3JUZ, 1 Central Barrier, R.A.F. Finningley, Nr. Doncaster, Yorks.

TE149 WAVEMETER, 200 kc - 20 mc, perfect order, £10. ADVANCE constant voltage transformer; input 190 - 260v., output 230v., 150 watts, £4. " Viceroy " hand-operated shaver, new, £4 10s.—Boys, Cold Arbor, Pyrford, Woking. *(Byfleet 3906).*

740 Rx, 1955 model, brand-new; no reasonable offer refused over £30.—12 Zealand Road, Bow, London, E.3.

WANTED: CR100 Manual; UM2; 750v., 250 mA c.t. transformer; 78A relay. SALE: TW6/126 line transformer and S914 scanning coils by Haynes; HRO handbook; 12 Set manual. Offers or exchanges similar, new condition.—Box No. 1818, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

SMALL ADVERTISEMENTS, READERS—*continued*

PHILIPS Recordergram Major; mike, 2 tapes; as new; best offer or exchange for good Communications Receiver (cash adjustment if necessary). —Box No. 1817, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

HALLICRAFTERS Communications Receiver SX-23, 540 kc - 34 mc, xtal, good order, with manual, £25. Original owner.—G4JW, 580 Redmires Road, Sheffield, 10.

FOR SALE: New 813 and base, 40/-. PT15 (three), 8012 (two), 807 (four), 3/6 each; EF50 (ten), 2/- each. Various ceramic switches (four).—Box No. 1819, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

JERSEY HOLIDAY.—Stay at "The Lincoln," 3 St. Saviour's Road, near sea/town centre; s.a.e., please, for brochure.—Douglas Byrne, GC3KPO.

B2 POWER PACKS wanted; must be in new condition. — G2NJ, 34 West Parade, Peterborough, Northants.

RECEIVER 1155A with power supply, speaker, medium wave swung to cover Top Band, £7 10s.; BC348N built-in power supply, needs re-aligning, £10; BC453 Q/Fiver, £2; ex-Government 50-watt amplifier, four KT66 in parallel push-pull, 250-volt, output imp. 600-ohms, less valves, £19. Admiralty Rectifier unit SE8, input 230v. 50c., output 300v. at ½-amp., bias 150v., LT 13v.; £5. Atlas power supply RM250/350, input 230v. 50c., output 250/350 mA at 210/230v. or 250v., metal rectifier; £3. Rees-Mace AC/DC Amplifier, UA66 200/250v., output 10w.; £10. TU5B tuning unit, 15/-; Tx Marconi TW12 Rotary Transformer, 1300v., with shunt starter, suppressor, £5; 80-ohm dummy load resistors, 7/-. All articles over £1, carriage extra, *via* S. Walker, 34 Humberstone Road, Grimsby, Lincs.

HALLICRAFTERS Communication Receiver, Type S27, 28 - 143 mc, AM/FM. G.E.C. Miniscope in case; double beam unit; wobbulator. All in good condition; all handbooks. What offers?—G3KRJ, 41 St. John's Avenue, Chelmsford, Essex.

FOR SALE: B4/40 Table-top Tx, 80 - 10 mc, 40w. CW/35w. Phone; 100% mod. plate-screen; appearance immaculate—but needs slight attention—complete with xtal mic. and handbook. What offers? —Box No. 1816, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

SALE: Complete course in Morse (twenty lessons), cheap.—38 Fowley Common, Glazebury, Nr. Manchester.

CLEARANCE: 1191A Wavemeter, set spare valves, £4 (and carriage 10/-); Handbooks 504, 640, 2/-; BC221M, 7/6; MN26C, 5/6. Valves: New boxed — EF37A (two), 10/-; CV321 (KT66) (four), 807 (six), 7/6; 6V6GT (seven), 6SN7 (six), 5/-; VR150/30 (five), CVS1 (two), 4/-; 2C39A (two), 50/-. Small qtys. unboxed — VR65, VR100, TT11, 25L6, VR99, 2/-; 6J5G, 6V6G, VS110, 6SL7GT, 4/-; VU39, VR91, 2/6; 6L6G, 7/6. Three-inch Magslip Tx, 10/-; Dynamotor PM, 12-480v., 10/-; VR91 ceramic holders, 6d. Urgently required: 522 mod. xformer.—G3IEX, Roper, 21Q Alderton, Woodbridge, Suffolk.

AR88D with speaker and manual, £55 10s.; BC348 with speaker, 12 volts DC input, £22 10s.; Wavemeter, Class-D, No. 1, Mk. II, input 6-volt AC, and manual, £6.—*After 7.30 p.m.:* R. Jones, 124 Dunlace Road, Clapton, E.5.

SMALL ADVERTISEMENTS, READERS—*continued*

CR100/7, very good condition and performance. £14; crystal oven, mains voltage, with 100 or 1000 kc crystal, 50/-; AR88LF, I.F. and B.F.O. coils, 5/-; AR88 Trimmers, 2/-; 832's and TT15's. 10/-. WANTED: AR88 trimming tools and S27 CA manual.—Box No. 1820, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

WANTED by VK5EU, arriving U.K. 27th January, good Rx and Tx (preferably Minimitter or Panda). — Write Young, Bishopsgarth, Heathside Road, Woking, Surrey.

FOR SALE: BC221-T, new condition, £45; also BC624 receiver, £2. WANTED: Manual or BC639A receiver.—Box No. 1821, Short Wave Magazine, 55 Victoria Street, London, S.W.1.

WANTED: T1403 manual, buy or hire; ARRL handbook; R109 or R1224A — cheap, for breaking.—Wallace, Newington Lodge, Annan, Dumfries-shire.

GELOSO VFO/6146 PA, CW Tx, 50-watt input; completely bandswitched and TVI-proof; table-top cabinet; £17 (power supply, £3 10s.). Plus carriage.—Details from G3GHB. 31 Franklin Road, Birmingham, 30.

WANTED: 813 Base, 12/6 cash (or exchange for 832, plus base). FOR SALE: Unmodified S640, with selected valves and preselector, £16 (o.n.o.). WANTED: SX28, CR100, HRO, or similar Rx.—G3KJG, 6 Handforth Grove, Manchester, 13.

FOR QUICK SALE: Eddystone 750, virtually new, with S-meter; perfect. Also Chapman FM Tuner. London area.—Box No. 1822, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

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