

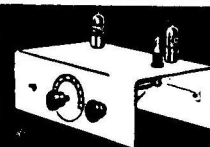
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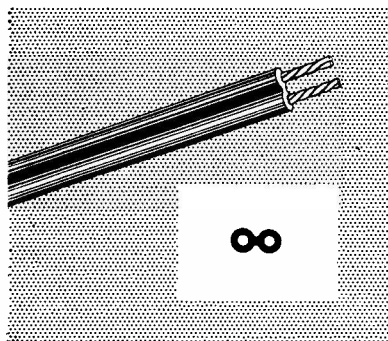
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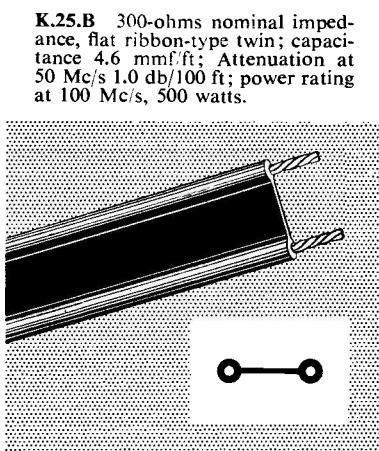
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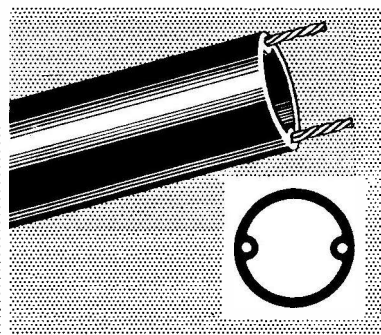
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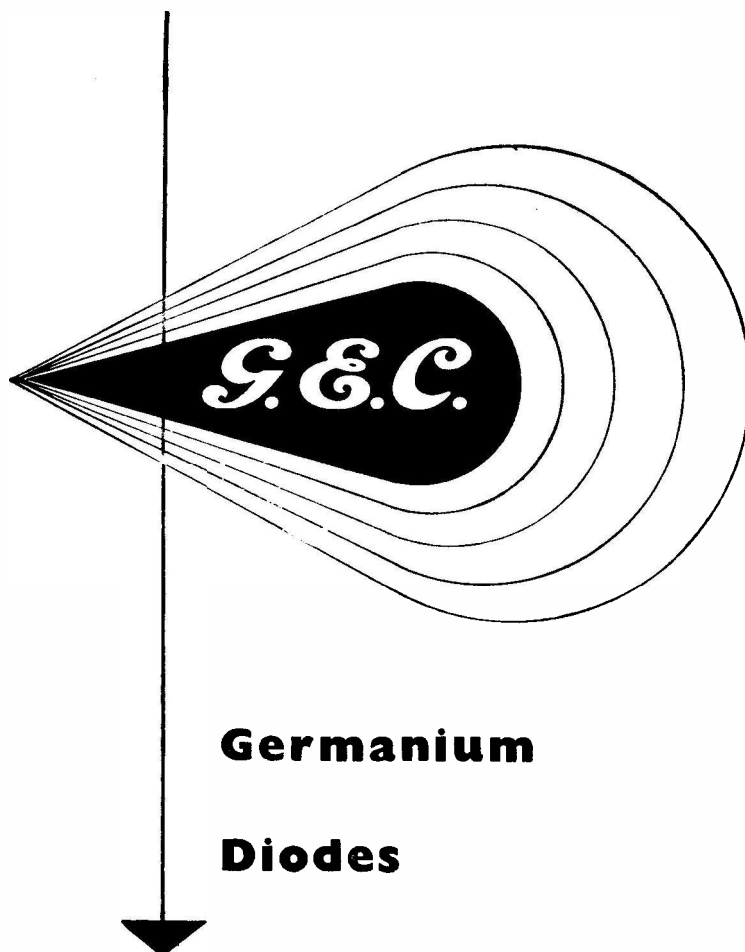
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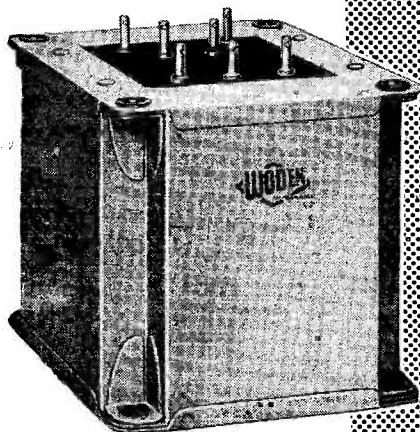
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FOR THE EXPERIMENTER AND THE RADIO ENGINEER

The SHORT-WAVE Magazine

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There can be no question that among the best amateurs are those who have served a long apprenticeship as SWL's. There can be few who, holding callsigns that mean anything today, did not cut their teeth as SWL's. They were introduced to Amateur Radio either by the chance hearing of some local transmitter (usually on 160 metres) on a home-built receiver or, in later years, by listening round on the bands marked "amateur" on the short-wave ranges of the family BC receiver. Whatever their introduction, they found that progress in the art and science of Amateur Radio depended largely upon their own efforts.

It is this self-dependence that makes the majority of radio amateurs the unique body they are — able to think for themselves, individualistic and self-reliant, but without being absorbed in Amateur Radio to the exclusion of all other interests.

The SWL's of the present generation are exactly the same sort of people as those who, looking for advice and guidance 30 years ago, are the leading lights in the world of Amateur Radio as it is today.

If an SWL— young or old, shy or self-confident, professional or with only an amateur interest in radio — approaches you for advice, it is not only your duty, but also your privilege, to do all you can to help and encourage him and maintain his enthusiasm.

*Austin Fobell
G6FO.*

Multi-Band Exciter for TVI Reduction

DESIGN OF TWO-STAGE
UNIT FOR CW, AM OR
NBFM OPERATION ON 1·8
TO 28 MC

PART I

B. WARDMAN (G5GQ)

This interesting article discusses in considerable detail the practical problems involved in producing an all-band Exciter which can be expected to be reasonably TVI-proof. Using NBFM and normal PA inputs, TVI-free operation should be possible on most bands, except perhaps in the most difficult locations. And of these there can be few more difficult than the author's own. He brings out an important and interesting point as regards VFO design — that since a stable, switchable HF oscillator is taken for granted in any normal receiver working right up to the 28 mc band, it should be possible for an amateur-band VFO

WE radio amateurs are an individualistic crowd — we like to read constructional articles, but we don't always like to follow their designs to the letter. Quite right, too, because why should one rush out to buy new components and valves when there are lots lying about already in the cupboard? And anyhow, our needs are different from those of the chap who wrote the article, so we've just got to adapt his ideas to our particular circumstances. Hence, this is neither a "how to build" article, nor is it a theoretical digest: instead it's the story of three years' work on exciter design, of the things that were tried out and failed, and of those which finally turned out successful. Thus readers, and especially those worried about TVI, can pick up any points that appeal to them whilst avoiding those which are likely to prove unsuccessful.

Before getting down to brass tacks, the writer would make two points: First, there will be constant references to NBFM. For those not interested in 'phone, this definitely does not mean that this is an article on NBFM exciters: it was because NBFM was tried that vital factors to CW operation were high-lighted. Secondly, all the work was done with simple test equipment of the sort possessed by all

to attain at least the same degree of stability using similar circuitry. He shows that this can, in fact, be done and his approach is therefore the use of a multi-band oscillator as distinct from a multi-band exciter with its chain of frequency multipliers. So many practical points connected with VFO-exciter design and construction are covered in the discussion that it will be of interest and value even to those not bothered with TVI or particularly anxious to change over to NBFM 'phone.—Editor.

amateurs, e.g., a normal multi-range meter, a simple RF indicator (germanium detector and 100 micro-amp galvo), and so forth.

The beginning of it all goes back some five years when an article by the author, explaining simple NBFM, was published in *Short Wave Magazine*. In those days NBFM was only permitted on the 28 mc band, and that article was the first to point out that that system of modulation was one of the most promising anti-TV devices in sight. Subsequently, the GPO authorised its use on all our DX bands, and many stations are now able to use 'phone during TV hours as a consequence.

At that time, the exciter unit at G5GQ was very simple, almost breadboard. An EF50, doubling from 3·5 mc to 7 mc, was used as a combined oscillator-doubler in a Clapp circuit. A second EF50 doubled to 14 mc, whilst a third valve (QV04-7) doubled again to 28 mc, this driving a pair of 807's in push-pull. A 6SA7 reactance modulator applied NBFM to the oscillator. This arrangement gave excellent results, local stations going out of their way to be complimentary on modulation quality, whilst, during the ARRL 'phone contest, over fifty W stations were worked in one afternoon. Plug-in coils were used in the PA which, almost needless to say, produced stacks of harmonics guaranteed to appear on all the local TV screens!

With this promising start, it was decided to rebuild the station, modernising it for all-band switched operation with harmonic-reducing circuits. The PA contemplated was a pair of 807's in parallel "pi," though an 813 would be equally good.

Multi-Stage Exciter

Knowing the drive requirements, the first item started was the exciter unit and, after many months of work, an all-band exciter was constructed based on existing techniques. This consisted of a 1·7 mc Clapp oscillator, followed by a cathode-coupled isolator stage, and then

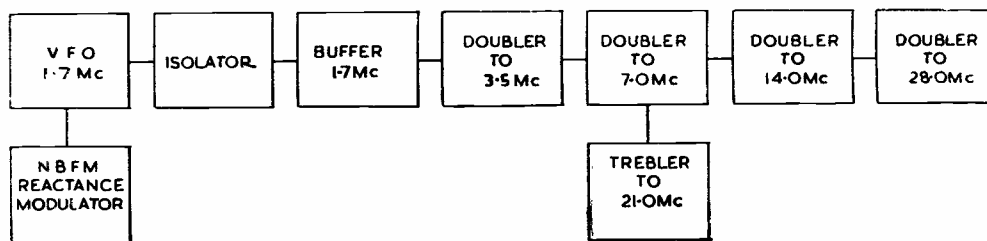


Fig. 1. Block schematic of the first exciter unit (with NBFM) used by G5GQ and discussed in his article.

a tuned buffer on 1.7 mc. Additional doublers were then switched in for each higher frequency band, as shown in the block layout in Fig. 1.

As far as tests possible in the average station could show, this unit should have worked properly. Hours were spent on screening it; each coil had its own separate shield. First tests, on CW and AM 'phone, were most satisfactory. But as soon as the NBFM was switched in, the trouble started. "Don't know what it is," said the locals, "but the quality just does not compare with your old rig." Every kind of adjustment, test and alteration was made, even to the extent of buying a new microphone, but all to no avail.

Eventually, the sheets of notes made on the tests and symptoms were gone through very carefully to see if a lead could be found. Only one conclusion could be drawn, parasitic oscillation. But if so, why did it not appear to show up on CW or amplitude 'phone? More thinking, and the answer to that one also became clear—which is that on CW and AM phone, 100% control from the drive unit is not necessary. Some readers will remember the old Goyder Lock circuit which operated on partial control. Briefly, this consisted of a high-power oscillator to feed the aerial (taking the place of the modern PA). Coupled to its grid circuit (link or similar coupling) was a low-power crystal oscillator, or oscillator and doubler, as drive source. When these were coupled together, the final oscillator, which on its own probably produced a rough and somewhat unsteady frequency, became "locked" to the drive frequency, taking on its characteristics and sounding like a crystal-controlled PA. Only a fraction of power was needed from the crystal unit, so the semi-power frequency multipliers used today were not required. Keying, of course, had to be done in the final stage since doing it earlier would have no effect. Yet this arrangement worked very well indeed on CW and, with careful adjustment, also on 'phone.

When it didn't, and the PA went off on its

own, the gibe about "You've lost the key to your Goyder Lock" was a favourite crack among old timers of 25 years ago!

And that was exactly what was happening with the new unit at G5GQ; it was controlling part of the time (when it worked properly) and locking the rest. With NBFM, however, one can't get away with "locking"; the PA must be properly driven all the time by the exciter unit. If there is any sign of parasitic oscillation — indeed, even of regeneration to any extent — in the exciter, then phase shift occurs, and with NBFM that sounds rough.

The obvious thought that occurred was what effect these parasites were having on CW transmission. Careful examination showed the existence of fairly weak but rough carriers in all sorts of places, not just truly accountable for by the local oscillator of the receiver. Again, tuning over all bands for key clicks, they would be completely silent on most bands and then suddenly re-appear elsewhere. How much interference could these cause to TV? And, of course, why spend time and money on suppressor circuits before stopping as much of the trouble as possible at the very source?

Parasitic Oscillations

Each stage of the unit was then examined very carefully, biasing being reduced or removed until the valve under test was running at just over maximum dissipation. The funny thing about valves is that they seem to have a rooted objection to oscillating where you want them to, but to oscillate just where you don't want them. Except for the oscillator, each valve was trying hard to play up on one band or another. That applied even to the isolator stage. Remember that it's only too easy to get an accidental resonance of grid circuit with plate or screen circuit; a small capacity and a long lead in the one can resonate with a short lead and a larger capacity in the other. Maybe it resonates around 29 mc. Nothing happens normally because nothing like that frequency is being used. The trans-

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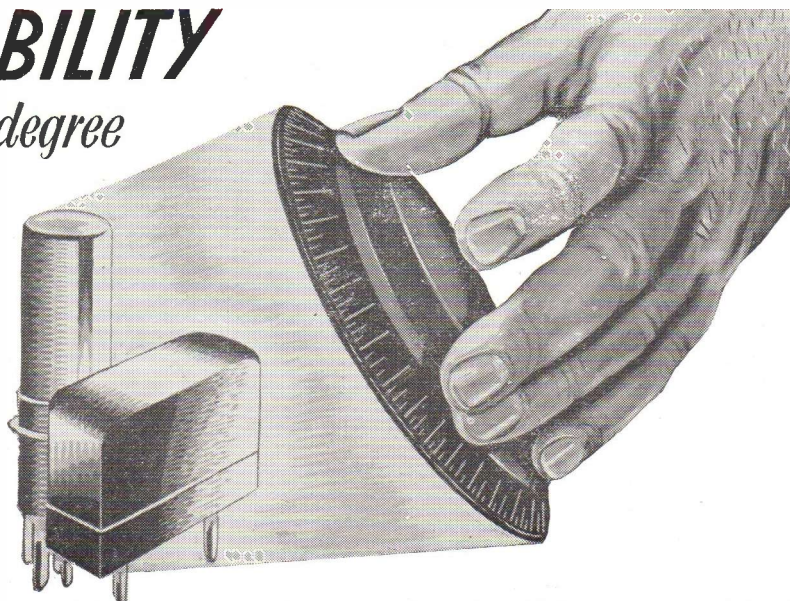
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mitter is put on 3.5 mc, using a fundamental of 1.7 mc in the oscillator circuit. This might generate a small harmonic just on that 29 mc spot, and off goes that particular isolator or doubler for part of the cycle. Into the PA it goes, where its amplified up. So from the PA we get a main output on 3.5 mc, and maybe up to 3 or 4 per cent. on this spurious 29 mc. That means a loss of power, and we don't spot it because we don't analyse our output frequencies. But worse, this 29 mc thing will only happen over *part* of the cycle, especially in a keyed transmitter. The key goes down, and output on 3.5 mc starts going into the aerial; but after a microsecond or so, the shock of pressing the key starts the faulty doubler generating the 29 mc parasitic, which it does with a nasty click. When the key is released, the 3.5 mc output may be stopped instantaneously, but this parasitic (being self-oscillation) will continue just those few micro-seconds longer, with a further click. Of course, it can be filtered out from the mains and from the aerial, but the sensible thing is to see that it doesn't happen in the first place, limiting any final filtering to genuine harmonic content which cannot be avoided by any other means.

So there was nothing for it but to scrap all this work and start afresh, this time reducing valves and circuits to an absolute minimum so that there would be the fewest possible chances of generating spurious oscillations. That could not be less than two valves, *i.e.*, an oscillator/doubler and a second doubler, to cover any reasonable required number of bands. Indeed, even for one-band operation, this minimum seemed necessary, for, once all other snags have been overcome, the eventual problem is maintaining stability in the oscillator whilst at the same time using it to control the PA or subsequent stage frequency. Thus, it was found quite unsatisfactory to attempt to feed the PA directly from the oscillator stage; any variation of load, *e.g.*, PA keying, reacted back and shifted the oscillator frequency by a fraction sufficient to give a pronounced chirp. This occurred even when the anode of the oscillator was tuned to a harmonic, though to a lesser

extent. An oscillator stage became essential.

First Simplified Approach

The first attempt to produce a two-valve, multi-band job was then begun. The bright idea was to use a good output valve for an oscillator on 1.7 mc, tuning its anode to the various harmonics required. For 28 mc operation, this meant trying to take the 16th harmonic from the anode circuit of the oscillator valve. Of course, harmonic output drops off very quickly, and anything higher than the third or fourth harmonic is too weak to *drive* a second doubler stage. But the usual driven doubler requires quite an appreciable amount of power, because it is biased back to take power and generate harmonics. The Class-A voltage amplifier, *e.g.*, the usual receiver RF amplifier, takes no power. Could we extract sufficient 16th harmonic content from an oscillator to make a straight RF Class-A amplifier produce enough volts on 28 mc to drive a small, 2 x 807 PA? (See Fig. 2.)

An exciter of that type would be an extremely neat unit—if it could be produced. Again constructional work was started, this time with even greater care because, as the second valve was a straight-through amplifier, it needed far more screening than did the first exciter in which the valves worked on different frequencies.

Despite an enormous amount of work, in which practically every type of harmonic-producing oscillator was tried, and many different types of valve tested, it again proved a failure. Working with the oscillator portion of the first valve on 1.7 mc, sufficient 4th harmonic could be extracted from the anode to excite a Class-A voltage amplifier on 7 mc as a straight-through stage, but it was useless beyond the 4th harmonic. This Class-A section required the most careful screening to hold it down. Greater output, simpler construction, and greater stability could be obtained by doubling in the first anode, with sufficient output from that to drive a conventional doubler to 7 mc. Back to more thinking.

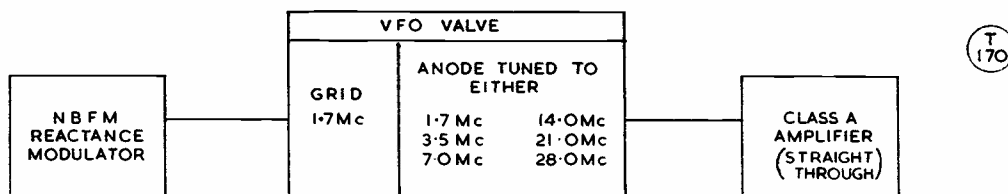


Fig. 2. Experimental two-stage VFO-buffer unit, using a Class-A RF amplifier in an attempt to produce increased drive from high-order harmonics. This arrangement failed to work satisfactorily beyond the 4th harmonic and was abandoned—see text for discussion.

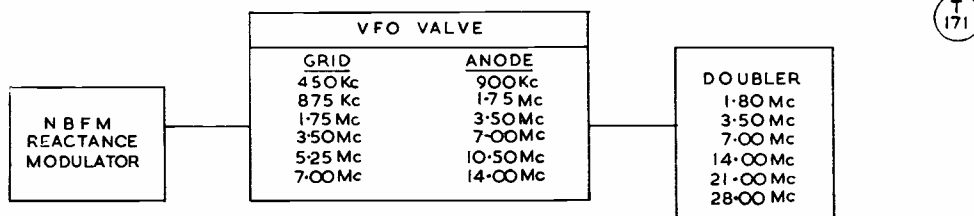


Fig. 3. Block diagram of an oscillator-doubler arrangement capable of giving stable drive output on all required bands. The valve combination is 6AG7-QVO4/7, and the finalised circuit is given at Fig. 4. See also the table of frequency relationships below.

Multi-Band Oscillators

Up to now a fixed fundamental frequency had been used. The oscillator had stayed on 1.7 mc and this used to try to produce final output on all bands to 28 mc, first by adding a number of doubler stages, and then by trying to "trick" harmonics from the oscillator itself—and the result had been failure. Why on earth stick to a fixed fundamental frequency? The text books all said that the Clapp and such types should preferably be used on about 1 mc to attain reasonable stability; most folk used them on 1.7 mc or perhaps 3.5 mc, but very rarely above. There seemed to be plenty of theoretical reasons against higher frequency oscillators for transmitter control, but just about zero practical information.

Yet, somehow, most receivers work nicely on 28 mc, and *they* have to operate almost to 28 mc on fundamental oscillators. It doesn't add up!

And so, by dint of these trials and tribulations, came the final design, using oscillator switching. But first, back to the preliminary working out of the idea. What sort of fundamental oscillator frequencies would be involved, and how would it work out in practice?

Now the basic conception of this simple type of unit had been for a two-valve job, using tetrodes or pentodes so that the second harmonic of the oscillator could be extracted in its own anode circuit and doubled in the second stage. In other words, the sort of frequencies involved would be as shown in the Table herewith.

OSCILLATOR VALVE		DOUBLER VALVE	
Grid	Anode		
450 kc	900 kc	...	1.8 mc
875 kc	1.75 mc	...	3.5 mc
1.75 mc	3.5 mc	...	7.0 mc
3.5 mc	7.0 mc	...	14.0 mc
5.25 mc	10.5 mc	...	21.0 mc
7.0 mc	14.0 mc	...	28.0 mc

This immediately becomes an interesting proposition. Two valves only, always operat-

ing on different frequencies, thus keeping down the risk of mutual interaction and eliminating the need for complicated screening. And, what's even more attractive, a constant frequency multiplication factor of 4 throughout. This means that all-band NBFM is made easy. The reason is that NBFM must be applied to the *oscillator* stage and the final deviation is proportional to the frequency multiplication involved.

For example, supposing a fixed frequency band around 1750 kc were used in the oscillator stage: For operation on 1.8 mc, no multiplication would be required, whereas for 28 mc, the fundamental would have to be multiplied 16 times; in plain English, any NBFM modulation applied to that unit would have 16 times the deviation on 28 mc that it would on 1.8 mc. That means that the audio control would have to be turned down proportionately, not just on 28 mc, but on all other bands. Using constant frequency multiplication avoids all that and brings in a simple modulation system which needs to be set once approximately for all bands. This can be shown in a block diagram (Fig. 3).

Reverting back, the initial purpose of this unit was to drive a pair of 807's in parallel—and to do this, allowing for all the losses involved, with plenty in hand. The drive aimed at was 10 mA with grid bias of -90 volts; in practice, 4 mA at -75 volts is the optimum, so that the reserve planned is ample for any 150-watt transmitter.

To provide this level of input at 28 mc to the PA probably means about 2.5 to 3 watts output from the final doubler. Assuming an efficiency of 40-50%, this would require a valve of 6V6 size. To drive a valve of that type requires about 75 volts (rectified) at its grid. This can be proved quite easily by setting up an oscillator on one of the lower frequencies, say 1.75 mc, using variable power control (variable cathode resistor, or variable screen volts) and driving a 6V6 doubler with it. With 300 volts on an EF50 as oscillator,

rectified voltages of around 200 can be measured at the doubler grid. (Note: This means taking a *voltage* reading instead of the more usual current reading in the doubler grid.) A flashlamp bulb coupled tightly to the doubler anode can provide a rough indication of power. It will be found that about 75 volts on the grid is quite ample drive. On 1.75 mc, it's easy to develop that sort of voltage, but on 14 mc it's a far tougher proposition! So the next problem was to work on the actual oscillator.

Summarising a great deal of detailed work, the following points can be taken for granted:

(1) The size of the feedback condensers (C1 and C2 in Fig. 4) is roughly proportionate to the frequency. For example, on 1.7 mc and 3.5 mc, the usual value is .001 μ F. In actual practice, this value will be found very suitable for fundamental frequencies up to 1.7 mc, *i.e.* for the 450 kc, 875 kc, and 1750 kc oscillator circuits. For 3.5 mc, drop the value to half, *i.e.* to 500 μ F, to 300 μ F for 5.25 mc, and to 250 μ F for 7 mc. Departure from these makes very little difference, but certainly the use of 1000 μ F on 5.25 mc and 7 mc would just about stop it working.

(2) The oscillator grid coil (L1) *must* be switched at both ends; that is, entirely and completely disconnected from the circuit when not in use. It is virtually impossible to get it to work on the higher frequency bands otherwise.

(3) The only valve which has been found to oscillate freely in this circuit, and develop the volts required at the various frequencies, is the 6AG7. The operating conditions appear to demand a valve with a high slope and a short grid base. The EF50, which is another valve of that type, was excellent up to fundamental frequencies of 3.5 mc, but was extremely unhappy at 5.25 mc and practically stopped at 7.0 mc. Even though tailing off at 7 mc, the 6AG7, with its higher slope, is still idling whilst providing sufficient drive for the doubler. There appears to be no British substitute for the 6AG7 in this mode.

(4) The doubler valve, apart from having a dissipation of at least 5 watts, can be any available type. This unit happens to use a QV04-7, but a 6V6 or similar would be just as good.

In Fig. 4, the basic circuit will be seen. This deliberately ignores switching, *i.e.*, shows one band only, because, although the switching is really very straightforward, it *looks* very complicated in a complete circuit diagram. Therefore details of the switching are shown

Table of Values

Fig. 4. Circuit of the G5GQ Exciter as finally evolved.

C1, C2 = See separate switch diagrams	C6 = 300 μ F silver mica
C3, C10, C16 = 100 μ F silver mica	C8, C9 = 75 x 75 μ F split stator variables
C4, C7, C11, C12, C17 = 1.000 μ F mica	C13 = 1,000 μ F silver mica
C5 = 150 μ F variable	C14, C15 = .01 μ F tubular
	C18 = .005 μ F tubular
All fixed condensers 350 volts working.	
P1 = 100,000 ohm 1-watt pot'meter, for screen of final doubler to adjust power output	R7 = 4,000 ohms, $\frac{1}{2}$ -w.
R1 = 50,000 ohms, $\frac{1}{2}$ -w.	R8 = $\frac{1}{2}$ megohm, $\frac{1}{2}$ -w.
R2 = 220 ohms, 1 w.	R9 = 100,000 ohms, $\frac{1}{2}$ -w.
R3 = 100,000 ohms, $\frac{1}{2}$ -w.	RFC = 2.5 millihenry RF chokes
R4 = 500 ohms, 1 w.	
R5 = 10,000 ohms, $\frac{1}{2}$ -w.	V1 = 6SA7
R6 = 20,000 ohms, $\frac{1}{2}$ -w.	V2 = 6AG7
	V3 = QV04-7
	L1, L2, L3, L4 = See separate switching diagrams

separately and described in more detail later.

Although looking the most complicated, the easiest are the two anode circuits, tuned by C8 and C9 respectively. Now the type of anode circuit (LC ratio) which is going to be satisfactory on 1.8 mc will have far too great a capacity for easy handling and efficiency on 28 mc. Different values of tuning condenser are required.

Rather than switch in different variables, split stator types are used. Capacities can be 50-50 or 75-75 μ F. *Note that no part of these condensers may be earthed, because both rotor and stators are switched.* Those available at G5GQ happened to have ceramic ends, so mounting was no problem. By the switching system these condensers can be connected in three different ways, *viz.*:

Both stators coupled in parallel, making a normal, two-ended variable condenser equivalent to 150 μ F

For 1.7 & 3.5 mc

Connecting one stator and the rotor, making a normal 75 μ F variable ... *For 7 mc*

Connecting to the two stators only, *i.e.* using the rotor in series, giving a maximum of 37.5 μ F ... *For 14, 21 & 28 mc*

Since it does not matter if the tuning range of the doublers does extend outside the bands, the coil sizes are not critical, and the approximate figures given with the main circuit are sufficient.

With the oscillator circuit, however, the target is not only to prevent it ever being outside the band required, but also that it should tune exactly over it. To do all that exactly is almost impossible, but with a little "tailoring" one can get pretty close.

First of all, to divert for a moment on coil/

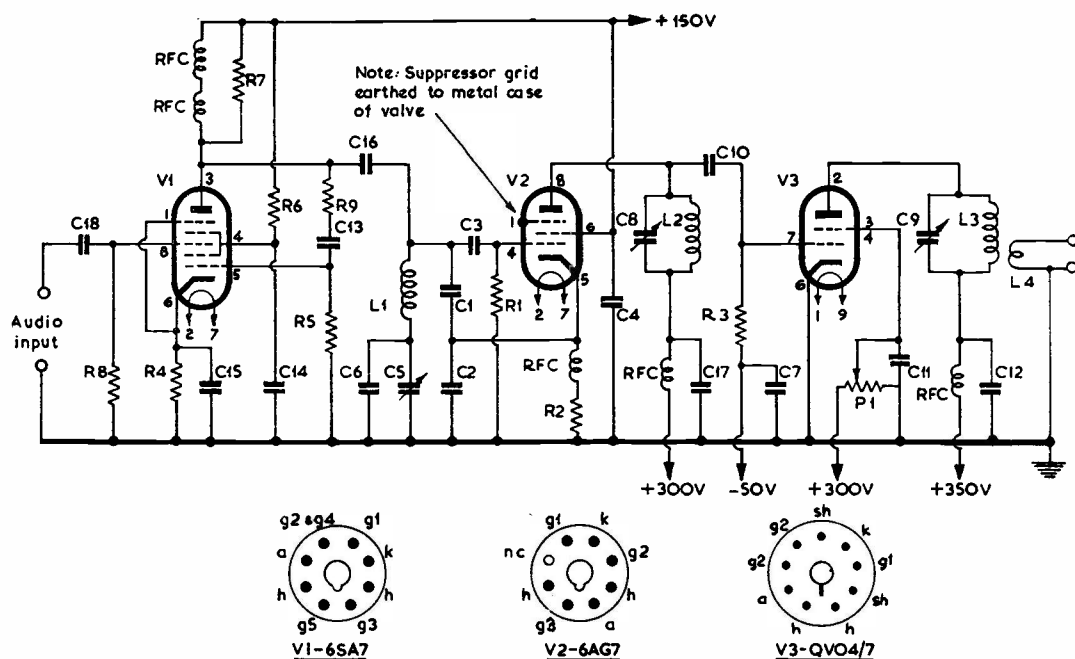


Fig. 4. Circuit of the band-switched Exciter as finally evolved, for audio input at C18, and V1 as the frequency-modulator stage. This Exciter will produce enough modulated RF drive, on all bands, for a pair of 807's.

condenser requirements. Here is a simple rule which sums up the formulæ. You want double the inductance and double the capacity for half the frequency. For example, supposing a 20-turn coil were used and resonated on 7 mc with a 50 μF variable at full capacity: To resonate on 3.5 mc would require a 40-turn similar coil and a 100 μF condenser. The other way, 14 mc, would need a 10-turn coil and a 25 μF capacity.

The same applies to tuning range. Supposing on 7 mc the circuit tuned to 7.3 mc at minimum capacity, i.e., 50 μF tuned over 300 kc at 7 mc. On 3.5 mc, a variation of 50 μF would only tune over half, i.e., 150 kc, whilst on 14 mc it would cover 600 kc.

Reverting back, it is clear that the same condenser variation which would tune for 1800-2000 kc (output) would also tune from 3500-3900 kc and from 28 mc to slightly under 31 mc, this latter because stray capacities come more into prominence. This means that it would tune 100 kc above the HF end of the 3.5 mc band, and just under 1 mc higher than the HF end of the 28 mc band. In practice, it is hardly worth bothering about tailoring those three bands; the first (1.8 mc) is dead in both ends, the second (3.5) overlaps by about 100 kc, which mean marking the end of the band on the dial, and this can also be done

to the higher edge of the 28 mc band. Even on that band, with a Muirhead dial, the VFO can be set to within 150 cycles of a channel very easily. If, however, anyone does decide to trim the 28 mc band oscillator, then he would be advised to get it running first on the above simple lines, and trim it later when the snags have been ironed out.

With the other bands, the coverage without tailoring is so great as to make operation far too difficult. The tuning ranges would approximate to (respectively): 7-7.8 mc, 14-15.5 mc, and 21-24 mc.

(To be continued)

VOLTAGE REFERENCE AND STABILIZER TUBES

Glow-discharge tubes are now widely used in industry, telecommunications and research, and this new Mullard booklet should be invaluable to designers of equipment in these fields.

The booklet contains sections on fundamentals of voltage reference and stabilizer tubes; the interpretation of published characteristics; and applications (including design formulæ for associated components). There are also tabulated data on current Mullard tubes.

A Guide to the Application of Voltage Reference and Stabilizer Tubes is issued by the Communications and Industrial Valve Department of Mullard, Ltd., Century House, Shaftesbury Avenue, W.C.2.

Use and Operation of Relays

CONSTRUCTION AND WORKING OF STANDARD TYPES

G. WHITBY

Relays in great variety are available as "surplus" at very low prices. They can be used in so many ways that there is no longer any excuse for long, directly switched leads in amateur stations. It is not always understood that what are known as P.O. type relays can be adapted to suit any particular circuit requirement, and that the energising voltage/current needed to operate the relay depends mainly upon the loading on the spring-set. Our contributor discusses in detail the construction of the popular P.O. 600 and 3000 types, and shows how they can be dismantled for alteration.—Editor.

ALTHOUGH a large number of relays have found their way into the hands of radio amateurs from "surplus" sources, there is little published information available about them and their operation in control circuits. It is hoped, therefore, that this article will help to remedy the deficiency by explaining how the commoner types of "surplus" relays are constructed, and how they may be put to good use without involved experimenting.

Construction

The relays normally encountered in ex-Service equipment are the P.O. types 3000 and 600, although other relays for aerial change-over and power control have also found their way into the market.

The 600-type relay is almost identical in construction with the 3000-type shown in Fig. 1, only minor differences being apparent; but the 600 relay is physically smaller than the 3000.

As any relay involves a mechanical process in addition to the electrical circuit, it is necessary to appreciate its construction to obtain a proper understanding of the operation.

The construction itself may be split into three sections: (a) The magnetic circuit; (b) The energising circuit; and (c) The spring-sets.

The Magnetic Circuit

As will be seen from Fig. 1, the relay is

built around the yoke which is, like the coil core and the armature, of soft iron. In the 3000-type relay shown the front of the yoke has a knife edge upon which the armature is pivoted, although in the 600-type this edge is absent. In both types the armature is held in position by a spring-loaded washer on the armature retaining screw.

In the centre of the armature face (Fig. 2) is fitted a non-magnetic residual stud or screw for the purpose of maintaining an air gap between coil core and armature; this is to ensure positive releasing action, and, as will be explained later, the residual screw adjustment is preferable to the fixed stud.

The Energising Circuit

The energising coil resistance can vary between 0.3 and 20,000 ohms, depending on the gauge of wire employed and the number of coil turns. The coil itself may be a single winding, or split into two separate windings which can be joined together to make a single circuit or used as a relay common to two separate control circuits. The windings are normally tested at 500 volts, although the insulation can be higher where necessary, and the connections to the coils are brought out to the rear of the yoke.

The Spring-Sets

This term applies to the entire switching assembly of the relay, and the individual springs are either "fixed" or "travellers"—depending on their function.

The springs are fitted between insulated spacers which are secured to the heel of the relay by screws passing through the metal holding plates, down through insulating sleeves (threaded through the spacers) to the yoke. The central screw on each spring-set goes only into the bottom holding plate, so that the spring-set may be removed without coming apart.

A centrally positioned, stepped insulated block is fitted to control the movement of certain springs, thus reducing pressure on the armature and preventing excessive spring movement when the relay is operated.

The spring combinations are detailed in Fig. 3, a complete spring-set consisting of any of these combinations so long as the total number of *springs* does not exceed eighteen for the 3000-type relay and twelve for the 600-type. This designates one of the basic differences between them.

The small contacts on the spring ends can carry a maximum current of 300 milliamps, and the larger, flat contacts up to one ampere

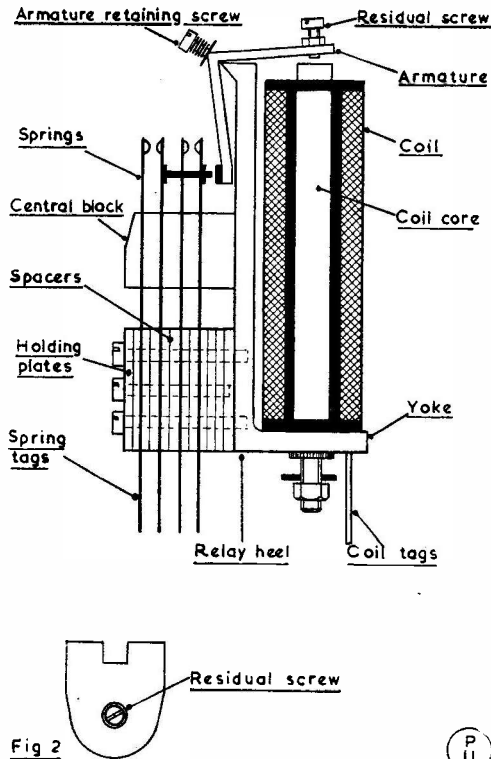


Fig. 1. Construction in detail of the well-known 3000-type relay; the 600-type is almost identical, but is smaller in size. The sketch Fig. 2 is a front view of the armature.

at a maximum inter-spring potential of 500 volts — although if the insulating spacers are thickened, with a corresponding increase in the diameter of the bolt sleeves, a higher potential may safely be applied.

Operating Characteristics

These are rendered complex by the necessity of converting the power in the energising coil into the purely mechanical pull of the armature against the spring-set and frictional forces involved.

As a result, these latter forces determine the operating current, *i.e.*, the current necessary to close the contacts for any given relay, and any change in the spring-set force—for it is difficult to change the *frictional* forces involved—will result in a corresponding change in the current.

The mechanical pull of the armature can, therefore, be measured in milliwatts and the table in Fig. 4 tabulates the power necessary to operate a relay with the given spring-set combinations. When the spring-set contains more than one type of combination, the powers quoted for each combination must be added and

the total multiplied by 1.5 to overcome the additional friction involved and ensure satisfactory operation.

When the power is determined, the voltage necessary for operation is $V = \sqrt{WR}$, where W is the power in watts and R is the coil resistance in ohms.

For example. A relay with a 2000 ohms energising coil has a single "make" and a single "change-over" combination. To use this relay, the practical information required is the voltage to be applied.

From the table, the "make" combination requires 22 mW and the "change-over" requires 36 mW, total = 58 mW. Taking into account the additional friction = $58 \times 1.5 = 87$ milliwatts.

$$\text{Now as } V = \sqrt{WR} \text{ and} \\ \text{Minimum voltage necessary for operation} = \sqrt{\frac{87}{1000}} \text{ (watts) } \times 2000 \text{ (ohms)} = \sqrt{\frac{174000}{1000}} \\ = \sqrt{174}$$

= 13 volts approx.

and if this is applied to the relay, then the current will be $I = \frac{V}{R} = \frac{13}{2000} = 6.5$ milliamps.

Tolerances

Relays are manufactured to close tolerances, but operating characteristics—which depend on the spring-set force—can differ widely between otherwise identical relays, and so users invariably employ higher voltages than are absolutely necessary to ensure reliable operation. For instance, in the example quoted it is quite permissible to apply 24 volts instead of the minimum of 13, and as the relay coil is quite rugged and not easily overheated, then

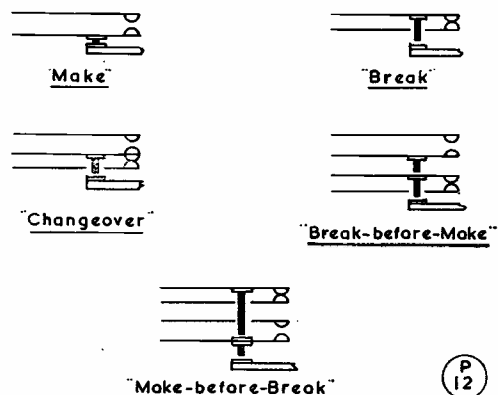


Fig. 3. Spring-set combination for various functions; gaps in the springs indicate holes for the actuating pins and each combination is shown in the "unoperated" position. The spring-sets on a single relay can be built up to perform a number of switching operations, as explained in the text.

the only effect of the increased potential will be to cause magnetic saturation of the core.

In actual fact, relays are normally designed to operate on standard voltages of 6, 12, 24 or 50 volts, although when using "surplus" relays the guiding factor should be the calculation already illustrated, because some of the relays were designed for HT operation.

A good general rule when designing circuits to operate these relays is to ensure that the operating voltage will err on the high side rather than the low—although it will be appreciated that it is not possible to stipulate, in this article, definite minimum potentials due to the mechanical factors involved.

Spring-Set Modification

It is quite in order to modify or arrange spring-sets to suit individual requirements, so long as it is appreciated that a relay is a sensitive mechanical device the satisfactory operation of which can easily be impaired by rough handling, and every care should be taken not to twist or bend the springs.

Removal of the two fixing bolts will permit the relevant half of the spring-set to be removed, which will come away from the relay as a unit that is held together by the third central bolt—screwed into the metal holding plates at top and bottom of the spring assembly.

Before dismantling the assembly a rough drawing should be made, and as dismantling proceeds a note kept of the number of spacers—which may vary—between the springs, so that reassembly will present no problems of alignment.

The most efficient way of dismantling is to start from the bottom of the assembly and place the component parts in sequence, as they are removed. The springs themselves should not be touched during either dismantling or reassembly, being gently eased out of, or into, position at the spacer end to avoid any twisting or buckling, which will damage the springs.

Removal of springs or spacers will naturally result in both bolts and bolt sleeves being too long and both must be carefully cut to the new length. Under no circumstances should the bolt sleeves be omitted during reassembly, as the springs may short on the "naked" bolts.

When reassembled, the fixing bolt should not be tightened until the springs have been carefully realigned so that the traveller contacts meet those of the fixed springs, and on replacing the assembly on the yoke all springs that were fitted into the central block should be replaced in the correct sequence.

SPRING-SET COMBINATION	OPERATING POWER
1 make.	22 mW
2 make.	43 "
3 make.	64 "
4 make.	81 "
6 make.	144 "
1 break.	36 mW
2 break.	64 "
4 break.	144 "
1 change-over.	36 mW
2 change-over.	72 "
4 change-over.	144 "
1 make-before break.	25 mW
2 make-before break.	49 "
4 make-before break.	100 "

Fig. 4. The power in milliwatts required to operate a 3000- or 600-type relay, with the spring-set combinations given. As the actuating voltage/current depends upon the armature pull necessary to close the relay, and as this in turn depends upon the number of springs in the combination, it is convenient to rate relays in this way. The operating voltage is usually not critical, and for most "surplus" types a 12-14 DC supply is suitable.

Increasing Sensitivity

If sensitivity is to be improved to reduce the operating current (and hence lower the minimum operating voltage) then unwanted springs must be removed to reduce the force on the armature and the resultant magnetic pull necessary to close the relay.

When all spring combinations are in use, adjustment of the residual screw will directly affect the sensitivity and this is why it was stated earlier that relays with residual screws, instead of studs, are preferable, when other things are equal. However, the stud can always be drilled out, the hole tapped, and a non-magnetic screw inserted with an external locknut to take the place of the stud when necessary.

Taking the mechanics for granted, the energising current necessary for operation will be directly proportional to the gap between coil core and armature in the operated position, and from published figures it is found that where a gap of 4 mils (thousandths of an inch) demands 43 milliwatts to operate a given relay, a gap of 12 mils requires 64 milliwatts, while 100 milliwatts is required when the gap is 20 mils.

The Isthmus Armature

This is a method of reducing relay sensitivity and bringing the values of operating and releasing currents closer together, and is particularly useful when a relay is inserted into

the anode circuit of a control valve—the relay being inactive under a given value of standing anode current, but operating on a slight increase of current due to an applied signal.

The armature is cut into the form shown in Fig. 5 by removing the two dotted sections and thus increasing the reluctance of the magnetic circuit. Commercially available isthmus armatures are usually slotted, but the V-shape accomplishes the same purpose and is easier to do on the bench.

As will be realised, relay sensitivity may also be reduced by increasing the gap between coil core and armature by a suitable adjustment of the residual screw. However, a standing current through the relay may cause “chatter” and the real solution is an isthmus armature.

Aerial Change-Over Relays

This type of relay is not common on the surplus market, and is rarely of the 3000-type, because the insulation between springs and core is insufficient. Aerial relays are usually larger, with more robust springs, adequate insulation and large, flat contacts to handle the RF current involved.

The operational principles are, however, identical to other relays and the power expended in operating the relay again depends upon the pull necessary to close the armature, although aerial relays are usually fitted with adjustable spring-loaded contacts, the tension on which may be varied.

For amateur use it is possible to modify the spring-set of a 3000- or 600-type relay to act as an aerial change-over by replacing the insulated spacers with low-loss washers fitting over the individual bolt sleeves, or making new spacers out of mica foil, in both cases the spacing being the same. The relay itself should be isolated from earth by mounting on an insulated panel, thus increasing the insulation between contacts and earth by that of the energising coil insulation.

VHF Relay

The spring-set of this type of relay is shown in Fig. 6, and it will be seen that additional springs are fitted between the normal springs for the purpose of earthing the spring that is not in use. The inter-spring distances are equal to the physical dimensions required for a 70-ohm transmission line. Other features are ceramic insulators to reduce VHF losses and the actual contacts are as large as possible.

When this type of relay is to be used for VHF working the springs should not be unduly disturbed because of the possibility of up-

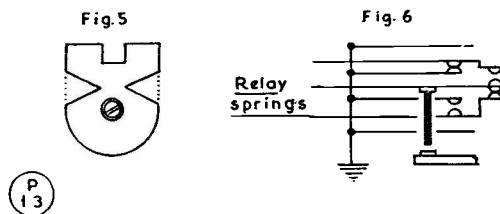


Fig. 5. This is the isthmus armature, explained in the text. In Fig. 6 is shown the spring-set arrangement in a VHF relay for use with coaxial cable, the change-over combination being given.

setting the dimensions between the springs.

Mains Switching

Relays for this purpose, of the 3000- or 600-type, are designed to carry five amps AC; the contacts are large and circular, and the distance between them when opened is limited to the gap necessary to avoid flash-over, or short circuiting by dust. Insulation is much stronger than normally and the relay itself is sometimes fitted with a slugging device to reduce the speed of operation and release.

The ordinary relays may be safely utilised by amateurs for switching mains so long as the current through the contacts does not greatly exceed one amp. The contacts themselves should be as large as possible; “arcing,” on closure or opening, can be prevented by connecting a 0.1 μ F condenser in series with a 100,000-ohm resistor across the contacts, to absorb the energy which would otherwise burn the contacts.

Any sharp points, or “pitting,” observed after relays have been in operation for a while should be smoothed away with a fine file, although with the arrangement mentioned this should not occur.

It is hoped that this article will assist not only those who are contemplating the use of relays, but are already using them. One final point: Power supply (DC) for the 600- or 3000-type is most easily provided by using a low-voltage output AC transformer, 14 volts, with a small metal rectifier of the battery-charging type. (No smoothing chokes or condensers are necessary.) If this combination will give about one amp. at 12 volts, it will be found that several relays, in parallel, can be operated satisfactorily. The relay supply can, in fact, be fitted and forgotten.

NATIONAL RADIO EXHIBITION

This will be at Earls Court during August 22 to September 1st, and will be the first Radio Show to be held since CTV came on the scene. The ITA and their commercial TV programme contractors will be represented at the Exhibition.

DX COMMENTARY

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

THE month from January 15 to February 15, which is the period under review, seems to have been pretty patchy but nevertheless interesting. All bands were open at some time or another, and if there was no exotic DX to be had, there was no shortage of the ordinary variety. As a great American once nearly remarked, "You can work some of the bands all of the time, and all of the bands some of the time, *but . . .*"

On the whole we should say that the most active part of the spectrum these days is the phone section of 21 mc, which never seems to lack population. True, there are times when it sounds a bit like Forty, with Il's and DL's packed tight, but if you strike the right moment you may well find all sorts of DX jostling around there. The CW end is often disappointing apart from W's, who are always with us after about noon.

The LF bands have also been quite good, and we will start this month's tour at the top end.

Top-Band DX

As usual, the W's are getting nearly all the 160-metre fun and rounding up most of the new countries. DL1FF and DL1IX have been giving lots of them their first contact with DL; YN1AA has likewise obliged many W's with a first contact. TI2BX, KZ5PB and the KP4's have also been very active, but all this, unfortunately, doesn't mean much in the life of the average G 10-watter.

ZB1HKO made a welcome appearance, and worked G3JJZ, G2BB, G3HQQ and G3PU. As mentioned here last time,



G2YS

CALLS HEARD, WORKED and QSL'd

HB1CM/HE showed up on January 14 and quite a few G's were lucky enough to get him. 3V8AX has been *reported* on the band, but apparently the real 3V8AX denies the whole thing, which was a hoax.

The DX tests on January 22 and 29 were fairish on the American side, with the Caribbean stations previously mentioned, and also HR3HH, handing out plenty of contacts. W5SOT in New Mexico was another interesting one, but not heard over here, so far as we can tell.

A new Loran station operating on 1850 kc apparently blots out the band 1820-1880 kc for the East Coast boys and makes it just about impossible for them to hear the G's at all. On January 29 W1BB reports that the only European station heard was HB9CM, who chose a very low frequency and beat the QRM.

Previous references to "LUIEL" on the band should read LU1BL, who was heard over here by SWL N. C. Smith and others.

On February 12 there was a

slight improvement in overall conditions, and G3IGW (Halifax) heard W1BB (569) and W2EQS (54/59) as the best DX signals, but very few G's were active.

W1BB says that on the whole he would describe conditions this season as only about one-third as good as last year; so it really does seem that the increasing sunspot activity which is livening up the other bands is working to the detriment of 160 metres. We always thought it would, but somehow it didn't seem so obvious while the last cycle was dying down.

Local Working

And so to the domestic side of the Top Band, where activity is still concentrated and continuous. G3KDP (Aldridge), a newcomer to One-Sixty, was delighted to work OK1AEH twice. G3IGW hooked HB1CM/HE, and also GC3KAV (Guernsey) on phone.

G3KKC (Bury St. Edmunds) raised OK1KKO and 2BEK, HB9CM and GC3KAV in early February — incidentally, he uses

the "Beginner's Transmitter" as described in our issue of September 1955. G2FTK (Coventry) made WABC with GM3KLA supplying the vital card. He also worked OK's and an HB.

G2CZU (Bath), another recent WABC-claimer, was pleased to get GM3KJA (Roxburgh), on both CW and phone. G3ICH (Leighton Buzzard) raised Glamorgan, Cambridge, Guernsey and OK1AEH. G3KEP (Bingley) got his phone over to OK1VH, and has just completed a rebuild with a new sky-wire 260 feet long; it will be remembered that G3KEP is one of the younger generation of amateurs, with all the pleasure and excitement to be had from Amateur Radio still before him.

GW3CBX (Pembroke) makes his WABC with 75/79, and awaits QSL's from GM2FNF (Bute), GM3KHJ (Inverness), GM3IAE (Ayr) and GC3KAV (Guernsey). G3JHH (Hounslow) raised HB1CM/HE sundry OK's and GM3KJA in Roxburgh for a new one. Other "long hauls" were also made with GM's, EI3R and GC3KAV.

G2NJ (Peterborough) confirms his position on the ladder, and says that he has kept his boat on the air from Hunts despite the Arctic weather — frozen in, too, we wouldn't wonder!

Top Band Expeditions

G3EJF (Bury) asks whether there is any demand for Westmorland. If so, he might be able to organise a trip. He also suggests that some of the South Wales or Bristol boys might do a trip into Monmouthshire. Well, there are stations in Monmouthshire. . . .!

G3IGW will keep the pot a-boiling once more this Easter, and notifies us of operation from Wigtown on Easter Saturday, Peebles on the Sunday, and "X-shire" on the Monday; he is keeping the last as a surprise. Operation will be mainly CW and quick, snappy QSO's only.

G3BHT (Liverpool) promises operation during the Easter weekend from either Montgomery or Merioneth. He and G3JIR will be taking a B.2, a Command receiver and a couple of motor-

bikes! He also proposes to go to Anglesey some time—probably at Whitsun.

List of U.K. Counties

In response to numerous requests and, as they say, "by popular demand," we print this month a List of British Counties—which it is hoped will settle once and for all any queries on this subject. Note, in particular, that "administrative counties," e.g. the Ridings of Yorkshire, the Parts of Lincolnshire, the Sokes and the Isles (of Ely and Thanet), city and county boroughs and other non-geographical divisions or sub-divisions do *not* score as separate counties. We accept only those given in this List, which is for the information of readers, home and now overseas, claiming respectively our WABC and WBC awards.

Incidentally, as we are *already* getting enquiries from overseas readers interested in WBC as to what county such-and-such a town or city is in, all G's should make sure the county is included in their QSL card address. For instance, "Bristol, England" is quite sufficient as a postal address, but depending upon which side of the Avon the station is located, the address as printed on the QSL card should include Gloucestershire or Somerset.

This month we have the largest Certificates-issued list yet printed here—35 have been claimed in the last three months, from no less than 15 different call areas.

Eighty Metres

There are a few more references to *Eighty* this month, and despite the general mess that the band is still in, DX is feasible now and again, especially in the early mornings.

G3IGW heard ZL1CI, 569 at 0800 GMT; also VQ2X and "ZD7AB" — about which see "DX Gossip" in later paragraph.

G3FPQ (Bordon) had an unexpected week-end at home, and on *Eighty* he raised ZL3GQ and VQ2J; he heard ZS5U but didn't work him.

G2DC (Bulford), who is, of course, ex-DL2RO, had a few late sittings and worked VE, VO and East Coast W's, but thought the

band was pretty disappointing on the whole.

DX on Forty

G5BZ (Croydon) worked over 40 metres and raised ZD2, VE2 and VE3. G3IGW collected VQ4AQ, 4EO and 4 RF, also W, PY, CT3 and ZB2; he heard

TOP BAND COUNTIES LADDER

(Starting Jan. 1, 1952)

Station	Confirmed	Worked
G2NJ	97	97
G5JM	97	97
G3HIS	95	95
GM3EFS	94	94
G3JEQ	93	93
G3JEL	92	94
G3HIW	92	93
G6VC	92	92
G3EUK	91	93
G3CO	91	92
G3GZB	89	91
G2AYG	86	87
G3HYJ	84	85
G3JHH	81	83
G3FAS	80	82
G3BRL	79	80
G3GGS	77	82
G3KEP	76	76
G3FTV	74	82
G3DO	74	74
G3JKO	73	85
G3JJZ	71	73
GM3DOD	70	71
G3JBK	69	74
G3HZM	67	69
G3FNV	64	71
G2GGL	63	70
G3JVL	62	77
G3JAM	62	70
G2HKU	62	62
G3AKX	60	71
G3FTV/A	60	69
G3DGN	60	64
GW3HZZ	60	63
G2CZU	60	62
G3JNX	60	61
G8CO	54	66
G3EJF	51	58
GM3JZK	46	55
G3HQT	44	39
G3ICH	16	39
G3JZP	14	31

ZD9AD working W's (559 at 2100 GMT), also PJ2CS and a mysterious "FE2AB."

G3ICH strayed from the Top

Band to work some daylight contacts on Forty, and with a single 6V6 CO and a modulator he got around G and GW with average

reports of R5, S7.

G3INR (Hereford), another fugitive from the Top Band, raised IS, CT2, PY, KP4; nice gotaways were CR4, ZP, VP6, YI, HK and KZ5. G3FPQ managed good QSO's with VQ4 and ZC4.

G2DC says there is some DX to be wheedled out, if one can put up with the Tin-Pan Alley Gang, and his best was VP2SH, who emerged from the mush at 2215 one night—and was just as surprised as G2DC! Other DX was W, VE, VO, VQ4, ZD2, 4 and 6, all between 1900 and 2330, plus VK and ZL in the mornings.

Just to confirm that the DX really *is* there, we quote a very interesting report from SWL J. Balfour (Kirkcaldy). On January 15 he logged VP8BR calling CQ at 0005, and later working an SM. Then at 0020 he heard a CQ call from VP8BC/P (579), who apparently didn't raise any DX but settled down to work VP8BR.

VK6HJ and JA1AHC were worked by W's on January 21 (around 0900 GMT), but were not audible here at that time—although they should have been coming through one or two hours earlier, had they been on then.

Twenty Metres

All the real DX still seems to cling to this band, where overall conditions have been better and more consistent than on any of the others. Exotic ones show up here with apparently no thought for the other bands at all, safe in the knowledge that they will find plenty of customers at any time of day or night.

Not that we find many of the Exotics to share between us—they all seem to be working W's while we are in bed!

G5BZ winkled out JA 1, 2, 4 and 5, FB8, ZL, KG6, VK, CX, CR6, OY, ZD2 and 6, VQ2 and 4, VP8, VK9 and KH6—just to show that the band still works! His beam froze solid for several days and he had to use a long wire, which brought him the VP8, VK9 and KH6. On February 5 at 2320 G5BZ heard a watery signal from the mysterious ZD7AB, but fifteen minutes of calling didn't raise him. There was no other DX on the band at the time.

COUNTIES OF THE UNITED KINGDOM

As Used for Scoring in WBC and WABC

ENGLAND (41)

Bedfordshire
Berkshire
Buckinghamshire
Cambridgeshire
Cheshire
Cornwall
Cumberland
Derbyshire
Devonshire
Dorsetshire
Durham
Essex
Gloucestershire
Hampshire (*incl. I.O.W.*)
Herefordshire
Hertfordshire
Huntingdonshire
Kent
Lancashire
Leicestershire
Lincolnshire
London (Postal Districts)
Middlesex
Norfolk
Northamptonshire
Northumberland
Nottinghamshire
Oxfordshire
Rutland
Shropshire (Salop)
Somerset
Staffordshire
Suffolk
Surrey
Sussex
Warwickshire
Westmorland
Wiltshire
Worcestershire
Yorkshire
Scilly Islands

NORTHERN IRELAND (6)

Antrim
Armagh
Down
Fermanagh
Londonderry
Tyrone

ISLE OF MAN (1)

SCOTLAND (33)

Aberdeen
Angus
Argyll
Ayr
Banff
Berwick
Bute
Caithness
Clackmannan
Dumfries
Dunbarton
East Lothian
Elgin (Moray)
Fife
Inverness
Kincardine
Kinross
Kirkcudbright
Lanark
Midlothian
Nairn
Orkney
Peebles
Perth
Renfrew
Ross and Cromarty
Roxburgh
Selkirk
Shetland (Zetland)
Stirling
Sutherland
West Lothian
Wigtown

WALES (13)

Anglesey
Brecknock
Caernarvon
Cardigan
Carmarthen
Denbigh
Flint
Glamorgan
Merioneth
Monmouth
Montgomery
Pembroke
Radnor

CHANNEL ISLANDS (4)

Alderney
Guernsey
Jersey
Sark

This is the accepted SHORT WAVE MAGAZINE List for WBC and WABC. It is published for the information of readers interested in these Certificates, details of which were given on p. 538 of the December 1955 issue of the Magazine.

G3FPQ collected two new ones—FY7YF and VK9XK. G3IGW worked ZD6BX and VE8WN. G3INR tried phone and got CT3AB for a new one. G3GZJ was puzzled by SU2AO, who said "QTH Cairo" and promised a QSL, but why they had to work at about 5 w.p.m. worries him.

G2DC thought conditions on Twenty were deteriorating, and found it fading out rather early—sometimes soon after 1800 GMT. But, as he says, it was like old times to hear VE7VC coming over at S7/8, together with other VE5, 6 and 7 signals such as VE5DR, 5EH, 6NX, 7GI and 7YR.

DX phones reported on this band by W's include VP8BQ,



This interesting photograph was taken at the Southern California DX Club's AGM at Fresno, on January 16. It shows W6YY, on the right, receiving the Club's DX Award for 1955 from the president, W6YMD. The important thing about this award is that it is given not only for successful DX work but also in recognition of those other qualities that go to make up a good amateur—helpfulness and courtesy, considerate operating, and active participation in all forms of Amateur Radio activity. W6YY, whom all readers of this feature will be glad to see here, is always ready to work G stations and is one of our regular DX correspondents.

Short Wave Magazine DX CERTIFICATES

The following have been awarded since the publication of our last list, in the December 1955 issue:

WFE

No. 21 4X4RE (Haifa)

FBA

No. 54 G3BDS (Worcester)
55 GM3HQH (Falkirk)
56 EI4X (Dublin)
57 DL7FW (Berlin)
58 ZE3JP (Causeway)
59 4X4RE (Haifa)

WNACA

No. 88 G2LU (Coventry)
89 G2BFF (Harrow)
90 G2WQ (Prestwich)
91 G3JW (Exminster)
92 ZL1RD (Owhango)
93 OH2VZ (Helsinki)
94 4X4RE (Haifa)

WABC

No. 110 G3FTV/A (Ripon)
111 G8PG (Wirral)
112 G3FRV (Carshalton)
113 GW3KCC (Lampeter)
114 HB9T (Zurich)
115 G3FNV (Chester)
116 G2CZU (Bath)
117 G2FTK (Coventry)
118 G3JAM (Woodford Green)
119 G3IUD (Wilmslow)
120 G3JNX (Manchester)
121 GW3CBX (Pembroke)

WBC

No. 1 OZ2NU (Aalborg)
2 F9IL (Aubencheyl)
3 ON4IB (Bruges)
4 ZB2I (Gibraltar)
5 DL2RO (Hamburg)
6 ZE3JP (Causeway)
7 K2BZT (Summit, N.J.)
8 ZE3JO (Salisbury)
9 4X4RE (Haifa)

Details of MAGAZINE DX AWARDS and CERTIFICATES, and the claims required for them, appeared on p. 538 of the December, 1955, issue.

ZK1BS, FB8BC, HC8GI, VR6AC, VK1IJ, KM6AX, CR9AH, ZM6AT and VP3LF, to mention a few. Why don't we hear these gentry over here?

Fifteen-Metre DX

G3GZJ (London, S.E.23) thinks *Fifteen* the best DX band at the moment, and he comments on XE1PJ's beautiful signal around mid-day. His best so far have been ZC4, VQ4, ZB1, VE, IT and W2JNA/MM, near the Azores.

G3HCU (Chiddingfold) worked 58 countries on phone, the best being AP, CE, CR9, FF, MP4, VP2, VP4, VP5, VP8, HC, KG6 and 4S7. He found the evening of February 15 exceptionally good, up to 2000 GMT.

G2CDI (Stokenchurch) doesn't tell us which countries he has worked, but he heads the 1956 Marathon handsomely with 82 countries on Fifteen phone, since January 1; his total up-to-date is 118.

G3INR collected ST, ZS and VQ4 for three new ones, as well as the usual W's and the like. G3IGW reports working VQ2GW, ZD2DCP, ZD4BQ, ZE, ZS and VQ4—all on CW.

G2FUU (Hoddesdon) has stuck

to the 21 mc band for his one or two hours a week of operation, and has raised ZB1, VS2BD, ZL, 5A and Europeans, all on phone; heard but not worked were VS6CW, VP6WR, PZ1RM and KR6PY.

G3FPQ booked in VP8AI and OK3AL for two new ones. G2DC's main activity was on this band, where he has raised 42 countries since early January. The best of them were VP8AI, VQ6LQ, CR9AH, FM7WD, KG4AK (all between 1100 and 1300 GMT) and KH6AFS (1800). Others include ZL's, VS6, VU, MP4, ZD2, 4 and 6.

G5BZ caught MP4KAC and KP4 on phone, as well as ST, XE, OD, UB5, VQ, ZD, VS6, VP6, ZB2 and three VP8's on CW. He doesn't think 21 mc has been as good as it was before Christmas, but agrees that it was showing signs of improvement on February 15 and onwards.

Ten Metres

The figures for the 1956 Marathon prove pretty clearly that *Ten* has not yet had much to offer, compared with *Fifteen*. The band has been open, however, for long stretches at a time, and there is

not really a lack of activity. Those who like uninterrupted QSO's and the quiet life might well start pitching their tents on 10 metres, with a ground plane or even a beam.

G5BZ thought the band was "a bit of a time-waster," but he did raise VQ4, ZD6, ZB1, ZC4, ZS and VE3. G2DC found it wide open for North America and Africa most of the time, and he had a good QSO with W3HTF/M. who was sitting in his car outside his front door, running 30 watts to an eight-foot whip! Apart from W's, the best QSO's were with VE, PY, ZS, VQ4, ZC4 and ZD6.

G3IGW raised some W's and VE's; G3INR collected ZD6, CR6, ZS6, ZB1 and VP8—all new ones on the band for him.

G3HCU worked TI3LA, HP1EH, YN4CB, CT2AG, ZS3B and CR7AF, among others — all on phone.

Five-Band Champion

Every now and then we receive an amended score from DL7AA (Berlin) which once more puts him well out of reach at the top of the Five-Band ladder. His latest score does just this, and reveals that Rudi has now made DXCC on all five bands—the first DL to do so, and probably the first station in the world. Note his scores of 101 countries on Eighty and 160 on Forty! Recent new ones on *Ten* were EL2P, KC6CG and ISLV, and on *Eighty* UC2AA, UQ2AN and PX1EX.

Rudi also passes the news that ZA1KAD is OK — First Radio

Club of Albania, c/o Radio Tirana, Technical Service, Tirana. And that LA9LD/P on Spitzbergen is active near 3500 kc, 0600-0800 GMT.

Helvetia-22 Contest

The annual Helvetia-22 Contest is coming up once more. Organised by the USKA, it will run from 1500 GMT on May 12 to 1500 GMT on May 13. Stations outside HB try to work as many stations in each of the 22 Swiss Cantons as possible, on all bands 80 to 10 metres inclusive. Entrants will call "CQ HB" or "CQ H22," and the serial number will be six (or five) figures for CW (or Phone), consisting of the RST (or RS) report plus the number of the contact, starting at 001.

Three points per contact, the multiplier being the number of Cantons worked on each band. CW and Phone counting separately—i.e. a possible multiplier of 44 *per band*. Entries on a separate sheet for each band, with the usual declaration, to be mailed not later than May 31 to USKA, Box 1203, St. Gallen, Switzerland.

The "Helvetia-22" Award, available to those who have worked all 22 Cantons and can produce proof, is quite a popular certificate. Latest figures show that 83 have been issued, nine of them to G's. Applications, together with the 22 QSL's, to USKA at the above address.

Case of Piracy

We have a "disclaimer" from G3ABK (Darlington), who has not been active on any band since last July, due to several changes of QTH. But his call-sign has apparently been going strong in the hands of someone else, who even made GC3ABK out of it on one occasion.

News from Overseas

W2QHH (Hamilton, N.Y.) finds there are still some Certificates left for him to claim, and accordingly has applied for WAVKCA, WPR-300, ADXA (KL7) and WGSA. He also has enough QSO's for OHA and YLCC-500. He is applying for our WBC when he has the counties sorted out! Recent additions to his DX scores were OY7ML and 3V8AB on



"... And as this is our first QSO, I am delighted to meet you ..."

21-28mc MARATHON, 1956

Station	21 mc.	28 mc.	Total
G2CDI (Phone)	82	23	85
G3HCU (Phone)	58	12	64
G5BZ	55	10	55
G2DC	42	10	44
MP4BBW	30	11	34
ZB1HKO	15	8	20
G3IGW	14	3	17

Eighty, making 116 on that band. He and GI6TK heard one another on Top Band, but fish-fone intervened.

4X4RE (Tel-Aviv) collects WFE, WNACA, FBA and WBC in one swoop. If it weren't for the absence of Top-Band permits out there he would be hot on the trail of the Magazine DX Award, too.

The redoubtable W6AM goes up to 215 confirmed on Phone, the latest two being MP4QAL and FB8BR; the card from XW8AB makes him 258 confirmed on CW. And concerning our recent remark on the way some of these chaps can claim 100 per cent. confirmed, we have a letter from 4S7MG (Colombo) on the subject. He says that the Americans are very enterprising in this respect, and that even to Ceylon many of them will send off a card by air mail, enclosing an IRC for return postage and sometimes a "blank" QSL which one has only to fill in and post. (4S7MG says he now has enough American stamps to go into the philately business.) Incidentally he adds that he considers that, in operating procedure, the Americans are better than the G's.

MP4BBW (Bahrain) joins in the Five-Band Table and the 1956 Marathon, and tells us that he runs 40 watts into an 80-ft. ended wire on three crystal frequencies. Receiving is difficult, despite his 75-A3, owing to power leak noises, electrical machinery and the like. He is mostly on 21 mc, occasionally on 14 and 28 — dependent upon which band MP4BBL, who shares his mast, is using at the time! He confirms

that all MP4B's are Bahrain, K's Kuwait, Q's Qatar and T's Trucial Oman. Others are unofficial or unlicensed, except MP4KK, who is a police mobile.

From Bombay comes a letter from ex-AP2N, who says that the Indian Government refuse to grant him a licence, probably because he held a Pakistan licence previously. He thought those who had worked AP2N at some time or other would be glad to know of his present whereabouts. QSL's are still available to those who want them—write to N. P. Henry, c/o The Bombay Co. Ltd., 9 Wallace Street, Fort, Bombay.

G. F. Quantrill (H.M.S. *Ursa*) reports good signals on 14 mc from GD2FRV, while at Beirut, Lebanon, badly jammed by local YL OD5CY working an SP5 at the time! E. Elsley (s.t.s. *San Florentino*) continues to cover the 28 mc band, and sends a long list of calls heard off the East American Coast. One strange one is "GB14JL," working W's! SWL Elsley has some unkind words to say about the types who call CQ for one minute, then give their call-sign once and go over.

ZB1HKO is an OM/XYL

station that has only just opened up on all bands, including the Top Band, where they recently worked DL1FF and DL1IX for what are believed to be the first ZB1/DL contacts on 160 metres. G's have also been worked (see Top Band notes). ZB1HKO sends an entry for the Five-Band Table and also for the 1956 Marathon, so it seems that the station is really doing its stuff. The OM is ex-G3HKO, the XYL, who writes the letter, describing herself as "QSL manager and secretary"!

DX Gossip

KP6AK (Palmyra) works occasionally on 14215 kc phone . . . 15AAW is on from Italian Somaliland, 14165 kc phone . . . VR6AC (Pitcairn) works the East Coast W's on 14145 kc phone around 1500 GMT . . . VP2VB/P, at present FO8AN, expects to be signing a VR1 call around March 15 . . . Bahamas call-signs, having run out of the "N" series, are now using the "B" series, so calls like VP7BA need not cause a raised eyebrow. (Most of the above from W6YY, acknowledged with thanks).

The KC4 gang in Antarctica

**FIVE BAND DX TABLE
(POST-WAR)**

Station	Points	3.5 mc	7 mc	14 mc	21 mc	28 mc	Countries	Station	Points	3.5 mc	7 mc	14 mc	21 mc	28 mc	Countries
DL7AA	711	101	160	220	122	108	225	G8VG	284	36	77	124	21	26	141
G5BZ	623	63	114	235	129	82	239	G6VC	254	26	31	125	45	27	122
G6QB	623	52	109	223	104	135	237	G3INR	242	43	48	96	37	18	107
G3FXB	538	67	122	189	113	47	196	G6TC	230	17	61	113	12	27	122
G4ZU	534	12	45	215	138	124	222	G3IGW	211	40	53	64	45	9	88
W8KIA	530	55	141	251	4	79	247	GM3JDR	211	39	36	101	34	1	108
G2VD	511	48	94	180	90	109	189	GM3EFS	189	22	39	96	12	20	105
G3DO	496	24	46	205	114	107	225	G2DHV	172	19	25	110	6	12	113
G2BJY	466	48	78	141	83	116	181	G3HSM	129	14	43	44	25	3	63
G2YS	427	61	79	146	87	54	161	ZB1HKO	110	18	21	45	15	11	49
G3FPQ	383	50	54	139	112	28	156	MP4BBW	98	1	2	35	48	12	65
GM2DBX (Phone)	382	33	31	158	79	81	169	G3GZJ	73	18	4	30	20	1	42
G2BW	368	24	57	144	100	43	165	GM3DOD	71	10	15	36	9	1	40
W6AM	367	23	34	258	39	23	258	G3IDG	44	11	10	6	1	16	26
G8KU	347	23	52	161	36	75	171	G3HEV	43	8	19	14	1	1	26
W6AM (Phone)	320	13	32	215	39	21	215								

are reported to have fired up around January 23 and put a good signal into New Zealand . . . UC2AA and UQ2AN have been heard, apparently making "free-for all" QSO's . . . ZS7C is now very active on 21 mc . . . YJ1DL is leaving New Hebrides about now and, after a holiday in FO8-land (Tahiti), may turn up almost anywhere, but will try to pick a rare DX spot.

HL9AA has been heard and worked on 14050 kc, around 1100 GMT; status doubtful . . . In the same category is ZD7AB, giving name as "Jasim" . . . Stan Crow, ex-VQ4SGC and VP5SC, is due to spend some years on Ascension Island on behalf of Cable and Wireless Ltd. So we may hope for some genuine ZD8 activity.

ZD9AD (Gough Island) is active on 28 mc phone, but hopes to be on 21 and 14 mc CW soon

. . . CE0AD (Easter Island) promises operation shortly. . .

San Martin Activity

W6ITH is apparently on the air from the French side of St. Martin Island. G3JU tells us that the call being used is FS7RT, on 14313 kc SSB; QSL's direct to W6ITH . . . From other sources we gather that he plans to operate from the Dutch side as well. License difficulties have held it up, but PJ2AA (ex-PJ2MA) has agreed to accompany him and that should solve it.

Quite independently of the above, we hear from W6SAI that he and W6WWQ plan a DX-pedition to the same spot. They expect to sign FP8AC/FG7 from the French side, and they have clearance for Dutch territory. CW only on 14 mc, and possibly some activity on 21 mc as well. Contest-type QSO's, no nattering, and no

"please listen for my friend." All QSL's, for either PJ2M- or FG7, direct to W6SAI.

Antarctica

Last month we referred to earlier Byrd Expeditions to Antarctica, mentioning that we couldn't remember the call-sign of the very first one. Old Timer G6CI (Kenilworth) supplies full details, QSL and all. He worked WFA, on what is now the 20-metre band, on October 3, 1929, giving them R6 and receiving an R4 report—the S-scale of today was the R-scale of 25 years ago. G6CI used a TP-TG circuit with a UX-210, a half-wave aerial and an 0-V-1 receiver; WFA had a pair of 204A's in a TP-TG circuit with "500-cycle self-rectified" supply, and their receiver was a G.E. affair in a 1-V-2 layout. WFA was the southernmost radio station in the world, operating from "Little America," Bay of Whales, Antarctica, and sent out a nice QSL depicting penguins and a vintage aircraft of the period, in which Byrd flew over the Pole. Many thanks to Brian, G6CI, for this most interesting gen, a reminder of the old days.

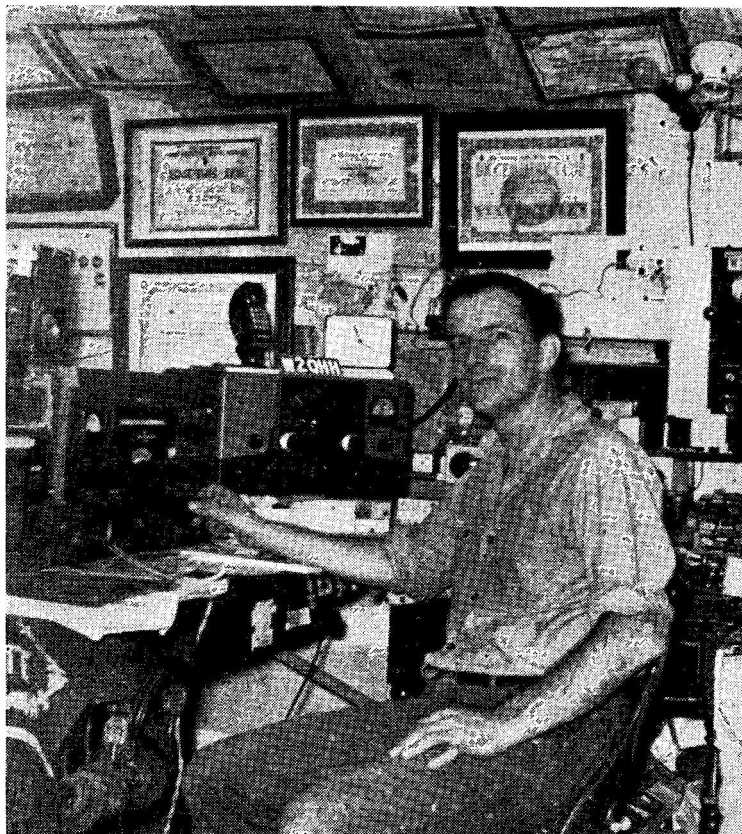
Miscellany

SWL A. D. Moore (Goole) tells us that W7VMD/KG6 is active from Guam (Box 149, Agana, Guam Island), and that K2HGU/KW6 has been heard on phone from Wake Island. FP8AP has also been a strong signal around 1700 GMT on Twenty.

W. E. Wilkinson (Bromley) logged OY1R and VO3X on Eighty CW, and VO2N and several W's on Eighty Phone. Forty CW was represented by UF6, UG6, YI, CT2, PZ, CT3, VP4 and ZP5, among many others.

J. Melvin (BAOR 23) settled down to some listening over there and on Twenty he logged FB8, DU, I5, ZK1, KS4, FC2 (?), all good signals. He wonders whether conditions are better there than in England.

N. C. Smith, of Petts Wood, Kent, a well-known SWL with an outstanding DX record, writes that he has had a card from HR3HH confirming 160-metre reception on



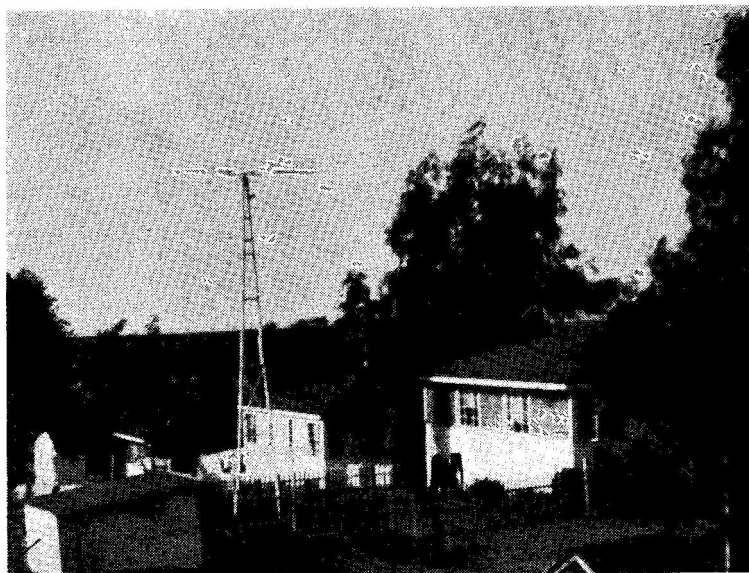
The remarkable Howy, W2QHH, of Hamilton, N.J., who holds nearly all the achievement certificates worth mentioning but yet uses nothing but QRP.

January 8 last. Information given on the QSL is that HR3HH runs 130w. to a 600-ft. aerial and is calling and listening around 1807 kc each Sunday before 0630 GMT, looking for G's; he asks for slow, careful Morse! QTH is c/o Standard Fruit Co., Coyoles, Honduras, C.A.—and if HR3HH can be heard, YN1AA and YN1KK are usually coming through, too. It would be worth trying for them until the end of April.

Strays

It seems that ZK1BL, 1BM and 1BS are all active on Twenty phone, and have been working W's at various times between 0400 and 0630 GMT. Rare Pacific stations on Twenty CW include VR3B (14085 kc, 0200), ZK1BL (14163 kc, 0400), YJ1DL (14005 kc, 2100), KJ6BN (14035 kc, 0300), FO8AN (14080 kc, 0200), FK8AC (14030 kc, 0740), KM6AX (14080 kc, 0330), KH6ASP/KB6 (14032 kc, 0400), all of whom have been worked by members of the West Gulf DX Club at the times specified. Let's hope our time for part of the shareout will arrive soon!

VK1 activity for 1956 will come from VK1IJ and 1PA at the Mawson Antarctic Base, and from



Homestead on the edge of the ocean. W6FEV, in the outskirts of San Diego, Calif., has a nice 10-metre beam assembly looking out over the Pacific.

VK1DA on Macquarie. All other projected calls have apparently been cancelled.

The ZK1BS whose call has been mentioned in preceding paragraphs is one-time ZK2AA, who has left Niue Island without an amateur population and will be active from ZK1 for at least three years.

And that concludes this month's offerings. Next month's deadline is **first post on Friday, March 16**, or very soon after you see this. Address everything, as usual, to "DX Commentary," *Short Wave Magazine*, 55 Victoria Street, London, S.W.1. Until then we wish you 73, Good Hunting, and —BCNU.

G9AED in LANCASHIRE

We are informed that the Belling-Lee experimental Band III TV transmitter, signing G9AED, is now sited on Winter Hill in Lancashire, at a height of 1450 ft. a.s.l. The vision frequency is 194.75 mc, the sound carrier is on 191.25 mc, and the transmitting schedule is: Week-days, 10.00 a.m. to 1.00 p.m., 2.00 p.m. to 5.30 p.m.; Saturdays, 10.00 a.m. to 1.00 p.m. Reports are requested to Belling & Lee, Ltd., Great Cambridge Road, Enfield, Middlesex.

SAFETY in MOBILE WORKING

One of the best rules for good and careful driving is "Hands on the wheel and eyes on the road." To observe this essential principle, the control system in an amateur mobile installation needs to be very carefully contrived—say, a single flick-switch on the steering column for change-over, and a throat microphone. For a protracted spell of contest-type working, it is probably better to take along a passenger as operator and leave the gear entirely to him.

What is certain is that any serious motor accident directly involving an amateur /M operator will attract a great deal of unwelcome press attention, and

probably questions in the House. If there is a fatal accident, it might well lead to some prohibition of amateur mobile working. So take care!

SPRING MOBILE RALLY

Sunday, April 8, 12.00-6.00 p.m.

at

OVERSTONE SOLARIUM
NORTHAMPTON

Six miles N/E of Northampton, off the Northampton-Kettering road. Events include mobile treasure hunt and measured field strength contest.

Lunch at 1.0 p.m. (8s. 6d.) and/or Tea (2s. 6d.) at 5.0 p.m. must be booked seven days in advance with the Hon. Secretary, Northampton Short Wave Club, 8 Duke Street, Northampton.

Talk-in stations signing G2HCG/A and G3GWB/A will be operating on 1896 kc, 3650 kc and 144.66 mc. Telephone watch will also be kept on Northampton — Moulton 324411.

Entry to the Solarium grounds: 6d. a head, payable at the gate.

RESTRICTIVE PRACTICES ON THE AIR

IMPROPER OPERATING PROCEDURES

N. P. SPOONER (G2NS)

THIS article is intended as a timely reminder, first, of those practices that invite official restriction; and secondly, of those that themselves restrict the smooth working, intelligibility and enjoyment of amateur contacts.

In the case of the enthusiast who passed his Morse test, only to find to his dismay that the World War II balloon had already gone up before he could introduce himself to the air, the exact nature of the official restriction placed upon him alone can best be left to the imagination. When the rest of the U.K. had dutifully closed down and surrendered its transmitting gear, he hastily re-built and allotted himself an HX prefix with QRA "On a ship in the North Sea"—a rare combination that was heard to bring him quite a measure of neutral DX before the precipitous arrival of the little green van! A later restriction, felt by all, came at the end of the War, through the action of one small spiv who readily agreed to abide by the "personal use, not for re-sale" understanding attached to the Government surplus gear scheme—and who then promptly flogged a priced-by-the-hundredweight communications receiver at the very gates of the docks from where he had just acquired it, making himself many pounds thereby, in a matter of minutes.

Illegal Practices

Today many operators can be heard openly inviting fresh official restriction by a repeated infringement of the licensing terms, and it is upon this practice that readers are asked first to dwell. With every outlet of wired and wireless communication jealously guarded by the Post Office, and not by a Federal Communications Commission, and living as we do in a small island that is normally not afflicted by the widespread disasters that strike the United States, communication "in the public interest," third-party messages and traffic-handling nets have never been countenanced here. The authorities have therefore had ample time in which to observe that, with us, many of the so-called nets are merely small gatherings of congenial telephonists working on the same frequency in the same district, and in the main discussing matters of radio interest only. Imagine, therefore, their surprise at finding that, in some cases, "unauthorised persons" are being allowed to transform these innocent nets into domestic nattering parties, at which the presence of the station owner often only makes itself apparent by an occasional guffaw or facetious remark in the background. The worst aspect is that he is, in some cases, permitting these "unauthorised persons" actually to switch the station carrier and generally to conduct proceedings. What does the Amateur (Sound) Licence have to say? In perfectly plain language, Limitation 2C on

the first page tells us that a station shall be operated only by its owner or, in his presence and under his direct supervision, by another licensed amateur or the holder of an R.A.E. Certificate.

Bad Public Relations

Further to silence any sea-lawyers who argue that this obviously includes the station owner's wife, children, relatives, neighbours and friends, Clause 5 on the second page goes on to emphasise that a station owner shall allow nobody except those persons authorised by Limitation 2C to operate the station or handle the apparatus. The crux of the matter is that, even if we choose to disregard the likelihood of official action, the fact remains that, as amateurs, we need all the goodwill we can attract in these band-sharing and frequency-grabbing days. To the layman who did not learn to unravel it in the Services, CW telegraphy on his favourite BBC programme could be "a loose connection somewhere," or a meteorological annoyance. But not so with AM telephony that requires no unscrambling. When amateurs are thus overheard discussing radio, while it may be thought that they talk some rubbish, they are tolerated because of the obvious technicalities they bandy about, and there is the thought that they may be doing something useful. When, on the other hand, two XYL's are overheard discussing little Willie's rapid growth or the sharp increase in pork-sausage prices, the layman is tempted to think that the intolerable burden of present-day BC jamming and interference would be more evenly spread if precious space was not wasted in this manner.

Let it not be thought by this that the writer is advocating telegraphic secrecy at all times, even if CW always has been and is likely to remain the basic form of Amateur Radio communication. The point emphasised is that as long as telephony remains open to interception, such a method of conveying intelligence from one point to another should be carried out with as little public excitement as possible. And the best way to ensure this is for station owners to keep all unauthorised persons, however dear to the heart, away from that microphone.

Go-Slow Telephony

Turning now to practices that restrict the smooth working and intelligibility of amateur contacts, we have the operator who switches to telephony for a rag-chew because he is convinced that, by voice working, he can express very much more in a given time than would be possible in Morse. This holds true only so long as he refrains completely from using spoken "Q" and other abbreviations that require phonetics to clarify their meanings. While it may be flattering to brass-pounders to hear telephonists paying such constant tribute to code procedure, it is still very much simpler and more business-like for an operator to say "Fading" than "QSB Quebec Santiago Baltimore," or whatever word list he happens to favour at the time. Another insidious, not to say ridiculous, time-waster is the jargon that, over the years, has attached itself to

telephony working. Such expressions as "Come in somebody please, Carefully tuning for any possible call. Pulling the Big Switch, K, Dahdedah, Wot sa, Take it away, It's all yours" and the nerve-shattering "Overoffanclear" mean, in some cases, very little and in others precisely nothing, and are therefore best left unsaid. There are suitable voice equivalents to every code instruction and abbreviation used when keying. "Calling any station, this is G9BCF G9 Baker Charlie Fox G9BCF by for any calls" — "G9BCF this is G1EOQ G1 Easy Oboe Queen go ahead please" — "G1EOQ this is (or From) G9BCF" — "G9BCF from G1EOQ, over" — "G1EOQ this is G9BCF clear (or clear and closing down)" — are all simple, concise and worthy of adoption where needed. The use of CW telegraphy abbreviations and cobweb jargon by voice-operated stations leads to confusion and loss of time; code mutilation should be left to those brass-pounders who, through ignorance or laziness, have acquired bad habits.

Sloppy CW

While it creates no particular havoc, a favourite habit of the Code Improver, and one into which QSL printers have fallen before now, is to add an "s" to 73 and turn it into "best regards's." Quite a small matter, but as amateur operating is only as clean as we each make it, we would be wallowing deeper in the mire than we already do were each of us to please himself and refuse to adopt a standard code and operating procedure. Certain departures from the orthodox are constantly to be heard, and each in its own way spreads a little confusion. A commercial telegraphist listening for the first time to some of the bad-habit exponents on the air, might well be excused for thinking that a family quarrel must be in progress on the amateur bands. The frequent exclamations of "No, no, mother" (N N MA) would, however, only turn out to be someone disjointedly calling "CQ"; requests to perform, please, a contortion called "Tet" (pse tet) would merely be a polite request to "pse K." There are hasty operators who fire off a string of nervous dots, and more sober ones who send \overline{VE} or even \overline{ii} instead of an 8-dot erasure; there are others who employ the hyphen for a break sign, and quite a few who prefer RI and even LE for \overline{AS} (Wait). Our geographical position has always linked us with the sea, and it is a natural outcome of this that, while the amateur Morse test does not include the accented letters, figures and punctuation signs of the international code, our procedure closely follows that of coast and ship stations as laid down by the British Post Office.

To dispel any hang-over about the code, it should be mentioned that the old semicolon (\overline{NNN}), inverted commas (\overline{LN}), exclamation mark (\overline{MIM}), and underline (\overline{UK}) have all been abolished for some time, although the exclamation mark (\overline{MIM}) will still be heard used as such on amateur frequencies, and the Army may use the underline (\overline{UK}) to denote "Print in capitals." The old full stop (\overline{iii}) is

obsolete, but the original comma (\overline{AAA}) has become the present full stop, while the old exclamation mark (\overline{MIM}) is now the present comma. These two latter signs will mainly be heard punctuating the address of American amateurs when giving their QTH. The meaning and correct use of the post-war ending signal \overline{KN} , popularised in the U.S.A., is not fully understood by many on this side. It is a dual request that one specified station alone should go ahead and that those not specified should remain silent and keep off, because they will not be answered. It should be tacked on to the tail-end of a directional CQ, to the tail-end of a call to a specified station with whom contact is desired, and it should be used at the end of each "over" after contact has been established. Employed in this manner, it denotes to all hearers exactly for what and to whom the operator using it intends to listen.

Bearing upon the subject of operating is the belief held by many that, to increase sending speed, they must pound faster, whereas all they have to do, *without the slightest extra exertion*, is to shorten letter and word-spacing in proportion, just as, in exactly the reverse manner, speed can be slowed down by lengthening the spacing. And thus could one continue, were it not for printing space. To all guiltless readers, the writer expresses his admiration, and to those whom the cap happens to fit in some small degree is offered the friendly suggestion that they study the code again, the abbreviations and modern procedure. For the Morse code, which includes the procedure signals, is cleverly designed to make everything as easy as possible and clear to all. By using it properly, they will develop their operating and thereby extract greater enjoyment from the hobby.

ANYTHING TO SELL?

One of the best and quickest ways of disposing of unwanted gear is to put a notice in our Small Advertisement columns; and if there is anything you particularly need, it is well worth trying a "wanted" advertisement. Every month large quantities of equipment are bought and sold through "Readers' Small Advertisements," and over the years the value of items such as second-hand receivers and commercial gear of all kinds has been established through SHORT WAVE MAGAZINE small advertising. Notices should be set out concisely and sent, with remittance, to Advertising Dept., Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1 Rates are low (at 3d. a word, minimum charge 5s.) and coverage is overseas as well as throughout the United Kingdom.

AMERICAN SUBSCRIPTION SERVICE

Readers are reminded that we can accept, in sterling, subscriptions for CQ and QST, as well as for all American radio periodicals and technical publications on any subject. The cost of these subscriptions is regularly advertised by our Publications Department—see p.2, this issue.

WORK AT THE BENCH

MAKING PLUG SOCKETS

G. L. FLINT (G3IHH)

HOW many times do we see "junk box" when reading over a *Magazine* article, and how often do we smile to ourselves as we visualize the author diving into the depths of a huge crate, or similar capacious receptacle, to bring out just the very thing required for the job in hand?

Of course, he doesn't get it out of the junk box! More often than not he has a store cupboard with all his stock neatly grouped and graded (or has he?), so that he can quickly see if the required piece is there. No serious-minded amateur should do otherwise, anyway.

Nevertheless, it is a good idea to have a real "junk" box or two, in which to store all those odds and ends which cannot be graded, but which look as if they will be useful some day.

There is a peculiar satisfaction to be experienced as the result of "making something out of nothing," and often, Necessity, the old Mother of Invention, will give inspiration if the imagination is allowed a little rein.

One item of this nature is the multi-plug to be found in the small control box (*Ref. B.C.451.A.*), which also provides two very nice miniature switches.

The latter are carefully stored away, but the plug, which has a real crop of heavily silver-plated banana-type contacts, is often disdained, because there is no socket to fit, and anyway, who wants an eighteen-way plug and socket?

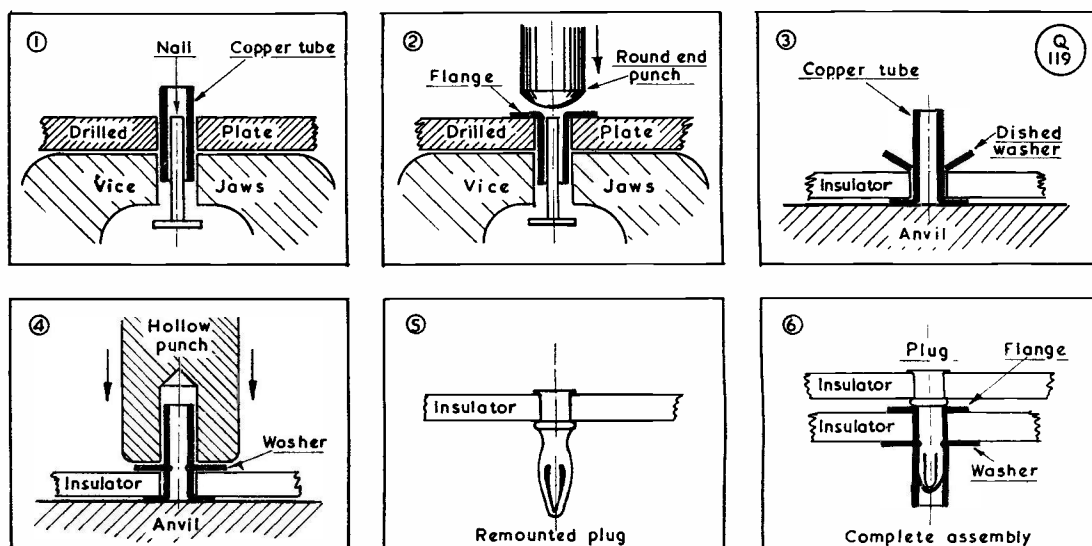
However, with care and patience, the individual plugs can be persuaded to part company with the mount, and may be put aside for re-mounting when required.

Then comes the question of sockets to fit! If you are still interested, read on!

Sequence of Operations

Take a length of copper tube of suitable bore to fit tightly over the plug, anneal (soften) it by heating to red heat and cooling quickly, and cut from it a length (about half-an-inch) with that most useful of hand tools, a piercing saw. (This saw, which is a kind of metal-cutting fret-saw, will cut through a quarter-inch steel rod and leave a perfect finish without burr.) Then take a brass washer of such a size that it will just *not* pass on to the tube. Place the washer on a resilient base and strike it smartly in the middle with a small ball-pene hammer, or, better still, make a round-ended punch for the job from $\frac{1}{4}$ in. steel rod. This treatment will "dish" the washer, and should be continued until it will just fit over the copper tube.

Next, take a piece of $\frac{1}{4}$ in. mild steel plate, or scrap brass, and drill through it a hole of a size to take the copper tube. Slide the tubing over a wire nail (point cut off square with the piercing saw) to prevent it being squashed, and, resting the drilled plate on the jaws of the vice, pass the tube and nail between the jaws, and through the hole, so that, when tightened up, the vice grips the tube and nail and leaves about a tenth of an inch of tube protruding above the plate, with the end of the nail, inside the tube, level with the plate surface. With a centre punch, open out the end of the tube, finish off with the ball-pene hammer, and you have a neat flange. (Next, remove the nail!).



These sketches show the sequence of operations, as described in the article. It is a good example of how a required part can be fabricated from available odds and ends.

Now to assemble the bits and pieces. Take the insulant in which the socket is to be fitted and drill a hole in the required position, to take the tube. Pass the tube through until the flange stops further progress, and lay the job aside.

Into a short length of mild steel, or brass rod, drill a hole in one end just big enough to take the tube, and deep enough to bed right down on the insulant. Place the dished washer on the tube, invert the assembly—flange end down—on an anvil or plate; apply and strike the end of the tube, which

becomes a hollow punch, with the hammer.

This will flatten out the washer, causing it to grip the copper tube and, at the same time, fixing it to the insulant. Clean up the inside of the tube with a drill, and you have a neat and tidy socket for your plug. Applications of this method are obvious—coil-mounts, battery connections, and so on, while a socket of any size required can be made by using the appropriate tube and washer.

The sequence of operations is shown in the "strip cartoon" herewith.

PIONEER BROADCASTING — ANOTHER HISTORICAL NOTE

Who of our readers heard Dame Nellie Melba make what was the first public broadcast by an internationally-known artiste? The date was June 15, 1920; the station was MZX, Chelmsford, operated by the Marconi Company on 2,800 metres; Melba's fee for this single appearance before the (carbon) microphone was £1,000—equivalent to about £5,000 nett by present-day values; and her sponsors were the *Daily Mail*, at that time at the height of its influence. Station MZX commenced regular transmission on 2,800 metres in 1919 and was on the air long before Writtle, 2MT. The announcer was a Mr. Ditcham, of the Marconi Company—the "grandfather" of the John Snagges, F. Grisewoods and Macdonald Hobleys of our time—and the very first artistes regularly employed on MZX were Mr. Edward Cooper and Miss Winifred Sayer, whose fee for each broadcast was just 10s. Some hundreds of devoted and enthusiastic listeners followed the activities of MZX, which could be received at distances up to 1,000 miles.

It is well that these facts should be remembered and recorded for posterity because, in the broadest sense, the whole effort was as amateur as the audience. Yet by their efforts the foundations of broadcasting were being laid.

MULTICORE SOLDER for PRINTED CIRCUITS

As a result of the many and varied home-constructor radio, television, tuner and amplifier kits now becoming available with Printed Circuits incorporated in them, Multicore Solders Ltd. will shortly be marketing, at 2/6d., a special solder referred to as the Printed Circuit Pack for Home Constructors. It comprises approximately 40 ft. of extra fine 22 SWG high tin content Ersin Multicore Solder wound on a reel and packed in an individual carton. One dozen cartons are fitted in a display very similar to the existing Home Constructor's 2/6d. Pack. Extra fine 22 SWG 5-core Ersin Multicore Solder is specially recommended by manufacturers of Printed Circuits for the fine soldering made necessary by the nature of the copper laminates and other features of Printed Circuits. Only a minute deposit of solder is required to join wires effectively to Printed Circuits, and the 22 SWG specification has been formulated after experiments with many gauges, and as a result of recommendations made by manufacturers already using Printed Circuits in their receivers.

NEW "LONG PLAY" EMITAPE NOW AVAILABLE

Emitape "99" is a specially developed thin P.V.C. base tape; its magnetic oxide coating and electrical characteristics are identical with the high sensitivity "88" tape, and it possesses the same outstanding features of high tensile strength, freedom from curl, negligible elastic elongation, and very low noise level.

Emitape is exclusively used for all "His Master's Voice," Columbia and Parlophone recordings, for "His Master's Voice" and Columbia standard and "Stereo-sonic" tape records, and by many other recording companies. The great increase in the demand for Emitape, both at home and abroad, has made it necessary to double the capacity of the tape production plant at Hayes, and, with the further extensions now in progress, the Emitape factory will be easily the largest and most up-to-date anywhere in Europe.

OBITUARY

We much regret to have to report the death, on February 2, at the age of 58, after a long illness, of Reginald Mitchell, G5LH, of Horbury, Yorks. His station and DX results have often been featured in *SHORT WAVE MAGAZINE*, and he will be remembered as a good amateur and a fine operator.

* * * *

Another sad loss to the ranks of Amateur Radio is Jack Booth, G3DMP, of Wakefield, Yorks., who died on February 7 last. Licensed in 1948, he was active mainly on the LF bands and was well known on the Yorkshire air. He leaves a widow, two young children and two grown-up sons.

* * * *

We regret to have to announce the death, suddenly, on November 20, 1955, of Miss C. A. Marshall, G2HNB, of Oldham, Lancs. She had held an amateur licence for many years, and had made numerous friends over the air on both CW and phone. Her brother is G3JT, to whom and her family we express condolences.

* * * *

The death is also reported of Old Timer William Victor Parker, G6WJ, formerly of Wakefield, Yorks.

Wave-Form Analysis

INTERPRETING HARMONIC PATTERNS

E. JOHNSON (G2HR)

INTERPRETATION of the "picture" seen with the aid of an oscilloscope often presents a problem to the beginner. It is usually fairly obvious whether a more or less pure sine-wave is thrown on the screen, but any serious departure therefrom frequently means "distortion" to the uninitiated and little else.

Distortion in Audio Amplifiers

Distortion in audio amplifiers is largely caused by the unintentional introduction of harmonics not present in the original. Harmonic content in itself is not of necessity objectionable—indeed, much of the beauty of musical instruments and their individual characteristics are governed by the richness of harmonics. A pure sine-wave is uninspiring and soulless (as witness a steam-train whistle which contains few harmonics) and could not possibly be termed "musical."

Nevertheless, the fortuitous introduction of harmonics can be very objectionable. Provided the amplitude of even harmonics is not inordinately high, reproduction is not offensive, and in any case the intruding frequencies can be virtually eliminated by push-pull operation. Even a small percentage of odd-harmonic distortion, however, can be extremely jarring to the ear. Moreover, this form of colouration cannot be eliminated by a balanced amplifier.

Harmonic Identification

Unless the wave-form is very involved it is possible by visual inspection of an oscillograph to say whether the harmonic content is preponderantly odd or even. After that, it is up to us to apply what palliatives we can.

It will, of course, be obvious that we must in the first instance apply as pure a sine-wave as possible to the amplifier.

Fig. 1 shows two possible illustrations of second harmonic distortion with different phase angles. This type of complex wave is known as "non-alternant," and is characteristic of even-harmonic components. In other words, the negative half-cycle is not a copy of its positive counterpart. One may be tempted to

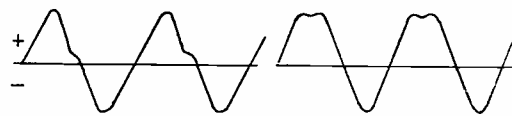


Fig. 1 Second harmonic distortion

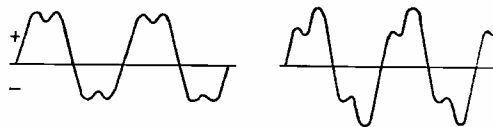


Fig. 2 Third harmonic distortion



Fig. 3 Third harmonic distortion showing "fold-over" test

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124

disagree in the first illustration, but a little thought will show that a constant rise in the positive direction followed by a *change of rate of fall* in the positive direction, is again followed by a change of rate of *rise* in the negative half-cycle. This in turn is followed by a constant *fall*.

Fig. 2 illustrates third harmonic distortion, again with two different phase angles. In this case it is quite clear that the waves are "alternant," i.e., the negative half-cycle is an exact copy of the positive side. If the same tests are carried out as suggested above, it will be found that whatever irregularities are shown on the positive rise or fall, the identical irregularities show up on the respective negative rise and fall.

Another way of tackling the problem is to fold the "picture" mentally along the horizontal time axis as shown in Fig. 3. The two half-cycles will then be seen to be identical.

CARDS IN THE BOX

If the operators listed below, for whom we have no forwarding address, will send in a large, stamped addressed envelope to BCM/QSL, London, W.C.1, they will receive the cards held for them in our QSL Bureau. If publication of the call-sign/address is required, that should be mentioned at the same time; it will ensure appearance in our "New QTH" feature and also in the *Radio Amateur Call Book*, the world-wide directory to radio amateurs, for which we are sole agents for Europe and the U.K.

G2ADG, 2BOQ, 2DNQ, 2DQO, 2GT,
3BBR, 3BDI, 3EMG, 3GTI, 3IA, 3JTJ,
3JVB, 3JKM, 3KOH, 3KOR, 3KPR,
3KQC, 3KRN, GM3JDH.

Aerial Coupler for the R.1155

PEAKING UP ON TWENTY

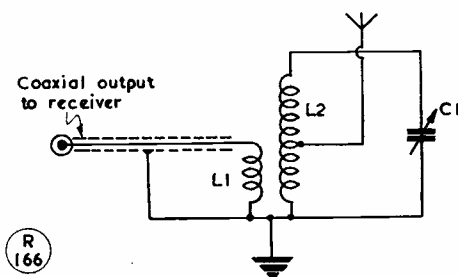
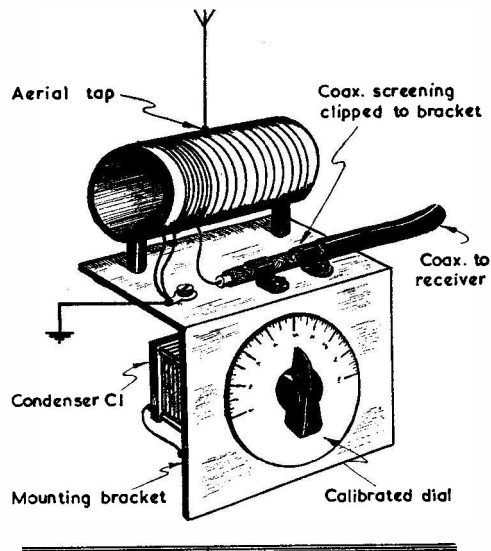
J. BROWN

MANY readers are aware of the merits of the R.1155 receiver which, in the last ten years, has appeared in various guises and with many modifications. One of its disadvantages is insensitivity on the 14 mc band, apart from the difficulty of picking out stations due to the limited dial coverage on this band.

To those operating an R.1155 which has not been modified for band-spread, the circuit arrangement shown herewith is worth trying. It is no more than a tuned aerial coupler matched into the receiver, but nevertheless it produces a marked improvement in performance on the 20-metre band. The only modification to the R.1155 itself is to provide a coax inlet by disconnecting the aerial leads on the "Jones plug" and taking them to a Pye or Belling-Lee coax socket mounted on the front panel.

Except for coil data, the sketch is self-explanatory. L2 is 14 turns, slightly spaced, of 22 SWG on a 1½-in. former, tapped 4 turns up from the earthy end for the aerial connection. L1 is a 4-turn link wound over the earthy end of L2, and the condenser is 150 $\mu\mu\text{F}$.

In operation, the condenser is used to peak up the incoming signal; tuning is not critical



in the accepted sense, in that the setting will hold over much of the dial coverage of the 14 mc band on the R.1155 main tuning control.

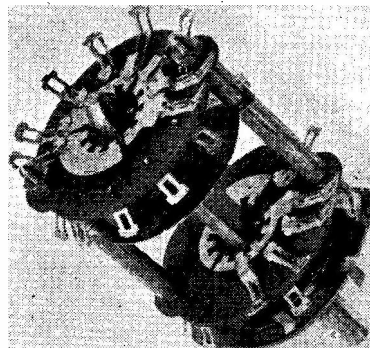
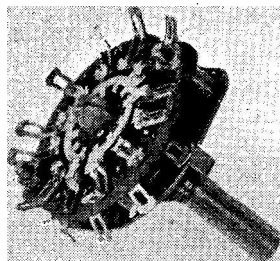
PLESSEY ROTARY SWITCHES

A rotary switch of advanced design is now being manufactured by The Plessey Company Limited.

The new switch is known as the G.A.1, and its robust construction represents a considerable advance on previous types, giving accurate control of manufacturing processes and new assembly methods, and ensuring long life and reliable service. The Plessey G.A.1 is a compact rotary wafer-type switch, and it can be constructed either as a single-wafer or multi-wafer unit with up to 12 positions. Each wafer permits up to 20 fully-insulated fixed contacts to be fitted. The contacts, which are of the double-wiping type, are fixed to the stator board by an entirely new method which

ensures that the tags remain absolutely immobile under tangential pressure.

Repeated tests, to stringent Government specifications, have proved that the Plessey G.A.1 switch can withstand the harshest treatment.



BINDING THE MAGAZINE

Those readers who wish to have their volume of *SHORT WAVE MAGAZINE* bound are recommended to the firm of Underwood, Earls Road, Amesbury, Wilts., who do a first-class job, very promptly, for the modest sum of 12s. 6d. G3ESO is in charge here, so he knows the requirements; we understand that he has been doing this work for many readers, at home and overseas, for a number of years.

INDEX, VOLUME XIII

Every reader should find, as a free loose supplement in his copy of this issue, a complete Index to Vol. XIII of *SHORT WAVE MAGAZINE*, concluded for the year with the February issue. Those who for any reason do not receive the Index should apply at once, enclosing a large stamped, addressed envelope.

BRITISH STANDARD — "The Performance of Power Transformers"

The British Standards Institution announces the publication of B.S.2214/1955 on "The performance of power transformers not exceeding 2 kVA rating for radio and allied electronic equipment." The standard covers general-purpose power transformers at up to the given rating, for operation at frequencies from 50 to 3000 cycles/sec. It applies to open, enclosed non-sealed, and hermetically sealed types. Copies of B.S.2214/1955, price 3s., can be obtained from the British Standards Institution, Sales Branch, 2 Park Street, London, W.1.

"LETTERS TO THE EDITOR"

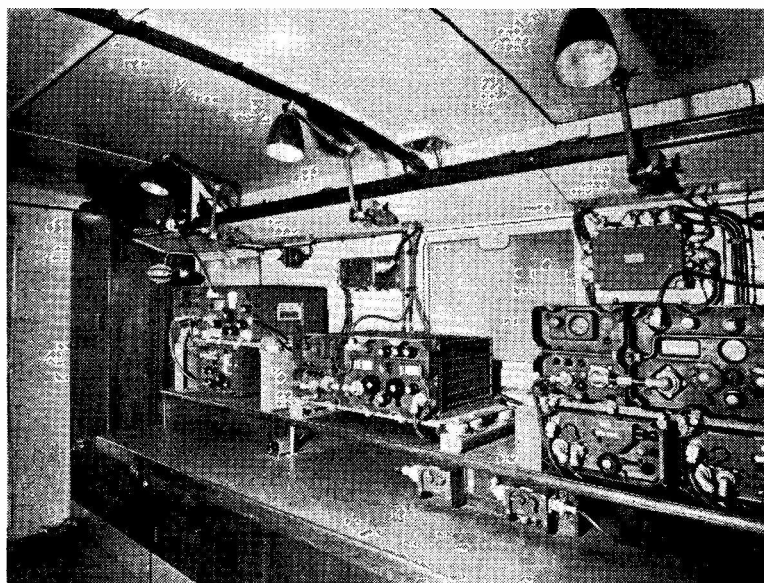
Heavy pressure on space has held back the appearance of many interesting letters; this does not at all mean that we do not want letters for publication from readers, which can be on any topic of current interest in the Amateur Radio field. Appearance of any letter is at the discretion of the Editor.

WENVOE on VHF/FM

The BBC station at Wenvoe, near Cardiff, which came into service on December 20 with FM transmission of the Welsh Home Service, is to have two more VHF/FM transmitters installed to carry the Light Programme and the West of England Home Service. BBC FM is operated in Band II, 87.5-100 mc.

WRAPPERS and ENVELOPES

The recent heavy increase in postage charges—from 2d. to 3½d. a copy—has compelled us to send out subscriber copies of *SHORT WAVE MAGAZINE* in a wrapper instead of an envelope, as the price of envelopes has also risen steeply. Though the wrapper we are now using is a strong one, some readers have complained that their copies are being battered about in the post. While it is for the Post Office to handle wrapped mail so that it is not damaged—we would suggest that readers who feel strongly about the matter should lodge a complaint with their local postmaster—it is true that envelopes give more protection, and we will revert to their use as soon as possible.



The firms of Mullard and Plessey recently gave demonstrations of the latest British developments in mobile military radio equipment to representatives of N.A.T.O. and the Commonwealth. The actual equipment, shown here in one of the vehicles fitted for the demonstration, includes an HF transmitter and receiver, four VHF transceivers, a speaker unit, and control system. In these modernised designs, special attention has been paid to ease of operation; for instance, frequency stability and accuracy of calibration are such that it is no longer necessary to go through the process of "netting," or "back tuning." Servicing is simplified by unit construction and design for maximum accessibility, while the need for servicing has itself been reduced by robust construction and by sealing all units against dust and moisture.

Modulating the Screen

SYSTEM FOR 50-WATT STATIONS

This is a very useful discussion on the practice of screen modulation, which has not yet achieved nearly the popularity it deserves in amateur circles. Excellent results are possible with reasonable efficiency and a very definite saving in modulator power compared with AM systems. Valves such as the 6L6, 807, KT8 and 813 are quite suitable for SAM working, and show considerable economies at higher power inputs. In a practical case, an 813 run at 140 watts DC input can be screen modulated to a depth of 70 per cent. with good quality using less than 6 watts of audio.—Editor.

WHILST adherence to convention and accepted techniques may be sound policy, usually based upon wide experience and findings gained over a number of years, the adoption of "unorthodox" methods can be extremely advantageous.

Some excellent articles have been published lately in *Short Wave Magazine* dealing with the various methods of applying modulation to the carrier, and it is hoped that these notes will prove of interest to those wishing to construct a simple but effective screen modulator.

When deciding upon a modulation system other than anode or anode-and-screen, it is advisable in the first instance to aim for a method which will give as high an efficiency as possible, together with a minimum of audio equipment and power expenditure.

It will be of interest, before examining in detail any one particular method of modulation, to compare the relative merits of the more conventional anode modulation with one of the lesser used systems.

The average medium power phone station probably uses a VFO-PA arrangement, the PA often being a single-ended stage employing an 807 or similar RF tetrode.

The audio equipment required fully to modulate, say, a 40-watt carrier, using the anode and screen system, will need to develop 20 watts, necessitating the use of (a) a reasonably high gain pre-amplifier (dependent on the type of microphone used); (b) a phase inverter; and (c), two output valves of the 6L6 class, resulting in a total current drain of the order of 100 mA, assuming 400 volts HT.

Before proceeding further it will be obvious that for optimum results two power packs are required, one for the RF and one for the audio equipment. The total valve complement of the transmitter will be at least six or seven, plus rectifiers, so making for heavy demands on heater supplies, apart from HT drain.

Assuming that the transmitter is efficient from the point of view of low-loss power transfer to the aerial, also that the aerial has a good radiation characteristic, it has been proved that, for one additional valve in the PA, minus three in the modulator, telephony operation equal to any anode modulated transmitter can be achieved with screen modulation. The PA efficiency using this system can be as high as 60 per cent.; furthermore, the modulator can be an RF pentode of the receiving type, operating in Class-A, and having a total HT consumption of the order of 10mA, thereby enabling it to be fed via a series dropping resistor from the PA power pack.

Requirements for Screen Modulation

It is believed by some that screen modulation of a PA stage is difficult to achieve. This is not the case, and these notes show how simple to install and adjust is this very effective modulator.

The reader's reaction at this juncture will undoubtedly be one of disapproval at the relatively low PA efficiency obtained, but a little thought will dispel any misgivings when it is realised that the *overall* efficiency of the transmitter is actually increased, and the standard of the emitted signal maintained.

In order that reasonable RF power may be obtained with the reduced screen voltage necessary for symmetrical modulation, two 807's are used in push-pull, with 500 volts on the anodes. A variable resistor is in series with the screen HT feed, to provide a means of varying the screen potential when adjusting the transmitter for optimum conditions.

A matching transformer between modulator plate and PA screens having a ratio of 5:1 is suitable, but a little time spent on experimenting with various modulator valves (provided they are rated for at least 3 watts), and different transformer ratios, will be well worth while.

The screen impedance for practical purposes can be calculated from E_s/I_s , and having determined the optimum load for the modulator, the transformer taps can be selected in the usual way. It is desirable to carry out the initial adjustments using a dummy aerial and an oscilloscope for checking the modulation. [over

The highest possible PA efficiency together with a modulation factor of unity should be aimed for, and these conditions are achieved by commencing with a low screen voltage of the order of 100 volts, then increasing this figure gradually until the screen potential is at such a value as to permit symmetrical full modulation.

The limiting factor can be regarded as the ratio V_a/V_g2 , which should be made as small as possible, but in any case the recommended screen voltage of the particular PA valves in use should never be exceeded.

It will be seen that if the screen voltage is made too high, the positive excursions on peaks of modulation will be limited by the anode potential, yet the negative modulation half-cycle will be comparatively unrestricted, thereby causing asymmetrical and consequent "downward" modulation.

A particularly useful feature of screen as opposed to control grid modulation lies in its independence of critical grid current adjustment, and provided that this latter is sufficient to drive the PA to maximum rated output with normal screen and anode potentials for Class-C operation, then it will certainly suffice for this

system. An important point is that it is essential to ensure that the modulator valve (an EF50 will do) is operating in true Class-A.

Results

When carrying out the initial tests with a dummy aerial load and oscilloscope, it was found that the PA—two 807's in push-pull, with 500 volts on the anodes—could be driven up to 40 watts, whilst maintaining symmetrical modulation to a depth of 90 per cent. Increasing the 807 screen potential, and hence the RF output, resulted in the positive modulation peaks becoming flattened, causing downward modulation and very noticeable distortion.

It is true to say that by the simple expedient of using a push-pull final for a 25- to 40-watt transmitter, instead of the more usual single-ended arrangement, full modulation of good audio quality can be obtained with a single EF50 as modulator. It will be appreciated, of course, that in order to make full use of the linear portion of the EF50 I_a/V_g characteristic, the output from the microphone and speech amplifier must be sufficient. If not, a small pentode voltage amplifier, e.g., an EF37, preceding the modulator, will be necessary.

ADAPTING RECEIVERS FOR TOUCH TUNING

OPERATION FOR THE BLIND

ONE of the first problems facing a blind operator is to equip himself with a good standard communications receiver which he can use with complete independence, and after several years of comparative floundering, this was found in the famous National HRO. With its splendid slow-motion dial engraved with degree markings which can be easily *felt*, this receiver requires no adapting at all except for identification marks on the coil packs. This is achieved simply by fitting soldering tags under one of the fixing screws in the corners of the frames enclosing the graphs, putting a tag in a different position for each coil pack.

In spite of success with the HRO, the search has gone on for other receivers which can be easily adapted for use by a blind operator without too much mechanical complication, expense, or disfigurement. But it was not until a Hallicrafters SX24 became available, that it was possible to extend these researches. This receiver also can be adapted in a reasonably simple way, and although so far the same accuracy of handling has not been achieved as with the HRO, the writer is satisfied that it is

only a matter of careful operating practice to get equally satisfactory results.

The SX24 Modification

The first thing to do is to remove the existing bandset and bandspread dials. Take out the four self-threading screws (two at each end of the top edge of the cabinet) which secure the frame of the hinged cover, then lift out the front edge of the frame. Loosen the rotating dials on the spindles. Remove the four screws and nuts securing the bandset dial cover, when by springing the panel slightly forward it should be possible to slide the cover out. The circular dial will then come out through the hole in the panel.

Now remove the three screws securing the bandspread frame on the panel—this is a little tricky, as the bottom screws are not easily accessible—and then extract the bandspread dial. This is the most difficult operation, as there is very little space between the end of the spindle and the back of the panel, but a little judicious "brute force" achieved it, as the object here was to try to do the job without removing the receiver from its case. Now, with a fine hacksaw blade, cut a small piece out of the panel in the bottom edge of the bandspread opening to expose the spindle. (Before doing this, slip a piece of stiffish folded paper between the panel and the chassis to catch as much of the metal cuttings as possible.) This cutting can, of course, be avoided by drilling a hole accurately opposite the end of the

spindle—but the cutting is easier, as the drilling of a hole at least half-an-inch in diameter in a springy panel is a difficult operation.

The Touch Dials

For the bandset dial, a 6½-in. disc of light gauge aluminium is marked with the “minutes of a clock face,” embossing double dots at the points which would represent the hours; this disc is drilled half-inch at its centre and secured to the panel by four short screws and nuts.

A brass boss drilled quarter-inch to a depth of ⅝-in. is slipped through the dial on to the spindle and tapped for a grub screw. Slotted and screwed into the end of the boss is the pointer. The pointer is fitted with the main set of condensers at minimum capacity, and fixed to read “12 o'clock”; the smaller bandspread dial is fixed in the same way. Adequate clearance of the boss in the dial is most important, as any binding may cause the belt drive to slip.

In applying the same method of fitting and marking to the bandspread dial, it was punched with two rings of markings; the conclusion since reached, however, is that this is pointless—it is, in fact, confusing to the touch to have *too* many markings, as any blind person will appreciate. Like using a Braille watch, it is only a matter of practice to achieve a high degree of accuracy in reading.

Operation

On the SX24 the writer now knows that if the

wave switch is on “two” and the bandset pointer at “three minutes before nine” (in other words, at 84 degrees) the bandspread covers the whole 80-metre band; similarly, with the switch at “three” and the pointer at “three-quarters of a minute before five,” the bandspread covers 40 metres.

The marking out of these dials is not at all a difficult matter for a sighted person, but as the writer is stubbornly independent, a most satisfactory machine has been devised with which any dial from two to ten inches in diameter can be punched, dividing the circumference into tenths or multiples of ten, or twelfths or multiples. The markings are done with an adjustable automatic spring punch so that the embossings come out reasonably even. The fundamental idea for this marker is due to Stanley Wartenberg (W2ET), who wrote a splendid article on making Braille dials for the *Braille Technical Press*. In the writer's machine the positioning of the disc to be marked is achieved by a ratchet; hence the spacing of the markings is dependent on the number of teeth on the ratchet wheel and the number of notches counted between each punching. Being in the fortunate position of having a lot of useful tools, including a small power-driven lathe, it was possible to make at home every part for the marker except the gear wheels. There is no doubt that many other types of standard communications receiver could be similarly modified for accurate use by blind operators, of whom there are an increasing number on the amateur bands.

DIP COATING USING BAKELITE RESINS

Bakelite Ltd. have developed a simple method of applying a reliable insulating layer over intricately shaped radionic components; this is produced by a bakelite dip, the mix consisting of bakelite polyester resins with a suitable catalyst. The result is a thin, very hard, semi-transparent finish, with a high breakdown resistance, capable of protecting the component against anything from tropical heat and humidity to Arctic cold. An information leaflet on the process can be obtained from Bakelite, Ltd., 12-18 Grosvenor Gardens, London, S.W.1.

MULLARD REGULATED VOLTAGE UNIT L.153

The Mullard regulated voltage unit L.153 is a general-purpose laboratory power unit, which provides a stable low impedance DC supply continuously variable between 0 and 300v. at up to 300 mA. Two 4A AC supplies of 6.3v., tapped at 4v., are also incorporated, as well as an unregulated EHT supply of 1.2 kV at 2 mA.

The DC outputs of two units can be connected in series to give up to 600v. positive and negative to earth. The variation in output voltage is less than 100 mV for mains variations of +10% to -15%. Ripple voltage is less than 3 mV, and output resist-

ance is about 0.2 ohms. Output voltage and current meters are incorporated, and the unit is protected against overloads by a circuit-breaker which cuts the supply connections and lights a warning lamp. This circuit-breaker may be re-set by operating a push-button on the front of the unit.

A new form of construction is used which enables the bench mounting case, in which the unit is supplied, to be very quickly removed for servicing and maintenance. The front panel and chassis are designed to fit any standard 19 in. rack.

FARADAY MEDAL for PROF. G. W. O. HOWE

It has been announced by the Institution of Electrical Engineers that the recipient of the 34th award of the Faraday Medal is Professor G. W. O. Howe, D.Sc., LL.D., M.I.E.E.

The Faraday Medal is awarded by the Council of the Institution for notable scientific or industrial achievement in electrical engineering or for conspicuous service rendered to the advancement of electrical science.

Professor Howe, who is Emeritus Professor of Electrical Engineering at the University of Glasgow and a director of Mullard Limited, has received the award for “his pioneering work in the study and analysis of high frequency oscillations and on the theory of radio propagation; and for his outstanding contributions to engineering education.”

IT is fair to say that during the protracted cold spell both conditions and activity on the VHF bands struck an all-time low—this is reflected in the fact that for the first time that your A.J.D. can remember there is only one claim for a move in any of the Tables. The volume of mail has likewise been low, though this is more likely to have been due to some idea that we would not be able to produce SHORT WAVE MAGAZINE on time, or at all, and that therefore a report for "VHF Bands" would be wasted. Well, in spite of that, here we are, and we hope that by the 19th of this month we shall be hearing from *you* for the next issue!

In general, the intensely cold weather held most people to within their radius of local coverage; there was nothing in the way of a GDX or EDX opening, though conditions did take an upward swing around February 7, when there was a change from "cold" to "mild," with a fairly high glass; again, from February 26 onwards, conditions improved when the long, cold spell was breaking up, with the thaw setting in and the glass remaining high.

It is not at all surprising that with the weather as cold as it was, activity was low—it was just too cold for most people to think of going into the shack. Nevertheless, the usual local QSO's and schedules went on, and a score or so of stations were being heard or worked over longer distances.

Solar Flare

The eruptions from the sun during the period February 23-25 aroused a great deal of interest, it being reported that the intensity of the cosmic ray bombardment of the earth was at one of the highest levels ever recorded. An appearance of Aurora Borealis ("Northern Lights") was expected on the evening of February 25—though at the latitude of your A.J.D., nothing was actually seen. However, a variable hiss level was audible on the two-metre receiver with the beam headed north; unfortunately, at the time (0100 GMT, 26th) no two-metre stations at all could be heard, and it was therefore not possible to get any check on pro-

VHF BANDS

A. J. DEVON

Low Activity & Few Reports—

The February Solar Flare—

Past Results by Auroral

Reflection—

General Notes and News—

pagation over known distances.

However, two-metre stations on regular schedules at more usual times report nothing abnormal at least up to the evening of the 26th when, as mentioned earlier, conditions were distinctly better than they had been during the previous three weeks or so. Through it all G2HCG was able to maintain his schedules with PE1PL and G3FAN.

Of course, the old hands on VHF—that is, those who were active and fully operational in 5-metre days—know all about Aurora Borealis manifestations, and the effect they had on propagation. It was quickly found that the intensely ionised curtain produced under auroral conditions was a very efficient reflector of 56 mc CW (but not phone) signals—so much so, that everyone could work everybody else with beams headed north. Many long-distance contacts were effected under these conditions, but always with a CW note much degraded in quality; a normal T9 signal would come out at T5 or worse. This was due to violent phase distortion and scatter effect, and was the reason why phone could not be used. Even a strong

telephony signal was almost unrecognisable as speech.

These were happenings of eight years and more ago, when we used to look out not only for the Aurora but also for sporadic-E, since it was possible to work well over 1,000 miles if one struck a good patch, usually during the height of the summer.

All this is faithfully recorded under the "VHF Bands" heading in SHORT WAVE MAGAZINE for the period from 1946 to April 1949, the 5-metre band having closed to us on March 31, '49. Indeed, there is no written record extant which is either so detailed or as accurate, with an enormous number of long-distance contacts reported under Tropospheric, sporadic-E and Auroral conditions. Results and experiences on five metres are well summarised (by G2XC, who at that time conducted this feature) in our issue for April 1949. If you have it, the story is worth re-reading.

The point to make and to emphasise, and re-emphasise, here is that it was amateur effort, probing beyond line-of-sight distances, that disclosed and proved the VHF propagation mechanisms of which so much is now being heard. A good instance of this is noted in "VHF Bands" for March 1953, where it is shown that as amateurs we were using the Aurora Borealis as a reflecting curtain for communication purposes before it occurred to any professional propagation expert to try it for a radar echo, let alone as a signal path.

Going further back still in the records, there is an extremely interesting report, in "VHF Bands" for November 1951, on auroral reflection effects on *two* metres (previously, there had been no evidence of this on wavelengths shorter than five metres). Anyway, on September 25, 1951, auroral reflection suddenly began to make itself evident to stations in normal CW contact on the two-metre band. Notes went from T9 to as bad as T2 for a period of about half-an-hour, and these signals could only be heard with beams headed north. The operators involved in this remarkable experience were G3CYY, G3EHY, G4HT, G4LX, GM2FHH, GM3BDA, GM3EGW, and

GW5MQ, all of whose reports tally on the details.

Coming right down to the immediate past, we would be very glad to hear from any VHF operator able to report auroral reflection effects during the manifestation on February 25 last, when northerly stations who happened to be on about midnight may have encountered these same phenomena of dirty notes and strong reception in the northerly direction.

VHF Contest—March 10-11

Now right upon us—we would remind you that this is the week-end—rules will be found on pp. 590-591 of the January issue, to which there is that slight amendment to Rule 4(e), which should read "Ten points for all stations worked over 200 miles (E)."

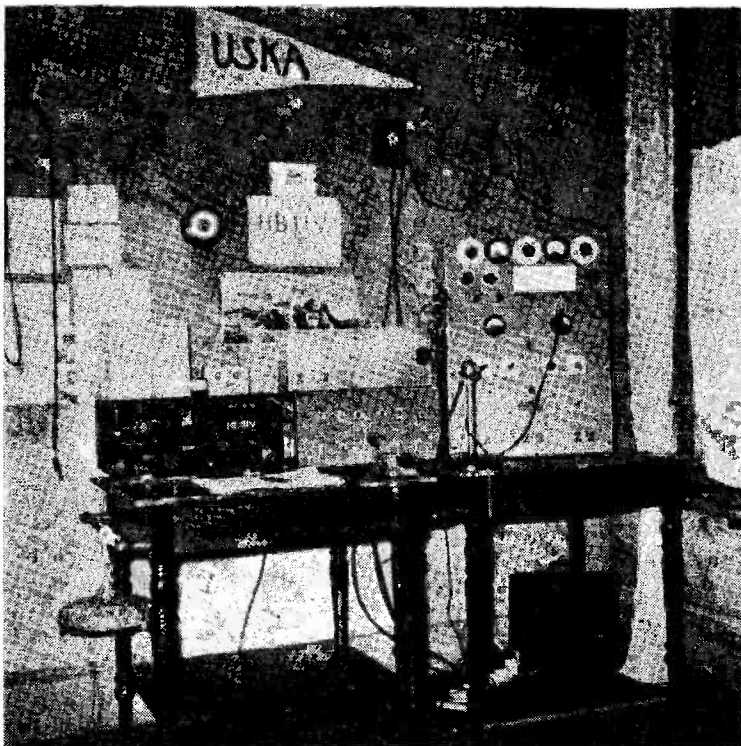
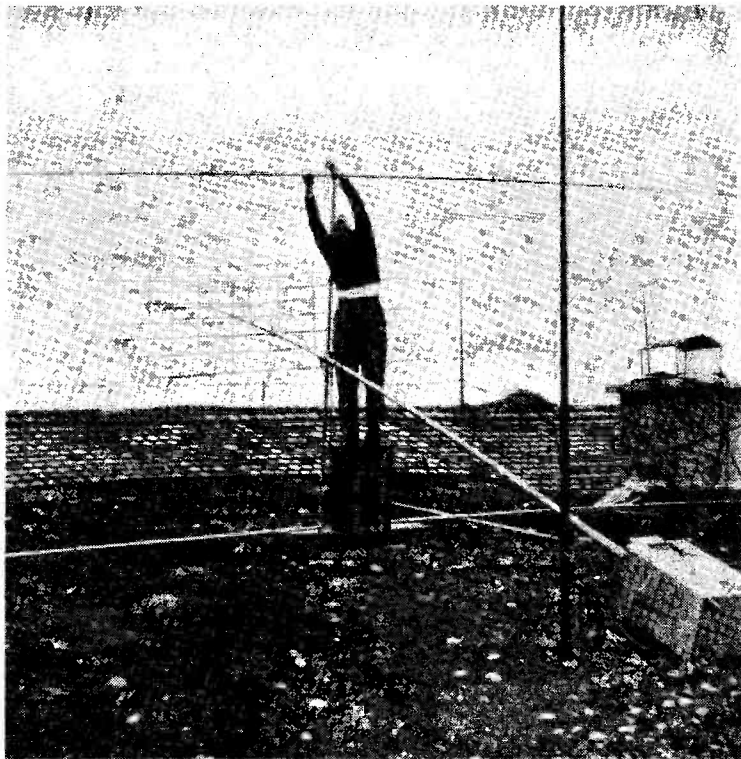
This Contest is the very first two-band affair in the VHF field and we are looking forward to a big entry; it is also the first Contest of the VHF season and if there is anything of an EDX opening, the results should be very interesting. At the moment of writing, it is not possible even to hazard a guess as to what the weather will be like, except to say that we ought to be out of the cold spell!

In connection with the Contest, the other important thing to remind you of at this stage is that we must have entry logs by March 26, as stated in Rule 9. Late logs seriously delay the work of checking and as we have allowed a whole fortnight for the "office work" after the Contest, there should be no need for anyone to be late with his entry.

The Tabular Matter

The counties tables are not being shown this time because there is no significant movement in either of them. Claims should, of course, be made in the ordinary way as soon as they accrue and we hope that after the Contest there will be many new movements to report.

Several protesting letters have been received about the absence of



HB9IV and HB9MO were on Mt. Rigi in May last year, with gear for 14 and 144 mc. Above, HB9MO adjusting the 14 mc section of the composite beam array. Below, the 144 mc station. They hope to be there again this summer, using the two-metre band.

the Activity Report—that is, the calls heard/worked lists—from the last two issues. One of the strongest protests was from a reader who, as far as we can trace, has never himself sent in a list! This rather puts the finger on the matter.

We are only too glad to print calls heard/worked lists in the Activity Report—it we get enough of them to make a showing, and if

they conform, reasonably, to the rules. Those received for the February issue were not only few, but all needed re-typing. Moreover, though not many readers appear to have noticed it, we were out right on time with the February issue; this involved an enormous effort behind the scenes, and there was just no opportunity to get round to re-arranging and typing out the lists that did come in.

Your list for the Activity Report is always welcome; we are even more pleased to see it if it is set out in the way in which it can be used without having to be re-arranged, or re-typed. That is, on a separate sheet, with callsign and address above, the date area or other notes below, and the list itself divided into calls worked (first) and then heard, with each of these sections set out in strict alphabetical and numerical order, numerals being given with each call, but the appropriate prefix once only. In fact, just as you see the lists set out in print! Take ample space, run the calls from left to right as if reading text, and (if not using a typewriter) take care to differentiate clearly between U and V, 5 and S, 2 and Z, 1 and I, D and O, C and G. Remember, nothing is obvious to the machine operator who actually has to set the type. What you have to do is to make it all clear to him, not to us!

Fortunately, a good half of the lists we normally receive do conform to these simple rules (otherwise we should never be able to get the Activity Report prepared in time). But the other half do not. The calls list is run into the body of the letter, callsigns are out of order, or ambiguous, or, if the list is properly set out, it is impossible to separate it from the letter (for pasting down) without losing a lot of the contents of the report.

It does not take us very long to deal with one or two lists which are "all wrong," but it is a very big job if any large proportion of those sent in do not conform—and that is what we hope this dissertation on the subject will avoid for the future.

Claims for the Tables also should always be set out on a separate sheet, showing clearly which Table the claim is for, and what the move-

ment is. The reason for these requests is that all the tabular matter is set up in print separately from the text; hence, to prepare the tables, the details have to be extracted from each report. There have been times when preparation of the tabular matter alone has involved 16 hours or more of work; this can be greatly reduced if the rules as given here are observed, the point being that it is not so much relieving your old A.J.D. of unnecessary work, as allowing more time for the preparation of the text, since the production schedule is such that whatever the volume of work involved, there is no more than the given amount of time in which to do it.

It is hoped that these matters are now wrapped up for a long time to come!

More About Forward Scatter

There is still a great deal to be brought out in connection with this absorbing topic—and much of it can be found in the October 1955 issue of the *American Proc. I.R.E.*, which devotes practically all its 450 or so pages to the subject.

Boiling the whole concept down to its essentials, the reflecting layer is found at a height of about 50 miles above the surface of the earth. To obtain VHF communication between two points the transmitting and receiving beams must be aligned, horizontally and vertically, so that they both illuminate the same reflecting area. It is this factor that, so far as work has gone at the moment, appears to limit range to about 1,200-1,500 miles.

The propagation mode with which we, as amateurs, are most familiar is the tropospheric, in which everything happens at much lower levels (a matter of a few hundred feet only) and it is at this level that the weather day-to-day plays the vital part in determining whether conditions are going to be good, bad or the "same as usual."

At this moment, a vast amount of effort is going into propagation research on VHF, and large sums of money are being spent on long-term study programmes, involving, in many cases, the construction of experimental stations specially sited to facilitate observations. While

TWO-METRE FIRSTS

G/DL	G3DIV/A-DL4XS/3KE	5/6/50
G/EI	G8SB-EI8G	23/4/51
G/F	G6DH-F8OL	10/11/48
G/GC	G8IL-GC2CNC	24/5/51
G/GD	G3GMX-GD3DA/P	29/7/51
G/GI	G3DA-GI2HML	29/6/49
G/GM	G3BW-GM3OL	13/2/49
G/GW	G5MQ-GW5UO	22/10/48
G/HB	G6OU-HB1IV	12/9/53
G/LA	G6NB-LA8RB	29/6/53
G/LX	G5MR-LX1AS	23/7/55
G/ON	G6DH-ON4FG	25/9/48
G/OZ	G3WW-OZ2FR	1/6/51
G/PA	G6DH-PA0PN	14/9/48
G/SM	G5YV-SM7BE	1/6/51
GC/DL	GC3EBK-DL3VJ/P	22/3/53
GC/EI	GC2CNC-EI2W	8/10/51
GC/F	GC2CNC-F9OK	17/11/53
GC/GW	GC2FZC-GW8SU	16/6/54
GC/ON	GC3EBK-ON4BZ	4/3/53
GC/OZ	GC3EBK-OZ2FR	2/3/53
GC/PA	GC3EBK-PA0HA	16/7/55
GD/EI	GD3DA/P-EI2W	30/7/51
GD/GM	GD3DA/P-GM3DAP	29/7/51
GD/GW	GD3DA/P-GW5MQ	28/7/51
GI/DL	GI3GXP-DLISE	5/1/56
GI/EI	GI3GQB-EI2W	13/6/51
GI/GD	GI2FHN-GD3DA/P	29/7/51
GI/GM	GI2FHN-GM3OL	1/7/49
GI/GW	GI2FHN-GW3ELM	8/7/49
GI/ON	GI3GXP-ON4BZ	5/1/56
GM/DL	GM2FHH-DJ1XX	29/5/55
GM/EI	GM3BDA-EI2W	12/6/51
GM/ON	GM3EGW-ON4BZ	21/11/53
GM/PA	GM3EGW-PE1PL	22/4/53
GW/DL	GW5MQ-DL4XS	22/9/51
GW/EI	GW2ADZ-EI8G	19/4/51
GW/F	GW2ADZ-F3LQ	14/5/50
GW/HB	GW2ADZ-HB1IV	14/9/53
GW/ON	GW2ADZ-ON4YV	13/5/50
GW/PA	GW2ADZ-PA0HA	13/5/50
GW/SM	GW2ADZ-SM6QP	1/7/53
DL/OZ	DL6SW-OZ2FR	4/3/51
DL/SM	DL2DV-SM7BE	10/3/51
EI/DL	EI2W-DL3VJ/P	29/8/52
EI/ON	EI2W-ON4BZ	21/9/51
EI/PA	EI2W-PA0FC	10/10/53
ON/LA	ON4BZ-LA1KB	4/7/53
ON/LX	ON4TR-LX1MS	? ?
ON/OZ	ON4BZ-OZ2FR	3/6/51
ON/SM	ON4BZ-SM7BE	2/3/53

there is much yet to be learnt, it seems certain that the "professional" approach to the VHF's as commercially exploitable territory has undergone a profound change in the last few months.

Exotic Europeans

It is now established that there are two stations regularly active in Luxembourg—LX1AS in Luxembourg City, and LX1SI, who is connected with Radio Luxembourg, and runs a real high-power job on two metres; at any rate, his modulator is said to be a pair of 813's, and his receiver has a measured noise factor of 4 dB.

LX1SI has worked OE9BF, which QSO was overheard by ON4BZ, who has himself had contacts with three LX stations, the other one being LX1MS. Guy of ON4BZ suggests that "with such fine equipment," a G/LX QSO should again be possible very soon. Well, there will probably be further opportunities this summer.

The VHF Century Club

From time to time, we get enquiries as to what VHFCC stands for, and how one becomes a member. The certificate of the VHF Century Club, the only established award for VHF achievement, was mooted by us as long ago as April 1948, and the first list appeared in "VHF Bands" for June 1948. In that issue, the "founder members" are given as G5PY, G2AJ, G6VX, G2MR, G5BY, G5BD and G2XC—in that order. Since then, nearly 200 VHFCC certificates have been issued, and the letters "VHFCC" have become a recognised distinction in the VHF world.

The requirement is proof of two-way contact with not less than 100

different stations on VHF, on any band from 50 mc (6 metres) upwards. Claims must be accompanied by the cards, with a *check list*, and addressed to A. J. Devon at the office. Certificates are countersigned and issued after scrutiny of the cards which, of course, are returned.

First claim for this month is from JA1AG, Kawasaki, Japan, who shows cards from 106 JA's worked on 50 mc exclusively; we are glad to send VHF Certificate No. 191 to Akira Kurokawa, who runs 15w. to an 832 PA, and a converter into his Super-Pro main receiver, with a 4-ele Yagi.

Certificate No. 192 goes to H. Biltcliffe, G5HB, of Watchfield, Wilts, all of whose cards were for contacts on two metres, and all with U.K. stations. Josef Reithofer, DL6MH, of Straubing-Bayern, gains Certificate No. 193, all but ten of his contacts having been with DL's; he shows two HB's, OK1KRC and no less than seven OE's—so it can be assumed that there is some regular two-metre activity in Austria.

We were also very interested to have a claim from W1UIZ, George Gadbois, of Salem, Conn., who is awarded VHF Century Club Certi-

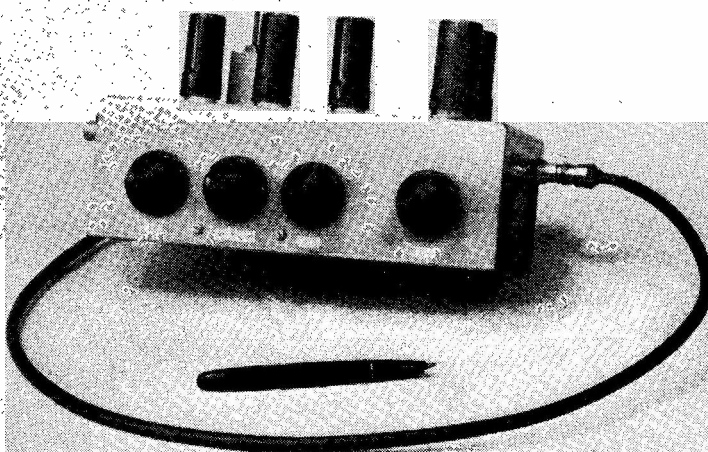
TWO METRES COUNTRIES WORKED

Starting Figure, 8

- 15 G3GHO, G4MW, G5YV, G6NB
(DL, EI, F, G, GC, GD, GI,
GM, GW, HB, LA, ON, OZ,
PA, SM)
- 15 ON4BZ (DL, EI, F, G, GC, GI,
GM, GW, HB, LA, LX, ON,
OZ, PA, SM)
- 14 G2HDZ, G5BD, G8OU
- 13 G2FJR, G3BLP, G3CCH, G3DMU,
G3GPT, G3IOO, G5DS, G6XM,
G6XX
- 12 G2HIF, G2XV, G3WW, G6LI,
G6RH
- 11 G2AJ, G3ABA, G3HAZ, G4RO,
G4SA, G5UD
- 10 EI2W, G2FQP, G3BK, G3BNC,
G3EHY, G3FAN, G3GHL,
G3GSE, G3WS, G5MA,
G8IC, GM3EGW, GW5MQ
- 9 G2AHP, G2DVD, G3DVK, G3FIJ,
G3IUD, G5MR, PA0FB
- 8 G2CZS, G2DDD, G2XC, G3AEP,
G3BO, G3HCU, G3HWJ,
G3VM, G5BM, G5BY, G5ML,
G8SB, GC3EBK.

ficate No. 194. Starting on two metres in February 1954, W1UIZ has worked 385 different stations in 17 states, covering six call areas; he runs an 829B in the PA, with 85 watts input, a CC converter into a HQ-129X, and the beam is a 5-over-5 on a tower.

On February 3, 1955, G3KEQ (Sanderstead, Sy.) opened up on



General appearance of the two-metre converter described in the May 1955 issue of "Short Wave Magazine," pp. 151-155, in which full design and constructional details were given. The knob on the left peaks the 1st RF stage; the next is the regeneration control; the third knob peaks the mixer circuit and the fourth panel control on the right is for varying the degree of injection. This converter will work very well with any good receiver tuning 24-26 mc.

70-CENTIMETRE FIRSTS

G/DL	G2WJ-DL3FM	10/8/53
G/EI	G5YV-EI2W	14/7/55
G/F	G3DIV/A-F8GH	5/9/51
G/GD	G2JT-GD3DA/P	26/8/51
G/GW	G4LU-GW2ADZ	5/7/50
G/ON	G3DIV/A-ON4UV	15/10/51
G/PA	G3DIV/A-PA0PN	15/10/51
GD/GW	GD3DA/P-GW5M1Q	29/7/51
GI/GD	GI3GQB-GD3DA/P	14/6/53
GM/GI	GM6WL/P-GI3FWF/P	9/9/53
GW/EI	GW2ADZ-EI2W	10/7/54
GW/ON	GW2ADZ-ON4UV	3/3/53
GW/PA	GW2ADZ-PA0NL	1/7/53

two metres, CW only, and is now able to claim VHFCC Certificate No. 195, all his QSO's being with G's on two metres.

Any reader able to show the required number of cards for VHFCC is eligible for this award.

VHF Dinner—Scotland

We are asked to announce that the annual dinner of the Scottish VHF Group will take place on Friday, May 4, at the Carlton Hotel, North Bridge, Edinburgh, proceedings commencing at 7.30 for dinner at 8.0 p.m. G2HCG will be giving his lecture-demonstration on Skeleton Slots, after which there will be a discussion, and the QRT will not be until 12.00 midnight.

The Carlton is a few minutes' walk from Waverley Station, Edinburgh; the charge for the dinner-meeting is 14s.; it is understood that night bookings are possible at the Carlton (20s., bed and breakfast); and all interested are invited to make their reservations, with remittance, as soon as they can, as this has always been a very successful meeting. This year the organisation is in the hands of: W. C. Bradford, GM3DIQ, 40 Kaimes Road, Corstorphine, Edinburgh, 12. He

also asks that those who care to do so should bring items of gear along, as it is hoped to have a small display of VHF equipment.

April Issue—

We are due out again on April 6, when your A.J.D. hopes to have a good deal of more individual interest to discuss. To do that, we need your reports, claims for the Tables, and lists of calls heard and worked.

As this is a "short" month, the date for reports is a little nearer than usual—**Monday, March 19** certain. If you like to send in your Contest entry at the same time, so much the better, but please keep it separate from the activity report. The Contest firm closing date for entries is a week later, March 26, and it is *not* proposed to discuss it in any great detail in the April issue, as there will not have been time to go through the logs.

Address all your VHF correspondence for notice in this column to: A. J. Devon, "VHF Bands," *Short Wave Magazine*, 55 Victoria Street, London, S.W.1. Good luck in the Contest—and send in an entry, even if you know yours is a low score. We want this event to be as representative as possible.

BRITISH ISLES

TWO-METRE ZONE PLAN

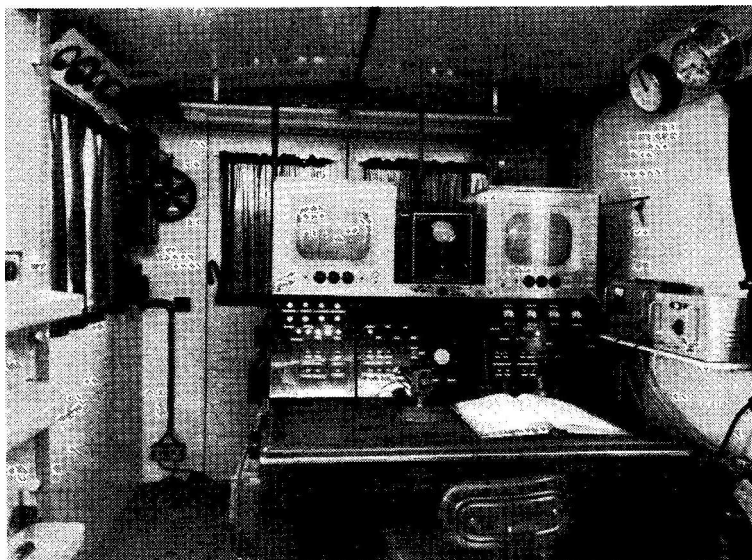
(This is reproduced here for the benefit of newcomers to the band).

Zone A & B: 144.0 to 144.2 mc.	All Scotland.
Zone C: 144.2 to 144.4 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., Wores., 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.

U.K. TWO-BAND VHF CONTEST

MARCH 10-11

See Rules in full pp. 590-591, January issue. Rule 4(e) amended to read "... over 200 miles." Entries to be in by March 26.



G9AED, the Belling-Lee Band III TV test transmitter, is now up in Lancashire. This is the control console in the trailer housing the transmitter, which operates on 194.75 mc for vision and 191.25 mc for sound.

COMPONENT EXHIBITION

The next Exhibition organised by the Radio & Electronic Component Manufacturers Federation takes place during April 10-12 at Grosvenor House, Park Lane, London, W.1. As there are more exhibitors than ever, it will be interesting to see whether the plans for restricting attendance will reduce the intolerable congestion of recent years. It is, in any case, high time this important Exhibition was moved from the over-heated atmosphere of a West End hotel.

TV RECEIVING LICENCES

The GPO announces that the total of TV licences in issue as at December 31 was 5,400,083. This compares with 8,848,297 licences for sound reception only.

Long Life to Your Valves

SIMPLE SWITCHING PRECAUTION

IN commercial transmitting stations, it is a common practice to apply power gradually to the valve heaters and filaments (and often the HT supply also) and this is a rule which the amateur would do well to follow, particularly with the more expensive types of valve. The resistance of a valve filament or heater when cold is very much less than when hot and the current which flows at the moment of switching on the mains supply will be much higher than the normal working current. How many users of the popular 813, for instance, realise that the resistance of the filament, *when at working temperature*, is only two ohms? When cold, it is only a fraction of an ohm and, with the normal ten volts applied suddenly, the amperes flowing for a second or two can be 20 or more. It is worthy of note that Mullards, in their literature relating to the larger types of transmitting valves, state the initial current should not be allowed to exceed 150% of normal, which in the case quoted above would be 7.5 amperes, and not 20!

The surge is less in receiving valves because the cold resistance is higher, but who has not seen the unusually bright glow often present at the centre of the electrode structure when switching on? This is especially evident in some miniature valves and it is certainly not doing the valve any good.

Putting Precept Into Practice

It is a fairly simple matter to arrange the switching system so that a heavy surge is eliminated, thus obtaining greater freedom from the risk of valve filament or heater burn-out and at the same time extending the lives of the valves in normal circumstances. Possibly some alterations to the mains switching system will be necessary, and, where the job is done thoroughly, duplication of the device to be described will be required. But this need cause no perturbation as only very few parts are called for anyway.

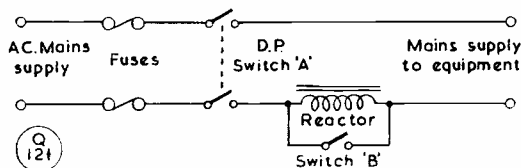
As described, the scheme is as used in the writer's own station, and can easily be adapted to suit other installations. For various reasons, the mains supply to all the transmitting equipment is brought up to the radio room direct

from the main switch-cum-fusebox, where the incoming power cable terminates. The wiring is lead-covered cable, effectively earthed at several points, and, with a screened filter unit at the "shack" end, radiation through the mains wiring is practically eliminated. Another good reason for the separate mains feed is to avoid fluctuations in mains voltage which were previously found when other heavy-loading electrical equipment in the house was switched on and off.

(The receiving equipment is fed from the ordinary mains power supply point, but there would probably be some benefit to be gained, particularly in the way of reduced mains-borne interference, if a second similar line was installed and maybe this, too, will be done in due course.)

The general scheme of things is shown in the accompanying sketch. It has been found most satisfactory in practice and conforms to the advocated safety style of giving complete isolation when the switch labelled "A" is in the "off" position. This switch, carrying as it does the whole load of the transmitting equipment, should of course be of a substantial pattern and located where it can be reached quickly and easily by *anyone*. It is hardly necessary to emphasise that all occupants of the house should be informed of the existence and of the purpose of this switch—so that in case of accidents, somebody knows it will cut power off everything.

In the *live* leg of the mains supply, at the point indicated in the diagram, is fitted a small choke reactor (heavy duty LF choke) which has a short-circuiting switch in parallel with it. This second switch can be of a lighter pattern than the other and the two are mounted close together, with the toggles operating in the same direction. When opening up the station, switch "A" only is closed, and, with the reactor in circuit, the applied AC voltage is considerably reduced. After a short warming-up period (but not less than fifteen seconds) switch "B" is



Our contributor's method of avoiding immediate application of full voltage to valve heaters and filaments in transmitting (and other) equipment. Switches marked "A" and "B" are placed near together and arranged to move in the same direction for "On." When starting up, switch "B" is closed some 30 secs. after "A"; the choke is then shorted and the equipment gets full mains voltage.

is closed and after a further short pause for all heaters and filaments to reach full operating temperature, the equipment is ready for operation.

During a break in an "on the air" session, say for a meal, switch "B" can be opened again, keeping the valves warm, but not at full temperature—it is better to do this than to leave full on or to switch off completely.

On completely closing down, both switches are placed in the "off" position so that no mistake occurs when the time comes to open up the station again.

Choice of Choke Reactor

No chokes specifically designed for the purpose are made commercially as standard components but fortunately the tolerances can be extremely wide, and, in any case, the choke is not called upon to do a lot of work. It has to carry alternating current only and therefore should preferably have a closed iron core but even this is not essential.

The main requirements are that the choke be rated to carry the mains current at the reduced load and that it has an inductance/reactance sufficient to reduce the voltage to something of the order of 100 to 130 volts, where the normal is 220/240 volts. The load current is likely to vary a lot between one station and another and a rough indication can be obtained by measuring the normal standby current taken from the mains and allow half this value.

As regards the second requirement, experiment will be necessary. A convenient method is to utilise a spare mains transformer having a number of primary tapplings, though a tapped auto-transformer will serve nicely. First of all, that section of the winding showing a marked difference of about 100 volts should be tried. If, as is probable, the actual applied voltage is rather on the low side, the tapplings can be altered to those showing a lower voltage difference.

Further Hints

The location of the reactor choke is of little importance, other than that live metal parts, e.g., terminals or tags, must be inaccessible to accidental contact, either with human beings or anything metallic. A long lead to the choke is quite permissible and it can then be stowed away perhaps in an odd corner.

If the choke has any loose laminations, clamps or windings, a buzz will naturally be heard when the choke is in circuit and the mains "on." but this is no bad thing as it gives audible warning of the state of things!

Irrespective of this and if not already installed, warning lamps are desirable. The brilliance will be much reduced when initially switching on and will remind the operator of the need for making the second operation before energising the HT circuits. Not that any harm will be done thereby, as the HT will also be much lower than normal—but the transmitting gear just will not function!

Other Applications

It is debatable whether or not such a scheme is worthwhile with a receiver or with any equipment in which the HT comes on simultaneously with the heater voltage. The writer uses the same system with a modulator and finds that, with an applied voltage of about 110 in the reduced state, no current flows through the rectifier valve, so presumably no deterioration of the latter can occur. But it would certainly not be wise to allow HT to be applied simultaneously in the case of a mercury vapour rectifier valve. The modulator is often left in the reduced standby state for long intervals and can quickly be brought into use when the need arises.

Probably the best way to obtain maximum life from receiver valves is to use a power pack having separate heater and HT transformers and unless a long idle period is envisaged (a week or more), to keep the filaments at half-voltage when the receiver is not in use, with the HT off. But probably few will want to go to this trouble.

J.N.W.

XTAL XCHANGE

This space is free to those wishing to exchange crystals. Notices should be set out as below, headed "Xtal Xchange—Free Insertion," and all negotiations conducted direct.

G2BCY, 23 Whitefield Terrace, Newcastle-on-Tyne, 6.

Has 1,000 kc bar; 1930 and 5000 kc crystals, $\frac{1}{2}$ -in. mounting; 1948.3 and 1962.5 kc, 3-pin; 6200 kc, octal based; and 18.125 mc harmonic type crystal. Wants 3500 kc octal based, 6000 kc any fitting, and 8 mc or 16 mc crystal for multiplying into Zone C (144.2-144.4 mc).

G3IOZ, The Gables, Kilsley, Nr. Rugby, Warks.

Has 3563, 6010, 7100 and 7175 kc crystals, $\frac{1}{2}$ -in. mounting; and 5840, 8225 kc crystals, $\frac{1}{2}$ -in. pins. Wants 7000-7050 kc frequencies, and 6 mc crystals to multiply into Zone E (144.4-144.65 mc).

G3JFF, 11 Westerland Terrace, Kingswear, S. Devon.

Has 3720, 7090, 7210 and 7260 kc crystals, $\frac{1}{2}$ -in. pins. Wants 1000 kc bar, and any frequency 7000-7050 kc, $\frac{3}{4}$ -in. mounting.

RADIO AMATEURS' EXAMINATION — MAY

Those taking the next R.A.E. are reminded that their applications—see p.647, February—should be in before March 31.

Putting the Bendix TA-12 into Operation

80 AND 40 METRES
WITHOUT CONVERSION

M. J. CAVENEY (VE3GG)

A short introductory article on the TA-12 appeared in our December issue; in this, several modifications were suggested. Our contributor here explains how, in fact, the various marks of this transmitter can be put on the air unmodified.—Editor.

THE article in the December, 1955, issue of SHORT WAVE MAGAZINE has prompted the writer to offer the following comments on the Bendix TA-12 series of transmitters, with which he is personally very familiar.

In the first place, all marks of TA-12 can be operated without any conversion whatever. One simply obtains an AC transformer giving 25v.—this can either be bought, or wound up by adding turns-in-series to an existing LT winding or windings, or by putting several such windings in series, or otherwise contrived. With the series-parallel connection of the valves, the current requirement is only 1.2 amp. The 25v. AC connection is made to pins 1 and 2 (battery heater supply points). In six years of operation using AC on the heaters, all reports have been T9.

The Bendix VFO

In the writer's estimation, the TA-12 has one of the finest VFO's on the air today. The 80-metre dial gives a calibration of 500 cycles per degree; on regular checks against a BC-221, the calibration change has not been one kilocycle. This VFO will, in fact, stay zero-beat for weeks against any good frequency standard.

The fundamental of the VFO covers the 160-metre band; it is gang-tuned with an 807 buffer-doubler giving drive output on 80 metres.

When any mark of Bendix TA-12 is about to be put into operation, one of the first things to do is to remove the chassis from the case and close, permanently, the remote keying relay (using a tapered wooden wedge). This relay, which is in full view on the right-hand top

side, should not be used because far better results are obtained by keying the BA stage. The "remote" relay can, of course, be removed altogether and the appropriate leads shorted in what would be the "relay on" position.

Aerial Connection and Adjustment

80 Metres: The PA tank of any TA-12 will load into any type of aerial; at VE3GG, an 80-metre dipole is in use.

For aerial matching, there will be found just to the right of the remote keying relay already mentioned a panel of switches marked S106-S109; these are for aerial and PA tuning adjustment (S109 for Channel 2, 80 metres) depending upon what type of aerial is to be used. S106 is a fixed condenser in series with the aerial, and can be switched in or out. S109 when at position "in" puts a fixed condenser in parallel with the PA tank, but for 80-metre operation is hardly ever needed—the switch should be moved to position 1 or 3, which puts this condenser out of circuit.

The aim is to find a combination of S106-S109 settings which gives the best loading characteristic into the aerial; this is done by trying different switch positions and load-coil turns while swinging the load condenser for minimum dip.

40 Metres: The channel selecting the 40-metre band varies with different models. Here let it be said that two different TA-12B's owned by the writer will tune into the LF end of the 7 mc band, to 7060 and 7100 kc respectively. (It was implied on p.526 of the December issue that there might be difficulty in getting the '12B into the 40-metre band.) In the TA-12C, 40 metres is found on Channel 3, whereas in the marks "B" and "G" it is on Channel 4.

When trying to load up on 40 metres, the switches S105 and S108 control the series and parallel capacities, in the same way as S106, S109 do for 80 metres. The procedure is also much the same; S108 puts a condenser in parallel either with the variable load capacity (posn. 2) or with the loading coil and tuning condenser (posn. 3); in posn. 1 it is out of circuit altogether. S105 controls a condenser either in series with the aerial, or out of circuit.

A "best setting" will be found, with S105, S108 in combination with the correct number of turns on the slider-adjusted PA tank coil. Once the right settings have been established for S105, S108 and S106, S109, in conjunction with their respective tank inductances for the 80- and 40-metre bands, they need not be touched again unless the aerial is changed;

and once these combinations are found, it will be possible to QSY through wide frequency areas in either band without it being necessary to re-tune the PA.

The 40- and 80-metre band tuning procedures discussed above apply to the TA-12C, but are valid also for the TA-12 models B, E, F, G and H (should readers encounter these marks). In the case of the TA-12G, there is an additional refinement on the tank side in the form of a "valve relay," which is to be found behind the meter mounting. This was intended, in the original, for "listening through," and should simply be shorted out.

Connector Code

In the original, the TA-12 required a 16-way cable to feed in power and provide the control circuits. However, the transmitter will function perfectly well if the marked connector pins are wired as follows :

Pin 11, 750v. HT + ; *Pin 8*, 600v. HT + (which can be obtained from Pin 11 through a 2,500 ohm 50w. resistor) ; *Pin 1*, 25v. AC ; *Pin 2*, 25v. AC, earth, HT - line, Bias + ; *Pin 14*, negative Bias connection.

Bias Supply

Bias must be obtained externally (from a battery or pack) and should be set so that with key up, the standing current in the PA is about 50 mA. At VE3GG, with 750v. HT, the bias voltage used is - 80 volts ; the PA can be loaded to 200 mA, giving a maximum DC input to the paralleled 807's of 150 watts ; this is for CW operation.

Modulation

In Canada, the modulator originally designed for the Bendix TA-12 is readily available as "surplus" at a low price. It is fitted with control relays and a 24v. dynamotor. These unwanted items are stripped off, and the modulator can be re-built on a smaller chassis, using only the needed items.

Since this modulator itself consists of a pair of 807's, with a 6N7-6F6 speech amplifier, the same type of audio equipment can be used for modulating any mark of TA-12 the reader may happen to possess. Alternatively, any speech amplifier-modulator giving about 60-70 watts of audio would serve equally well. The point is that for full control, whatever modulator is used should be capable of giving 60 watts audio.

On phone, it may be necessary to reduce the PA bias for full modulation and good speech quality. The writer runs his TA-12

RF amplifier biased - 40v. when the transmitter is operated with the Bendix modulator.

Some General Notes

The TA-12B will not only tune into the 7 mc band (just), but will double in the PA to 20 metres if the PA tank coil is set at about 29 on the "coil turns" control.

At VE3GG, all marks of the TA-12 have been tried or used, and all have performed very well. The transmitter gives very little trouble with TVI, because it is built into a heavy aluminium case which is itself contained in a steel cabinet. Used as an exciter for an 813 PA running 400 watts on 80 and 40 metres, VE3GG has had no complaints of TVI—and there are ten owners of TV receivers within 50 yards, to say nothing of the two sets in his own home.

EDITORIAL NOTE: We shall be very interested to hear from readers who follow the suggestions made by VE3GG. For the information of users, it has been reported to us by G3KFN and others that the TA-12 is capable of producing a strong "160-metre signal" even when the PA is tuned to 80 metres or some higher frequency band. This is due to straight-through radiation from the 160-metre VFO. Since the LF (CW) end of the 80-metre band is not in harmonic relation with the frequency area permitted to U.K. amateurs on 160 metres, this is a point to be watched. The 160-metre radiation can probably be suppressed by the use of an external aerial tuning panel, resonating sharply on the PA output frequency.

I.A.R.U. CONFERENCE in JUNE TRIP to ITALY

In connection with the Region 1 I.A.R.U. Conference, to take place at Stresa, Lake Maggiore, in June (attendance at which is open to any amateur in Europe) we are informed that a holiday party from the U.K. is being arranged, under the leadership of G3ASQ, to coincide with the period of the conference. Departure is from London on June 10, duration is 14 days, the cost is 37 guineas all-in (with a group booking reduction) and the trip is being organised by G3GVZ of the Francis Glynn Travel Service, 13 Station Road, East Grinstead, Sussex, to whom application should be made for further details.

MACQUARIE ISLAND

With all the activity now taking place from the Antarctic—including VK1DA on Macquarie Island, at 55° South—it is worth remembering that the history of radio in the Antarctic goes right back to 1911. It was in December of that year that Sir Douglas Mawson, the great Australian explorer, established a permanent 600-metre spark station, with 300-ft. masts, on Macquarie Is. to act as a linking point between his ship *Aurora* and Australia. Ever since then, the Australian Government has maintained a radio-weather station on Macquarie.

AMATEUR RADIO

PART XII

For The Beginner

SIMPLE MODULATOR FOR THE BEGINNER'S TRANSMITTER

By A. A. Mawse

THE recent lifting of the first-year ban on telephony operation has undoubtedly created a situation where many graduates have found themselves legally entitled and anxious to get going on phone but are lacking in the necessary equipment and "know-how."

The object of this article, then, is to describe the theory, construction and adjustment of some modulation equipment of a very simple but yet quite efficient form.

With it, the beginner can get quick and tolerably good results with the minimum of outlay, both in time and capital, particularly so if he has been following the present series of articles and has built the Power Pack and Transmitter described in *SHORT WAVE MAGAZINE* for the July and September issues of last year.

The system to be described is one of the oldest—it might almost be described as biblical—and is known as Choke or Heising modulation. The basic form was dealt with briefly and in a general manner on p.659 in the February issue of the *Magazine*; but since to know *why* a thing works is of great assistance when it comes to *making* it work, the theoretical side will be dealt with in greater detail.

Theory of Choke Control

Referring to Fig. 1, it will be seen that the modulator valve V1 has as its anode load an iron-cored choke, Ch. The anode of the PA valve V2 is fed from the anode of V1 via a dropping resistor R, which is by-passed by a capacity, C (the reactance of which at audio frequencies should be low in comparison with that of the resistance) and via the normal RF choke forming part of the PA circuit.

Audio volts are fed into the grid of V1, which is designed to operate in Class-A, and hence an amplified version of the input appears across the choke. The audio output voltage of an amplifier operating in this mode does not attain a value equal to the DC anode voltage; for this reason, the DC voltage applied to the plate of the PA stage must be reduced to a value equal to the peak *audio* voltage, if 100% modulation without distortion is to be obtained.

By virtue of the PA current, there is a voltage drop across the resistor, and, if this latter is made variable, means are thereby provided for making the desired adjustment.

Since the modulation choke provides a 1-to-1 ratio, it is also necessary for the PA to be adjusted until its plate impedance matches the output of the modulator. The required impedance figures in each

case can be arrived at from the formula: $1000E/I$, where E is the anode voltage and I the anode current in milliamperes.

Finally, to obtain 100% modulation, the modulator output power in audio watts must be equal to approximately 50% of the PA input. The efficiency of a Class-A tetrode can be taken as 30%, so that, as a rough guide, the PA stage should not be loaded to more than 60% of the modulator *input* figure in order to attain 100% modulation.

These, then, are the three main points to watch, for operation at maximum efficiency. But let it be said here and now that very wide divergencies from these ideals can be practised and still quite tolerable results will be obtained.

Practical Considerations

Where economy and ease of construction are of some importance, a sacrifice must be made in terms of high-fidelity, and consequently the carbon microphone has been selected instead of a crystal type, since the latter requires so much more amplification—see p.585, January. Because the output from a carbon microphone is so much greater than that of other forms, only one stage of speech amplification becomes necessary, and this can be adequately handled by a single 6J5 triode working in Class-A, which is resistance capacity coupled to the grid of the modulator—see Fig. 2.

A carbon microphone requires some energising current, and this is often provided by means of a dry battery of the flash-lamp variety. In this design, however, a further simplification has been achieved by utilising the cathode current of the two valves and bleeding-off a small portion of this for energising purposes, as shown by R1 in Fig. 2. This method is

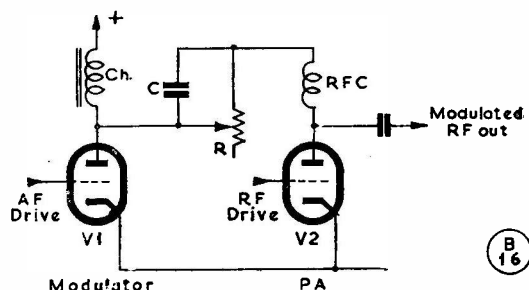


Fig. 1. Illustrating the theory of choke control. This is the original and simplest form of amplitude modulation, and can be made to give quite satisfactory results. A refinement is to feed the PA and modulator through separate chokes from separate HT supplies. Audio voltages are then impressed on the PA across condenser C alone.

Table of Values

Circuit of the Simple Modulator

M = Any good Carbon microphone	C1 = 1.0 μ F
T = Microphone transformer, ratio about 50 or 100:1	C2 = .005 μ F
R1 = 2,000 ohms variable resistor, 2 watt	C3 = 0.1 μ F
R2 = 3,900 ohms, $\frac{1}{2}$ watt	C4 = 25 μ F, electrolytic, 50 volts
R3 = 200,000 ohms, $\frac{1}{2}$ watt	C5 = 2.0 μ F
R4 = 47,000 ohms, $\frac{1}{2}$ watt	Ch. = 5-10 Henry choke (preferably 10 Hy.)
R5 = 82,000 ohms, $\frac{1}{2}$ watt	S = Single-pole single-throw switch
R6 = 450 ohms, 2 watt	V1 = 6J5
R7 = 2,000 ohms variable, 2 watt	V2 = 6L6

much to be preferred, since very often a great deal of trouble is experienced when dry batteries commence to run down, causing a considerable increase in microphone noise. The degree of energising current required can be quite critical, depending upon the individual microphone; in order to keep noise down to a minimum, only sufficient should be provided to give satisfactory results. For this reason, a variable control is fitted to the input circuit of the microphone transformer T instead of the more usual method of a high-value potentiometer across the grid of the speech amplifier valve.

The modulator valve must be capable of withstanding the full high-tension line supply, and, as explained earlier, the anode dissipation figure should be rather more than one-and-a-half times the desired PA input figure.

Circuit Design

Fig. 2 gives the complete circuit design and should be read in conjunction with the table of values.

It will be seen that the modulator valve is a 6L6; it is cheap, readily obtainable on the "surplus" market, and is adequately rated for the job in hand, having regard for the fact that this Modulator has been designed for operation from the Beginners' Power Pack, which is now loaded almost to its maximum capacity.

The microphone transformer T is one taken from a piece of "surplus" equipment and is by no means critical. Any small transformer having a step-up ratio of 50 or 100:1 with a primary resistance of 100-500 ohms would be quite suitable.

The choke Ch. is likewise of "surplus" origin, and though in the model it is of 5 Henry inductance, preferably it should be somewhat larger; say, 10 Henry. A constructional point to watch here is to choose a choke with adequate insulation between the windings and the frame, because quite high voltages can be developed across it, particularly if the microphone circuit should be accidentally broken with power on. The writer found it desirable to insulate the frame from the chassis, thereby at one stroke reducing the potential between windings and earth to the extent of the HT supply—some 450-500 volts.

Lay-out

This is left to the individual and will depend to some extent upon the choice of components. It is

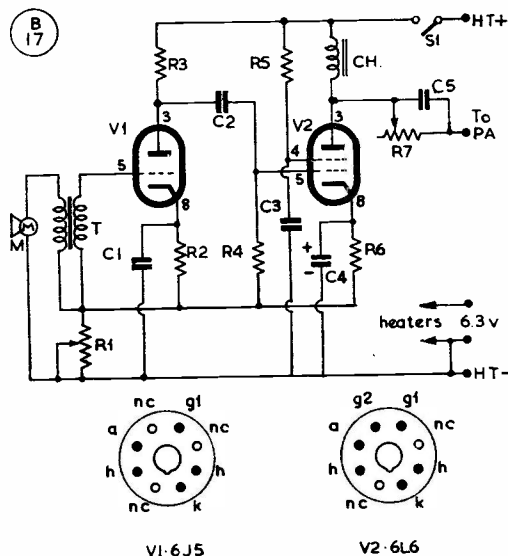


Fig. 2. Circuit of the choke control modulator as discussed and illustrated here. Though intended for the Beginner's Transmitter (operated VFO-PA using the variable frequency drive oscillator described in our December issue) and with which it has been tested and is in operation, as it stands this Modulator could be used to control any 10-watt PA stage.

good practice to keep input and output as far apart as possible, and the writer's model has been built up on a long, narrow chassis measuring 10 ins. x 3 ins. x 2½ ins. deep. The microphone input terminals are placed at one end; the gain and dropping resistor controls R1 and R7 are brought out on the front drop, as also are the HT switch S and the output terminal. HT and heater terminals are fitted to the rear drop. As a matter of general interest, the actual time taken in the constructional work, including the cutting, bending and drilling of the chassis, did not exceed ten man-hours.

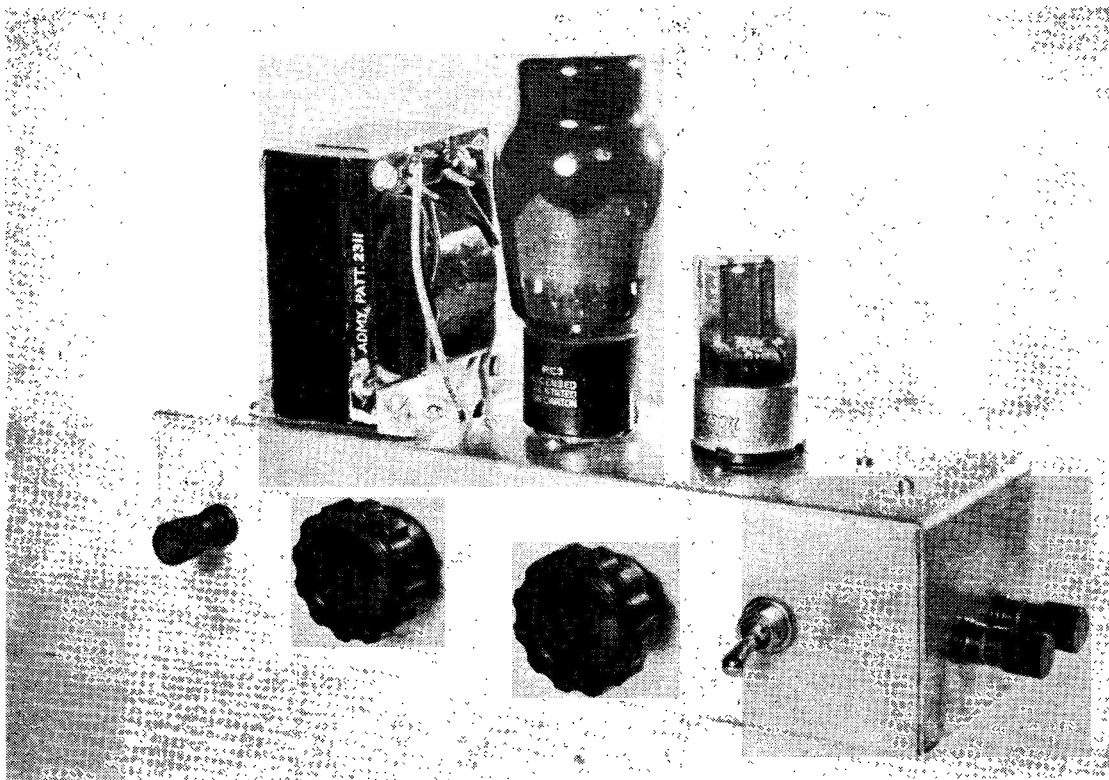
Hum Suppression

Since the gain is relatively low, no very special precautions need be taken in this respect. The heater leads should be kept well into the fold of the chassis as much as possible and, as previously stated, input and output sections kept at opposite ends. If an unscreened microphone connecting lead is used, see that the earthed lead is connected to the body of the microphone and not to the "button" side.

The Transmitter

This section is of concern only to those who have made a more or less faithful copy of the particular Top Band Transmitter previously referred to in this article, since a few slight modifications are desirable before it is suitable for connection to this modulator.

It will be recalled that in the original design of this Transmitter (described September, 1955) the anode and screen supplies were taken from the 400-volt and stabilized 255-volt lines of the Power Pack via a two-pole single-way switch S1, which is opened for VFO adjustment or for stand-by purposes.



The Beginner's choke control Modulator as described in this month's article, and designed to work with the Beginner's Transmitter (September, 1955) when driven by the VFO (December 1955), in conjunction with the Beginner's Power Pack (July 1955). With a carbon microphone, 4-5 watts of audio should be available, sufficient for Top Band operation. Microphone input terminals are on the right, and the two knobs are for microphone excitation control, R1 in the circuit (right), and for the adjustment of R7; the terminal on the left is for modulated HT feed to the Transmitter. Combining simplicity with reasonable efficiency, this Modulator is about the easiest way possible to get on the air with phone. The quality of the output depends directly upon the sensitivity, handling and excitation of the microphone; the model as illustrated and described here has been tested with three different kinds of carbon microphone, the GPO handset type giving the best result.

The screen should be disconnected from the stabilized supply and re-connected to a point between the 400-volt switch and the meter M1; the decoupling resistor R3 should be replaced with a dropping resistor of about 60,000 ohms, 2 watts rating; from the same point of re-connection another lead should be taken off to an insulated terminal mounted on some convenient point on the chassis, and to which the output from the modulator is connected.

Now, for CW operation the modulator switch is opened and S1 on the transmitter closed; stand-by is obtained by opening S1 as before. For telephony operation, S1 is opened and the modulator switch closed.

Setting-up

With the auto-bias resistor selected for V2, the current drain of this valve is approximately 30 mA and the anode voltage from the Power Pack about 450 volts. The theoretical audio output with R1 at full gain is, therefore, about 4 watts. Set R7 to maximum value and, by means of the pi-network coupler on the Transmitter, adjust the loading on the PA stage until the DC input is limited to 8 watts. (The voltmeter, set to 500 volts, should be connected

across the output of the modulator and earth in order to arrive at the correct figure.) Check the PA impedance figure, which should be fairly close to 15,000 ohms, thereby providing the correct match to the modulator.

The next most satisfactory step is to secure the co-operation of a local station and see by how much you can reduce the gain control without upsetting the level of modulation; then try reducing R7, both with and without any corresponding readjustment of the PA loading, until the most satisfactory position is found.

As stated earlier, the system will work with quite wide variations, but some adjustments and trial-and-error tests are required for best results. As an indication of what can be done with simple equipment of this kind, the writer connected up to the Transmitter right away upon completion of the Modulator, without bothering much about the finer points; his first Top Band CQ resulted in a contact at 300 miles, with an RS59 report and some most encouraging comments on the speech quality!

It is hoped that this simple rig will make it possible for many beginners to have their first taste

of telephony operation without the necessity of having to lay out large sums of money on expensive and bulky equipment. It is *not* by any means suggested that this simple choke Modulator is the

ultimate in modulation equipment—but it does provide a means of getting on phone, utilising only the existing Power Pack, and calls for very little in the way of Transmitter modification.

FRED'S (*The Other Man's*) STATION

NOT TO BE INCLUDED
IN THE WELL-KNOWN
SERIES

By G3COI

WE have waited a long time to review the station operated and partly owned by Fred, but hitherto it has not been possible to get a photograph of it owing to the restricted field of view. To overcome this, we had to engage a technical artist, whose skill has enabled the hidden treasures of this unique shack to be spread before the public gaze.

Starting from the left top hand side of the picture and working across to the right (as if reading a comic strip by G3COI) the first shelf is entirely occupied by magazines, all borrowed from a close (but apparently not close enough) friend. Fred reads them from cover to cover and is thus extremely well informed as to the state of the "surplus" market; he can quote you the current price of anything from a Panda to a pea lamp, at the drop of a pea lamp. Of the QSL cards, not one is genuine.

Just out of the picture on the next shelf down, is a box which originally contained cornflakes, staple diet of our owner/operator, and munched at all times of the day and night. Next to this, still out of sight, is an alarm clock containing quarter-watt resistors (present from his family). The remainder of the shelf is taken up by a breadboard receiver constructed during the war by Fred's Dad and made entirely from receiver parts. It has never worked.

The object immediately under this shelf and attached by rubber bands is an automatic CQ sender. It incorporates the old idea of a wheel suitably cut to operate a switch. However, the wheel turns at several hundred r.p.m. so that the sender, in operation, produces what is virtually a long dash.

On the bench, or operating desk proper, behind the beer bottles, we have a wavemeter, which Fred has borrowed temporarily to impress the GPO man who is rumoured to be calling soon. Then we come to the main Station Receiver. This, as the connoisseurs will detect, has 1155 ancestry. In actual



fact, only the case remains—the inside is a neat job of radio surgery with the line-up Det., Audio. A new receiver, however, is in the offing, and may be in operation in time for the next sunspot cycle.

Check by jowl with the receiver is an 80-metre converter, adapted from an adapted 1155. Under the bench, and mercifully out of sight, is an audio-mechanical QRM filter, which resonates at an ear-splitting frequency and makes CW easier to copy under conditions when it is easy to copy anyway. It works on the principle of Sound Bending, but Fred's adaptation of this well-known theory is entirely original and indeed merits a place of its own.

In front of the receiver can be seen the microphone, which is a perfectly standard deaf aid insert in a perfectly standard half-coconut shell. Here, fortunately, we come to the end of all that we are allowed to describe. The object mysteriously swathed in a dust sheet is *the rig*, details of which Fred does not wish to release before good time. However, he did hint at single knob control, all bands from audio to light spectrum — of course, with CW, AFM, RF, NRF, SSSC, DSSC, DDT and bar available.

We can only round off this brief description by saying that it would indeed be a sad day for Amateur Radio if everybody had a collection of junk like this.

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.

EI9BC, A. Bradshaw, 7 Captain's Avenue, Crumlin, Dublin.

G3HOP, H. Smith (*ex-ZB2D*), 97 Stone Road, Stafford, Staffs.

GM3IQL, A. Lawrence, 40 Blake Street, Dunfermline, Fife.

GW3KHO, H. G. Owen, 7 The Bungalows, Maesgeirchen, Bangor, Caerns.

GM3KIG, W. J. H. Eaton, Cauldham, Innerleithen, Peebles-shire.

G3KIP, K. G. Grover, 4a Grove Hill Road, Tunbridge Wells, Kent.

GM3KJF, J. Wilson, 3 Whitehill Crescent, Annbank Station, Ayr.

G3KMP, C. A. May, 3 Upper Glen Road, Hollington, St. Leonards-on-Sea, Sussex.

G3KNJ, R. J. Wyatt, 43 Bransgrove Road, Edgware, Middlesex.

G3KOJ, R. J. Ezra (*ex-ZB1PP*), 38 Salcombe Gardens, Mill Hill, London, N.W.7.

GM3KRO, J. P. O'Donnell, 38 Forbes Road, Edinburgh, 10. (Tel.: *FOUtainbridge 6406*).

GM3KRQ, C. B. Connor, 66 Woodside Avenue, Rutherglen, Lanarkshire.

G3KRY, G. R. Byles, 42 Disraeli Road, Putney, London, S.W.15.

G3KSC, R. M. Tilley, 63 Stanley Road, Wellingborough, Northants.

G3KSE, J. A. Nightingale, 5 Varley Road, Mossley Hill, Liverpool, 19. (Tel.: *Allerton 4233*).

GM3KSJ, S. Bungard, 37 Cairnlea Gardens, Motherwell Road, Bellshill, Lanarkshire.

G3KSK, J. J. Phillips, 3 Queen's Road, Oldfield Park, Westbury, Wilts.

G3KSU, A. R. Williams, Brooklands, London Road, Chelmsford, Essex.

G3KTC, R. E. Tucker (*ex-VS7EA*), 8 School Road, Wednesfield, Staffs.

G3KTJ, G. P. Rigby, 32 Pimbo Lane, Upholland, nr. Wigan, Lancs.

G3KTN, J. F. Brown, 69 Beresford Road, North End, Portsmouth, Hants.

G3KTO, G. E. Coverdale, Kinross, 70 East Ella Drive, Anlaby High Road, Hull, Yorkshire.

G3KTQ, J. W. V. Rayner, 28 Tattenbury Road, Basford, Nottingham.

G3KTS, T. A. Shaw, 37 Horninglow Street, Burton-on-Trent, Staffs.

G3KTW, R. Thyer, 12 Spotland Tops, Cutgate, Rochdale, Lancs.

G3KTY, G. G. Williams, 4 Shunlock Lane, Moseley, Birmingham, 13.

GM3KUA, J. Rae, 53 Richmond Street, Aberdeen.

G3KUL, D. Stephenson, 4 Dean Street, Bedminster, Bristol, 3.

G3KUM, D. O. Boddey, 1 Kingsgate Drive, Ipswich, Suffolk.

G3KUP, L. E. Phasey, 51 Pine-wood Avenue, Sidcup, Kent. (Tel.: *FOOTscray 2805*).

G3KUQ, A. M. Gurney, 2 Dollis Hill Lane, Neasden, London, N.W.2.

CHANGE OF ADDRESS

G2DOT, K. Clark, Robin Hill, Gatesden Road, Fetcham, Leatherhead, Surrey.

G3ABK, F. Burns, 48 Stooperdale Avenue, Darlington, Co. Durham.

GM3CIG, J. E. Priddy, 34 Fraser Avenue, Inverkeithing, Fife.

GW3ESJ, J. W. Standard, 130 Garth Owen, Newtown, Montgomeryshire.

G13FJX, J. Davidson, 1 Carisbrook Park, Moss Road, Lambeg, Co. Antrim.

GW3GCZ, Rev. F. C. Dorken, Cranmere, Abbey Drive, Rhos-on-Sea, Colwyn Bay, Denbighshire.

G3GPX, P. J. Bartram, 19 Boscombe Road, R.A.F. Station, Watton, Thetford, Norfolk.

G3HEE, J. P. Fancourt, 30 Priory Terrace, Stamford, Lincs.

G3HEO, D. P. Hobbs, 36 Stanley Avenue, St. Albans, Herts.

G3HNB, L. E. Maund, 56 Exchange Road, Stevenage, Herts.

G13IQZ, K. E. White, 12 Hamel Road, Lisburn, Co. Antrim.

G3JBI, H. W. Parnell, 41 Charlton Crescent, Barking, Essex.

GM3JDR, D. Robertson, 116 McLagan Drive, Burnfoot, Hawick, Roxburgh.

GM3KJB, F. McClymont, 28 Bellevue Crescent, Ayr, Ayrshire.

G5BM, F. H. Watts, 16 Maidenhall Estate, Highnam, Glos. (Tel.: *Gloucester 25415*).

G5KC, G. W. Kelley, 5 Osbalwick Lane, York, Yorkshire.

G5YK, F/Lt. B. M. Morrissey, Officers' Mess, R.A.F. Station, Hemswell, nr. Gainsborough, Lincs.

G6SG, H. C. J. Seagood, 34 Chigwell Park Drive, Chigwell, Essex.

G8FI, H. Hargreaves, 157 Blackburn Road, Darwen, Lancs.

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THE MONTH WITH THE CLUBS

By "Club Secretary"

(Dead-line for April Issue : MARCH 16)

WE have often wondered, in the course of nearly ten years of compiling these Club reports, what it is that makes for regularity in attendance, regularity in reporting, and, in fact, a general healthy continuity of activity in a Club. Only the obvious answer comes to mind, and that seems to us to be the correct one. In case you don't know this obvious answer, it is *The Secretary*.

We are firmly of the opinion that the Hon. Sec. is the most important and most influential person in the Club movement, and that the Club or Society with a keen and efficient secretary is lucky indeed.

In our card index we have several examples which show no change of secretary for many years, and almost invariably the index also shows a long span of reports coming in month after month. On the other hand, a change of this official often means an abrupt cessation of all communication; and then, later on, the Club shows up again, but this time with yet another name in the panel.

The extreme case is that of Clubs who seem to change all their officials every time they have a meeting, until they finally have their cards moved to the "dead" section and we don't hear from them again for many years—if at all.

Moral—if you have a good Secretary, look after him well. Let him know your appreciation of his work. If he goes and gets married, give him an enormous wedding present and see that his wife is made to realise how vitally important his honorary work is. If he is an active amateur, don't let the bands steal too much of his time!

THE MULLARD LECTURES

To assist our many keen and hard-working Club Secretaries, Mullard, Ltd., operate a Film and Lecture department. The material they have available is extremely interesting and several Clubs have already been able to avail themselves of the service, which is most comprehensive.

Full information can be obtained from: The Films and Lectures Organisation, Mullard, Ltd., Century House, Shaftesbury Avenue, London, W.C.2. Any secretaries who have not used these facilities should write in for details, which will be gladly given.

We shall be glad to hear from other firms or organisations able to provide lecture material for Amateur Radio Clubs.

The Midlands Group of the **British Amateur Television Club** are holding regular meetings on the second Thursday of the month, and the January gathering saw a remarkably good quality Telecine demonstration by G3KBA/T. The next move is

to get a signal on the air. Interested amateurs, including optical experts, are asked to contact the Hon. Sec.

Barnsley held its Annual Dinner at the King George Hotel in January, and the event was attended by a good gathering of members and guests. On January 27, Mr. J. Wright of Rotherham gave a talk on Modern Methods of Construction, which led to an animated discussion.

Clifton had "a trip to outer space" in the shape of a talk on Astronomy by G3JJC. Slides were lent by the British Astronomical Society, and the talk was followed by a lively exchange of questions and answers. On March 9 G3FNZ will talk on Hearing Aids; the 16th will be devoted to a Constructional Evening and Ragchew; on the 23rd R. Poppi (a well-known SWL) will talk on The Art of Short Wave Listening. Other club secretaries may be interested to know that Clifton recently held a Salvage Drive—and were able to purchase a CR-100 receiver with the proceeds! They found that relatively high prices can be obtained for anything in the nature of sorted metal junk.

Members were asked to bring along old transformers, wire, brass, aluminium and so on, and when a reasonable amount had been collected it was sold to a local scrap dealer. The amount of cash that can be raised in this way is surprising, and it is suggested that other Clubs may wish to increase their funds by this painless method.

Crystal Palace, newly formed, elected its first officers at the February meeting, when the "Ann Cup" and Trophy Competitions for home-built equipment were also held. On March 19 G6LO will talk on The Radio Control of Models—8 p.m. at Windermere House.

Leicester meet at the Holly Bush Hotel, Belgrave Gate, Leicester, every Monday at 7.30 p.m. G2CFC is now their President, G3DVP Hon. Chairman and G3AWM Hon. Treasurer. A new secretary has also been appointed.

North West Kent are meeting on Friday, April 6, at the Shortlands Hotel, Station Road, Shortlands, to hear a lecture by G3BCM on The Miniature Amateur Radio Station, which many readers will have seen with interest at the Amateur Radio Exhibition last November.

Portsmouth held their AGM and elected G6WS President, G6NZ Life Vice-President, G8BU Hon.

Reports for this feature, welcomed from all Clubs, should reach us by March 16 for the April issue, addressed: "Club Secretary," *Short Wave Magazine*, 55 Victoria Street, London, S.W.1.



Action shot recently at GB2SM, the Science Museum station described in our December issue. G3JUL was working a demonstration QSO for some young visitors.

Sec. and G3ADZ Hon. Treasurer. On March 13 they will be holding a Junk Sale; on the 20th a "Club Night"; and on the 27th a Business Meeting. Visitors and members are welcome at the British Legion Club, Queens Crescent, Southsea, any Tuesday evening.

Purley met on January 20 and heard a talk on High-Fidelity Amplifiers by their Chairman, G3EFO, who took along his Williamson amplifier, pre-amplifier and transcription unit. On February 17 G6LX gave a talk on his recent trip to the U.S.A. March meeting is a Junk Sale.

Surrey (Croydon) were able to celebrate their MCC win at the recent Club Dinner. G3BFP and most of the operating staff were present, together with the largest turn-out of members and guests for many years. On March 13 G3DPW will be talking on Model Control, and the April meeting will be the AGM. The Constructional Contest drew fewer entries this year, and the winner was Chairman G8TB, with a Bug Key.

Thames Valley held their AGM in February and elected G5LC President, G8SM Vice-President, G3AIU Secretary and G3IKC Treasurer. Meetings are held monthly, generally on the first Wednesday, 8 p.m. at the Carnarvon Castle Hotel, Hampton Court. G6MB gives this year's first lecture on March 7, the subject being "Printed Circuits — their History and Development." The following meeting

will be on April 4.

Worthing met on February 13 and held their Club Dinner during the last week of February. Their next meeting will be on March 12, at the Adult Education Centre, Union Place, Worthing.

Bury Radio Society has recently been re-organised, and now meets on the second Tuesday of the month at the George Hotel, Kay Gardens, Bury, at 8 p.m. All amateurs in the district will be welcome—for further information they are asked to contact G3EJF.

Cardiff had a very successful meeting on February 13, with a large number of members present, both old and new. Morse classes are now held at 7 p.m. preceding the regular meetings on the second Monday of the month, as well as a whole evening's Morse on the fourth Monday.

Chester meet on March 13 to hear about Dopes and Varnishes, from a chemist, and on March 20 for a talk on Aerials and Transmission Lines by G3ATZ. March 27 is an Open Night. The club headquarters (The Tarran Hut, Y.M.C.A.) is to be re-decorated shortly, and future programmes will include film shows. Visitors are welcome at any meeting, 8 p.m. at the above location.

Deal met at Dover in February and discussed many topics, including their new headquarters, the QTH being Hillside Cottage, Mill Hill, Deal. They hope to acquire a call-sign shortly and to play an active part in future contests. For the present they

will meet on Saturday evenings, and any new members will be welcome.

Grafton have recently had lectures from G3AFC (latest "Top-Bander"), G2CJN (Pi-Network Calculations), G3HT (Amateur Direction Finding), a Radio-Quiz, a Junk Sale, and the presentation of no less than *nineteen* R.A.E. Certificates from the 1955 examination. Thirteen holders of these already have their call signs. Meetings continue on Mondays and Wednesdays (R.A.E. Theory and Morse) and Fridays (Club Night) at 7 p.m.

Lothians will be having a talk on Two Metres from GM3BDA on March 9, and a Brains Trust on March 22. On April 5 there will be a Bring-and-Buy Sale, and the Annual Social will be held on April 6 at the Scotia Hotel—tickets, price 7s. 6d., from the secretary. Lothians now has 51 members, and meets at 25 Charlotte Square, Edinburgh, at 7.30 p.m.

Scunthorpe Amateur Radio Society has just been formed, and meets fortnightly. Attendances have been quite good, with up to twenty members turning up. The aims of this Club are to further Amateur Radio and to help beginners in the art. Anyone interested is asked to contact the Hon. Sec.

Shefford, who meet at 8 p.m. on Fridays in Digs-well House, announce a Mullard Film-Strip lecture for March 16, a lecture on VHF Aerials by G3HXO on March 23, and an amateur television demonstration by G2DUS/T on April 6. The Club now holds the call G3FJE.

Sutton and Cheam hold their Annual Dinner on March 10, at Wilson's Café, Sutton. An attendance of over 100 is expected—and, of course, The Ladies. (It is said that the president is arranging something special in the way of entertainment.) On March 20 they will meet for a talk on the BC-221 Frequency Meter, by G5ZD. The AGM will be held on April 17 at the usual meeting-place—The Harrow Inn, Cheam Village.

Romford held their AGM recently, at which officers elected or re-elected were: Chairman, G2FWJ; Secretary, Mr. N. Miller; and Treasurer, G3AUG, with a committee of five members. Workshop facilities are now available here, and a brand new 150-watt all-bander is being installed. This society, which is one of the old-established and well-rooted Club groups, meets every Tuesday evening at RAFA House, 18 Carlton Road, Romford, at 8.15 p.m. Visitors and prospective new members are warmly welcomed.

"THE OTHER MAN'S STATION"

Readers interested in this feature are reminded that we are always glad to have station descriptions, with a good, clear photograph, for publication. Descriptions can be in "own words," but should be complete, on the lines of any of those appearing in recent issues under this title. Payment is made for all material used.

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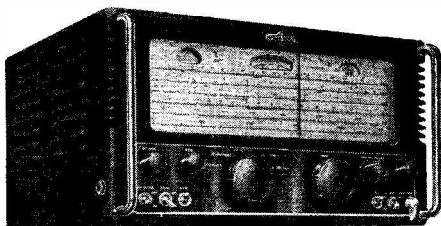
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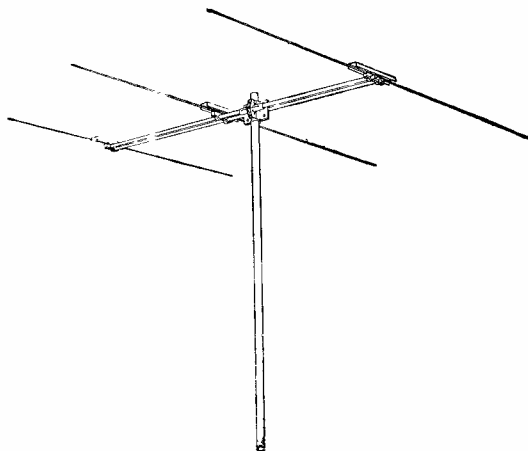
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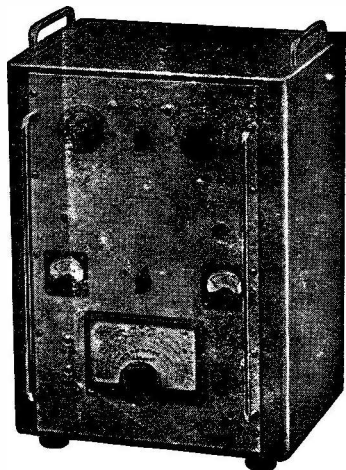
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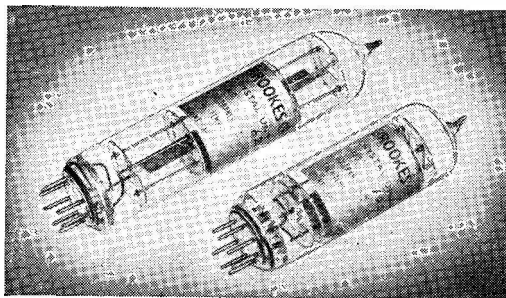
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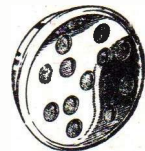
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