

The SHORT WAVE Magazine

3s.

VOL. XXI

JANUARY, 1964

NUMBER 11

HAMMARLUND

(Established 1910)

A Member of the Gianinni Scientific Group of Companies



The **HAMMARLUND HX-50** SSB transmitter — filter type — compact — 130 watts P.E.P. **£175**
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PACKAGE DEAL — HX-50 plus the latest model HQ170A Receiver **£299**

We shall be pleased to quote Commercial Concerns and Universities, etc., for the Hammarlund SP600 Professional Receiver

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The FABULOUS

Hammarlund HX-50

(as used on many famous DX-peditions)

Top left (opposite):
HQ145X. Double conversion super. General coverage and Bandspread, 11 tubes, **£110.**

Top right:
HX-50. SSB Transmitter. 130 watts p.e.p., crystal filter, self-contained power supply, **£175.**

Bottom left:
HQ170A. Triple-conversion super. Amateur bands only. 17 tubes, **£140.**

Bottom right:
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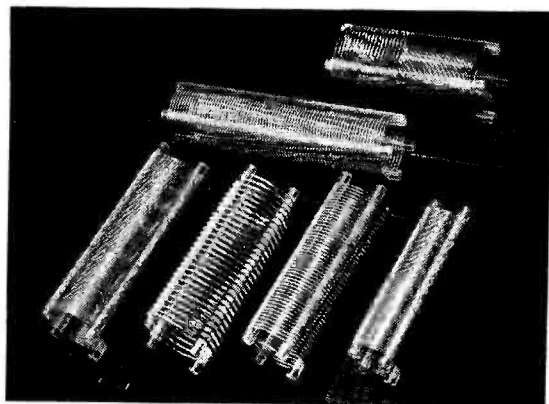
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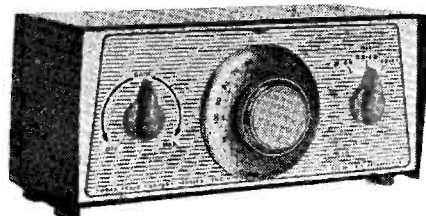
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Frequency range 1.5-30 Mc/s.

Substantially improves the performance of any superhet
receiver



G2LU writes . . .

You are to be congratulated on turning out a very fine piece of equipment. Several of the Coventry "gang" have heard the P.R.30 in use and all have expressed their amazement at the gain obtained and the absence of background noise . . . You may use any remarks I have made in this letter as I am so delighted with the Unit.

G3RIA writes . . .

The results in conjunction with my Eddystone 888 are amazing. Signals are twice as strong with much higher signal/noise ratio. A first class product well worth the money.

G3ADZ writes . . .

I feel I must congratulate you upon your P.R.30 Preselector. It is more than refreshing to find — Equipment well up to stated specification and performance . . . very well made and finished . . . at a fair price for Amateur . . . and care in packing.

G4HZ writes . . .

I am delighted with it, it improves my Eddystone 640 in all respects. The difference with the Preselector is fantastic, a weak signal on 15 metres about S2 changed to S8. On the L.F. Bands, unwanted noise and mush is cut out.

The P.R.30 Preselector uses EF 183 Frame Grid R.F. Amplifier and provides up to 20 dB gain. Outstanding features include vernier tuning, gain control, selector switch for either dipole or end fed antenna. Smart styling in grey and black, $8\frac{1}{2}$ " x 4" x 5". External power supplies (obtainable from Rx). Complete, ready for use, with all plugs, cables, £4/17/6. Carr. 3/-.

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G3IRE

CODAR RADIO COMPANY

G3HGQ

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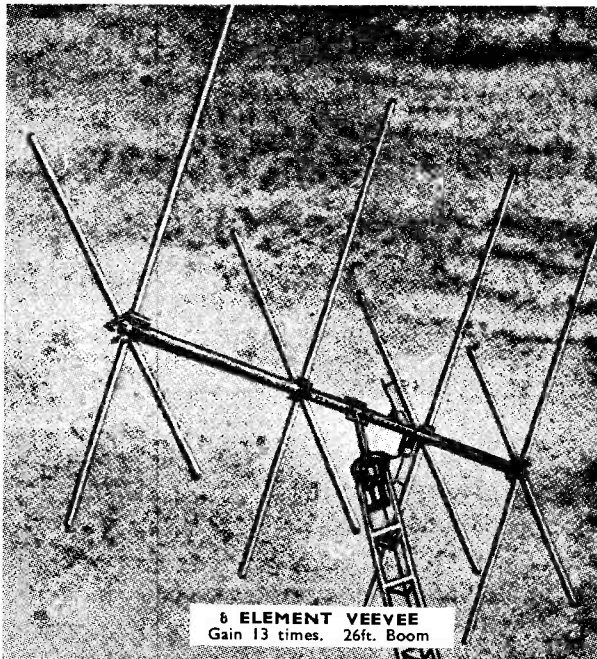
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Gain 13 times. 26ft. Boom

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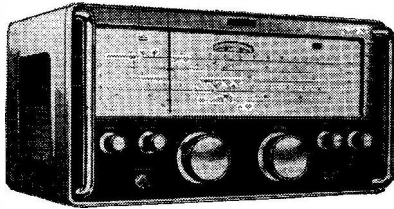
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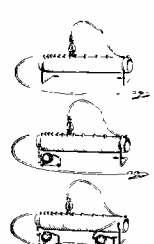
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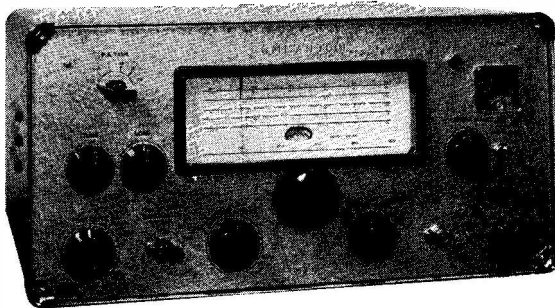
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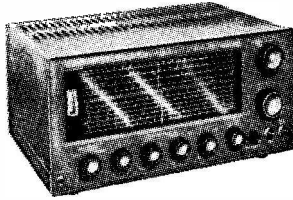
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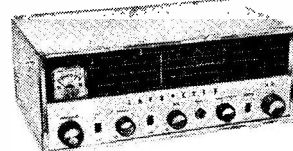
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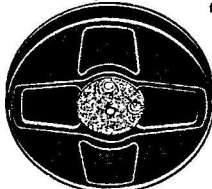


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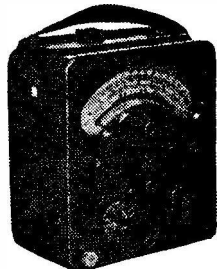
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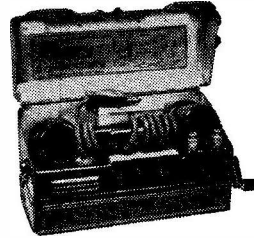
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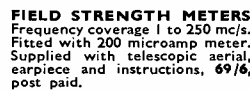
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Managing Editor : AUSTIN FORSYTH, O.B.E. (G6FO)

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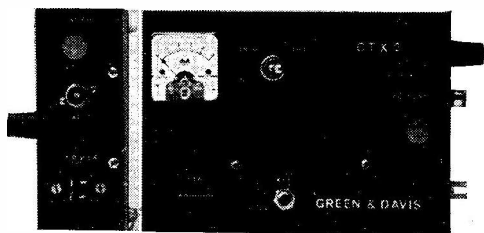
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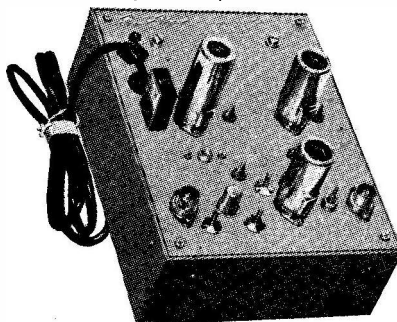
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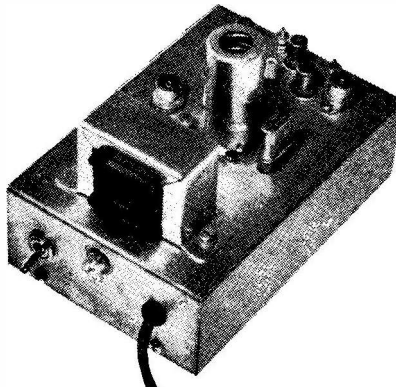
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The SHORT WAVE Magazine

E D I T O R I A L

Reappraisal *In common with other publishers, we have been faced during the last two years with steadily rising costs, on all fronts — culminating just recently in a considerable percentage increase in the charge for printing. Since this is by far the largest of our regular monthly commitments, its impact is correspondingly heavy.*

Though it is true that increased advertising revenue during the past year has to some extent helped to offset these costs, that in itself presents another problem: With more space being taken for advertising, we have had to run eight extra pages per issue for text matter, to make up the loss of reader pages — in fact, the last four issues of SHORT WAVE MAGAZINE (including the one in your hands) have each consisted of 64 pages, plus cover, against the 56 pages-with-cover of the issues prior to October, 1963. This, of course, has not helped us at all with the printing bill.

It is with regret and reluctance that we have to announce an increase in cover price to 3s. 6d., to take effect with the March issue.

In case anyone imagines that this means “another sixpence a copy” to us, let it be explained right away that the bulk of our circulation is through the bookstalls — that is, by way of the local newsagent. Hence, in addition to the high cost of distribution through the wholesale-retail trade, we have to give large discounts on the cover price to ensure that copies are available for local purchase, much of which is casual.

All through the years, we have been sustained and fortified by a solid body of direct subscribers, who receive SHORT WAVE MAGAZINE by post direct from us by payment of an annual subscription. There will be no increase in the direct-subscriber rate until individual subscriptions fall due for renewal. Furthermore, all new subscribers, and subscription renewals, entered between now and March 6 — publishing date for that month's issue, and the commencement of a new volume — will be accepted at the present rate of 36s. post free for a year of twelve issues. Additionally, the Magazine will henceforth carry the extra eight pages every month, making it regularly 64 pages plus cover.

We hope and believe that readers will understand our difficulties, and accept the enlarged issues as a fair bargain at the new price. SHORT WAVE MAGAZINE is, and always has been, independent and unsubsidised. It is to the advantage of all concerned, readers and advertisers, that it should remain so.

*Austin Foley
Gt. Po.*

MODIFYING THE HT-11 FOR 80 METRES

ON THE RECEIVER SIDE

A. H. CAIN (G3DVF)

THE Hallicrafters HT-11 Transmitter-Receiver is still a very useful piece of equipment, performing well on the 160-metre band, despite the fact that the design is now about 15 years old. As it stands, the commonly-available unit covers 1.5 mc to 3 mc, although a version having a broadcast band plus a 2.0-3.0 mc band was manufactured. The receiver section covers this in two bands, and the transmitter with any three switched crystal positions.

On 80 metres the transmitter can be operated without any modification, and it is the receiver section which requires attention. It is possible to bring the No. 2 band up to about 3.8 mc by the use of the coil trimmers—but, of course, this makes nonsense of the calibration, and in the writer's case could not be done as complete coverage from 1.5 to 4 mc was required.

At first, consideration was given to switching fixed condensers in series with the existing Band 1 or Band 2 coils to modify the coverage, but as a new band-switch is required in any case, it was decided to add a set of coils for a Band 3.

Procedure

All the wiring was removed from the existing band-switch, and a fairly detailed drawing made of the various connections as they were unsoldered. The switching is relatively simple, but it is far easier to keep a record as one goes along, rather than unsolder everything, then start trying to sort things out later. A point to watch is that although not shown on the circuit diagram, a section of the band-switch is used to short circuit all Band 1 coils when Band 2 is in operation. This is no doubt necessary because both windings are contained in the same screening can.

Having unsoldered all connections it is necessary to take off the control knobs, switches and front panel to get at the locking nut of the band-switch. This is a much easier job than at first appears. Four self-tapping screws come out from the edge of the panel and one screw from the middle front holding the change-over relay. The Tx on-off switch locking nut is removed, the various control knobs taken off, and the front panel comes away, being attached by long leads only to the phone/speaker switch. Make a note of the connections and unsolder the leads. The front panel can now be put to one side and out of the way. Remove the band-switch after taking off the lock nut. The requirements for the new band-

switch (coil switching) are as follows:

- (1) For aerial coupling winding, 1-pole, 3-way (Fig. 1b).
- (2) For RF amp. grid winding, 1-pole 3-way (Fig. 1b).
- (3) For intervalve winding, 1-pole, 2-way, (Fig. 2b). (Note that this is an extra requirement as the original circuitry used a single couple winding for both bands.)
- (4) For mixer grid winding, 1-pole, 3-way (Fig. 2b).
- (5) Oscillator grid winding, 1-pole, 3-way (Fig. 3b).
- (6) Oscillator anode winding, 1-pole, 3-way (Fig. 3b).

(This also is an extra requirement as the original circuitry used a single coupling winding for both bands.)

A Yaxley-type switch for these movements plus a follow-through shorting action could not be formed, so a selection of *Radiospares* switch parts were bought and assembled. Again the follow-through shorting action was not obtainable, but a separate set of contacts was used to short the Band 1 coils in the Band 2 position. As no interaction between these coils and the new, unscreened, separately-mounted Band 3 coils was expected, Band 2 was not shorted in Band 3 position, making switching requirements somewhat simpler.

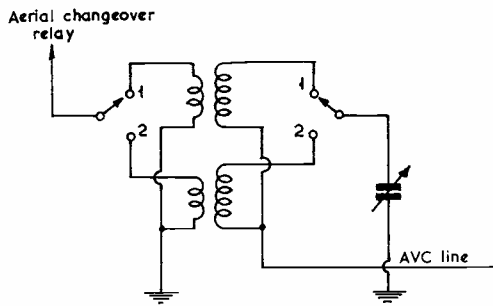
Switch Assembly

Allowing for sets of shorting contacts, and to standardise the wafers, three 4-pole 3-way wafers were assembled and spaced on a long shaft, keeping the overall length as near as possible to the previous switch. This eliminates cutting or extending existing wiring.

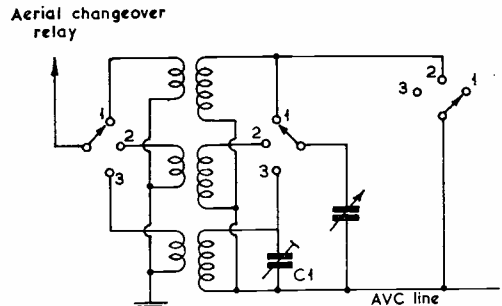
The wafer nearest the front panel switches aerial coupling and RF grid coils, and also provides the shorting facility for Band 1 aerial and grid coils. The middle wafer switches RF coupling, and mixer grid coils, and does the shorting for Band 1 mixer grid coil. The end wafer switches oscillator grid and oscillator anode coils and shorts the Band 1 oscillator grid coils. (A spare set of contacts is available on these last two wafers.) Note that, with the exception of the aerial coupling coil, the shorting action is *across the coil* and not coil-to-earth, which would disable the AVC line.

Coil Values

Three coils are required, aerial, RF and oscillator, such that, with the tuning condenser at minimum, the receiver should reach to about 4 mc. There are several sets of coils on the market which meet this requirement, most of them covering approximately 1.5-4.0 mc using a 350 $\mu\mu\text{F}$ or 500 $\mu\mu\text{F}$ variable condenser. The type with the highest "Q" should be chosen. Some of the miniature coils available do not appear to have very good "Q" values, and second-channel interference can be a nuisance. There is a fair amount of space under the chassis for mounting purposes so that coils of reasonable size



Band 1 in use
Fig. 1 (a) ORIGINAL



Band 1 in use
Fig 1 (b) MODIFIED

C1 : 0-30 μ F trimmer

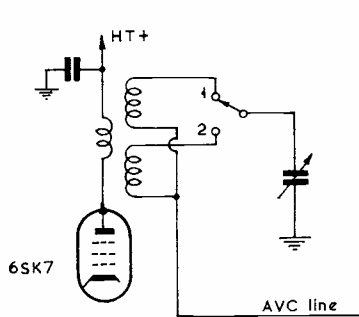


Fig. 2(a) ORIGINAL

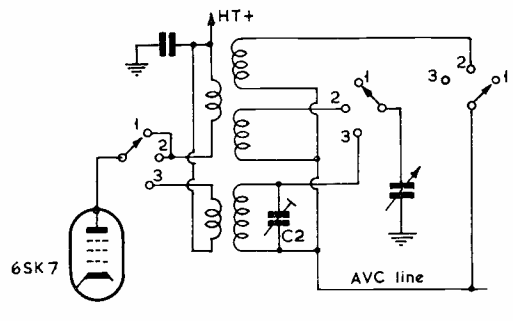


Fig 2 (b) MODIFIED

C2 : 0-30 μ F trimmer

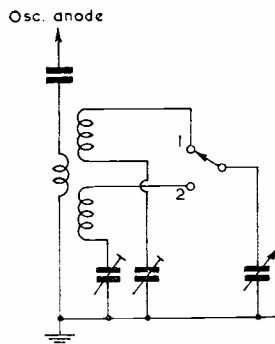


Fig. 3(a) ORIGINAL

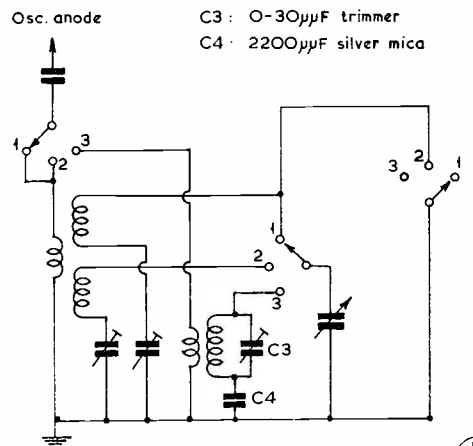


Fig 3 (b) MODIFIED

C3 : 0-30 μ F trimmer
C4 : 2200 μ F silver mica

R
394

can be fitted in.

Using unscreened coils these were fitted at right angles to each other to avoid unwanted coupling. The aerial coil fits horizontally from the inside of the chassis near the output transformer, and if mounted on a piece of aluminium can use the output transformer holding bolts as a mounting. The

RF coil mounts vertically in front of the Band 1 and 2 oscillator padding condensers, and can again, if mounted on a strip of aluminium, utilise existing bolts on the chassis. The oscillator coil, fitted behind the rear switch wafer on an L-shaped Al. bracket, is mounted horizontally, but at right angles to the aerial coil. With the coils used and 0-30 μ F trimmers across

them, 4.3 mc was found at minimum tuning capacity (trimmers were at approximately 20 $\mu\mu\text{F}$). Maximum capacity gave a frequency of 2.9 mc. The trimmers on Band 1 and Band 2 coils will require slight adjustment. It was found that due to the lower capacity of the new band-switch the trimmers had to be adjusted to give an increase in capacity.

Apart from the band-switch the only other wires unsoldered are the lead from RF coupling coil to RF amplifier anode (this is unsoldered at Pin 8 and taken to the band-switch 2b) and that from the oscillator coil side of the blocking condenser, which also goes to the band-switch.

SIMPLE NOISE-LIMITER AND CLIPPER CIRCUITS

FOR USE WITH THE RECEIVER

F. G. RAYER, Assoc.Brit.I.R.E. (G3OGR)

EITHER of these circuits can be added to a receiver of mains superhet type. The first is a self-adjusting noise limiter, and it will be found effective with static and similar noise, as encountered when using a receiver in a vehicle, and for general short-wave listening. The second circuit clips output to a pre-set level, and is thus very useful for phone reception, or any circumstances where sudden bursts of volume are to be avoided.

The limiter circuit is shown in Fig. 1, and requires an extra diode. This can be half a 6H6 octal, or a 6AL5 (B7G), or may be of any similar type. In most receivers, a DDT valve will be fitted for detection, AVC, and audio amplification, as in Fig. 1. This part of the circuit does not need to be changed.

Cathode and anode wiring of the new diode must be well clear of heater circuits, or hum may be introduced. During normal reception, the noise diode cathode follows the average signal level obtained from the final IFT of the receiver. When bursts of static noise arise, these drive the diode anode negative, so that the diode does not conduct. The delay time of the circuit can be adjusted by fitting condensers of about 0.01 μF to 0.05 μF , instead of 0.02 μF , for C3, though the latter is generally satisfactory.

In many circuits the audio gain control is present between the diode circuit and triode grid, and this may

remain unchanged. When the limiter switch is in the "off" position, this shorts out the noise diode. If leads to this switch are long, or near heater or other wiring, they should be screened.

The limiter switch can be anywhere convenient on the receiver panel. When the limiter is in action, the reduction in static noise should be very apparent. When it is working properly, there is also some loss of audio fidelity, so the limiter is switched off when not required.

With a little ingenuity 40-metre coils could probably be added. An extra "way" would, of course, be required on the band-switch, and possibly more efficient decoupling needed in the RF stages. After front-panel reassembly, a spot of white paint and a figure "3" is required to complete the modification.

When the limiter switch is in the "off" position, this shorts out the noise diode. If leads to this switch are long, or near heater or other wiring, they should be screened.

Clipper

A very effective clipper circuit is shown in Fig. 2. Heater current can be drawn from the receiver, as with Fig. 1. A double-diode valve with separate cathodes is required, and the 6H6 and 6AL5 will again be found satisfactory.

This clipper allows no signal in excess of a pre-set level to pass, the clipping level being set by means of the 100K potentiometer R4. It is best included between audio and output stages, in either superhet

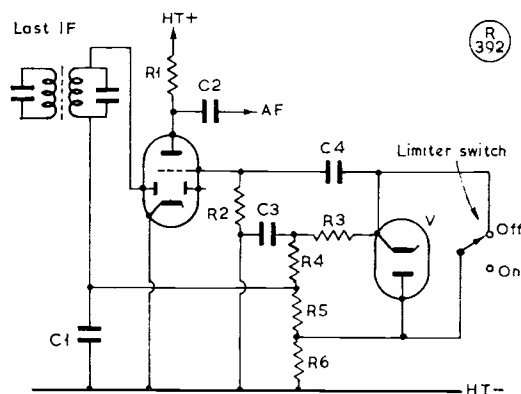


Fig. 1. The self-adjusting limiter, discussed in the article by G3OGR. Values are: C1, 100 $\mu\mu\text{F}$; C2, as in existing Rx; C3, .02 μF ; C4, .01 μF ; R1, as fitted; R2, 6.8 megohms; R3, R4, 1 megohm; R5, R6, 250K; V, any suitable diode.

or TRF receivers.

The clipper control should be panel mounted, or may be pre-set. Initially, it is set so that maximum voltage is applied to the diode anodes. The receiver volume control is then adjusted until headphone or speaker volume is at the normal level which it is desired should not be exceeded. The clipper control potentiometer is then slowly rotated, until volume just begins to fall. Reproduction at higher level is then prevented.

The clipper circuit is particularly effective when using phones, where sudden bursts of volume may be uncomfortable, especially when tuning a high-gain receiver on a strong signal. It is also excellent for holding the volume from a loudspeaker down to the pre-set level. The clipper must be included in circuit after the receiver volume control, which is used in the ordinary way, according to the strength of stations tuned in. In small receivers for headphones only, the clipper may be incorporated between receiver and phones.

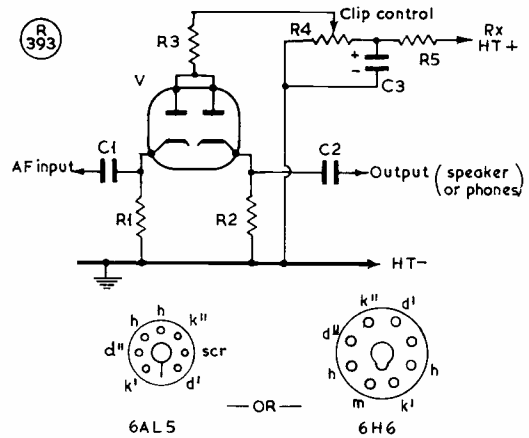
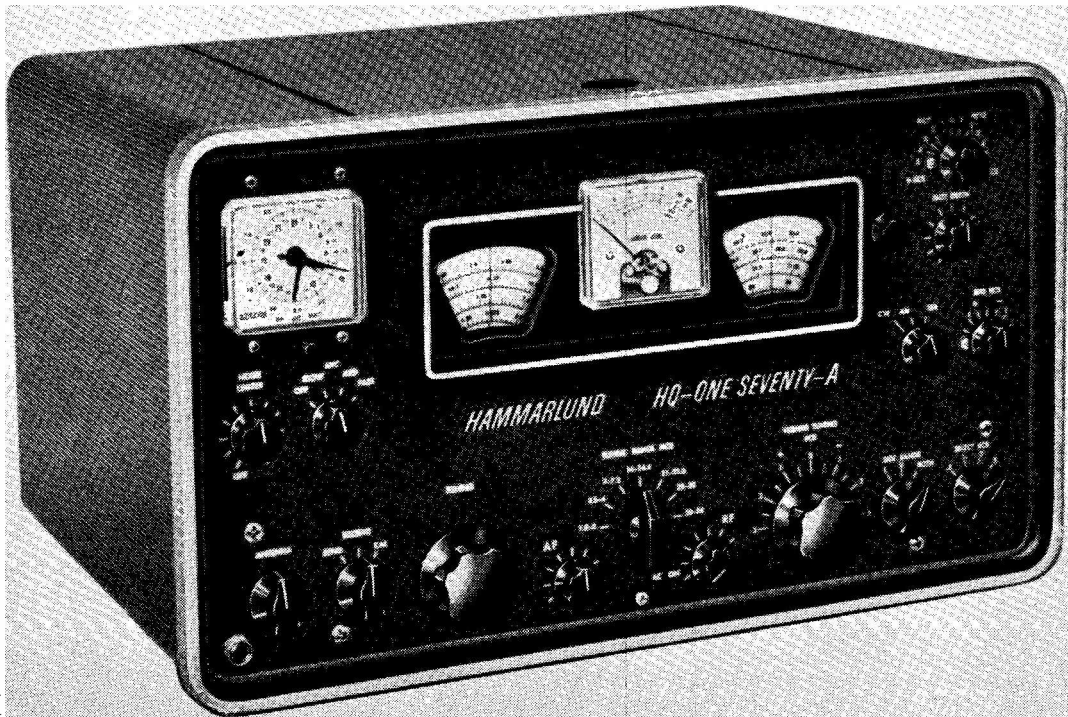


Fig. 2. A noise-limiter giving clipper action. Values are: C1, C2, .01 μ F; C3, 8 μ F; R1, R2, 220K, 5% equal; R3, 470K; R4, 100K potentiometer, clip control; R5, 47K; V, 6H6 or 6AL5.



The HQ-170A is a new Hammarlund receiver featuring triple-conversion, and special attention has been paid to electrical and mechanical stability. Seven amateur bands, from 6 to 160 metres, are covered, with vernier tuning and dial scale re-set adjustment for maintaining calibration accuracy. The IF's are 3035 kc, 455 kc (crystal controlled) and 60 kc; this third IF is heterodyned with a high stability oscillator having a very accurate vernier tuning control. The figures on the HQ-170A are 10 dB signal-to-noise ratio at 1.5 μ V for AM phone, and 0.5 μ V on CW. The receiver is a 17-valve job designed for SSB/CW and AM/MCW working and, as it has separate sideband selection with adjustable band-width, it offers a variety of tuning techniques to meet amateur-band conditions in any mode. The U.K. agents are K.W. Electronics, Ltd., Heath Street, Dartford, Kent.

SMALL TRANSMITTER FOR TOP BAND

FOR CW OR PHONE WORKING,
WITH SUITABLE POWER PACK

J. A. CALLOW (G3RBH)

THIS transmitter was intended to be compact, lightweight and portable, so that it could be used almost anywhere, and it makes a good basis for /A operating. It also represents a good start for the newly licensed and has been in use at G3RBH for some time now; it has given excellent results, and has proved itself worth a lot more than the few shillings it cost to build. It is easy to construct and operate. Most of the necessary components will probably be found in the junk box.

Circuit

The circuit, shown in Fig. 1, is quite conventional. A Colpitts VFO V1 is followed by an untuned buffer, V2, a PA V3 with a *pi*-section tank, and a single ended, two stage modulator, V4-V5.

The Colpitts VFO, chosen for its stability and simplicity, needs little comment. A high-slope pentode is used for good stability, and a small coil at L1 is found quite satisfactory. The HT on the VFO should be stabilised, otherwise much trouble may be experienced from chirp and drift. The voltage regulator used in the prototype was nothing more than a large neon tube, N, which was found to provide satisfactory regulation. A B7G-type regulator could be used here, though it may then be found necessary to change the value of R13 to suit the tube; this should have a permissible anode current of about 10 mA and a regulating voltage of somewhere around 75 volts.

The VFO is followed by an untuned buffer stage, V2, using a 6AM5, which serves the dual purpose of isolating the VFO from the keyed stage and providing drive to the PA—VR1 in the screen is used to adjust the grid current drive—and setting was found to have quite an effect on the efficiency of the final stage.

The 6BW6 PA is modulated on plate-and-screen by a single 6CH6. The transmitter was originally designed around a 6CH6 PA and a 6BW6 modulator, but on changing the valves over a good deal more audio power was found to be available, and the 6BW6 RF amplifier would load to fully ten watts, phone or CW. A *pi*-section output circuit C14-L2-C15 is used in the tank, which will give a possible match to almost any aerial. This stage is keyed in the cathode.

No plate current meter is included in the PA—instead, a 100 mA meter is plugged into the key jack to measure cathode current. For CW work a jack is mounted on the key, in series with it, into which the meter can be plugged, or the meter can be plugged into the key jack for tune-up only, and changed for the key after tune-up. This arrangement was found

to be quite convenient, and eliminated the need of a front panel on which to mount the meter, though this arrangement could be adopted if preferred. Parasitic chokes PC1, PC2, are included in the grid and anode circuits of the PA as a safeguard against TVI—though TVI should cause no trouble in a rig like this, on such a low frequency.

The audio section consists of a 12AX7 pre-amp. and a single 6CH6 modulator. More than enough gain is given by the 12AX7 from a crystal microphone, and the 6CH6 will provide sufficient audio power fully to modulate the carrier. The modulation transformer used was the ex-SCR522 type, which has been found very satisfactory. The required turns ratio is approximately 1:1, so that another transformer of this ratio, with windings rated for the current involved, would do as well.

Change-Over

The switching as shown enables the whole station to be changed from "transmit" to "receive" by throwing S1, or the VFO alone may be brought on for netting purposes by means of S2. When netting, HT is applied to the VFO, but the HT circuit to the buffer and PA is broken by another section of the netting switch. When on "transmit," S1 applies HT to the transmitter and also earths a lead which completes a relay circuit in the receiver, thereby muting it. This muting circuit is shown in Fig. 2. Alternatively, this switch can be used to put the same HT supply as used on the transmitter on to the receiver, and to change the aerial over from transmitter to

Table of Values

Figs. 1, 2, 4. Circuit of the Transmitter, Power Supply and Receiver Muting

C1 = 30 μ F, trimmer	R12 = 220 ohms
C2 = 100 μ F, silver mica	R13 = 7,500 ohms, 5w.
C3 = 30 μ F, VFO tune	R14 = 47,000 ohms, 2w.
C4 = .001 μ F, zero temp.	VR1 = 100,000 ohms, pre-set
C5, C7, C8, C10, C11, C12, C13 = .01 μ F, 350v.	VR2 = 50,000 ohms
C6, C9, C17 = 100 μ F, 350v.	VR3 = 1 megohm
C14 = 300 μ F, PA tune	S1, S2 = DPDT, toggle
C15 = .0015 μ F (500 μ F BC 3-gang)	S3 = 1-make, 1-break, toggle
C16 = 100 μ F, 1000v.	RFC1-5 = RF chokes, Rx type
C18, C22 = .003 μ F, 350v.	Ch = 100 mA smoothing
C19, C23 = 50 μ F, 25v.	T1 = Mod. xformer, 1:1, ex-SCR522, or similar
C20, C21, C24 = 8 μ F, 350v.	T2 = Power xformer, 250-0-250v. 100 mA, 4v. 1A
C25 = 16 μ F, 350v.	T3 = Heater xformer, 6.3v. 4-5 amps
R1, R2, R9 = 47,000 ohms	V1 = 6BW7, or EF80
R3, R4 = 1,000 ohms	V2 = 6AM5
R5 = 2 megohm	V3 = 6BW6
R6, R8, R11 = 470,000 ohms	V4 = 12AX7
R7 = 27,000 ohms	V5 = 6CH6
R10 = 4,700	V6 = AZ31, or similar

COIL DATA FOR TOP BAND TRANSMITTER

L1 — 60 turns 30-gauge enamelled, pile-wound over $\frac{1}{4}$ -inch on 5/8-inch diameter former.

L2 — 80 turns 24-gauge enamelled, close wound on 1-inch diameter former, tapped every 5t. from 40t. up.

PC1, PC2 — Anti-parasitic chokes; any 1-watt type resistor body with 15 turns of 18-24 gauge wire; coils soldered to resistor terminations.

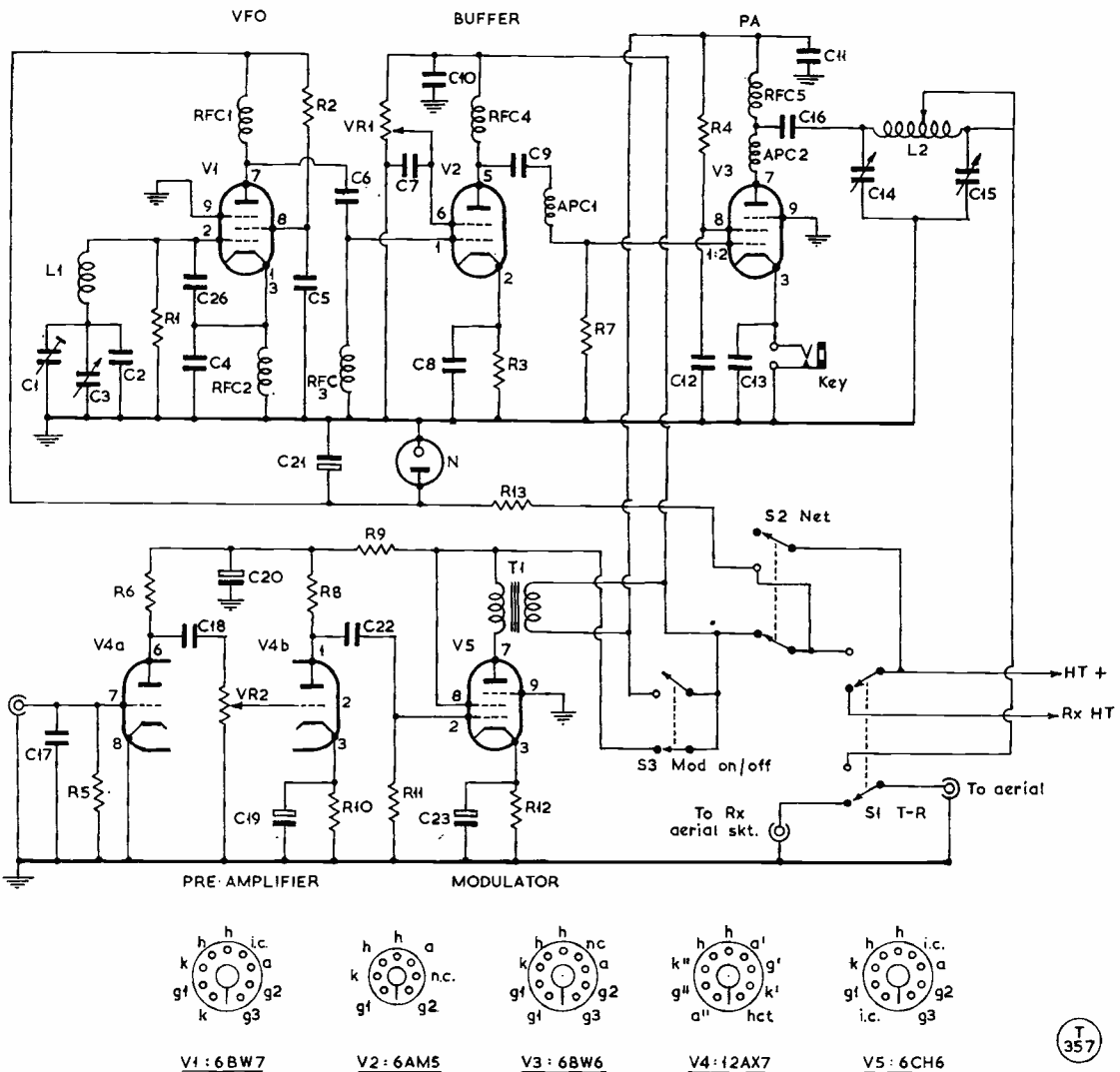


Fig. 1. Circuit complete of the Top Band CW/Phone transmitter described by G3RBH. It can be built up in a form suitable for fixed-station operation, or portable use from a /A location. The buffer stage V2 ensures adequate isolation of the VFO, while keying in the cathode of the PA gives a clean, sharp note on CW. The switching is for change-over control by a single motion, on either phone or CW; a separate net switch is provided to bring on the VFO alone; and with S3 in the "mod.-off" position, HT is cut to both speech amplifier and modulator, while the secondary of the modulation transformer T1 is shorted. A suitable power supply is shown in Fig. 4, with a suggested general layout plan at Fig. 3 and a receiver muting circuit in Fig. 2.

receiver, as shown in Fig. 1 (though this would not allow CW monitoring). Another arrangement would be merely to put HT on the transmitter at the same time as it is turned off the receiver, and *vice versa* on receive. If the arrangement of Fig. 2 is adopted, as at G3RBH, then the monitoring potentiometer, VR2, must be turned right back to prevent any feedback when working phone.

Construction

The transmitter is built on an 11in. x 4in. x 2in. aluminium chassis. Fig. 3 shows the mounting

positions of the major components. The VFO is built on the top of the chassis, at the left-hand end, with the valve projecting below the chassis. In this way good screening of the VFO from the rest of the circuit is possible and heat can be kept away from the tuned circuits. The neon regulator tube is held in a condenser-clip on top of the chassis, and has the leads soldered directly to the contacts on the base of the tube. The VFO coil L1 consists of 60 turns of about 30g., either enamelled or cotton covered, pile-wound over half-an-inch on a 1/4in. diameter former. The coil should be well shellaced when completed, and

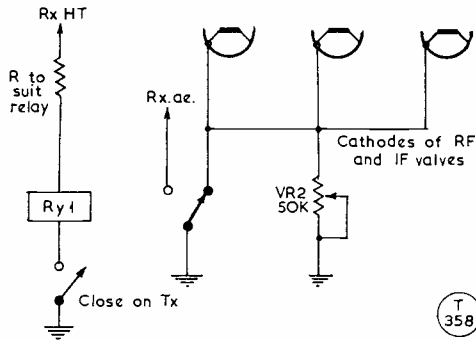


Fig. 2. Suitable circuit for Rx muting, in connection with the transmitter design at Fig. 1, as suggested by G3RBH. There are other ways of doing it, of course, but this will give single-switch control.

mounted in a screening can on the top of the chassis. As the shellacing will increase the self-capacitance of the coil, it may be necessary to change the value of the shunt condenser C1 in the tuned circuit, depending on the degree of shellacing.

The buffer stage is screened from the PA by a small piece of aluminium, about one inch in height. This was found necessary to prevent feedback effects.

The principal point to remember when wiring the PA is to avoid any feedback couplings, which will inevitably lead to trouble. It is quite easy to prevent feedback, as this stage operates with a low voltage gain. The coil L2 in the pi-section consists of 80 turns of 24g. enamelled wire, close wound on a one-inch former. The coil should be tapped every five turns from 40, and the tapping points tried for best aerial loading. For a 70-ohm output, 65 turns (roughly 26 μ H) should be used, while 60 turns will probably be more suitable for a 50-ohm load. Ordinary receiver-type tuning condensers were found satisfactory for C14, C15, in the pi-section output circuit—the output condenser C15 being a three-gang broadcast type. To meter cathode current a 100 mA or 50 mA meter is connected to a piece of coax, about a foot long, which has a jack plug fitted to it. The centre of the jack plug goes to the centre of the coax, which is connected to the positive terminal of the meter. The coax should be anchored by a piece of wire to one of the screw-holes on the front of the meter which normally would be used for panel mounting.

The modulator is built at the right-hand end of the chassis, and presents little difficulty. The pre-amp., which is fitted at the front of the chassis, should be wired carefully to avoid feedback. Extensive use can be made of tag strips. The modulator valve is mounted nearer the back of the chassis, next to the modulation transformer; the 12AX7 should be screened.

The Power Supply

Fig. 4 shows the circuit of the power pack. A standard "replacement" type mains transformer (T2) can be used, but it should have a current rating of about 100 mA. The output voltage should be in the region of 250-300 volts; if the voltage is much

less it will not be possible to load to fully ten watts input, while a voltage in excess of 300v. would probably damage the valves. As the heaters of both receiver and transmitter will have to run continuously, a separate heater transformer should be included for the extra amps. if the receiver is run off the same power supply. Two amps. of LT are required by the transmitter; the heater transformer will have to provide all this in addition to the receiver load. A bleeder R14 is included in the HT smoothing circuit for safety, and an HT switch is fitted, which was found to be a very useful addition. The power supply is built on a separate aluminium chassis measuring 2ins. x 3ins. x 6ins. An octal socket is fitted at one end of the chassis, to receive the octal power plug from the transmitter. A piece of 3-core cable connects the transmitter to the power pack.

Setting Up

When the wiring has been completed and checked, plug in the cathode meter, and wire a 5 mA meter between earth and the earthy end of R7, the 27K grid leak resistor. When the heaters have been allowed to warm up, apply HT. Close the netting switch and the voltage regulator should strike. Adjust the trimmer C1 so that the VFO tunes to 2.0 mc with the tuning condenser, C3, at minimum capacity. Then the VFO should tune to 1.8 mc with the condenser at full mesh. The value of shunt capacity needed will vary according to the construction of the transmitter, and it would be a good plan to replace all the shunt capacitance with a 200 μ F variable condenser and adjust it to tune to Top Band. Then guess the value of the capacity by the degree of mesh, and replace it by a fixed condenser of that value.

When the VFO is properly adjusted, open the

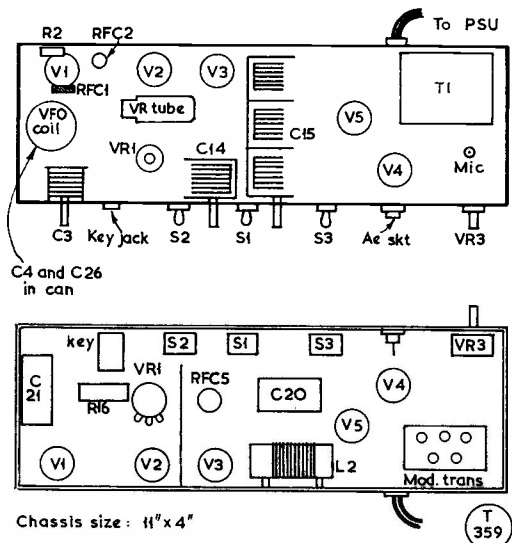


Fig. 3. Layout plans to show the positioning of the major items for the Top Band transmitter. This need not be followed in detail and is for general guidance only—but it has been found satisfactory in practice.

TABLE I:
Positions and Scores, Eighteenth MCC

CLUB	REGION	POINTS	CLUB	REGION	POINTS
1. GW3FSP, Port Talbot	W	803	48. G3NGZ, RAF Little Rissington	S	402
2. G3RBP, Oxford	S	741	49. G3GGS, Chorley and Leyland	N	393
3. GM3OBC, Leven (Fife)	F	721	50. G3RAL, Loughborough	M	386
4. G3KMO, Ash Green and Guildford	S	691	51. G3ILO, Dursley	S	373
5. G6OI/A, Stourbridge	M	657	52. G3GBU, Stoke-on-Trent	M	350
6. G3GRS, Gravesend	S	649	53. G2CUZ, Ainsdale	N	347
7. G4JW, Sheffield "A"	N	642	54. G3GIW, Burnham-on-Sea	S	345
8. GM3SIG, 92 Sig. Regt., Forfar	F	634	55. G3IUU, Acton, Brentford and Chiswick	S	340
9. GM3JFS/A, Morayshire	F	625	56. G3BXF, Rugby	M	337
10. G3KIN, Kingston	S	617	57. G3BRS/A, Bury	N	332
11. G3REI, Reigate "A"	S	592	58. G16YM, City of Belfast	W	330
12. G3KVG, Hallamshire	N	590	59. G5FK, GEC Research	S	313
13. G3LCS, Wolverton	S	587	60. G3NIS, STC (Harlow)	S	297
14. G3OUV, Chiltern	S	586	61. GW3IIZ, RAF Sealand	W	295
15. G3BFP, Surrey	S	579	62. G3ASR, Edware	S	292
16. G3LYW/G3MBN, Bath Spa	S	575	63. G3GJL/A, Worcester	M	291
17. GM3GDU, Davaar (Argyll)	F	571	64. G3IDV/A, Hartlepoons	N	282
18. G3RSR, MRCC	M	560	65. G3EKW, Nottingham	M	277
19. G3TR/A, Crawley	S	552	66. G3FTQ, Purley	S	275
20. G3MAR, Midland	M	535	67. G3FNV, Chester	M	272
21. G3AHD/A, Liverpool	N	515	68. G3SJB, R. Sigs. (Catterick)	N	267
22. G5BK, Cheltenham	S	511	69. G3SND, Grimsby	M	255
23. G3OCB, Cornish	W	510	70. G3FKF/A, Salisbury	S	245
24. G2FJA/A, Medway	S	507	71. G3SAD, Stevenage	S	243
25. G3JWZ/A, Verulam	S	501	72. G3GHN, Clifton "A"	S	242
26. G5YC, City and Guilds	S	499	73. G3SLM, South London Mobile	S	241
27. G3PPG, Ariel (Evesham)	M	493	74. G3BRK, Aquila (Bromley)	S	228
28. G3AFT/A, Grafton	S	482	75. G3NJJ, Blackpool	N	227
29. G3NWR, Wirral	M	481	76. G3OBR, Aldershot	S	220
30. G3RBZ, Lymington	S	476	77. G3LDT, Macclesfield	M	218
31. GW6CW, Blackwood	W	471	78. G3BZU, RNARS	S	216
32. G3HVI, Burslem	M	467	79. G3SDW, Greenford	S	215
33. G8AB/A, Loughton	S	462	80. G3RCV/A, Cray Valley	S	214
34. G2XP, Sutton and Cheam	S	457	81. GM3PJP, Buchan	F	211
35. G3SDR/A, Stroud	S	452	82. G3LPT, Sole Bay	M	210
36. G3LUU/A, Leeds University	N	448	83. G4BP, Scarborough	N	204
37. G3OYU, Clifton "B"	S	443	84. G3SMD, University of Keele	M	190
38. G3ELJ, Newark	M	441	85. G3GDT, Ariel (Bush House)	S	186
39. G3RAE, Reigate "C"	S	435	86. G3PMZ, 42nd Sig. Regt. (Liverpool)	N	185
40. GW3PMR, University College of North Wales	W	427	87. G3MGZ, Basingstoke	S	184
41. G3LST, Brentwood	S	422	88. G6DT, Petersfield	S	182
42. G3RCW, North Notts	M	421	89. G3JGE, 238 Sqdn. ATC (Staffs.)	M	177
43. G3MEH, East Cheam	S	420	90. G3HEV/A, Ravensbourne	S	171
44. G3PWW, Reigate "B"	S	417	91. G3RCM, Sheffield "B"	N	163
45. G3PIA, AERE (Harwell)	S	407	92. G3LCW, Deal	S	157
46. G3OWM, University of Newcastle	N	404	93. G2DPQ, Shefford	M	149
47. G3DDI, South Shields	N	403	94. GM3BSQ, Aberdeen	F	141
			95. G3CMH, Yeovil	S	136

THE EIGHTEENTH MCC

The Magazine Top-Band Club Contest November 16-17, 1963

YET again we have to report even greater activity, with 102 logs received (seven of them too late to qualify), compared with 89 last year. Again, well over 100 stations were in action, and some of the contestants have put the number as high as 126. And once again the regional system of scoring seems to have justified itself, since we have three different regions at the top of the table.

This year it was the Western region's turn to take the top place—the first time they have made it with the present scoring method.

1st : Port Talbot, GW3FSP (Western) ...	803
2nd : Oxford, G3RBP (Southern) ...	741
3rd : Leven (Fife), GM3OBC (Far North) ...	721

In fourth place were **Ash Green (G3KMO)**, another Southerner, and fifth came **Stourbridge (G6OI/A)**, the highest scorer in the Midland region.

The four-hour periods made even more difference to the scores than was expected—they are considerably higher in proportion than last year's totals.

The Top Scorers

Port Talbot, winners by a handsome margin, used GW3FSP's station, the operators being GW3FSP and GW3KSQ on the Saturday; GW3FSP and GW3BQY on the Sunday. The transmitter (6V6-6V6-807) was almost the same as the one that GW3FSP used in MCC more than twelve years ago! The receiver was an AR88D and the aerial a half-wave Zepp, 40 feet high.

Oxford nominated G3RBP's station, in which the gear consisted of a 10-watt crystal-mixer type transmitter with full break-in; a modified HRO with 85-kc second IF; and a half-wave Zepp 60 feet high.

The Scottish top-scorer, *Leven*, had three operators on the job at GM3OBC, with a "home-built 10-watt Tx," a Drake 2B and a quarter-wave wire with an ATU and Z-match.

The System

GW3FSP writes "Very enjoyable, and I was glad to be back in MCC after a break of many years. I only hope that it will not be spoiled by the cry of 'unfair scoring system,' which usually occurs should we be somewhere near the top." Too true:—*Stourbridge* say "As you have already committed yourselves to maintaining the existing ridiculous rules, we can only say that as a contest it was a first-class farce."

We leave readers to judge; but Table II should interest our friends at *Stourbridge*. It shows who would have been the Top Six under the previous system, with all Club contacts counting the same number of points, and exposes the fact that if the old rules had obtained *Stourbridge* would have been sixth instead of fifth—and still beaten on the actual number of QSO's by GW3FSP, for club and non-club contacts alike. Enough said?

The fact is that the handicapping system is not meant to make it possible for all stations, in all regions, to score the same number of points. If it did that, there would be no reward for good operating. The six stations entered from the Western region



The Welsh team that did so well in the Eighteenth MCC — left to right: GW3KSQ, GW3FSP (call signed for the Port Talbot Club), and GW3BQY. Knocking up 803 points to run into first place, their Tx was a 3-stage gang-tuned job, using screen block keying, with a 3-way foot switch for receive-net-transmit; their Rx was an AR88D, and the aerial a 275-ft. top, 40ft. high and well in the clear, running near enough N-S, and Zepp-fed through 66-ft. feeders. Their operating throughout was first rate — as the results show, it was that and not the scoring system that brought them out on top. Well done, boys—back!

achieved the positions of 1st, 23rd, 31st, 40th, 58th and 62nd . . . from which one might reasonably deduce that *Port Talbot* won the event by good operating, not by the scoring system.

In any case, all Clubs should feel that they are taking part in a contest within a contest—that is to say, they compete in the first place against others in their own region. It is almost as much of an achievement to lead one's region as to come up in the first three. All credit, then, to the regional leaders, who are shown in Table III.

As a matter of interest—since there were 48 stations in the Southern region and only 20 in Midland—our computer tells us that the possible score for the Midlanders was somewhat *higher* than that for the Southerners, who, of course, made only three points by working each other.

Under Fire

Clubs who put in two (or, in the case of *Reigate*, three) stations have been criticised by some of the others; but the judges can see no reason whatever against it. Not everyone treats every contest as a rat-race, and the idea in some quarters was to give the maximum number of operators some contest experience. *Bath Spa*, who used G3LYW's station one day and G3MBN's the next, also brought forth some doubtful comments, but this was not considered contrary to the spirit of the rules—nor was there anything in the *letter* of the rules which forbade this procedure. But it is not the sort of thing that must happen again.

Nice to see an entry from Northern Ireland this year—they sportingly put GI6YM in, despite the fact that the scoring system undoubtedly works to their disadvantage. Still nothing, however, from GC or GD. And a few foreign stations were worked by some of the contestants—notably OH3NY and PAØPN (GW3FSP raised them both, but said it



Though this is not a very good photograph, we print it because it represents the Oxford Club's entry for MCC, in which G3RBP (Abingdon), assisted by SWL Barry Crook, made the very fine score of 741 points to get into second place. Their Tx consisted of a crystal-mixer-type VFO, with two buffer stages and keying in the intermediate circuits, using a valve-type T/R switch and full BK; their receiver was a modified HRO with 85 kc second IF—and the aerial a 260ft. Zepp-fed, at a height of 60 feet. Though G3RBP was not licensed until comparatively recently, he has already made a reputation on Top Band, and his MCC performance proves him to be one of our leading operators.

was not policy to waste time on such contacts for only one point).

Operating

The general opinion seems to have been that the operating standard was very good. Some of those using "BK" really meant it this time; but most sent it when they really meant "K". Long CQ's were out, but there were still a lot of time-wasters who called "QRZ?" after each contact, despite the fact that others were waiting for an immediate QSO. This must have cost scores of points to some of the offenders.

Notes were good and clean, with one exception. The judges were in favour of making a disqualification, but when his log was received, only about twelve T8's were apparent in more than 100 entries, so they were lenient. (But they would *not* have been if he were in the top six!)

General Comment

With 95 logs in the pile, brevity is essential. Here are some short quotes from the leaders: "Feel that the fairest method would be one point per contact, with some sort of bonus for the GM's" (*Oxford*) . . . "Aerial 500ft. long, 50ft. high, with Z-match" (*Ash Green*) . . . "Our effort not too hot this year—probably electrical interference, which was about six S-points above the receiver noise" (*Gravesend*).

"Feel that many stations didn't search for the 10-point GM's but preferred to work the easier

TABLE II

Club contacts made by the Leading Clubs

Oxford, G3RBP	...	...	...	...	...	180
Ash Green, G3KMO	...	...	...	...	...	174
Gravesend, G3GRS	...	...	...	...	...	164
Port Talbot, GW3FSP	...	...	...	...	...	163
Kingston, G3KIN	...	...	...	...	...	163
Stourbridge, G6OI/A	...	...	...	...	...	162

locals" (92nd Sig. Regt.) . . . "Our contact with G3OCB (Cornish) was probably the most DX club contact of the contest" (Morayshire) . . . "New identity letters first-class, but would prefer to abolish non-Club contacts" (Kingston) . . . "Nice to hear and work the GM's (at ten points!)—largest number yet heard in any MCC" (Reigate) . . . "Can't we revert to three hours, but start at 1800?" (Wolverton).

Thoughts on Technique

As always, some of the really well-operated stations point out the worst faults of some of the—well, not-so-good ones. Most common of all was the waste of time occasioned by calling unnecessary CQ's when others were already waiting on the frequency. (Curiously, though, Oxford, the runners-up, remark that they made more points by calling CQ than by looking for other people who were doing it.)

East Cheam suggest that one cannot standardise "three times three" as a reasonable CQ call—at times a "one times one" might be sufficient, and later, when contacts were getting scarce, a "three times three" hardly long enough.

Another club even made the suggestion that there should be a points differential between contacts made on a CQ call and those made by listening and then calling someone. (Who, we might ask, would be checking all this? A full-time job for a panel of invigilators, following every QSO throughout the Contest!)

G6BQ of Gravesend, who knows quite a lot about Top-Band contests, thinks the handicapping system would be fair enough with quarter-wave inverted-L type aerials used in daylight! But his opinion is that a half-wave is now a "must," and will give an advantage of two S-points. He also thinks the scoring system would be fair to all if only mediocre operators showed up in the more remote regions—but as soon as a good one appears, he is bound to win.

In general, it appeared that the transmitter was the least important part of the gear. What mattered most was probably the receiver; then the aerial system; and then the "listening device" hooked on to the receiver . . . in fact the latter was possibly even more important than the receiver itself. (It doesn't matter how many stations call you if you don't hear them.)

The over-crowding of a narrow slice of the band made high selectivity and good CW operating ability absolutely essential; and, after all, this is the essence of a contest that means

TABLE III
Top Scorers in each Region

<i>Western</i>			
1.	Port Talbot, GW3FSP	... ..	803
(Six entries)			
<i>Southern</i>			
2.	Oxford, G3RBP	... ..	741
4.	Ash Green, G3KMO	... ..	691
6.	Gravesend, G3GRS	... ..	649
(48 entries)			
<i>Far North</i>			
3.	Leven, GM3OBC	... ..	721
8.	92 Sig. Regt., GM3SIG	... ..	634
(Six entries)			
<i>Midland</i>			
5.	Stourbridge, G6OI/A	... ..	657
18.	MRCC, G3RSR	... ..	560
20.	Midland, G3MAR	... ..	535
(20 entries)			
<i>Northern</i>			
7.	Sheffield "A," G4JW	... ..	642
12.	Hallamshire, G3KVG	... ..	590
21.	Liverpool, G3AHD/A	... ..	515
(15 entries)			

anything.

More Shorts

"Suggest that Rule 6 be amended to mean that Club stations be required to send RST report, Zone and club identification only—irrespective of whether working club or non-club station" (Aquila) . . .

"Nearest 'local' to us was 50 miles away" (Davaar) . . . "How about special 'long-haul' points



Leven Radio Club, of Methil, Fife, signing GM3OBC, came third with 721 points in this season's MCC. Their operators were GM3OBC and GM3PFQ (right), with GM3LVS (unable to be present when this picture was taken). The GM3OBC transmitter is interesting: A K.W. "Viceroy" exciter on 40m, feeding into a mixer-PA unit to get on to 160m., using a TT21 taking 10w. coupled through a Z-match into a 150ft. wire 30ft. high, with a 120ft. counterpoise. Their receiver was a Drake 2B, with the Top Band modification. This time, there were six entries from the Far North Zone, and we congratulate the Leven group on their fine effort.

for contacts with DL, PAØ, OK, 5N2, W, etc.?" (MRCC) . . . "We found only two stations who reacted to break-in" (Crawley) . . . "MCC is the finest LF-band contest, and with still more practice by many operators it will still improve" (Cheltenham) . . . "We worked GI6YM (in Western Zone like ourselves) for only three points, although he was as far as Scotland" (Cornish) . . . "A number of stations using bug keys need more practice—we found difficulty in reading even the call-signs of some" (Lymington).

"So damp in the shack that our break-in unit started to key the Tx on its own. Our old cottage is supposed to be haunted" (Blackpool) . . . "What a pleasant surprise this contest was, with its high standard of operating" (Stroud) . . . "We borrowed a Tx from one of the locals, and had to fit a key-jack, as there was no provision for CW!" (University College of North Wales) . . . "Why, out of a band 200 kc wide, does everyone have to congregate into 30 kc?" (A.E.R.E., Harwell).

"Non-club QSO's with members of one's own group should not be allowed" (Chorley and Leyland) . . . "Extra hour each evening most welcome—could have done with more" (Loughborough) . . . "Started with a bug key, but this proved too much for other contestants, so went back to brass-pounding" (Stoke-on-Trent) . . . "We really make this a club event and let everyone have a go—eight operators this year" (Burnham-on-Sea) . . . "If GI has to be lumped with some area for scoring purposes, surely it should be GM" (City of Belfast) . . . "Non-Club stations were calling CQ MCC . . . all Clubs should be allowed only one station each" (Purley) . . . "We ran two stations, the intention being to give the newer ops. a turn at the club, while the other one, with two good ops. and a favourable site, went out to win" (Clifton).

That's a pretty good cross-section of the general



The "A" station of the Reigate Amateur Radio Society, signing G3REI, made 592 points to get into 11th place in the November "Magazine Club Contest" (MCC), and was operated by G3NKS and G3FM (logging). Their transmitter was a 3-stage job with an 807 PA; the receiver an AR88 modified to incorporate three 1-lattice filters; and their aerial system consisted of a 60ft. vertical and a half-wave wire. Since Reigate also entered "B" and "C" stations in this season's MCC, both of which gained places in the first half-100, it may be assumed that the Club now has a useful reservoir of experienced operators for the 1964 event!

reaction, and we have had to omit all those who said "Jolly good event, enjoyed by all," and "Looking forward to next year." Thanks, all the same, to everyone who offered comments of any kind.

Great Ideas

As always, suggestions were not lacking. Every year we get the same collection, and inevitably "Why not publish a full list of clubs taking part, with call-signs, QTH's and code letters?" How can we, possibly, when Clubs deciding to enter are writing in for code letters up to the day of the contest, and perhaps even asking for them by telephone at the very last moment? And we never know, in advance, exactly how many are entering, or what calls they are using—neither, in many cases, do they, as often a final decision is not taken until the week before the contest! Any attempt at a full list would necessitate a closing date *more than a month before MCC* and would probably result in halving the entry—nor could it allow for sickness and any last-minute change of plan.

An even more fantastic suggestion was that we should publish and circulate to every club a map of the British Isles, showing the exact location of each club taking part, and a calibrated disc enabling distances to be read off, with a scoring system based on this. (Why, when it is just as easy

TABLE IV
Regional Roll of Honour

	1st	2nd	3rd
1961*	Northern (Hallamshire)	Western (Port Talbot)	Southern (Harlow)
1962	Southern (Gravesend)	Midland (Stockport)	Far North (92nd Sig. Rgt.)
1963	Western (Port Talbot)	Southern (Oxford)	Far North (Leven)

*Prior to 1961 all Clubs competed on an equal-points basis.

RTTY Topics

OPERATING NOTES AND NEWS— IMPROVING MACHINE PERFORMANCE—SOME RECEIVER PROBLEMS IN RADIO TELEPRINTER WORKING

W. M. BRENNAN (G3CQE)

THE writer wishes to apologise for the non-appearance of this feature recently. It has been due to the difficulties brought about by a 280-mile change of QTH—from Norwich to Somerset. Although at the time of writing the move is by no means complete, it is hoped that by the next appearance of the feature, normal RTTY operation will have been resumed! Meanwhile, mail for this column can still be addressed to the old QTH or *via* THE EDITOR, SHORT WAVE MAGAZINE.

New countries continue to appear on RTTY and the latest seems to be FG7XT (Guadeloupe). HZ1AB has been very active, giving many stations their first Asian contact, with the result that W6CG reports a sudden increase in the number of applicants for the WAC RTTY certificate! F9RY/FC (Corsica), in common with three French stations, is equipped for RTTY but is awaiting permission. OY7ML is also likely to have joined the active list by the time you read this. Two of the regulars on RTTY have changed their call signs: KH6COY/KW becomes KW6DS, and ZL3HY is now signing ZL2SN. The RTTY Sweepstakes Contest took place during very poor conditions as far as U.K. operators were concerned. As the closing date for claims in this contest was in December the winner had not been declared at the time of writing this. Whoever he is, he will receive a brand-new Olivetti Lettera 32 portable typewriter, all carriage and Customs dues paid. (This gift was very kindly donated for the purpose by IIRIF.) German stations have until recently been handicapped by severe restrictions on the frequencies they were permitted to use for RTTY. These restrictions have now been relaxed and their new RTTY allocations are: 3575-3625; 3725-3775; 7025-7050; 14075-14110; 21075-21125; 28110-28150 kc; and 145.8-145.9 mc. This of course gives them the use of four new bands. Meanwhile, in this country activity appears to be confined mainly to 2m., 20m. and 80m. On the VHF band G3CRH, G3GGR, G3IIR, G3LAY, G3NES, G6CW and G8DD seem to be those responsible for most of the activity, whilst on 80m. those most often heard are: G2UK, G2DSF, G2HIO, G3HVB, G3LLV, G3OBD, G6CW and G8DD.

Test Transmissions

G2HIO and G6CW are between them running a test transmission at 1100 GMT every Sunday morning on 3575 kc approximately. These transmissions are intended to provide a signal for anyone wanting to check their receiving gear; a series of test phrases is transmitted at both the 50 and the 45.5 baud speeds. The frequency shift used is the usual 850 c/s. Reports on the reception of these transmissions are welcomed and they should be sent to G6CW (QTHR).

The 20m. band seems to have come in for very little attention from G stations recently—with the exception of G2HIO, who now only requires Asia for WAC. This is a pity, since there is a great deal of activity on Twenty and calls recently logged include W, VE, KL7, TG9, OZ, YV, LU, KZ5, XE, II, DL, HZ, ZS, ET3 and 5A5—all on RTTY! VK3KF is now installed in his new shack and turns his beam in the direction of Europe between 0900 and 1100 GMT every week-end. It seems therefore that the DX is still there and all you have to do is to dig it out!

1964 and All That

Radio amateurs are a pretty mixed bunch (of individuals) and Amateur Radio is viewed in many different lights by its adherents. To some, the transmitting licence is only necessary to permit them to go on the air from time to time to test out some new piece of gear they have spent weeks building. To others, any building is done purely to enable them to get on the air and communicate with their fellow amateurs.

Whilst both types of amateur—and of course all the shades in between—are essential to our hobby, it is a fact that as far as RTTY is concerned the man who wants communication and nothing else is unlikely to be satisfied. For one thing, there are not enough teleprinters readily available to provide for a large number of RTTY stations. For another, in order to get on to RTTY a fair amount of building is essential and (because amateur radio T/P working is yet in its infancy) still more building is going to be needed to stay with it. Perhaps the best RTTY man is one who spends half his time in building and experimenting and the other half using the gear he has built, for—let's face it—there's no point in improving a form of communication that is not going to be used. RTTY techniques are improving all the time. During the last few months there has been a great change in the philosophy of Terminal Unit design resulting in a claimed 20 to 30 times better performance than that of the conventional T.U. during selective fading over a DX path. Then there is the gradual adoption of narrow-shift techniques in order to improve the chances of having a QSO without having the odd CW-CQ call splashing through the filters. During the next year we shall have the opportunity of trying out these techniques on the HF bands which are becoming more crowded daily as amateur and commercial stations alike follow the

MUF lower. To some, the crowded bands are a sad fact; to others, this state of affairs merely represents a challenge. Whichever way you view it, 1964 looks like being an interesting year on RTTY.

Improving the Copy

Practically every newcomer to RTTY seems to get his T.U. and printer running after a fashion and then comes up with the same complaint—usually something like this: “Although I can get very good copy from a commercial station I just don’t seem to be able to get any copy at all from amateur stations.” This sort of complaint has been heard by the more experienced RTTY men time and time again and, indeed, most would probably admit that they themselves had the same sort of trouble during their first weeks on RTTY. Unfortunately there is no quick and ready answer to the problem since there may be a number of different reasons for it. Usually the trouble is either in the T/P itself or in the T.U. Anyway it is worthwhile taking a look at some of the causes and cures of not-so-good copy with not-so-strong signals.

Incorrectly Adjusted Machines

There are so many adjustments that can be made to a teleprinter that without either the aid of the instruction manual or someone who knows, it is highly improbable that the new owner will get it working properly. A correctly adjusted machine will accept quite badly distorted signals and turn out perfect copy whilst, on the other hand, one which is badly adjusted may be operating just within its distortion margin. Such a machine will come up with misprints if anything less than a near-perfect signal appears on the keying circuit. In other words, the better the machine adjustment, the more tolerant it will be towards distorted signals produced by deficiencies in the rest of the T/P-to-T/P link. Perhaps the most common maladjustment of amateur machines is the actual motor speed. The RTTY signal contains two pulses which can be looked upon as synchronising signals—these are the start and stop pulses. The start-pulse initiates the activities of the receiving printer and provides a point in time from which the machine can determine the correct moment at which to make the “mark” or “space” selection for each of the five code elements which follow. However, during the period between the start and stop pulses the machine relies purely on *motor speed* to determine *when* to make the selections. These selections are pre-arranged to take place at the centre of each pulse when the sending and receiving motors are in synchronism. If, however, the receiving T/P motor is running slow then the machine will make the mark/space decision after the centre of the incoming pulse and since this error is cumulative, the decision for the second code element will occur even later. If the error is great enough, the receiving machine will be making the selection for the fourth code element when in fact it is the fifth pulse which is incoming. When this happens, a misprint will occur—unless both the fourth and fifth pulses of the signal happen to be both “mark” pulses, *i.e.*, the

same as the following stop pulse. The stop pulse is one and a half times longer than the others and is long enough to give the receiving machine time to catch up and finally come to rest once more.

It is obvious that correct motor speed is most important. Most amateur RTTY operators are fully aware of this but nevertheless it is surprising how often one encounters a transmission running at an incorrect speed. Sometimes this can be due to the DC supply unit for the motor. In some cases it has been found that although the motor speed is correct when the machine is idling, the voltage from the power supply falls when the motor takes a greater load during printing operations, or when another motor (on a reper for example) is also switched on. When the voltage supplied to the motor is too low, the motor governor is unable to function properly.

Another common T/P fault is a form of bias. This is usually due either to an incorrectly adjusted electromagnet and/or the finger setting blade. Both are easily adjusted. With the link between the electromagnet and the control unit disconnected, the force required to move the electromagnet armature from left to right and *vice versa* should be the same—between 8 and 10 ozs. If not, then the adjusting screw at the rear of the electromagnet should be altered accordingly. Having done this, the link should be re-connected and this check again carried out. It should still require an equal (though slightly reduced) force to move the armature either way. If this is not the case, then the finger setting blade will be found to be exerting an unwanted force on the electromagnet armature. The finger setting blade should be removed from its guide and bent slightly up or down until the condition is corrected.

These are the most common faults encountered, but of course the receiving mechanism of a teleprinter is very complex and only a complete check of all the clearances and adjustments given in the maker’s manual is the final answer to the problem.

The Terminal Unit

This piece of RTTY gear is the one which usually receives the most attention from an owner who is trying to improve his station’s performance. A newly built T.U. must be accurately aligned if it is to perform well. The discriminator should give an equal response for an equal change in frequency at either side of the centre frequency. There are so many different T.U. circuits that it is difficult to be specific about teething troubles. Any polar relays involved should be carefully checked. The contacts of any such relays can cause a great deal of RF hash in the receiver and suitable suppression circuits should be included in the T.U. as a matter of course.

The Receiver

Most terminal units are of the audio frequency type and so the receiver BFO is used when receiving FSK. If the two tones required for the T.U. are the usual ones of 2125 and 2975 c/s then the BFO must be adjusted to a frequency 2550 c/s from the centre of the receiver passband. This will place the “mark” and “space” frequencies of the RTTY signal at

equal spacing either side of the receiver IF centre when a signal is tuned in to produce the required two audio frequencies. Once the BFO has been correctly set up for this it should *always* be used in this position for RTTY reception, and tuning for RTTY signals should be done by using the main receiver tuning, *not* the BFO. Many amateurs are tempted to tune a RTTY signal in by BFO adjustment, usually because it has a slower tuning rate than that of the main dial. It is quite wrong to do this—particularly with a receiver possessing a high degree of selectivity, since it results in unequal receiver response to the two RTTY frequencies. A receiver which is lacking in selectivity will give the most disappointing results on RTTY. Many of the older receivers have an IF bandwidth in the region of 8 to 10 kc, which is hopelessly inadequate for receiving RTTY, which only requires about 1.1 kc. On the other hand the single xtal filter often found in these receivers is much too narrow. Some of the selectivity required can of course be introduced after the receiver in the form of an audio bandpass filter. This is inserted between the receiver output and the input to the T.U. Limiter/Amplifier stages. It is usually arranged to pass all frequencies between 1,900 and 3,100 c/s and rapidly to attenuate all others. Unfortunately this is not the complete answer to deficiencies in receiver selectivity, since there still remains the problem of the BFO image. As already mentioned, the BFO is set to 2,550 c/s from the centre of the receiver IF passband in order to produce the 2125 and 2975 c/s tones from the signal and, of course, the bandpass audio filter is arranged to pass these two tones. The trouble is that not only will signals close to the centre of the IF passband produce the signals that will be passed through the audio filter; there is another selection of frequencies that will also beat with the BFO and do the same thing. These are only 4.45 to 4.65 kc away from the centre of the IF. Unless the selectivity is sufficient to attenuate these frequencies by at least 20 dB, strong signals in this region will always cause interference.

A simple check to see how the station receiver performs on this count is to switch on the transmitter VFO and tune it in on the receiver to produce the usual mark frequency in the T.U. Having done this, next move the VFO 4 to 5 kc LF and then the same amount HF. If the T.U. responds to one of these moves you have selectivity problems. Just how severe the trouble is can be judged by how far the receiver gain is advanced before this occurs.

A quick and simple answer can often be found in the use of a Q5'er. Correctly adjusted this will give adequate selectivity for RTTY—about 1.5 kc. The BC-453 (the original Q-Fiver) tunes 200 to 500 kc and so can be set to the intermediate frequency of most receivers. Other solutions to the problem are the use of one or more half-lattice xtal filters in the receiver, or alternatively a mechanical filter. Though expensive, the latter is much easier to install in the IF of an existing receiver and it is possible to make up an IF filter and amplifier unit that is small enough to plug into the socket of the 1st IF amplifier valve which it replaces. In this way there is no need to

modify the receiver wiring at all.

Motor Hash

Unfortunately, almost all the motors used in teleprinters in this country are of the brush type. Although most machines are fitted with some sort of hash filter, these are completely inadequate when the T/P is close to the aerial. Since there is enough noise in the receiver without generating a good deal more in the shack, this is a problem that wants tackling right at the start. Complete screening and filtering of the DC power leads between the T/P and its power supply unit is the answer. A small spark suppressor fixed immediately across the governor contacts is usually necessary, too. Various values of mica capacitors should be tried between each brush holder and earth and of course the main chassis of the machine should be properly earthed. The actual amount of screening and filtering required seems to vary a great deal. Some amateurs seem to get by with very little extra filtering whilst others have had to spend much time and energy on the problem—even in some cases having to fit a small "brush," or collector, to make contact with the main drive shaft from the motor in order to earth it.

There is something that can be done to improve both the transmitting and receiving set-up at most RTTY stations. At this time of the year it might be a good idea for us all to give the matter some thought. We can also further the RTTY cause by spending a little more time on the air whenever possible—it pays to advertise, they say!

See you on the long white paper—and A Happy New Year to all who have read this far—*de G3CQE*.

THE ISSUE OF CERTIFICATES

We much regret that, unavoidably, there has been some delay in the processing of Certificate claims. A large number of reprints of the Certificates themselves has been necessary. The matter is now in hand, and it is intended to get the arrears cleared off as soon as possible.

FILMSTRIP FOR STUDENT ELECTRONIC ENGINEERS

The second of the teaching series of filmstrips introduced recently by the Mullard Educational Service, to assist the teaching of electronic engineering in technical colleges and similar establishments, is available. The first strip in the series, *Thermionic Oscillators*, Parts 1 and 2, dealt with the basic principles of oscillation and the various forms of sinusoidal oscillators. *Thermionic Oscillators*, Parts 3 and 4, resumes the story with an exposition of non-sinusoidal oscillators. It explains the generation of pulses, square-waves, and sawtooth waveforms for television and oscilloscope timebases, and describes in detail the various forms of relaxation oscillator, blocking oscillator and multivibrator.

The filmstrip comprises 22 frames in colour and may be obtained from the distributors, Unicorn Head Visual Aids Ltd., 42 Westminster Palace Gardens, London, S.W.1, price 25/- a copy, including comprehensive teaching notes.

METHOD OF WINDING COILS

TO GIVE EVEN SPACING TO ANY DIAMETER

W. C. GREEN (G3NQ)

VISITING a model-engineer friend recently the writer was interested to note the way in which he made the small springs for his models. It was realised that the method he used would be suitable for making radio coils, and after reading hundreds of books and magazines, and not having seen it described before, the idea is hereby passed on. The tools and material used are simple and easy to make and obtain. No great skill is needed to make coils even up to 1in. diameter and no one need fear the result.

The first thing to make is the winding mandrel (see Sketch 1). This can be of anything round—such as wood dowel, paxolin tube, or metal rod, the latter for preference. A slot is cut in one end of the rod, deep and wide enough to take the gauge of wire that is to be used. At the other end of the rod a means of rotating it is needed. Next, provide some padding material, such as scraps of leather. This, with a bench-vice and the necessary wire, is all that is needed for the production of perfect coils.

Making the Coil

Place the padding between the jaws of the vice and grip the mandrel between them; tighten it up so that it is just possible to turn the mandrel. The slotted end of the mandrel should be about half way along the vice jaws (see Sketch 2).

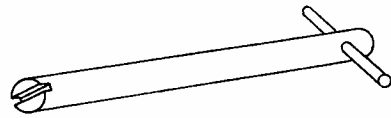
The wire is then fitted in the slot in the mandrel, which is turned with one hand as the wire is fed in with the other. Holding the wire at right angles to the jaws of the vice will give a close-wound coil which can be wound as long as required.

If the wire is fed in at an angle to the vice, a spaced-turn coil will be the result. As the wire is wound on the mandrel, it will look to be close-wound, but on releasing the coil the springing-out effect will give the spacing. It is possible to wind a coil beginning it as close-wound and then to change the spacing several times over its length merely by altering the angle of feeding in the wire. There is no need to straighten the wire—just feed it in from the reel. The writer's first coil made in this way was of ½in. diameter wound with 18g. tinned copper wire, and was perfect.

As in making coils by any other method, the diameter of the mandrel will govern the final dia. of coil required because the coil will expand on being released. For example, to wind a ½in. diameter coil the diameter of the mandrel will have to be less.

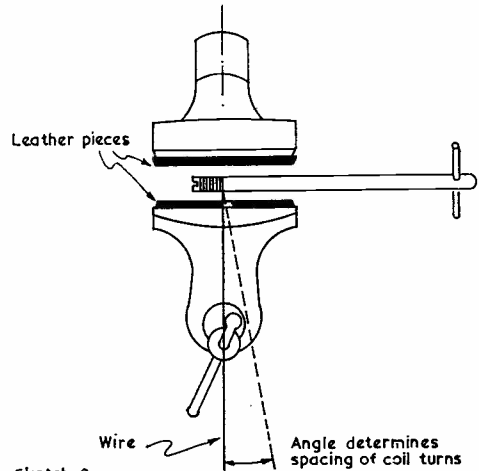
The method of making coils as described here is so simple that it leaves you wondering why you never thought of it yourself—there need from now on be

Q 282



Coil mandrel

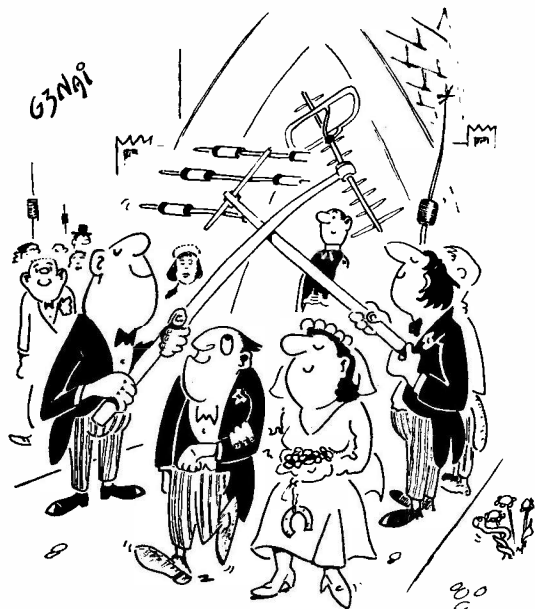
Sketch 1



Sketch 2

Sketches to illustrate the idea explained in the text. It certainly works very well, as we have seen from some samples sent in by G3NQ with his article.

no more tying the wire to a door handle and walking towards it, only to find when the coil is half-made someone wants to open the door.



DX COMMENTARY

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

HAPPY New Year to all readers! May they always find something worth chasing; may they *nearly* always catch it; and may they keep up their regular reporting on their doings, so that this feature may be eagerly read by others who hope to do equally well.

We have just come to the end of a remarkable year for DX—probably one of the best that most of us have ever known, *despite the state of the sunspot cycle*. It seems likely that 1964 will be no worse; in fact, an improvement is likely to be noticed. And in case some of the relative newcomers should ask “What was remarkable about 1963?” let us take a quick look at the winter of 1952-53, for comparison.

Eleven years ago we were at the trough of the previous cycle, although the actual sunspot numbers had not fallen as low as they have during 1963. Yet the opening words of this Commentary (January 1953) were to the effect that DX conditions had reached a new low, but that we should look on the bright side because they couldn't possibly get worse! *Quote*: “A sorry picture indeed, and a state of affairs that must have led to a rise in the sale of Good Books.”

There is none of that kind of feeling around at the present time. One might say that the only effect the low sunspot numbers has had is that *Ten* is not, for the present, a DX band, and that *Fifteen* is pretty spasmodic. The LF bands, by way of compensation, have been very interesting, and Top Band, in particular, has us all cliff-hanging

in anticipation of the next near-impossibility to be achieved.

Right, then—forget 1953 and its dismal forebodings, and let's see what this new year of 1964 has in store. But first let us give thanks for 1963, a wonderful DX year which none will soon forget. In terms of “new ones,” we have to thank that phenomenal operator, Gus of W4BPD, for such remarkable pieces as FR7ZI, FH8CE, FR7ZC/J, FR7ZC/E, FR7ZC/T, FR7ZC/G, FL5A, VS9KDV, 4W1, AC3, AC4, AC5, AC7, 9N1, YA and VS9H. All that lot could have been worked by anyone with reasonable gear and operating ability (and perhaps a little luck!) But the significance of the travels of Gus is this—they have shown that a medium-powered station in almost any part of the world could work these “rare” countries day after day, on a variety of bands, during the one year when nearly everyone thought DX would be at its lowest ebb.

Innumerable other pieces of DX have appeared to cheer or infuriate us (according to the luck of the draw), and on *One-Sixty* we didn't even have to wait for the cold winter mornings before things started happening. Several U.K. stations made their WAC on Top Band (obviously an impossible achievement, we said a few years back), thanks to ZL contacts in the autumn, and even a few VK's since then.

Stations in other parts of the world who can legitimately use more than our miserly ten watts on the band have shown that the next goal is a DXCC on 160 metres. Pioneer-enthusiasts like Stew Perry, W1BB, have provided many newly-licensed G's with a Trans-Atlantic contact to which they never aspired, as well as digging out the most improbable QSO's from all over the world.

Nowadays, it seems, one only has to persuade a station, somewhere or other, to get himself on a certain band, and *someone* will

undoubtedly be able to work him. What an incredible change from the low moans of 1953!

Since a lot of last year's achievements were on CW, we can hardly give the credit to the worldwide adoption of SSB. Probably it all boils down to three things—improved receivers, improved aerials, and greater general know-how. (And, of course, we can only guess at how much we have been helped by various man-made interferences with the ionosphere!)

So—on to 1964, with every hope that the trough will occur fairly early in the year; that the coming peak will be fairly steep-sided; and that a general improvement in Ten and Fifteen metres will begin to relieve some of the congestion on the other bands. Forgive us if we repeat—Happy New Year!

DX-plots, Past and Future

EA9 (Rio de Oro) may be opened up on SSB in March, by PY2PE and PY2PA (the XYL-OM combination formerly famous as CN8MM) . . . Gus was dormant at the time of writing, but is expected to show up at any moment from AC3 . . . VQ9HB will be covering Chagos, Rodriguez, St. Brandon and possibly Agalega, starting around February 14. Mainly SSB, but some CW, 14 and 21 mc only.

Angus, HZ2AMS, claims to have the only official Yemen licence issued—callsign 4W1Z; he hopes to be on from JY-land soon . . . Jan Mayen is now activated by a new one, LA4WH/P, on SSB . . . VK9DR has been operating from Christmas Island with only 12 watts—hopes to QRO to 100 watts soon. VK9MD is using the Hammarlund equipment (14125 kc SSB); VK9MV has been on with 40 watts CW; VK9XI tries on both CW and SSB. Considering the potential activity there, it's strange that this should still be

one of the most difficult spots on earth to find.

JT1CA now signs JT4KAA, but this seems to have no significance, except to prefix-hunters . . . 5N2RSB/TJ8 was heard and worked by a few during December . . . VKØVK was unable to call at Heard Is. after all, despite having spent an extra year in Antarctica largely in the hope of doing just that!

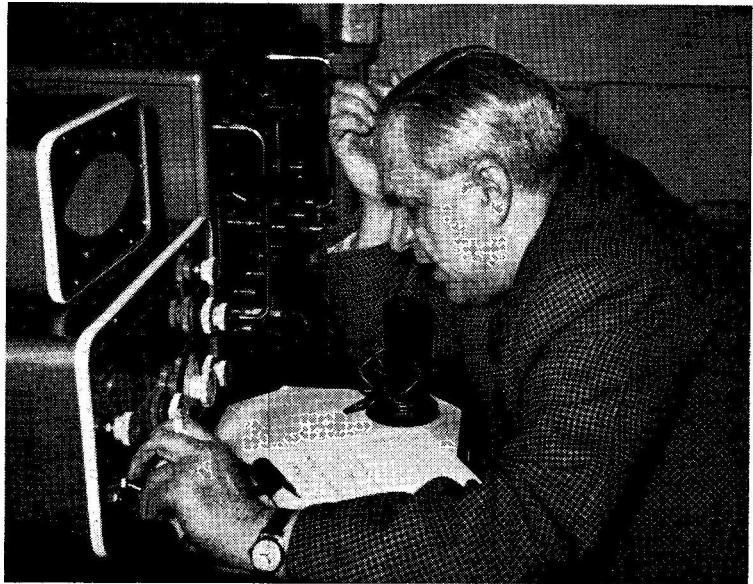
MP4DAH returned to operate from MP4QBG, but by the time you read this he will probably be G3NMQ again . . . XW8AL states that three new Laos stations are on Twenty SSB now—XW8AF, 8AU and 8AV . . . VP1TA is a permanent resident in British Honduras, said to be on 14315 SSB at 2300; 14105 SSB at 1800; and 14001 kc CW at 0300.

HL9KH shut his station down finally at the beginning of December, but proposed operation from YJ1 or FU8, or possibly both, on his way home . . . Kenya duly appeared, after the Independence celebrations, as 5Z4 (5Z4I was the special station). But the new prefix for Zanzibar seems to be surrounded by mystery. They will possibly become another member of the Octal Club!

Top Band DX Topics

The **Annual Trans-Atlantic Tests** opened with a bang on December 1, quite the best day on Top Band since last winter. Dozens of W's and VE's were logged, many of them at 579, with W1BB/1 actually reaching 589 at around 0630. Between 0545 and 0805 on that morning, G3GRL worked VP8GQ, WITX, 2GGL, 1WY, 1BB/1, 3AJS, 2KHT, VE2ATU, VE2UQ, W3GQF and 2IU.

The second test, on December 15, was not quite so good, although many W's were heard and worked. At 0645, VE3AGX was one of the best signals, and W1BB/1 was heard telling everyone that VE4RO was calling CQ on 1995 kc. (This was the signal for quite a few clueless ones to go down to that frequency and call



The station of G3NTE, owned and operated by John Martin at the Mercury House Hotel, 53 Pembroke Villas, Notting Hill Gate, London, W.11. At one time a sea-going radio officer in the Merchant Navy, John Martin lost his sight after being torpedoed during the war. His case was taken up by St. Dunstan's (which exists to look after those blinded on war service) and, having in spite of everything kept up his interest in radio, he is now regularly on the air on 80, 20 and 10 metres, using a Minimitter Mk. III Tx and Minimitter MR-44/II as receiver. Though rather badly placed as regards aerials, G3NTE gets his share of what is going, and nowadays operates mainly on phone.

him . . . really useful, since he was listening around 1825 kc!) W1BB/1 was again the best signal, peaking S7-8 and always outstanding compared with the others.

The strangest things happened, though, before these official tests started. At the week-end of the CQ Worldwide Contest (November 23-24) there was a lot of Top-Band activity, and on the Sunday evening several 'chasers' simultaneously discovered VE2UQ and VE1ZZ around 2215 GMT. Quite a few G's, including G3GRL, 3RBP, 3RRF, 3ORH and 3SCP, proceeded to work the DX as it appeared, and between them they cleaned up W2BYM, 2EQS, 2IU and the VE's. The strange part of all this was that they were workable around 2230 but gradually faded out until the whole thing had finished soon after midnight. Not at all according to the usual pattern.

G3PQA was overjoyed to work 5B4RF, thus completing his WAC on the band (there must be about a dozen of these distinguished Top-Band WAC'ers by now).

Shorts from W1BB: K1KSH is now licensed as VK9GL, whence he has worked ZL3RB on 160m. and heard W1BB/1 . . . ZE3JO made his "first" with W (again W1BB/1!) on November 6 . . . PAØPN did likewise in October . . . and Bob Snyder, who did such wonders from EP2BK last season, is now fully equipped at VS1LP. (DL1FF was heard calling him on December 14.)

W1WY worked DL1FF and several G's on December 1, and says he only hopes these conditions will prevail for the big contest (January 25-26). For this event, by the way, G3IGW and G3JML will be manning GM3IGW/A continuously for the whole 36 hours; the QTH is a "hand-picked" one in Wigtownshire and they propose to put up a variety of super-aerials. (G3IGW was top scorer for the U.K. in this event last year.)

REPORTING ACTIVITIES ON SIX BANDS

G3PLQ sailed again on December 12, this time heading for CT3, ZD3, 9L1, EL, 9G1, 5N2 and TJ8. After that, possibly to the U.S.A., which should make exciting Top-Band listening, especially if the tests are still on. He listens, meanwhile, at 2100 GMT and midnight *every day*, and also at 0500 at week-ends.

General Notes—Top Band

OHØNI was worked by a few G's around December 3-4. And now OH2YV promises to operate from OHØ, January 11-19, around 1824 kc. Also promised (between December 26 and January 5, so you may be just in time)—9A1VU, activated by DL1VU, on 1835 kc.

GM3KLA's mammoth aerial, described last month, seems to have had the effect of making him workable in daylight, right down in the south of England (650-700 miles!); G3IDG raised him at 1100 and says there was no trace of QSB. GM3KLA himself says that with the much greater signal-strengths available the new monster has brought severe cross-modulation trouble on the receiver; His longest GDY contact in daylight was with G5AQ in Sussex, worked 1130-1200 GMT.

GW3FSP describes the 1820-1830 kc area as "key-click corner" and says that some of the DX-hounds think they have a monopoly of this region, and that the manners exhibited at times are no credit to our hobby. Also, he remarks "I don't see why anyone can't put a 10-watter on the air without clicks which spread for 20-30 kc." (We would take this a stage further and say that we don't understand how anyone using 10 watts *can* spread clicks over such a bandwidth.) Dewi called a W8 and a W9 on December 15th without any luck, but W2IU was raised on first call, with a 579 report.

Some Comments from Overseas

G3RJS (m.v. *Crystal Sapphire*) writes from Suez, and says that while off the African coast, and in the Red Sea, he heard HS1S (14 mc AM), YA1AN (14 mc SSB), and VK's and ZL's every morning on both 14 and 21 mc. VS9OC was very active on 20m. AM, but has now left. And at the time G3RJS wrote, the Kuria Muria gang were "giving the ether a bashing" from VS9HAA, VS9HRK and VQ4IN/VS9H.

ZE3JO writes to say that he and ZE3JJ had a pretty good time from Basutoland during the CQ Contest (CW half). With the help of ZS8D they were quickly on the air from a police hut at the top of a hill overlooking Maseru. They had to start up signing their own calls with the ZS8 suffix, but a personal visit to the authorities soon fixed them up as ZS8JO and ZS8JJ. During the Contest, ZS8JO made about 250 contacts, and ZS8JJ over 300; but QSO's with G-land were very scarce, and the

whole of Europe was in short supply. A very high percentage of the contacts gave the chap at the other end a new country, so the expedition was considered well worth while, and the organisers want to thank ZS8D, 8K, 8J and 8C for their help. There is a possibility that ZS8-land will be more active from now on; and next year the boys hope to operate from ZS7 instead—permission was refused this year.

Operating Notes

As the bands become more crowded and the DX chased more keenly, things are bound to be more uncomfortable for all of us. One thing, though, is painfully obvious, and that is that manners are becoming worse and worse, especially in the matter of QSO-busting and QSO-jumping.

Leave that transmitter switched off, for once, and just take a listen on one of the DX bands. You will hear, perhaps, a G, or a DL, or an SM in contact with a VK. You will probably hear both ends, and if things are anything like normal, each time the European station goes over to the VK, whether he sends KN or just plain K, a whole horde of miscellaneous butters-in will also start calling the VK. This happens *all the time* on CW; on SSB it is either "break, break" half the time one is talking, or a bunch of stations treating the end of every over as though it were the end of the QSO.

Take, also, the case of two stations (not necessarily DX to each other) who are in a good old-fashioned two-way QSO, and, what's more, have plenty to talk about. How long can this go on before a loud noise proclaims that "G3XXX" is on the frequency (very often he isn't, quite!) Some of us really ought to forget our natural politeness occasionally and retort "So what!" Busting in on a QSO when you know, and are well-known to, those taking part is one matter, but just barging in indiscriminately is quite another.

Two strangers (to you) are chatting on the street corner: Would you stroll up, tap one of them on the shoulder, and say "I would like to join in your conver-

**TOP BAND COUNTIES
LADDER**

Station	Confirmed	Worked
<i>CW and Phone</i>		
G2NJ	98	98
G3GGS	97	98
G6VC	97	98
G3NFB	94	98
GM3KLA	94	95
G3LWQ	94	95
G3PLQ	92	93
G3REA	92	93
G3OLN	86	92
G3RFE	85	90
G3NFV	85	87
G3PHO	76	92
G3PDM	74	82
GM3IKD	65	75
G3RHM	62	66
G3REP	60	77
G3RJH	54	76
G2BP	53	64
GM3PPJ	52	69
G3IDG	50	54
G3HZL	25	52
<i>Phone only</i>		
G3FS	88	89
G3NFB	85	86
G3RHM	61	66
G2NJ	51	51
G3OLN	36	49
G3LHJ	27	31

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

sation"? Try it some time, then, and see what happens—you might be surprised. Yes, we know that this isn't a real parallel, and that to expose oneself on any amateur band is to invite others in, but QSO-crashing has become the accepted thing, and we don't all have to agree that it's good.

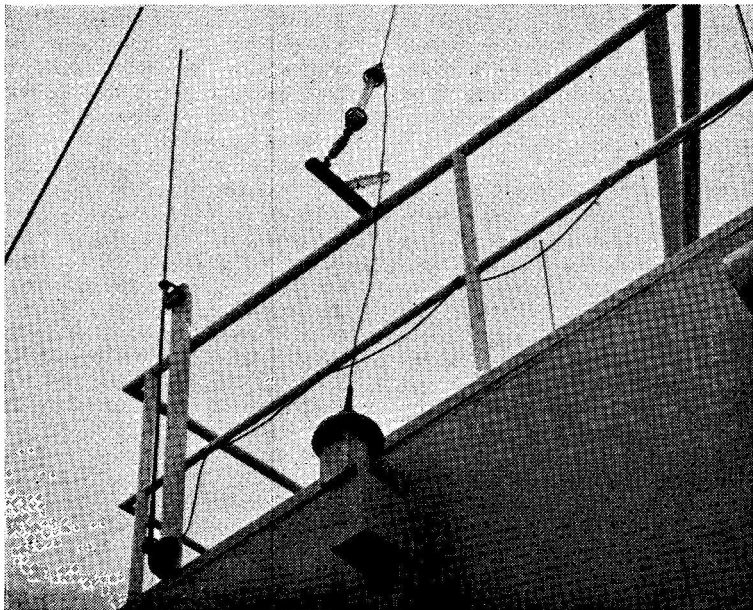
Daylight Robbery

What starts as a more or less harmless pursuit can turn into something really vicious, such as DX-stealing-from-under-your-nose. There are you, quite pleased at having raised a rare piece, but every time you send his call you cause another pair of ears to prick up, somewhere or other. And in due course some gentleman with a ghastly note and a fist like a jackboot will sit bang on the frequency and call the DX station (whom he has not yet heard, having a terrible receiver)—safe in the knowledge that the said DX station will much prefer to work someone else, rather than the person with whom he is in QSO.

G3PLQ waxed eloquent about this phenomenon, which showed up at its worst when he managed to raise VP8GQ on Top Band. Other stations were calling, or testing on the frequency, or sitting 2 kc off discussing how to work the DX. And invariably there is one who doesn't get his report, but says "All OK, pse repeat report" and then has someone else interpret for him. G3PLQ, in plain language, says "If you can't hear a DX station, then, for crying out loud, *shut up* and let the rest of us work him. And if you want to discuss DX and all that, move off the frequency first, and give those who use 10 watts a chance."

Strong words, but necessary. And a special personal raspberry to everyone who whoops and yoops on to a frequency and starts an interminable "CQ DX"—right on top of one of the very stations he would love to work, thereby shattering the eardrums of the innocent party who really was working the DX at the time.

A quick check round the CW end of Twenty, not long ago, found 32 stations pumping out "CQ DX"—nearly all of them UB5's, LZ's, YO's, YU's, HA's



H.M.S. "Protector," now in the Antarctic on protection duties for the Falklands Islands Dependencies and the survey work going on in those parts, has Ken Randall, G3RFH, as a member of the ship's company. He has got G3RFH/MM-VP8HF/MM fitted up very conveniently, and on the trip down into the South Atlantic he had more than 90 QSO's with 23 countries on ten metres — this was during the early part of November. He should now be appearing regularly on 20 metres, signing VP8HF/MM, and will be active till about mid-April. His amateur-band gear consists of a Heathkit VF-1U VFO with a DX-40U, and a Heathkit RA-1 receiver. The upper picture shows part of the aerial installation, which consists of a resonant system for 10 metres and a vertical wire for 20m. VP8HF/MM can be QSL'd via G3OLN or G3RFH, as "Call Book" — and he hopes to work many U.K. stations.

and the various UA prefixes. It must be a special disease which ravages those particular call areas. And the sad thing is that these boys who make all the noise rarely get any results. . .

General Chat

G3NUG forwards a letter from UT5AA, who managed to procure a JTICA card for him, and who says "I can get Russian QSL's—one IRC per card, two IRC's for airmail. . . I made happy many W boys!" UT5AA adds that his club would much appreciate old callbooks and copies of practically any radio publication, which can be sent directly to him: Leo Yailenko, UT5AA, Box 27, Donezk 66, Ukraine, U.S.S.R.

Peter Dodd, formerly VQ4HX, was reported as now being 9L1DO; G3RAM writes to say that he is, in fact, 9L1HX; his home call is G3LDO. (He has no connection with the other Peter Dodd, ex-VQ3PBD, who is now in ZD6-land.)

G2DC comments on the general state of things, as follows:—"Hard to believe that we are

somewhere near the trough of the current cycle. So far, with the exception of the 28 mc band, I have scarcely noted any serious decline in DX. Even on 21 mc, provided there is some such incentive, such as a major contest, the DX stations come through, at restricted periods of course, but all-round DX can be worked during the daylight hours." And he, like ourselves, is still constantly surprised at the absence of SSB on 21 mc—in fact, he recently dug out his old modulator, and with 60 watts of AM he worked 40 countries, of which 28 were outside Europe.

Recent gales did a little damage at G2DC's QTH, as a result of which he had to take his new 40-ft. mast down; but this did him a good turn, since he found that by loading up the 40-metre ground-plane on 80 metres he could get results at least equal to the old long wire. So it looks as though the latter has gone for ever!

"CQ" Worldwide SSB Contest

We have had the advance information about this popular contest, for which the rules have been somewhat changed. *Dates*: April 11-12, 1964. *Times*: 1200 GMT on the Saturday until midnight on the Sunday. Only 24 hours of operation allowed for single-operator stations, and the 12 hours of non-operation may be taken in two periods.

All bands, 3.5 to 28 mc; *Categories*: Single-operator, either all bands or single band; Multi-operator, all bands only. Only one transmitter allowed. Usual five-figure serial numbers; contacts between different continents three points, different countries within the same continent, one point.

Multiplier based on *prefixes*, and each different prefix may be worked only *once* during the contest. Prefix credit can be taken only once, regardless of band.

Logs: Separate sheet for each band. Indicate a prefix only the first time it is entered. Times in GMT; rest periods to be clearly indicated. Full score must be computed by the entrant, and prefix check list to be supplied.

Usual declaration to be made; log forms available from CQ, 300

West 43rd Street, New York 36, N.Y., U.S.A.—Send s.a.e. and one IRC. And all entries must be post-marked not later than April 30.

Awards will go to the highest-scoring single operator station in each country—and each call area of U.S.A., Canada and Australia—for the highest score on All Bands, and the highest on each single band. (For multi-operator stations, all bands only.) Alaska and Hawaii still counted as separate countries, both for scoring and awards.

Around the Bands

Because of delays in the mail (not unusual at this time of year!) we have not been able to incorporate the normal last-minute gen. on what has been worked on each band. However, a general survey is possible. *Top Band* has already been dealt with; *Eighty* has been quite promising, with G2DC working OX3AY, VE, VO, W, UA9, 4X4 and ZL4MF on CW, and many of the SSB specialists raising W's in the early mornings.

On *Forty* almost anything has been possible—if you have chosen the right hours. G2DC's bag includes CX2CO, CN8, HZ1AB, KV4AA, UM8, UI8, UL7, VE8RG, VQ4IV, ZS2HI, VE and all U.S. districts.

Twenty CW (G2DC reporting again) fetched in FB8ZZ and 8BB, JA1-7, EL2AD, MP4BBE, VS9HRK, VKØVK, VP8GQ and XE1AX. And *Fifteen*, on which he has already made some comments, gave him ET3, EL, EP, FR7ZD, HI8MMN, VK's, VS9H, ZS8JO, ZS1-6, 4S7NE and 5X5IU on CW; and, with 60 watts of AM phone, such pieces as EL2S, PZ1BK, PY1-7, VP7NX and 9BY, VK3 and 6, ZD3A, ZL, 5H3IW, 5N2's, 5A, 6YA, 9G1EV and 9Q5HF—all during a 24-hour contest period.

For *Ten* we go over to G3IDG, who reports that the month was not terribly good, although VQ2BC and 2WR were heard on phone; EA8CK, 4X4MJ and 5B4GT on AM. He suggests that the Russians showing up with three-letter calls (UA4HDK, for instance) are probably the novice stations who used to use the "R" prefix instead of "U."

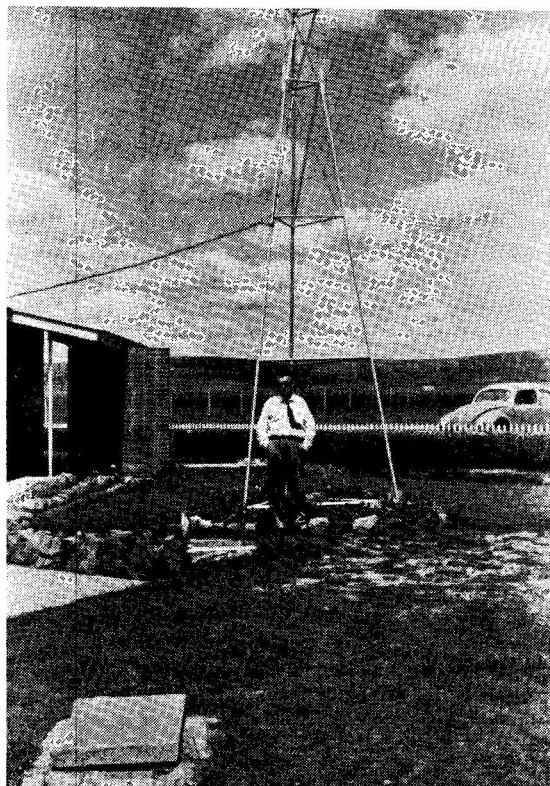
TOP BAND LADDER

(G3P-- and G3R-- stations only)

(Starting Date, July 1st, 1962)

Station	Counties	Countries
G3REA	93	16
G3RRU	91	16
G3PLQ	90	17
G3RBP	87	25
G3PVK	83	15
G3PWY	83	14
G3RJH	76	12
G3RHM	73	11
G3PPE	71	13
G3RQT	69	13
G3RFT	67	12
GM3PPJ	61	12
G13RCS	61	9
G3PRT	53	10
G3PMR	46	10
G3RJM	45	10
G3RJI	45	5
G3RDQ	42	8

(NOTE: The final appearance of this ladder will be in the February, 1964 issue, including all scores up to December 31, 1963.)



Though it has a small indigenous amateur population, Basutoland (ZS8) is still on the "rare country" list. So ZE3JO and ZE3JJ went there for the recent "CQ" Contest period, at first signing ZE3JJ/ZS8 and ZE3JO/ZS8, from a good site at Maseru Airport; they had a 250ft. long-wire, and portable gear. The two operators together made 575 QSO's during the "CQ" week-end (though the U.K. and Europe generally were difficult to work, few contacts being obtained) and then stayed on till the end of the week, signing ZS8JO/ZS8JJ, depending who was on; they finished up with 1,150 QSO's in the log, a high percentage giving the "new country." Though ZE3JO and ZE3JJ had to make a journey of 2,500 miles to mount the expedition, it was well worth it — they found Basutoland a delightful country, and had a lot of help from locals ZS8C, ZS8D, ZS8J and ZS8K in getting organised. In the left-hand photograph here, ZS8JJ is on the left, with ZS8C (local). The other picture is of ZE3JO at Maseru Airport.

Late Flashes

G3GRL had another excellent morning on Top Band, December 15, when he worked fourteen W's and four VE's, including VE4RO. HR3HH was heard but not worked; WIBB/1 was S7 to S9 plus from 0430 until 0810. John remarks that the five-minute sending and receiving periods go by the board on a morning like this—everyone just gets on with it. His 80-ft. vertical (see p.562, December issue) was "pulled down by the local kids," but put up again, after dark, in freezing rain, in time for the Sunday-morning spree!

G3NOF reports *nil* on 28 mc, but HC1MC, KP4BAJ, VP9DL, 5N2LJM, 9G1DM and ZS's on 21 mc AM (also ZS6QK and W's on SSB). The best band was 20m.,

where he raised HV1CN, JA, ST2AR, VE4, VP7CW, 9BY, 9FH, 9FK, VS9HRK, ZL, 9G1EX and 5N2RSB/TJ8, all on SSB. On 3·7 mc SSB he found VP7CW, ZL's and VE's.

G3NWT heard VK6QL say that he had had 220 contacts with G on *Fifteen* this year, and that a particular sked with a G2 had only failed for three weeks in the whole period—and he made a G contact on *Ten* at the end of November. G3NWT also reports that Peter Dodd (Mark I) has been VQ1, 3, 4 and 5 PBD at various times, with other possible excursions; and SWL Dave Gray (Easington) tops this off neatly by having actually heard ZD6PBD in a QSO with ZD7BW. So Peter is not only on the air with his KW-2000, but has collected the callsign he wanted.

Other notes from SWL Gray: W6NRT operated as 3A2CV on 14 mc SSB—QSL's, to home QTH, will be dealt with in the New Year . . . FB8XX has been an outstanding signal on 21 mc AM, and when he was coming in well, VP8DW was also heard . . . TT8AJ very active on 14 SSB (QSL via K2UYG) . . . And VP1TA is there on 14120 kc SSB, best time 1100-1300 GMT, but often rag-chewing with W's and VE's.

Late DX News

Gus, who was due to re-appear from AC3PT, changed his plans because of the death of King Namgyal and the customary six-weeks' mourning period. So he went to Bhutan, put AC7A on the air again, and may show up from the other districts within Bhutan.

Later he will again be welcomed in Sikkim, when the new King will open the palace-shack to him and AC3PT will be in full swing.

FG7XS, FG7XT, VP5LV (Grand Turk) and VP9FK are all on SSB, 14110-14130 kc, between 1230 and 1330 GMT at week-ends . . . G3HCL will be moving to both East and West Malaysia during the spring, and hopes to be active . . . Angus, HZ2AMS, says his trip to the Neutral Zones (9K3) is postponed owing to trouble with his gear—which is also why he has been heard so much on CW lately. He does not like transceiver operation on CW—the pile-ups are terrible!

VK9DR (Christmas Island) showed up on a recent Sunday, working CW on 14045 and listening on 14080 kc, and later on his own frequency.

Harvey, VQ9HB, will leave on February 14 for Chagos and the other spots already mentioned. The following is the plan: Transmit (SSB) on 14115 and 21400 kc, listening on 14250-260, and 21405-

THE ZONE-BAND TABLE

Station	Zones Worked						Total
	28 mc	21 mc	14 mc	7 mc	3.5 mc	1.8 mc	
G2DC	40	40	40	36	25	5	186
G3IGW	36	37	37	31	13	11	165

(Entries for this new table are invited; scores are post-war, i.e. starting from any time back to January 1946.)

450 kc. For CW, transmit on 14010 and 21010, listening 14020-30 and 21020-30 kc. No operation on 7 or 3.5 mc, but he will watch 28 mc for possible openings.

The New Table

The Christmas mail chaos has undoubtedly held out some of the possible entries for the new Zone-Band Table. However, G2DC and G3IGW have shown the way, and we hope to see many more entries by next month.

February will also mark the final appearance of the G3P--/G3R-- Top Band Table, and around the middle of the year we shall have to give the G3S--stations one on their own. Mean-

while, we are also thinking up other possible forms of torture!

Sign-Off

So that is it . . . the first offering for 1964. Apologies for the slightly unusual nature of these columns, and also to any who may have written, but whose letters are still in transit as this closes for press. All should run very smoothly next month, as the deadline is not until **Monday, January 20, first post**. So, please, all news, views, and lots of entries for the new table by that date, addressed to "DX Commentary," *Short Wave Magazine*, 55 Victoria Street, London, S.W.1. Happy Hunting in 1964; 73 and—BCNU.

KEN ELLIS OFF AGAIN

In the July '63 issue we mentioned a survey trip to the Middle East undertaken by Ken Ellis, G5KW, overseas sales representative for Redifon, Ltd., of Wandsworth, London, manufacturers of specialised radio communications equipment for commercial networks and the Services. G5KW has recently gone off on another tour, this time to Syria, Iraq, the Sudan, Egypt, Libya, Greece and Turkey.

4½in. IMAGE ORTHICONS IN "STUDIO FIVE"

Associated-Rediffusion has equipped "Studio Five" at Wembley—said to be the latest, largest and technologically the most advanced television studio in the world—with the 4½in. Image Orthicon camera tubes, developed and manufactured by the English Electric Valve Co., Ltd., in its new factory at Chelmsford, Essex. This factory is the largest single production unit in the world devoted solely to the manufacture of television camera tubes. Pioneers in the commercial development of 4½in. Image Orthicon

tubes, E.E.V. Co. started large-scale production early in 1954. Since that date many thousands of tubes have been supplied to television stations in all parts of the world; in this country all live outside broadcasts originate in an E.E.V. Co. Image Orthicon camera tube.

The success of the 4½in. tube stems entirely from its large storage target which has an area some three times larger than contemporary three-inch tubes. The increased target area gives considerable improvement in signal/noise ratio, resolution, true edge delineation, black halo elimination and grey scale reproduction. Field mesh controlled scanning reduces errors in the reproduction of bright highlights and ensures uniformity of picture level.

R.A.E. COURSE IN SHEFFIELD

We are asked to say that a course for the Radio Amateurs' Examination is being started on January 8 at the Western Road Evening School, Sheffield, 10. For details get in touch right away with: J. Bell, G3JON, 25 Edale Road, Sheffield, 11 (Tel.: 61281).

SWL • • • • •

CHOOSING THE BAND—DX ACTIVITIES — DX/TV RECEPTION—THE HPX LADDER

SOME of the newer SWL's, and also some of those who have been at the game for a long time without much success, must worry about how the "top men" manage to hear all the stuff they do. Is it a matter of the receiver, or the aerial, or the operator's concentration, or what? Well, it is usually a combination of all these three, but yet another ingredient is necessary for success, and that is an intimate knowledge of the behaviour of the DX bands.

So, while SWL "A" is busy scouring 14 mc, and hearing nothing but W's and a crop of Europeans, SWL "B" may be having a crafty look at 21 mc, where he will pick up a couple of new prefixes from Central Africa. And not entirely as a matter of guess-work, either, but because he happened to look on that band, at that time, a few days back, and thought something interesting was stirring there.

When 14 mc is wide open, many stay around that band and log all sorts of easy DX; but if it is really wide open, the chances are that 21 mc will also be doing something of interest. Likewise the division of time between 7 mc and 3.5 mc has to be planned intelligently.

Probably the best times of all are when a band is either just opening up or just fading out. The inexperienced, or the impatient, will pull the switch in disgust; the knowing ones will wait around, aware that the skip is changing rapidly and that something unusual may come up—for perhaps only five minutes—and fade out again.

A recent morning on 3.8 mc phone was a good example. Some G's were on, between 0700 and 0800, working a couple of W1's and a few VE's on SSB. The W's and the VE's went slowly down from S7 to noise level, the G's pulled out and went off to work, and the band was apparently dead at 0800. At 0815 what should show up but two W7's and a WØ! They were very strong but fading, and within fifteen minutes they also had completely vanished.

Remember that this sort of thing is a commonplace on *all bands* in this state of the sunspot cycle, and you will surely add to your collection of countries or prefixes heard. And *never* give a rapid swish over a band, say "It's dead," and leave it—five minutes of patient searching might reveal something a lot more interesting than you would hear on a full and noisy band.

Readers' Activities

Roger Western (Torquay) made good use of all the recent contests to push up his HPX totals, both phone and CW. He finds the HF bands pretty dead

by 1900, but then transfers to Top Band, where GDX and EDX have been very good. On two Sunday mornings he has heard at least seven W and VE stations on One-Sixty. He also agrees with P. J. Lennard's suggestion that British amateurs should try to pick up a foreign language; he himself speaks French and Spanish, and not only does he find it useful for identifying DX that would otherwise have slipped by, but he improves his command of the languages too.

Dave Gray (Easington) is now at the BBC Training School near Evesham, and is making use of the club station, G3PPG, where an AR88 and a long wire are available—and we might mention that they put out a very good, and well operated, signal during MCC. D.G. asks "Why do SSB operators neglect 21 mc, and why do those who *do* venture there all congregate up at the HF part of the band? It is our second largest DX band and there's no reason for mutual QRM." Further comment—the path to the South is often open on 14 mc as late as 2100 or after, with an outstanding signal from VP8GQ many nights.

A. F. Roberts (Kidderminster) says he finds 21 mc the best band for DX, and looks forward to the day when it will be open again for Oceania. (Try week-end mornings, 0900-1200—you may be surprised).

CW—For and Against

The Phone-CW controversy will *never* die down—it has been argued over for the last 40 years!



SWL R. Hodgson of Bookham, Surrey, has his own shack, and his gear includes a TCS-12 Rx for 40-80-160m., with a transistorised converter for 2m. and an RF-27 for 4m. A great deal of apparatus has been, or is being, constructed—such items as an SWR meter, a transistorised el-bug, a crystal calibrator, low-pass filter and dummy aerial load reflecting his intention to pass the R.A.E., which he took in December. He also has a 160m. Tx under construction and a GDO—much of this gear is taken from "Short Wave Magazine" designs. SWL Hodgson, who is a keen member of the Dorking Radio Society, can already do 12's, sending and receiving, in Morse, so should have no difficulty when the time comes. We wish him luck for that pass certificate!

Ten Metres

Our 28 mc band is almost as badly neglected by the SWL's as by the transmitting fraternity. *M. J. Gilding (Kenton)* thinks a lot of European working should be transferred to that band, in view of the strength of the Russian stations who endlessly call CQ. Also, he comments, so much of the activity on 21 mc is AM, and what wonders SSB could perform there, if more would use it.

Some First-Timers

C. Rees (Hatch End) joins the HPX Ladder, but says his main interest is amateur TV, and he is starting on a converter for 70 cm; he also goes for SSB on 3.7 and 14 mc, for which he finds his R.107 quite good.

John Fitzgerald (Great Missenden) has joined the ladder, with a score of 198 on an 8-transistor portable which covers 7 and 14 mc. He agrees that SWL's should follow whole QSO's and not flit about the band collecting call signs.

And a Last-Timer

E. F. Taylor (Birmingham) is now G3SQX, and starts chasing the DX all over again. He was an SWL for only a year, and was wise enough to take an interest in CW. He now replies to the SWL who said "SSB is the only worthwhile listening these days," and retorts "What a ridiculous statement—if he improved his Morse speed a bit he would find DX on a band when SSB, AM and other types gave nothing."

M. English (Yeovil) is the third of our correspondents this month to become connected with a University Radio Club. He is, in fact, the secretary of the newly-formed University College of North Wales Radio Society, and is delighted that he is not cut off from Amateur Radio. Nevertheless he looks forward to the Christmas vacation and some DX'ing from home.

Alan Huggett (Lamberhurst) has been persevering at the high end of 3.7 mc, and was rewarded with good SSB from VE, W, ZL1AIX, YV5BOI, TIØRC and 5A3CJ.

D. S. Smith (Stanmore) is building a new receiver, fully transistorised and needing only a car aerial. On the original design he heard VS1LQ on 21 mc AM, VS9MB, AC3PT and AC7A on 14 mc SSB. But he can't get much out of it on 3.7 mc, for which even a 33ft. wire is much better.

A. W. Nielson (Glasgow) second on the HPX Ladder and one of three Scots in the really high places thereon, is very pleased to see how well his

SWL • • • • •

continued

"ancient B.28" competes with a bunch of S.888A's. His analysis of conditions (Zones and Countries heard) shows that 1963 was almost identical with 1962 on Eighty, Forty and Twenty, but somewhat down on Fifteen and Ten. (Actually Twenty even showed a slight improvement.)

Tape Exchange

Barry Curnow (Plymouth) recently presented a tape recording to the First Minister at the American Embassy; it was made at the Youth Settlement on whose premises the Plymouth Radio Club meets, for exchange with a similar organisation in the U.S.A. Other high-spots for SWL Curnow—a QSL from ZL1ABZ (Kermadecs) for 3.7 mc SSB—a rarity if there ever was one—and the receipt of the CHC Award for Top English SWL in the 1963 CHC party. This brings his total number of awards to 54, and he is still chasing!

VHF and DX-TV

VHF reports come this month from *Malcolm Healey (Horsham)*, who has now heard ten countries and 40 counties on Two; from *David Douglas (Dundee)*, who covers both Two and Four with his AR77E and converters; and from *Martyn Vincent (Cheltenham)*, who reports little listening time because of G.C.E.

Charles Rafarel (Poole) continues his DX-TV researches, and had some very startling results during a big October opening, with 15 new stations identified; but he is even more intrigued with the UHF situation, and 'way up there he has not only received London (BBC II, Channel 33) but also Paris (Channel 22), West German stations (Channels 24 and 41) and several more unidentified stations. This first proof that the UHF bands will be productive of "DX" is very satisfying, and opens up new worlds to conquer. During the November gales, SWL Rafarel's "tip-over tower" was up and down like a see-saw, he says, and he was very glad to be able to fold it up when the really big blows started!

D. Boniface (Ripon) has been rebuilding the shack and learning Morse, so DX-TV has taken a back seat. He now wants some good gen. on suitable VHF aerials—and that's certainly the right way to go about it. He asks, also, for the address of the British Amateur Television Club . . . it is: The Hon. Secretary, B.A.T.C., 4 Inwood Close, Shirley, Croydon, Surrey.

Finally, a snippet of "printed CW" on which mode *Dave Rowan (Farnborough)* logged another 26 prefixes. Not RTTY, this, of course, but Morse received on a printer, which can be an almost equally fascinating business. He is now off to 5B4-land, with a Signal Squadron of the Parachute Brigade.

That winds things up until our next appearance, in the **March** issue, for which the deadline will be **Friday, January 24**. Happy New Year to all SWL's!

Correspondence for the next appearance of this feature, in the March issue, should reach us not later than January 24, addressed: "SWL," c/o The Editor, Short Wave Magazine, 55 Victoria Street, London, S.W.1. Good photographs of SWL interest are always wanted for illustration, and are paid for on appearance.

For The Beginner

IMPROVING THE RECEIVER

The coming of Single Sideband has exposed weaknesses in receivers which, a few years back, were considered excellent. Since many SWL's are looking forward to a call-sign and full transmitting activity, any time spent now on the receiver will be amply repaid in the future. Two aspects are discussed here—calibration and product detectors.

MANY a faithful old war-horse in the shape of an AR88, HRO, BC-348 or R.107, is now causing its owner a certain amount of heartache. Likewise several home-built receivers which were considered very good two or three years ago are now being regarded with a jaundiced eye.

The reason? Overwhelmingly, it is the rapid spread of SSB as the modern method of Amateur Radio communication. The old war veterans still perform just as well as ever on AM phone, but if you are a keen DX man that is not good enough. A look through "DX Commentary," any month, will show you just what you are missing if you are not equipped to regard SSB as the obvious and natural means of receiving phone DX.

Quite apart from this, nearly all but the most modern receivers are lacking in any means of calibration; and if you are looking forward to the day when your receiver will be helping you to *work* DX, then it is highly desirable that it should have an accurately calibrated scale. You ought to be able to switch on and tune your receiver, immediately, to 14115 kc, or 3796 kc, or whatever the frequency may be . . . and how many SWL's (or, at least, novice SWL's) can do this?

A directly calibrated scale is a great help. Once you have used a receiver fitted with one, you will feel as if you have lost one arm when you go back to one of these plain dials calibrated only in degrees (or divisions). And, admittedly, there isn't much you can do about this in most cases, except to draw up an accurate calibration chart showing frequency against dial reading, thus making the best of a bad job.

Frequency Curves

This is not such a tedious business as one might imagine. Certainly it doesn't involve the plotting of scores of known points within one of the amateur bands, because the scales of most of the popular receivers are reasonably linear within the very small sector represented by one of the amateur bands.

Take the AR88 as an example. On the direct-reading scale one can infer that a station is roughly on 7050 kc—

merely because he appears to be half-way between the 7000 and 7100 kc marks. But between these two marks the "degree" scale, you will find, has moved from a reading of 41 to one of 61 (to take an actual figure from an individual receiver). Twenty divisions of the scale to a bandwidth of 100 kc gives the simple answer of "5 kc per division"—and you can draw a straight-line "curve" on a piece of squared paper to correspond with this. *But*—you must know accurately where the 7000 and 7100 kc points fall, and for this you will need a calibrator of some sort.

The most modern receivers have not only a directly-calibrated scale but a built-in crystal calibrator giving 100-kc marks; and some simple means of setting the dial readings to correspond. (The Drake 2B, for instance, has a glass scale which is movable, and if the 7000 kc "cali-pip" does not correspond exactly with the hairline on the scale for 7000 kc, you simply slide the scale along very slightly until it does.)

Fig. 1 shows a very simple crystal oscillator which is suitable for a 100 kc calibrator. The crystal is in a Pierce circuit between the grid and screen of a pentode, and output is taken from the anode circuit, the anode being coupled through a very small condenser (C2, 5 $\mu\mu\text{F}$) direct to the aerial terminal of the receiver. With the constants shown in the Table of Values, this circuit will produce 100 kc "pips" up to 30 mc or even further. Naturally you will insert a switch in the HT line of the calibrator, so that your certain identification of the

Table of Values

Fig. 1. Circuit of 100 kc Crystal Calibrator

C1 = 3-30 $\mu\mu\text{F}$ air-dielectric trimmer	R3 = 1,000 ohms
C2 = 5 $\mu\mu\text{F}$ ceramic	R4 = 250,000 ohms
C3, C4, C5 = .001 μF	R5 = 100,000 ohms
R1 = 100 ohms	R6 = 10,000 ohms
R2 = 1 megohm	V1 = 6AM6, EF91, 6BA6, 6BZ6
	X1 = 100 kc crystal

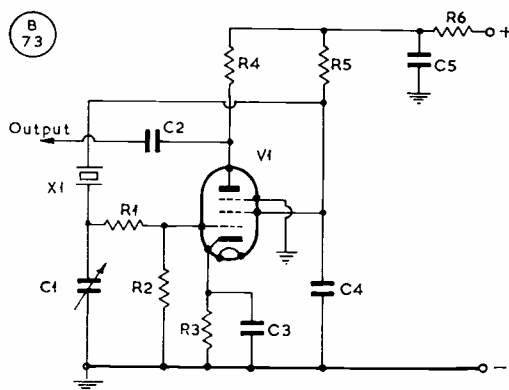


Fig. 1. Typical 100-kc crystal oscillator which, when very loosely coupled to the receiver aerial terminal through C2, should produce audible "pips" every 100 kc through the spectrum. C1 is a trimmer used to shift the crystal frequency very slightly in final checks against WWV.

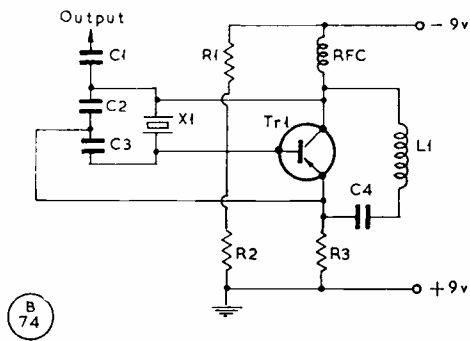


Fig. 2. Transistorised marker oscillator using a 1 mc crystal, although this same circuit can be adapted also for 100 kc crystals. A 1 mc oscillator has its uses, since the harmonics will extend further through the spectrum and should cover the VHF bands.

“pips” is achieved by merely switching them on and off. (Incidentally, this calibrator should be operated at the very lowest value of HT at which the pips are clearly audible . . . and that may be as low as 50 volts.)

However, even without such a device you can still arrive at some useful curves for your receiver, if you have recently confirmed that the direct-scale readings are not too far out. If you can borrow a frequency meter such as a BC-221, or, better still, build your own calibrator, then you can produce really *accurate* curves. Going back to the AR88 already referred to, spot checks reveal that the “divisions” scale gives roughly 1 kc per division on *Top Band*; 5 kc per division on *Forty*; 3 kc per division on *Twenty*; and that the curves come out as virtually straight lines, at least over each 100 kc of the bands. The non-linearity is such that the LF end of *Twenty* may give, say, 3.1 kc per division whereas the top 100 kc gives 3.2 or 3.3.

Finally, if you don't want to have to refer to curves (which does take time) you can draw up a little table relating dial reading with frequency. You may be tempted to write down the dial readings on the one hand, and the exact frequencies against them; but it is surely a little more useful to tackle it the other way. Write down *frequencies*—at 5 kc intervals—and in the adjacent column show the exact dial reading for each one. (You will have to draw a curve in the first place to arrive at these figures, but your table will be more useful than the actual curve for giving a quick frequency-check.) Remember that it is more likely that you will want to look for a station on, say, 14272 kc than that you will hear a station and then want to know what his exact frequency is. Thus, frequencies in the left-hand column, plotted against dial readings on the right, is more useful than the other way round.

Table of Values

Fig. 3. Circuit of Combined Product Detector and BFO

C1 = .001 μ F	R1, R2,
C2 = .01 μ F	R5 = 22,000 ohms
C3 = 0.1 μ F	R3 = 47,000 ohms
C4 = .002 μ F	R4 = 15,000 ohms
C5, C6 = .0025 μ F	R6 = 220 ohms
C7 = .005 μ F	RFC = see text
L1 = see text	V1 = 6BE6

Table of Values

Fig. 2. Circuit of Transistorised 1 mc Crystal Calibrator

C1, C2,	R1 = 33,000 ohms
C3 = 22 μ F ceramic	R2 = 68,000 ohms
C4 = 250 μ F	R3 = 10,000 ohms
L1 = 80 turns 32g. on	TR1 = OC45 or similar
4-in. former	X1 = 1 mc crystal

Fig. 2 shows a simple transistorised calibrator, in which the values given are those for a 1 mc crystal; this, of course, will give you at least one edge of each band and is a useful device to have in conjunction with a calibrated frequency-meter. But the 100-kc calibrator is naturally a far more desirable piece of gear to possess.

Stability

Many of the older receivers are prone to oscillator drift as they warm up. Oscillator circuits can be improved, it is true, but this becomes rather a major operation for the average SWL to undertake and it is not advised until you have reached a fairly advanced stage and had plenty of experience of such things. Calibrate only when the receiver has been running for long enough to be really warm, and, in actual use, don't switch the receiver off if you intend to come back to it in half an hour's time.

This long-term drift or instability is something you get used to; short-term instability is far more serious and makes a receiver almost hopeless for SSB work. A stable oscillator is a *necessity* these days, not a luxury, and if you are unlucky enough to have a receiver in which the oscillator shifts around unpredictably, then you will really have to tackle it. (A change of valve is usually what is needed!) AR88's, on the whole, are extremely stable both from the long- and short-term point of view; HRO's, particularly the war-time models with metal valves, are pretty good on short-term stability but rather horrid over a long period. And if you have the band-spread coils they will naturally make the warm-up shift even more obvious—stations will appear to drift by *ten* dial divisions rather than one!

(over)

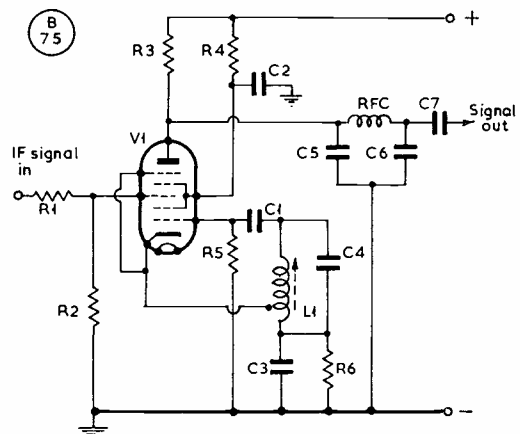


Fig. 3. A product detector with its own BFO, using a pentagrid valve. The oscillatory circuit L1, C4 should be of rigid construction and well screened, and the inductance of the RF choke will depend upon the frequency of the IF and the BFO.

must be in the middle of the band of frequencies that represents the SSB signal, usually ranging from 30 up to about 3000 cycles.) Mark your BFO control to give this position on either side of the zero setting, and use it that way all the time. Remember, too, that upper sideband is customary on the HF bands, and lower sideband on 40, 80 and 160 metres—although you must be prepared for the odd exception to the rule, as in the case of someone who switches sidebands for a quick escape from QRM. One is always reading that AVC should be switched

off for SSB reception, but this is really rather pointless, since it isn't operating when the RF gain is turned well back, as it should be. On an AR88, for instance, with the RF gain about a quarter of the way up, switching from AVC to manual makes no difference whatever.

A modern receiver is a beautiful addition to the shack, these days, but much more can be made of some of the "old brigade" than one would imagine, and it is hoped that the foregoing hints will result in the extended life of a few veterans of this kind.

MONITOR MUTING FOR THE KW-77 RECEIVER

SIMPLE MODIFICATION CIRCUIT

J. D. HEYS (G3BDQ)

MOST CW and SSB operators like to monitor their transmitted signals without having to fiddle with receiver controls after each change-over operation. In most instances this is easily effected by having a pre-set resistor somewhere in the receiver RF/IF gain circuit, to reduce greatly receiver sensitivity during transmission.

Owners of the KW-77 receiver will have discovered that such a check on transmission can be made only on 80m. and that on all the other bands the muting is such that the receiver is completely dead. Muting in the KW-77 is achieved by switching out the screen-grid HT feed to the RF stage, first mixer, and IF amplifier. The HT to the anode of the crystal controlled first oscillator is also switched off. This oscillator is not used when the receiver tunes 80m.

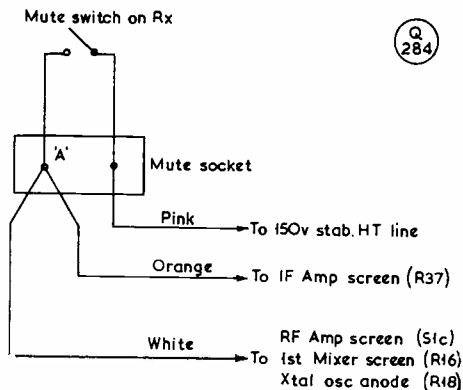


Fig. 1. Sketch to show the original muting circuit in the KW-77 receiver. This gives sidetone on 80 metres only.

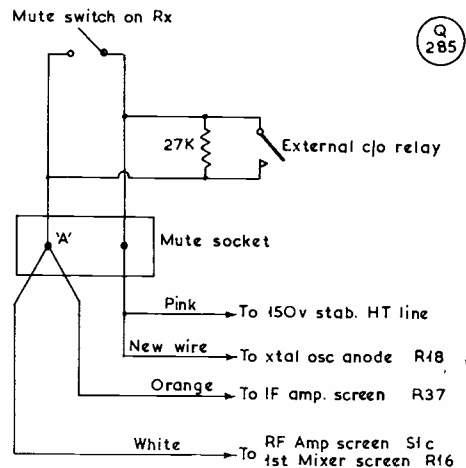


Fig. 2. The modified muting circuit, as suggested by G3BDQ. It provides for listen-through (monitoring) on all bands and, being easy to apply, is well worth incorporating.

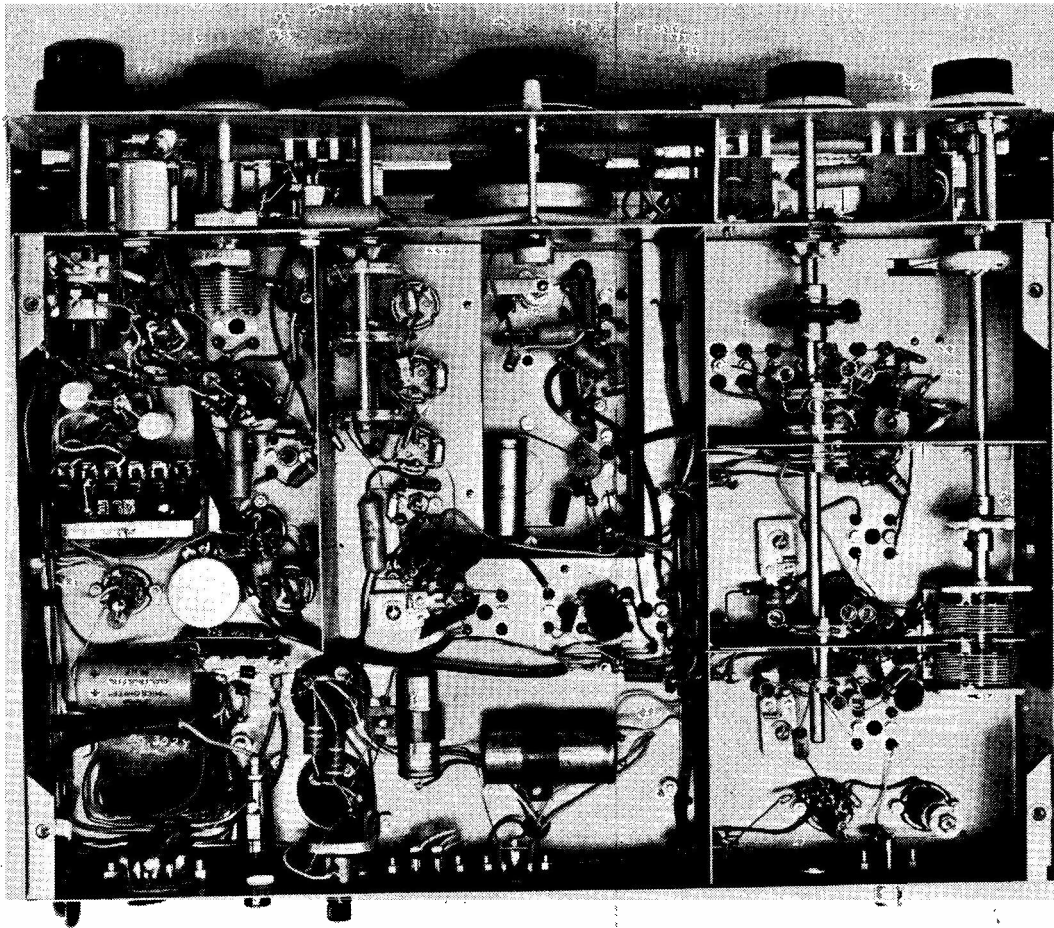
so the muting does not completely "kill" the receiver on this band. On all the other bands the crystal oscillator is essential to the operation of the receiver and it must be working if a listen-through facility is desired.

Modification

When the writer acquired a KW-77 the first thing was to explore the possibility of modifying the muting system without making involved changes in wiring which might reduce the re-sale value of the receiver. Examination of the circuit diagram and the underside of the receiver showed that the job could be done in less than five minutes, and that the original circuit could be put back in about the same length of time.

Fig. 1 shows the original muting circuit with the wiring identified and circuit references as in the KW-77 manual. Fig. 2 explains the modified version. The crystal oscillator HT supply is no longer switched but comes directly from the 150-volt stabilised line; and an external relay which closes when receiving is energised by the station push-to-talk or change-over switch. It was found that the sensitivity of the

With effect from the March issue, the cover price of "Short Wave Magazine" will be 3s. 6d.—see Editorial statement on p.593



Underneath the KW-77, which is very accessible for the purpose of the modification suggested by G3BDO. This is quite easy to carry out and as its purpose is to make monitoring of the radiated signal possible on all bands when the muting switch is pressed, it is well worth doing. In its original form, the KW-77 will only give monitoring on 80 metres; this is explained in the text. Unless the front end is properly protected during transmission — by disconnecting the aerial and shorting the input terminals — the pre-selector should in any case be put well off tune during transmission.

receiver during transmission was inadequate, so a 270K 2-watt resistor was wired across the relay contacts to provide a little HT for the screen grids.

The actual modification involves the unsoldering of the two white plastic covered wires from the lower of the three feed-through insulators located on the central screen beneath the chassis adjacent to V2 (first mixer/oscillator). The two white wires are soldered together and the joint is protected by a strip of insulating tape. The feed-through they came from connects to the anode of the crystal oscillator *via* R18, and a new lead is soldered to it and taken to the 150-volt stabilised line; a convenient point is the lug of

C90a (a metal cased electrolytic capacitor) carrying three pink wires. No other internal changes are necessary if an external relay is used for muting. Should the front panel muting switch be needed to function as a control, the 270K resistor can be wired across the mute socket at the back of the receiver.

Many amateurs hesitate to make any modifications to commercial equipment—but the changes outlined here will be in no way detrimental to the operation or the value of the receiver, and will prove to be the answer for CW, and SSB, operators who normally wear phones and like to know how they sound and that they are dead on frequency.

CLOSED-CIRCUIT TV FOR BBC SOUND NEWS SERVICE

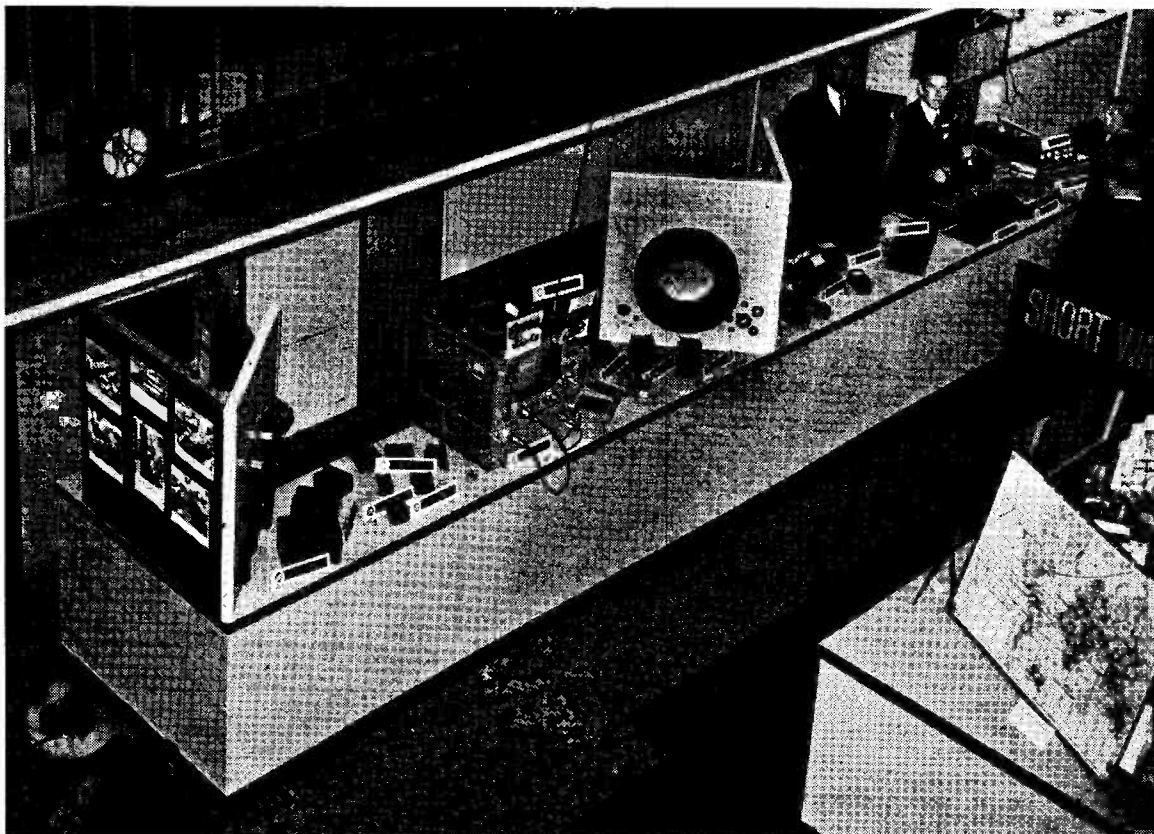
An interesting development to speed the presentation of news items in the BBC's Sound Broadcasting Service is the introduction of a closed-circuit *television* system to provide news readers and announcers with news flashes whilst they are actually broadcasting. Basically, the system comprises an industrial-type television camera using a Vidicon tube operating on 625-line standards which is built into a special cabinet and normally housed in the News Editing Room. The camera has a 1-in. lens and scans the information contained within an area of about 6ins. by 4ins., illuminated by lamps built into the cabinet. The output of the camera goes to the Television Switching Centre in Broadcasting House whence it can be extended to certain sound studios.

When any item of special interest come into the News Room a script is prepared and placed in the cabinet under the camera lens. An image is immediately reproduced on a high-grade 14-in. picture

monitor in the sound studio, and the news reader or announcer can then read the item at a convenient point in his broadcast. An extension of the camera cable terminates in the Sports Editing Room and at week-ends the camera cabinet can be used there for passing last-minute sports items to the studio for immediate inclusion in Sports Report.

ENTRIES FOR THE NEXT R.A.E.

Those intending to take the Radio Amateur Examination in May are reminded that their applications to sit must be in during February—the last day of the month could be too late, because the closing date varies with different centres up and down the country. Apply either through your class tutor if taking a course at a technical college, *or* through the local office of your County Education Authority—*or*, in case of difficulty, write to the City & Guilds of London Institute, 76 Portland Place, London, W.1, quoting "Subject No. 55, Radio Amateurs' Examination."



The stand of Avey Electric, Ltd., at the recent (Amateur Radio) Communications Exhibition. They showed a good selection of their wide range of products, including DC/DC converters; toroidally-wound coils and transformers; a mobile whip aerial with exceptional characteristics; instruments and test gear of interest in the educational field; and a fine display of high-fidelity audio equipment and amplifiers. Mr. John Brown, the managing director of Avey's, said that their results had been very gratifying, with many interesting enquiries, professional and amateur.

VHF BANDS

A. J. DEVON

THOUGH nothing very much has stirred since last we were out, in fact the hard bright weather has from time to time produced short spells of good conditions—as in the early part of December, when EU's were getting into the South Midlands; and the week-end of the 14th/15th, with GDX also coming in during the week following, culminating in a good near-European opening on December 21.

All this is shown quite well on the barograph trace, which has a rising characteristic until about the middle of the month, followed by some rather violent variations, and then levelling off to start going high again to the week-end of the 21st/22nd.

Naturally enough, the generally slack condition of the VHF bands, and the pre-Christmas chaos in which everyone is involved in greater or less degree, reduced the volume of report-letters—and so we have taken the opportunity of running the All-Time Counties table to bring all claims during the last few months right up-to-date. A.J.D. hopes you find yourself where you expect to be—it could well be his fault if you are not; on

the other hand, it might be that we have not been informed.

Turning to the activity, the RSGB's 4-metre CW contest took place on December 1st, under rather poor conditions, and in bad weather. The A.E.R.E., Harwell, boys were out with G3PIA/P in the back of G3NNG's Land Rover, and had 42 contacts for 3,300 points in 12 hours' operating. This seems to have been one of the best scores made—it is certainly the best reported. The general impression seems to be that this contest was hard going—and, of course, as we all know, CW is the least popular of modes!

Other news from the 4-metre front is that G3OHH (Macclesfield) has now worked 34 counties and just 100 stations; that G3FDW showed up as GM3FDW/P from Dumfries, giving many a new county; that G3JYP is now on regularly, for Westmorland; that G3EHY from Banwell, Som. is still a reliable contact for almost anyone in the North; and that the Lancashire group are around 70·260-70·265 mc, operating press-to-talk, "just like 80m. Sideband phones," says G3PMJ. A new station on from Liverpool is G3SKT. As usual, G3PMJ (Gorton, M'cr. 18) puts in a good budget of 4-metre news, and is getting on well in the Counties table. From Birmingham way, G5JU has now got to 33C on the band, and is one of the Sunday-morning regulars.

Those who read about the disaster to the Greek cruise liner *Lakonia*—which caught fire near Madeira on the night of December 22/23 and had to be abandoned—will be shocked and horrified to hear that among the 650 passengers were Harry Wilson, EI2W, his wife and their son—at the moment of writing it is not known how they fared—it must have been a terrible experience. News about the EI2W party is awaited anxiously.

Later: Reported on December 27 that the Wilson party had all been picked up by *s.s. Salta*.

For two metres, there is a report from G2DCG, the QRP man in Margate, who is running a 2-watt Tx almost identical with the G3PQM design in the March '63 issue of *SHORT WAVE MAGAZINE*; with this, he has a 6/6 J-Beam at 34 ft., with a CDR, and a Green & Davis Mk. I type converter into an HRO. G2DCG says that in spite of the fact that he is only 30-50 ft. a.s.l. (depending on the state of the tide!), he has now

TWO METRES

COUNTIES WORKED SINCE
SEPTEMBER 1, 1963

Starting Figure, 14

From Home QTH only

Worked	Station
57	G3BA
52	G3LRP
50	G3GWL
43	G3CO
42	G4LU
40	G3HRH
35	G3SAR
34	GM3LDU
32	G2CDX, G5JU
31	G2BJY, G3PSL
30	G3CKQ
27	G3LAS
26	G3GSO, G3PKT, GW3PWH
19	G2BDX, G3KPT
18	G3EKP, G3ONB
17	G3DVQ
16	G3HWR, G3OJY
14	G3CCA, G3OZF, G5UM, G5ZT

This annual Counties Worked Table will run till August 31, 1964. All two-metre operators who work 14 or more Counties on the band are eligible for entry. QSL cards or other proofs are not required. After the first 14 worked, simply claim from time to time with counties as they accrue, giving callsign and date for the county worked. To keep the Table up-to-date, claims should be made at intervals of not more than two months.

worked 112 stations in 6 countries and 14 counties, and finds that QRP is great fun—of course, with a gainy beam and a good converter he cannot go far wrong, even with such low power. Under good conditions, G2DCG is often a loud signal at A.J.D.'s, at well over 100 miles.

A well-known performer on relative QRP (12 watts) is G8VZ of Princes Risborough, who has been on the two-metre band for years and always puts out a good signal in the northerly directions. He and G3JWQ (Ripley, Derbys.) have maintained a regular schedule, several times each week, which practically never fails—and they have now had more than 1,870 QSO's over a path-distance of about 100 miles.

G4AC (Woodbridge, Suffolk) is fairly active on 70 centimetres, and though rather out on a limb, his score to date is 15 counties and four countries, all on phone, using only a tripling 832A in the output stage. His beam is a 4/4 at 33 ft., the site being 120 ft. a.s.l., and the Rx is a modification of the G3BKQ 70-cm. converter (described in the *Magazine* in our issue for July 1954), using an A.2521 pre-amp, and stub tuner, into a Hallicrafters 5/10 tuning 32-34 mc.

By reason of a confirmed QSO with LX1SI, a move to 12C in Countries is gained by G3BNC (Southsea)—he is on as and when his police duties permit (which, we believe, must be on the mobile side with Hants. County Police, as G3BNC gained fourth place in a recent national road-safety contest).

G3PKT, Rainham, Kent, has been having "beam blown-down" trouble, for the sixth time, but in spite of that has managed to book in a couple of new ones for the Annual. G3SAR (Sevenoaks) has his new equipment working well, and is making good progress. The Tx is running 75w. to a QQV06-40A, into a 6/6 J-Beam; he finds that distances up to about 175 miles are regularly workable and has been running successful schedules with G3RND and G5HA in Yorkshire.

G3GSO (Derby) takes a look round the band most evenings and works "the occasional new one,

along with the locals." On the Rx side, he is now using what he calls the "G3GSO experimental special," this being rather a complicated arrangement involving four Nuvistors—a 6DS4 as RF pre-amp, followed by two 6CW4's in cascode, into a 6CW4 mixer. G3GSO says that this layout is serving him well at his "low-level QTH." Anyway, he's got 26C for the Annual.

An interesting letter from G3IOE (West Denton, Newcastle) brings us up-to-date on his doings. With a new 4/4 outside, he finds he has a consistent path to GI, with G13OFT and G15AJ always workable. After eleven years on the band, the neighbouring county of Cumberland has at last been raised (G3BJD)! And during one of the recent openings, ON4BZ was worked. G3IOE acknowledges the considerable assistance given him by G3BA in getting his converter going properly—following Tom's ministrations, the NF is now down to 3 dB, and G3IOE says it's "working very well indeed." The regular two-metre activity for the north-east includes G3ABK, G3NJZ, G3OLW, G3OZP, G5LH and G6JY who, with G3IOE himself, between them give Northumberland and Durham. And GM3JGF can take it that G3IOE is on the *qui vive*.

G3JLA (Stevenage) writes to bring himself up-to-date in the Tables—probably for the last time under the G call, as he will shortly be taking up a new appointment in Dublin, whence he hopes, of course, to be on with an EI call. It will mean starting all over again in the Tables—never mind; that's all part of the fun, and we hope to hear in due course what the EI call is to be.

Odd things heard recently on, or about, two metres: A well-known G6, running full power, was somewhat embarrassed when he found himself responsible for modulating a local church organ quite heavily; it is of the electronic variety, and the G.P.O. boys had to do quite a lot of technical detective work to find

FOUR METRES

ALL-TIME COUNTIES WORKED LIST

Starting Figure, 8

From Home QTH Only

Worked	Station
40	G3EHY
36	G3PJK
34	G3OHH, EI2W
33	G5JU
32	G3IUD
30	G2OI, G3JHM/A
26	G5FK
25	G3PMJ
23	G3NUE
21	G3AYT
20	G3LZN
19	G3BNL
16	G3BJR, G3FDW, G3OWA
14	G3OKJ, G3HXV
12	G3LQR, G5DS
11	G3HWR
8	G3PRQ

This Table records Counties Worked on Four Metres, on an all-time basis. Claims can be made as for the other Tables, e.g. a list of counties with the stations worked for them, added to from time to time as more counties accrue. QSL cards or other confirmations are not required.

out how and why it was happening, particularly as the church is some considerable distance from the shack from which the unholy QRM was emanating.

At 1310 on December 8, a very strong signal appeared just HF of the beacon, proclaiming, with a strong American accent, that he was "Tack M Maintenance" and that he wanted the "No. 2 Party." Calling and testing and counting went on for some little time, with instructions being given for adjustments to equipment. Though your A.J.D. has a good idea what this was all about, and it is not likely to happen very often, or even again, it is a reminder that it is not only with the aircraft emergency service that we share the LF half of the two-metre band. (Incidentally, has anybody, ever, actually heard an aircraft-

safety transmission on one of those guard frequencies reserved by the Air Ministry?)

Once again, we have to apologise for not yet having been able to clear off the VHFCC claims outstanding. The period from September onwards is always an exceptionally busy one for us, and it has just not been possible to get round to the processing of certifi-

cates—don't worry, it will be seen to in due course.

So that's it for this month, and the year 1963. It has been a pretty good and rewarding twelvemonth on VHF, to which more and more people are being attracted—either because they are tired of the HF bands, or because they have preferred VHF from their beginnings on the air. Certainly, the two-metre population has never been

higher, and it will become much greater still. The prospects for 1964 are good, and your A.J.D. hopes to be able to justify another page or two for this feature.

In the meantime, the closing date for our next will be Friday, **January 24, latest**, with everything addressed: A. J. Devon, "VHF Bands," *Short Wave Magazine*, 55 Victoria Street, London, S.W.1.

Every good wish for the New Year to those who follow this piece—good luck on the air, and off it. *Vy 73 de A.J.D.*

TWO METRES

ALL-TIME COUNTIES WORKED LIST

Starting Figure, 14

From Home QTH Only

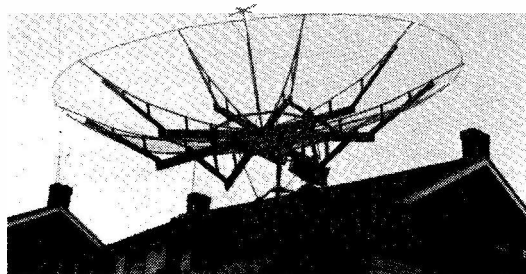
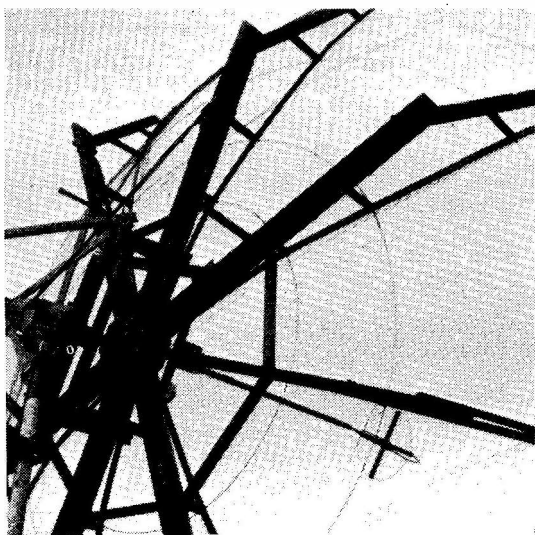
Worked	Station
90	EI2W
88	G3BA
87	G5MA, G6NB
85	G3CCH, G5YV
80	G2CIW (441), G3AOS, G3EHY, G3HBW
79	EI2A
77	G3IUD
74	G3KEQ
72	G3BLP (1,226), G3DKF, G6XM
71	GM3EGW (310)
69	G3HRH
68	G3BW, G3GHO
66	G2OI (585), G3JWQ (569), G3KPT*, G5BD
65	G3CO (742), G6XA (333)
64	G6RH
63	G2FJR (542), G3FAN (1,000), G3JYP, G4LU
62	G3BOC
61	G2HIF, G3HAZ
60	G3DMU, G3IOO
59	G4SA, G5DS (883), G5JU, G8VZ
58	G3LHA, G8OU
57	G3PBV, G8SB
56	G3WW (770), G3NUE (419)
55	G2HDZ (495), G3AQX, G5BM, GW3MFY, GW3MQ
53	G2AJ (519), G3JXN, G4CI
52	G2NH, G3FZL, G3OXD/A, G6XX, GM3DIQ, GW2ADZ

Worked	Station
51	G3LTN, G5ML
50	G3ABA, G3GSE (518), G3NAQ, GW3ATM
49	G3AYC, G3OJY*, GM3LDU
48	G3FIH, G3JLA, G3LAR, G6TA (487), GC2FZC, GW3ATM
47	G3OJY, G5WP
46	G3BNC, G3MTI (242), G3OHD, G4HT (476), G5BY, G6YU
45	G2AHP (647), G2DVD (362), G2HOP, G2XC, G3BJQ, G3GFD, G3MPS, G6GN, G13ONF
44	G2BHN (261), G3BK, G3DVK (282), G3JHM/A, G3GSO, G3NBQ (218), G8DA
43	G2DDD, G2FCL (322), G3COJ, G3DLU*, G3HWJ, G3KHA (262), G3KQF, G3RUH, G3NNG, G3WS, G4RO, G5DF
42	G2AXI, G3DO, G3IER, G3PSL, G5UM (1,026), G6CI (220)
41	G2DHV/P, G2CZS (282), G2FQP, G3FIJ (465), G3JAM (481), G3LAS
40	G3CGQ, G3FUR, G5MR (366), G8KL
39	G2IQ, G3GBO (434), G3LTF, G3NOH, G3OSS, G3VM, G8IL (325)
38	G3APY, G3CKQ, G3HTY, G3SAR, G8VN (190)
37	G2FNW, G2FZU (180), G3CCA, G3DLU, G3MAX, G3OSA, G8DR (482), GC3EBK (260)
36	G2DCI (155), G3CXD, G3DLU*, G3DVQ, G3HWR, G3IFT, G3OBD, G6CB (312), G8IP
35	G3CKQ, G3FYY (235), G3HCU (224), G3IOE, G4LX, G5TN
34	G2AHY (295), G3AEP, G3ILD, G8IC, G8NM
33	G2BDX, G3HHY (125), G3ICO, G3PTO, G4JJ/A

Worked	Station
32	G3BYY* (274), G3HIL, G3NNK (325), G3OBB, G3PTM, G8QY, G8VR
31	G3HXO, G3KPT (180), G5RP
30	G3FRY, G3GOP (208), G3GVF (129), G3IRA, G3KEF (110), G5NF, GM3JFG, GM/GW5UM/P, GW8UH
29	G2CVV, G3AGS, G3AKU
28	G3ITF, G3NPF, G3PKT (283), G8DL, GM3BDA
27	G3CVO (231), G3DAH, G3ISA (160), G3JGY, G3LDY (102), G3LTF/A, G6GR, G13GQB, GW3GWA
26	G2BRR, G3CFR (125), G3KGU (315), G3MED, G3SM (211), G3YH, G4MR (189)
25	G2BLA (138), G3JHM, G3JMA, G5SK, G6PJ
24	G3FD, G3FEX (226), G3FXG, G3FXR
23	G3BDQ, G3CWW (260), G3HSD (168), G3OPR (144), G5PY, G8VN (125)*, GC3OBM
22	G2DRA, G3AGR (135), G3ASG (150), G3BPM, G3GVV, G5AM, G5UM/P
21	G2AOL (110), G3IOE*, G3IWI, G6XY
20	G3EYV
19	G2HDR, G3GCX, G5LQ (176)
18	G3DBP, GC2CNC
17	G3EGG, G3MHD (195)
16	F3XY (200), G3FRE, G3MLS
15	G3IWA
14	G3CYY, G3OZF

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

* New QTH



These photographs are views of the 70-centimetre dish aerial at G3LTF, Galleywood, Essex, as described in the accompanying notes. The diameter of the paraboloid is 15 feet.

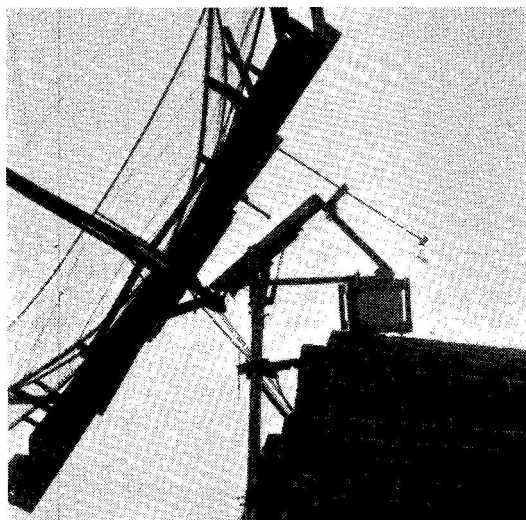
DISH AERIAL FOR 70 CENTIMETRES

INTERESTING AMATEUR INSTALLATION

THE photographs here show the Paraboloid for 70-cm. transmission and reception, designed and constructed by P. K. Blair, G3LTF, Galleywood, Essex. It is on the lines of the dish antennæ familiar in radar work and radio astronomy, and can be regarded as an advanced piece of aerial engineering in the amateur field.

Having a diameter of 15 ft., the centre of the dish is about 10 ft. above ground level. The basis of the structure is a "spider" framework of 4-in. by 1-in. wooden struts held to the centre of an octagonal block, all joints being glued and nailed. At the end of each spider arm a 2-in. by ½-in. wooden piece is fixed at an angle, to support 3/8th inch strips of wood strapping, bent to give the correct shape to the dish. The collecting area consists of ½-in. wire mesh carried on concentric circles of 14g. galvanized wire.

For operation on the 70-cm (430 mc) band, the surface accuracy need only be within 1½ ins., or 1/16th of a wavelength. The dish is fed by a dipole backed by a disc reflector ¼-wave behind it, matched to 75-ohm cable. Mounting of the dish is on a trunnion structure, after the manner of a



telescope, and one axis is aligned on the Pole Star, to give an axis of rotation parallel to that of the earth; since the other motion is from horizontal to vertical, the dish can be aligned to cover a wide sky area in the northern hemisphere.

G3LTF is to be congratulated on his enterprise in building this very fine aerial, on which he has already had some impressive results.

NEW QTH's

This space is available for the publication of the addresses of all holders of new U.K. call signs, as issued, or changes of address of transmitters already licensed. All addresses published here are reprinted in the U.K. section 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.

G3AHO, C. W. Finch, 65 Warlingham Road, Thornton Heath, Surrey (*re-issue*). (Tel.: *THO 4405*).

GM3KJZ, G. Paterson (*ex-VS6DC*), 18 Lomond Crescent, Lochgelly, Fife (*re-issue*).

G3RIV, G. Simpson, 22 Corringham Road, Levenshulme, Manchester 19, Lancs.

G3SKN, D. Naylor, 35 Farding Square, Marsden, South Shields, Co. Durham.

GM3SKX, L. W. Smith, Ernesdaal, Baltasound, Unst, Shetland.

G3SNA, S. J. Andrew, 69 Pine Tree Road, Limeside, Oldham, Lancs.

G3SOE, R. H. Jennings, 37 Springhill Lane, Penn, Wolverhampton, Staffs. (Tel.: *Wolverhampton 36127*).

G3SPP, A. Minett, 45 Patterdale Drive, Warndon, Worcester.

G3SQH, A. D. Reffold, 77 Princes Avenue, Hedon, Hull, E. Yorkshire.

GM3SQI, J. McCole, 204 Copland Road, Ibrox, Glasgow, S.W.1.

G3SQM, A. Smith, 15 Woodland Close, Sands, High Wycombe, Bucks.

G3SQN, J. W. R. Grant, Embers, Kingsdown, Box, Wilts.

G3SQR, P. Friend, 21 Wantage Road, Carrville, Durham.

G3SQX, E. F. Taylor, 5 Bernard Road, Edgbaston, Birmingham 17, Warks. (Tel.: *BEArwood 2581*).

G3SRM, S. Hulme, Crossway Flat, Somerset Bridge, Bridgwater, Somerset.

G3SRQ, R. C. Bissek, 88 Chapel Lane, Sands, High Wycombe, Bucks.

CHANGE OF ADDRESS

G2BTY, L. J. T. Lewis, West Winds, Arbor Lane, Winnersh, Berks.

G2FSJ, E. Thorne, 1 Romsey Close, Eastleigh, Hants.

G3BTQ, J. B. Staker, 5 Church Close, North Street, Anlaby, Hull, E. Yorkshire.

G3BWY, W. J. Crossan, 8A Beckenham Road, West Wickham, Kent.

G3DWQ, G. Lancefield, 191 Higher Walton Road, Walton-le-Dale, Preston, Lancs.

G3EER, N. Carless, 16 Waterloo Road, Alverstoke, Gosport, Hants.

G3FGY, T. Darn, Sandham Lodge, 1 Sandham Lane, Ripley, Derbyshire.

G3GRK, C. R. E. Ayley, 156 The Grove, West Wickham, Kent.

G3HAF, D. M. Heaps, 34 Highgate, Beverley, Yorkshire.

G3HDD, G. W. Seeney, 25 Windermere Road, Reading, Berks.

G3HZP, H. D. James, Mayfield, Rampton Road, Willingham, Cambs.

G3IEX, D. J. Roper, 9 Oulton Road, Fifers Lane, Norwich, Norfolk. (*NOR 62.N.*)

G3IUZ, H. R. Davis, Seaway House, 6 The Beach, Clevedon, Somerset. (Tel.: *Clevedon 3071*).

G3JFS, P. C. Cole, c/o The Red House, Pound Lane, Hemingford Grey, Hunts.

GM3JFS, P. C. Cole, *QSL to G3JFS (station at Lossiemouth, Morayshire)*.

G3JLZ, V. J. Ludlow, 56 Parker Road, Wittering, Peterborough, Northants.

G3KAN, A. T. Shrewsbury, 75 Delapre Street, Far Cotton, Northampton.

G3KML, R. Whitfield, 82B Windmill Road, Headington, Oxford.

G3KPB, S. A. Moore, 17 Rutter Road, South Court, Wingham, Kent.

G3LLV, J. A. McElvenney, 15 Havelock Square, Broomhill, Sheffield 10, Yorkshire.

G3LWC, M. Butchart, Pentre Maelor, Little Blakenham, Ipswich, Suffolk.

G3LXS, J. H. Scott, 2 Carlton Street, Bridlington, E. Yorkshire.

GW3MQX, P. Lane (*ex-G3MQX*), Davies 19, H.M.S. *Goldcrest*, R.N.A.S. Brawdy, Haverfordwest, Pems.

G3MXR, J. Wood, Geraldine Staff Club, Geraldine Road, Great Malvern, Worcs.

G3NGI, G. W. Davey, Rose Cottage, Duddington, Stamford, Northants. (Tel.: *Duddington 221*).

GW3NOP, D. J. Peacock, 6 Tennyson Close, Ferney Cross Estate, Caldicot, Mon.

G3NPU, P. Hill, Alpha, 16 North Street, Cowden, Kent.

G3NPZ, T. J. Griffiths, 16 Chilswell Road, Oxford, Oxon.

G3NZK, P. G. Robson, 32 Brixham Crescent, Ruislip, Middlesex.

G3ODK, N. K. Mort, Harwood, Manor Lane, Penwortham, Preston, Lancs.

G3OJW, Mrs. Joan Crossan, 8A Beckenham Road, West Wickham, Kent.

G3OVO, G. C. Allcock, Sudeley, Dauntsey Road, Great Somerford, Chippenham, Wilts.

G3OWM, University of Newcastle-upon-Tyne Radio Society, c/o The Union Society, Kings Walk, Newcastle-upon-Tyne 1.

G3PER, W. E. Delamere, 47 Bankside Lane, Bacup, Lancs.

G3PIH, F. R. Kent, 101 Ellesmere Avenue, Mill Hill, London, N.W.7.

G3RFG, H. S. Brown, 36 Three Star Caravan Park, Bedford Road, Lower Stondon, Beds.

G3RFO, G. A. Simmons, Plot 10, Cliff Road, Worlebury, Weston-super-Mare, Somerset.

G3RPI, J. V. G. O'Donovan, 25A Mackeson Road, Hampstead, London, N.W.3.

GM3RXU, Dr. I. A. Macpherson, 17 Selkirk Avenue, Paisley, Renfrewshire.

GW5WO, C. F. Woodward, 64 Albert Drive, Deganwy, Llandudno Junction, Caerns. (Tel.: *Deganwy 83724*).

G6QF, W. K. Miller, 10 Leaconfield Drive, Worsley, Manchester.

MOBILE IN A VOLKSWAGEN

ADAPTING EXISTING EQUIPMENT FOR SIX-VOLT CHARGING

C. R. PLANT, Assoc.I.E.E., A.M.Inst.E. (G5CP)

MOBILE operation has been of keen interest for the writer from the time, about nine years ago, that the G.P.O. first permitted U.K. amateurs to operate "transmitting equipment installed in vehicles." The first unit used was a modified ZC1, working on 1.8, 3.5 and 7 mc—this was followed by a Hamobile 144 mc Transmitter/Receiver and in 1957 by a home-built all-band 3.5-28 mc transmitter and Minimitter converter (described in *SHORT WAVE MAGAZINE* for July, 1957).

The ZC1 was installed in a Chrysler, the Hamobile in a Standard Vanguard, and later a Jaguar, in which also was the all-band equipment—in all these cars there was plenty of room for radio gear and the ancillary equipment.

The writer has recently changed to a Volkswagen 1200 and the object of this article is to show how the equipment was installed in the limited space available in a V-W.

Initial inspection ruled out the possibility of being able to accommodate the all-band transmitter and receiver, together with the associated battery and power packs, and an enquiry was put out to manu-



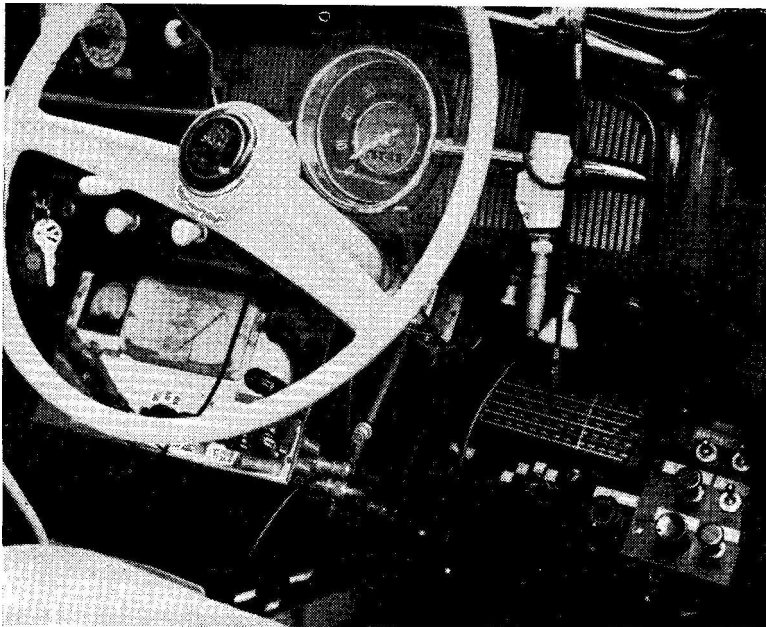
G5CP of Chesterfield, Derbyshire, has been active /M ever since the mobile facility became available to U.K. amateurs, just nine years ago. He was one of the /M's at the first Mobile Rally ever held in this country — at Oxford, on October 9, 1955 — when the count was barely 25 vehicles actually fitted mobile.

facturers for miniaturised /M equipment. Delivery dates being too late for the annual holiday, a second look was taken at the new car. This resulted in a

trial-and-error method of fitting and the final result is shown in the accompanying photographs. The transmitter, speech pre-amplifier and converter were bolted to the underside of the instrument panel housing, and the power supply units, tractor battery, IF amplifier and relay box fitted in the boot. The Master-Mobile aerial, clamped to the off-side rear bumper bracket, is connected to the transmitter by 72-ohm coax cable run under the car and entering the boot through a convenient drain-hole beneath the spare wheel.

Due to the size of the transmitter it was found necessary to slide the driver's seat fully-back to allow satisfactory operation of the pedals, but the passenger had adequate leg room.

The control panel was bolted to the converter cabinet and gave the following services: 1, Heaters on; 2, RF 500v.; 3, Transmit; 4, Modulator 400v.; 5, Audio gain; 6, BFO. The crystal microphone is suspended by a neck



The G5CP mobile installation in his Volkswagen 1200. The transmitter is a K.W. "Valiant," which gives all-band coverage and runs a 6146 in the PA, and the receiver is a Minimitter. The diagram at Fig. 1 shows the general equipment layout.

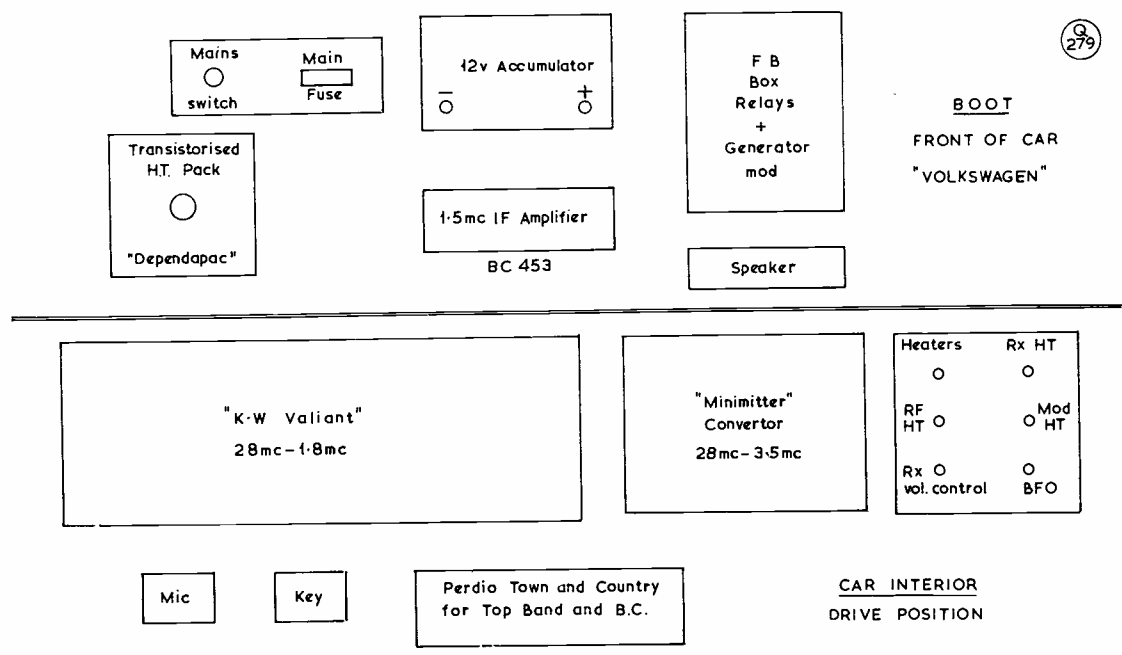


Fig. 1. General equipment layout plan for the G5CP/M installation in his Volkswagen 1200. Since it was a matter of accommodating units that were fairly large physically (having come out of previous cars having more space) their placing had to be worked out rather carefully. Another problem, discussed in the article, was that the V-W has 6-volt electrics, whereas the existing mobile gear was designed for a 12v. system.

cord, thus freeing both hands for driving.

Because of the possibility of explosive fumes being present in the boot—the petrol tank and the battery can produce these—a flame-proof cast-iron box was used to house the relay and modulator rotary generator.

Power Supply

A Dependapac 150-watt transistorised power pack provides the high tension for the RF section—it is intrinsically safe in an explosive atmosphere and did not therefore require any special treatment. The Volkswagen has a 6v. negative-earthed system, but the mobile gear is designed for a 12v. positive earth. Hence, the problem of charging the /M radio battery presented certain difficulties.

Because the 12v. battery was a block unit it was at first thought inadvisable to modify it in any way; but after an examination of possible alternative methods, including a transistorised oscillator charging unit, it was decided to take the easy course by cutting the lead strap, thus making two 6v. units. This made it possible for them to be paralleled and charged from the car system, but in order to do this easily a Santon 15 amp. 4-pole change-over switch was obtained and wired into the circuit, as shown in Fig. 2. This method has proved to be satisfactory, a charge rate of 8 amps. being obtained with the headlights off, dropping to 3-4 amps. as the battery comes up to a fully charged condition; even after a prolonged period of charging the dynamo shows no sign of overheating.

It is advisable to locate the Santon switch near the 12-volt battery and for the connections to be run in heavy-section copper wire; the writer used 7/029's for this purpose. An 0-10 amp. miniature meter, together with a suitable toggle switch, is fitted near the driving position so that the charge-rate can be continuously observed; this panel is secured by the bolt which holds the steering-column bracket.

The series-parallel c/o switch was included so that the remote battery can be isolated from the car

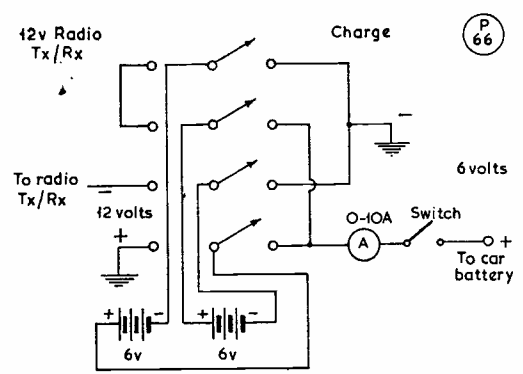


Fig. 2. Circuit arrangement devised by G5CP for putting series'd 6v. accumulators on parallel charge with the 6-volt system of his Volkswagen—his original /M gear being designed for 12v. electrics.

system. It is also useful because (a) When the engine is not running there is often a balancing-current flow from one battery to the other, and it may be desired to stop this; (b) It is an advantage, if the car battery is frequently used for starting the engine, temporarily to allow the full charge to go into the car battery and then, after a period, to switch in the remote battery.

It became increasingly apparent that the original bulky transmitter could only be looked upon as a temporary expedient. By good fortune a K.W. "Valiant"—the ideal for all-band mobile operation—

became available and was installed in place of the original unit. Being only two-thirds the size it has not only improved the appearance of the layout, but has given normal leg-room for driving.

Immediately following this modified installation, a holiday was taken in North Wales, when many contacts were made on all bands, except 10 and 40 metres. The results on Top Band and 3.5 mc were very good and occasional excursions to 14 and 21 mc were also rewarding; the outstanding contacts were with OR4F (Belgian Antarctic) and PY7ABY, using only the whip aerial.

EXTENDING TEST-METER RANGES

AND A MULTIMETER EXTENSION UNIT

G. A. W. PARTRIDGE

DURING the last few years multimeters have improved tremendously. The old low-resistance type with its limited range has been superseded by highly sensitive makes that can be put to a remarkable number of uses.

However, some of the older instruments need not be discarded as useless. Provided that a meter is not less than 1,000 ohms per volt it can still be used for general test work, but on low-power circuits it is better to employ an instrument with a sensitivity of not lower than 5,000 ohms per volt in order to avoid too great a current drain.

For example, a 1,000 ohms per volt meter will draw 1 mA at full scale deflection on its voltage ranges, but a 5,000 ohms per volt meter will only draw 200 μ A.

The limited range of these older meters can be easily increased, thus making them more useful. For example, a multimeter still in good condition, with the highest voltage range at 0-500, and the sensitivity at 1,000 ohms per volt, is to have a 0-1,000 volt range. It will therefore be necessary to place a resistor in series with the meter.

The total resistance will be: 1,000 ohms per volt \times 1,000 volts = 1,000,000 ohms.

On the 500-volt range there will already be an internal resistance of: 1,000 ohms per volt \times 500 volts = 500,000 ohms.

So, to increase the 500-volt range to 1,000 volts, it is only necessary to add another 500,000 ohms, thereby bringing up the total resistance to 1,000,000 ohms. Fig. 1 shows the idea. All readings on the 0-500 volt range must be multiplied by 2. It will now be seen that any multiplier (usually rated at 1 watt) can be calculated for any voltage provided the sensitivity of the meter is known. If it is unknown,

connect a milliammeter in series with the meter and find out what current it draws at full-scale deflection. Use any suitable range as the sensitivity usually remains the same on all DC ranges. (Fig. 2). A small rheostat (volume control potentiometer type) will enable the meter to be adjusted to full scale deflection.

For example, the current is 500 μ A and the 5-volt

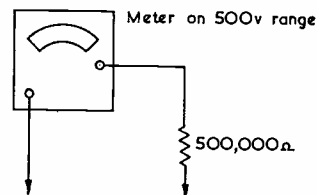


Fig. 1. 0-500volt range increased to 1000v.

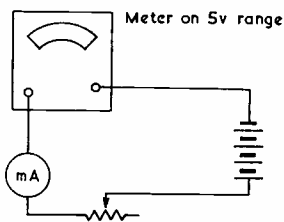


Fig. 2. Measuring meter sensitivity.

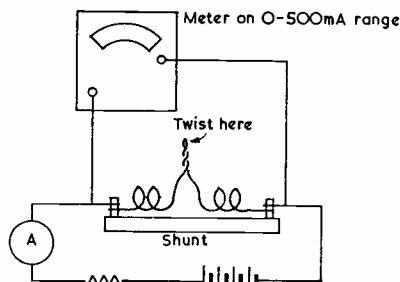


Fig. 3. Shunt calibration.

range was used.

$$\begin{aligned} \text{Total resistance} &= \frac{5 \text{ volts}}{500/1,000,000} \\ &= 10,000 \text{ ohms.} \\ \text{Ohms per volt} &= \frac{10,000 \text{ ohms}}{5 \text{ volts}} \\ &= 2,000 \text{ ohms per volt.} \end{aligned}$$

Current Ranges

The milliammeter ranges can be extended to amperes by using a suitable shunt. Make one up out of a short length of resistance wire and mount it between two terminals, as shown in Fig. 3. Make sure that the wire is thick enough to carry the current without heating. Calibrate the shunt by connecting it to a battery through a reliable ammeter and a resistor. The latter (which can be a valve heater) reduces the current to a suitable value. If it is intended to increase the 0-500 mA range to 5 amps. (5,000 mA), all the 500 mA scale readings will have to be multiplied by 10 (5,000/500). In Fig. 3 the ammeter reads, say, 4.2 which is 4,200 mA. With a pair of pliers twist the shunt wire up until 420 mA is indicated on the multimeter. It is now calibrated to the right value.

Adjusting Resistance Ranges

The resistance range can be doubled by adding an extra 1.5 volt dry cell and a rheostat, provided that the internal cell is also 1.5 volts. Fig. 4 illustrates the idea. First of all, short the meter leads together and adjust for "zero ohms." Now connect up the extra 1.5 volt cell and rheostat, which should be about 5,000 ohms, and this time use it for re-adjusting to "zero ohms." The Ohms scale will now be doubled; 10,000 ohms will be 20,000 ohms, and so on.

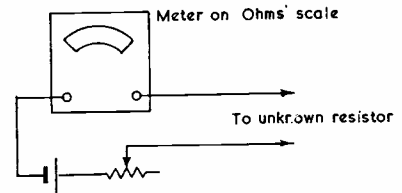


Fig. 4. Doubling the resistance range.

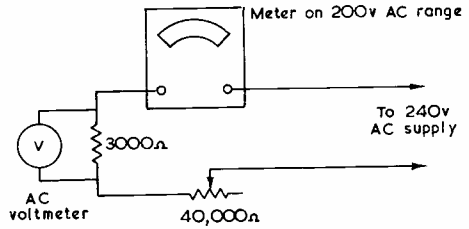


Fig. 5. Measuring AC sensitivity.

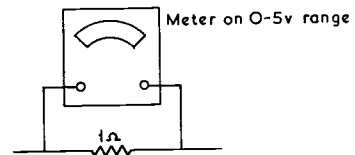


Fig. 6. Measuring AC current.

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AC Measurements

The AC voltage range can be increased in exactly the same way as the DC ranges except that it is essential to use a non-inductive resistor. The ohms-per-volt may not be the same as it is on the DC range. If it is unknown use the circuit shown in

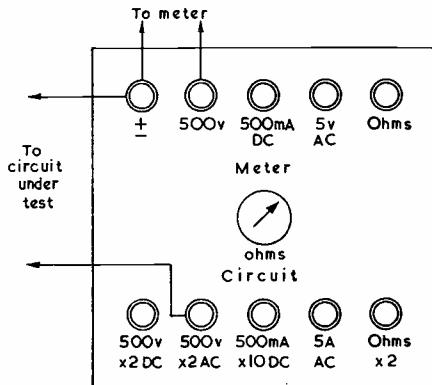


Fig. 8.

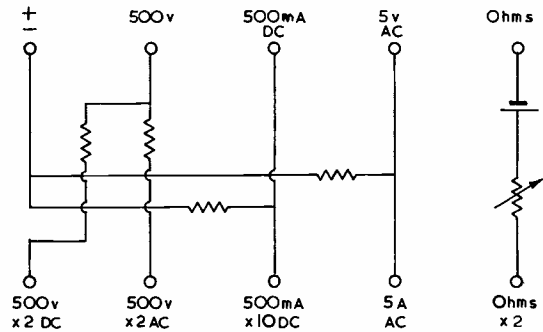


Fig. 7

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At Fig. 7 is the adaptor circuit evolved from the discussion in the text on extending the ranges of a basic multimeter. The idea is to enable those who may possess a test meter of an older pattern to put it to good use by the addition of shunt and series resistors, the calculations for which are explained in the article. At Fig. 8, on the left, is a suggested panel layout, which can be varied to suit individual requirements.

Fig. 5 to find the current consumption at full-scale deflection, and then calculate the sensitivity.

For example:— Adjust the rheostat until the meter reads at full scale deflection on the 0-200 volt range. If the AC voltmeter reads 3 then the current in the circuit will be:—

$$\frac{\text{AC voltmeter reading}}{\text{Resistor value}} = \frac{3}{3,000} = 1/1,000\text{th amp.}$$

The meter impedance will be:—

$$\frac{\text{Voltage at Full Scale Deflection}}{\text{current}} = \frac{200}{1/1,000\text{th amp.}} = 200,000 \text{ ohms.}$$

The ohms per volt is therefore:—

$$\frac{\text{Impedance}}{\text{Voltage at Full Scale Deflection}} = \frac{200,000}{200} = 1,000 \text{ ohms per volt.}$$

Now proceed to calculate the multiplier value in the same way as it is done for a DC range.

Many multimeters have no AC current ranges. However, this can be overcome as shown in Fig. 6. If the meter has a 0-5 AC voltage range, use a one-ohm resistor and it will be converted into an 0-5 amp. AC range. The same idea applies to any other low AC range.

These circuits can now be combined into a single unit as shown in Figs. 7 and 8. The upper terminals are connected to the meter only, except the \pm one which is common to the meter and the circuit under test. The lower terminals are for the circuit under test only. The ohms rheostat, which is a volume control type potentiometer, is mounted in the centre.

The entire circuit can be fitted into a suitable box. The terminals should be clearly marked in order to prevent confusion, and also to give a neat appearance. Fig. 8 shows the unit ready to test a 1,000-volt AC circuit.

IMPROVED AMATEUR FACSIMILE RECEIVING EQUIPMENT

MODIFICATIONS ON THE ORIGINAL DESIGN

J. B. TUKE (GM3BST)

Some years ago, our contributor broke new ground in the amateur constructional context by describing apparatus of his own design and construction for receiving facsimile transmissions—the system whereby black-and-white pictorial matter (such as weather charts) can be reproduced from radio signals. His equipment involved some interesting mechanical as well as electronic problems. Ever since the original article by GM3BST appeared in the Magazine during the summer of 1959, there has been a continuing interest in it. Here, our contributor discusses some improvements to his design, to give better pictures and easier control and operation—Editor.

IN the April, May, June and October, 1959, issues of SHORT WAVE MAGAZINE, an article was published entitled "Taking Facsimile Transmissions," describing the writer's construction of a facsimile receiver. As mentioned in the Editor's note at the head of that article, at the time the subject was hardly one of general amateur interest; nevertheless, considerable correspondence followed and letters from interested readers still come in from time to time asking for details of the equipment, as the issues in which the original article appeared are now right out of print.

The interest that has been shown is the principal

reason for this second article, which outlines the changes and improvements in the equipment that have taken place since 1959, in the light of experience gained. The present state of the facsimile receiving equipment is such that it is considered to be entirely adequate for the purpose for which it is designed.

For the benefit of those who may not have seen the original article, a short description of the complete system is that the receiver is designed to copy weather maps transmitted from various Meteorological Broadcasting Stations, using A4 (Facsimile) type transmission. Very briefly the overall system works as follows: The picture to be transmitted at the Weather Office is wrapped round a revolving drum, and is scanned by a photo-cell device which moves slowly parallel to the axis of the drum while the latter is rotating. This, in effect, scans the picture in a series of lines. The signals from the photo-cell modulate a transmitter by changing its frequency, and since the large majority of transmissions are not concerned with half-tones but only with black-and-white, the transmitter will radiate a form of frequency shift signal, radiating on one frequency for "black" and another for "white." These frequencies are in the order of 800 cycles apart for the HF bands and 300 c/s apart on the LF bands (below 200 kc). At the receiving end, the signal is picked up on a standard communications receiver, with the BFO switched on—the result being a two-tone output, one tone corresponding to "black" and the other to "white." In the writer's equipment, the lower frequency of the two tones is the "white" one. This composite signal from the receiver is fed to the facsimile receiver proper. The white tone is now removed by some form of AC bridge circuit and the black signal is then applied to a writing stylus. In the equipment at GM3BST, this stylus rests on electro-sensitive paper wrapped round a rotating drum, the stylus moving along the surface parallel to the drum axis; as the stylus "writes" on the paper for each impulse received, the picture is built up as an exact replica, or facsimile, of the picture as originally

transmitted.

The main design requirements at the receiving end are (a) To amplify the black signal to the correct value and apply it to the writing stylus; (b) To arrange that the drum rotates at exactly the same speed as the transmitting drum (there is no synchronization as in TV), and (c) The mechanical arrangement of motor, gearing and drum speed control.

Tone Selection

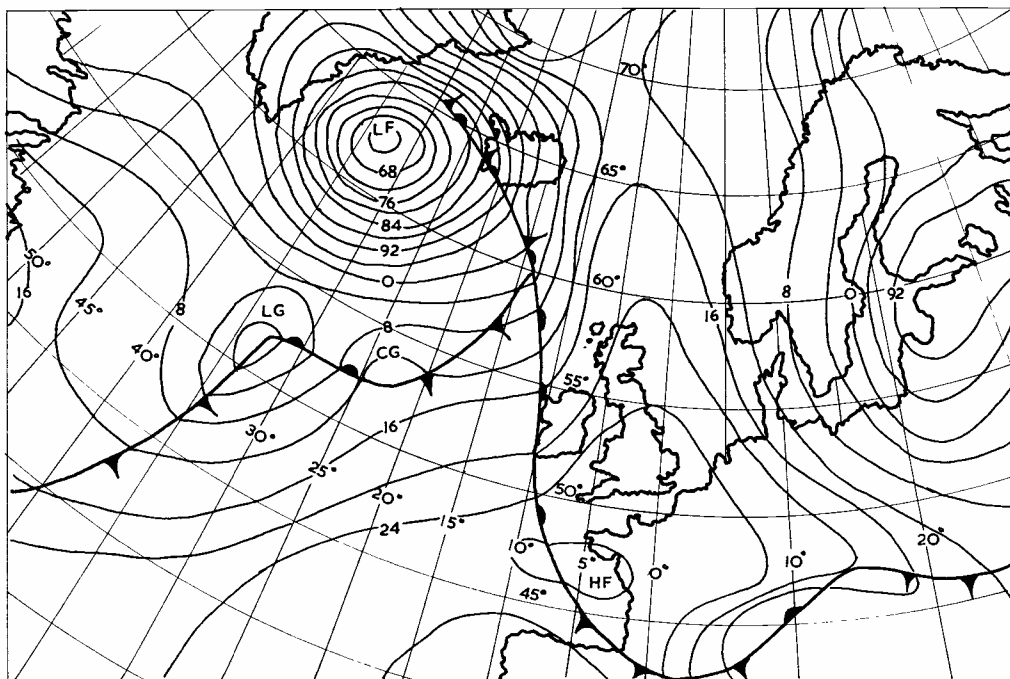
Dealing with the signal requirement first, the amplifier in use is similar, though not identical to, the original. When the "black" tone has been isolated by means of a Wien Bridge, it is fed to a two-stage amplifier using a 12AX7, followed by a 6AQ5 output stage. The 12AX7 has frequency-conscious positive feedback (identical in operation to the GM3BST RTTY converter) and this is used to peak up the black tone and provide additional AF selectivity. The tone selected has been increased in frequency compared with the old equipment and is now 2400 c/s. It was found when using a lower frequency that the individual cycles could be seen on the paper, causing some loss of definition. The black signal from the 6AQ5 is fed by choke capacity output to the stylus. A further AF choke between stylus and earth prevents low frequency signals from marking the paper—in fact the whole output circuit acts as a high-pass filter. A small condenser is connected between stylus and chassis, directly at the writing point, as it was found that TV

interference could be caused by the small spark present when writing. Even facsimile can cause TVI!

The mechanical arrangement of the receiver is best shown by the accompanying photograph. Meccano parts are still used particularly for the gearing, but the drum now runs on ball bearings instead of plain bearings as in the original. The drum has been increased in size from two to three inches in diameter and is now 13 inches long. This has proved a very worthwhile improvement as the charts produced now measure either 10ins. x 6ins. or 10ins. x 12ins. according to the type of transmission. A simple Meccano dog-clutch has also been incorporated in the stylus drive so that the drum can revolve without the stylus tracking—this is useful for tests and the stand-by condition. A geared hand-drive is also incorporated to return the stylus to the starting point after completing a map.

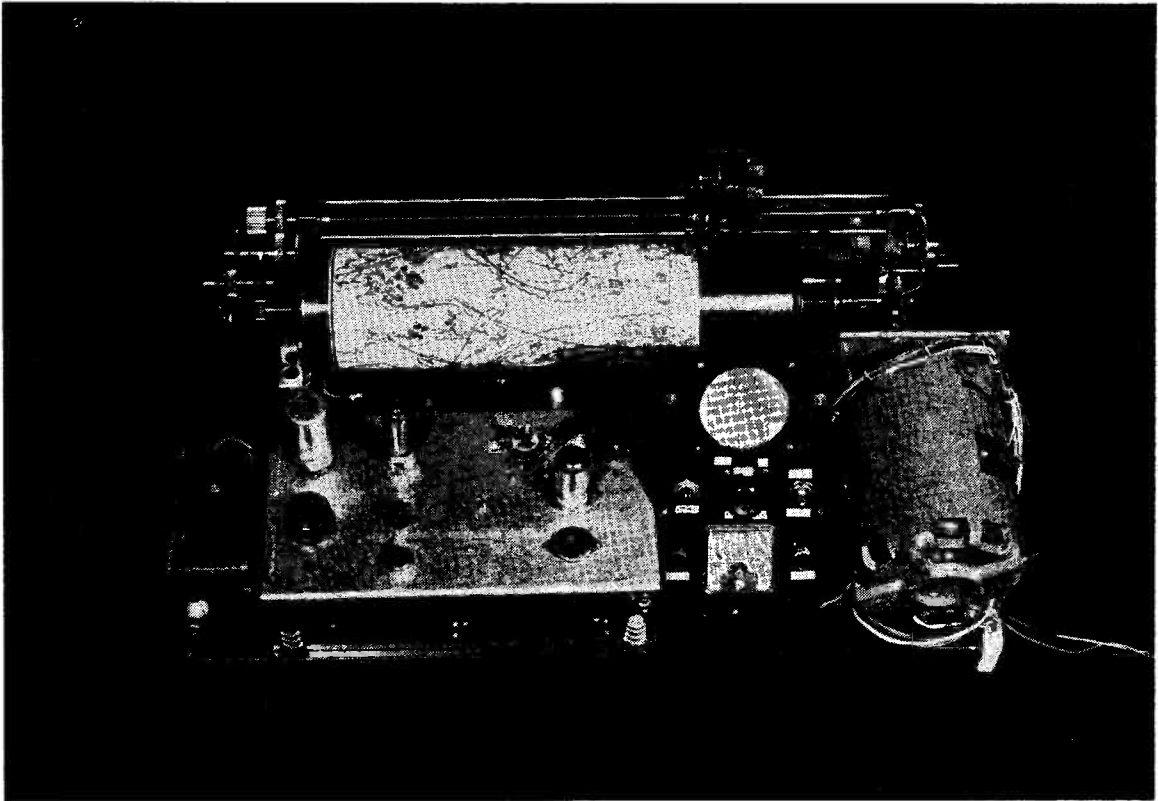
Overlap Correction

One weakness in the original receiver was some difficulty in "phasing." This requirement means positioning the drum in the correct angular position with respect to the transmitting drum so that the overlap of the paper will appear correctly at the edge of the finished picture and not in the middle or elsewhere. This difficulty has now been completely overcome. The drum is no longer an integral part of the central driving shaft, but runs on ball races on the shaft. A spring loaded clutch couples the shaft to the drum, and the tension on this clutch is



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Representation of the type of weather chart now being copied by GM3BST on his improved facsimile receiving equipment, as described in the text. The vortex of lines near the top centre is how the hurricane called "Flora" — which did such damage along the eastern seaboard of the United States — appeared to the meteorologists. This map was copied from the British Weather Centre at Bracknell, Berks. on 4780kc at 1848 GMT on October 14. It should be noted that, as reproduced, it is actually a tracing of the original, because the contrasts on the chart itself are such that it would not show up well enough when reduced to the size used here — which is exactly one half the original.



A general view of the GM3BST facsimile receiving set-up, with a weather chart forming on the drum. He has been very successful in designing and constructing all the apparatus, both mechanical and electrical, for a complete amateur facsimile receiver — being himself very interested in meteorology, he needed the equipment to copy charts direct from weather-transmitting stations all over the world. The original article by GM3BST on this apparatus appeared in our issues for April-May-June-October, 1959. The present discussion is on improvements to the gear, in particular the provision of an accurately controlled frequency drive for the drum motor, so that the chart as reproduced is an exact copy (facsimile) of the original.

such that although drive is positive under the normal light load of only the writing stylus and ordinary mechanical friction, the drum can be held stationary if desired, the motor and central shaft continuing to rotate. Before picture transmission commences from the distant end, the transmission contains a phasing signal—this is a short burst of signal corresponding to the exact moment when the photo-cell is over the join of the map wrapped round the transmitting drum. At the receiving end, the drum is held stationary against the clutch by means of a pin and solenoid-operated catch. It is so arranged that, at this position, the writing stylus is resting on the join of the paper. When a phasing pulse arrives, a relay closes, energising the solenoid which releases the catch, and the drum commences to rotate. Since, at that instant both transmitting and receiving drums were in exactly the same position, the system is correctly phased.

Drum Drive Modification

In the original equipment, the drum was driven by a small 10-watt synchronous motor. Since two drum speeds are in common use (60 and 120 r.p.m.) a simple form of two-speed gear box was used. Shortly after the original

article was published the gearing between motor and drum shaft was changed from straight pinions to worm-and-pinion in order to reduce the level of mechanical noise. However, this made gear changes rather more complicated, and recently a special two-speed synchronous motor was obtained from Croydon Ltd. This motor will rotate at either 1500 or 3000 r.p.m., according to which way the windings are connected; this is much more satisfactory. The drive gearing is now fixed at 25 : 1, and motor speed changes made by means of a 2-way switch with the appropriate connections.

Better 50-Cycle Drive

The motor runs from 230v. 50-cycle AC. It is not satisfactory, however, to run it direct from the AC mains, as the mains frequency is not controlled with sufficient accuracy. It is therefore necessary to generate locally a highly stable, accurate 50-cycle supply with which to drive the motor.

In the original equipment, a 50 c/s tuning fork was constructed specially for the job, and in spite of a letter from one reader assuring the Editor that it could not work, it *did*, and continued to do so for some years! Its disadvantages were: (a) A tendency to lock on to the

mains 50 c/s if any stray mains magnetic field was present; (b) It was temperature conscious, and (c) It was rather large.

When some 25 c/s tuning fork oscillator units came on the surplus market one was purchased and the frequency generating section re-designed. The 25 c/s output was doubled to 50 c/s and the locking with the mains was no longer troublesome. It had been hoped that the 25 c/s fork would be temperature compensated, but this was not so, and it was therefore placed in a double thermostatic oven. The outer oven was constructed of polished tinfoil, and a layer of cork and tinfoil was glued to the inside. The heating elements are two 15w. mains lamps, and a miniature "Otter" thermostat looks after the temperature. The inner oven is also of tinfoil, painted black, and this houses the 25 c/s fork. Leads are brought out to the associated oscillator valves. This simple device has put an end to all temperature problems. The thermostat is set for 80°F, so costs are negligible. The oven is left permanently on as it takes about 36 hours to become completely stable. It has now been on for about a year and no adjustments have been found necessary.

The 50 c/s output from the oscillator-doubler is fed to a 12AU7 amplifier, then a 6AQ5 driver and finally to a pair of 6146's in Class-B. This (rather massive) amplifier delivers 100 watts of frequency controlled 50-cycle output which is used for driving the motor. Stabilised HT is used extensively and various interlocking circuits make for safety and ease of operation.

Improved Operation

Operation of the equipment is now much easier than before. With the original set, it was necessary to wear headphones, fiddle about with the motor voltage to ensure correct phasing, check the fork frequency and generally have three hands in four places at once. With the present equipment all that is needed, apart from tuning in the signal on the main receiver, is to adjust the BFO for correct null, switch on the amplifier HT which starts the motor, press the phasing button when the phasing indicator starts flashing, lower the writing stylus on to the drum—and go for a cup of tea for the next 11 or 22 minutes according to the size of map being transmitted! Even if the whole thing gets forgotten about, a micro-switch shuts the HT off at the end of transmission time.

The equipment was built primarily for the writer's meteorological interest. Nevertheless, the electronic side has proved most interesting and the various problems stimulating. From an amateur meteorologist's point of view the received charts are invaluable. These include tephigrams, upper-air contours, prognostic charts, and from the U.S.A. re-broadcasts of the Tiros satellite transmissions.

Finally, the writer would like to say that he has always found the official Meteorological Organisations most helpful, both in this country and abroad. They have willingly supplied transmission schedules, and without their help, it would not have been worthwhile continuing to improve the equipment.

THIS MONTH'S BARGAINS

AERIAL EQUIPMENT

TWIN FEEDER. 300 ohm twin ribbon feeder similar K25 6d. per yard. K35B Telecon (round) 1/6 per yard. 75 ohm twin feeder 6d. per yard. Post on above feeders and cable, 1/6 any length.

COPPER WIRE, 14G, H/D, 140 ft., 17/-; 70 ft., 8/6, post and packing 2/6. Other lengths pro rata.

RIBBED GLASS 3" AERIAL INSULATORS. 1/9 each, P. & P. 1/6 up to 12.

SHELL INSULATORS 2" 9d. each. P. & P. 2/- up to 12.

FEEDER SPREADERS. 6" Ceramic type F.S., 10d. each. Postage 1/6 up to 12.

CERAMIC CENTRE PIECE for dipoles. Type AT, 1/6 each. P. & P. 1/-.

2 METRE BEAM, 5 element W.S. Yagi. Complete in box with 1" to 2 1/2" masthead bracket. Price 49/- P. & P. 3/6.

SUPER AERAXIAL, 70/80 ohm coax, 300 watt very low loss, 1/8 per yard. P. & P. 2/-.

FOR THE DX ENTHUSIAST MOSLEY TRAP BEAMS

Vertical 3 Band V3 ... £7 10s.
3 Band 3EL Beam TA 33dr. £24 15s.
Also the NEW Single Band Power Beams. Send for details.

50 ohm, 300w. 1/2" coax Low loss. Ideal for Mosley and other beams, 1/9 per yd. P. & P. 2/-.

BARGAIN TRANSFORMER OFFER. Made by Parmeko, half shrouded with screened primary, 200-240v. tapped, 200-0-200v., 40 mA., 6.3v. 3 Amp. Only 12/6, P. & P. 2/6. These are not Ex W.D.

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FOR SALE: R.308 Receiver, good condition, £22 o.n.o.?—L. Bayman, 4 St. Wilfrids Close, New Barnet, Herts. (*Phone (Evenings) BAR 6804.*)

FOR SALE: Minimitter Mobile Tx 160, 80, 40 metres, perfect condition, £10; MC8 Minimitter converter, perfect cond., 80-10 metres, £10; AR88D, S-meter, £30. Buyer collects.—G3POR, Glanhyd, Wisborough Green, Sussex.

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WANTED: Eddystone 750 or 888A; year, condition and lowest price, please? Also **WANTED:** Mains transformer for Eddystone 740.—Box No. 2932, Short Wave Magazine Ltd., 55 Victoria Street, London, S.W.1.

WANTED: Person with time, ability and test gear to construct and align G3BDQ receiver as described May/June, 1962, *Short Wave Magazine*. All components supplied, "Electroniques" coils and IF's. Please advise approx. fee.—Box No. 2933, Short Wave Magazine Ltd., 55 Victoria Street, London, S.W.1.

EDDYSTONE 888A receiver for sale, mint condition, very little used, £75 o.n.o.?—Buttar, 6 Bracks Road, Bishop Auckland (*Tel. 48*), Co. Durham.

FOR SALE: BC-1147 receiver, 1.5-30 mc, crystal calibrated, in good working order, can be seen working any week-day after 5.30 p.m. or any time Sunday. Price £25 or nearest offer; buyer collects.—A. A. Hopkins, 18 Sutton Park Road, Seaford, Sussex.

R.107 for sale, good condition, £10 plus carriage.—R. Page, 84 Enderby Road, Whetstone, Leicester.

DX-40U and **VF1-U**, mint condition, £23 10s.—J. R. Mason, G3DVH, 35 Benning Avenue, Dunstable, Beds.

CR-100 (gunmetal finish) £12 10s.; and **R.1155**, power pack and speaker, £7 10s.; both in nice condition.—J. H. Hall, 63 Etwall Road, Hall Green, Birmingham.

WANTED: Buy, borrow or hire circuit, data for BC-721 "Handie-Talkie."—G3PWF/T, 4 Appledore Gardens, Low Fell, Gateshead 9, Co. Durham.

SALE: Tri-Band Quad, £5. Eddystone Bug, £2. 60w. SSB Tx/PSU, £6. OC23/25/28, GET-572, 15s. 45/50 micro-ammeters, 30s.—G3LCS, *QTHR*.

PANORAMIC ADAPTOR American BC-1031A 455 kc input, adjustable bandwidth 2-200 kc, grey hammer finish, £25. **QST**, *Bulletin*, *Short Wave Magazine*, 1949-61, offers? **Command Rx** dynamotor, 25s. 6-12v. dynamotors and vibrator packs, offers? **Ardente** loud hailer, 12v. 25w., £5. 250v. AC 250w. petrol generator, £37. Buyer collects.—G3KLM, Laburnums, Chertsey Road, Chobham, Surrey (*Tel: 483, Evenings*).

WANTED: For RTTY. I would like to buy converter model FSR.1.1X with power unit, model FRS.1.2X, both in good working condition.—H. Holtman, OZ9DC, Sobakken 21, Charlottenlund, Denmark.

TOP BAND Command Rx/Tx for sale, complete with power supplies, Brookes calibrator, key, mic. and h/phones, £14 o.n.o.?—K. Nobbs, Windrush, Earls Gate, Winterton, Scunthorpe, Lincs. (*Phone Winterton 484*).

EXPORT MODEL 150w. Panda PR-120V, £60 (cost £150); Panda Cub, 160-10m., £37 10s.; both 100%. Small (American) 40w. Phone/CW xtal controlled Tx, complete, but requires overhaul, £9. **EXCHANGE:** Mint SX-101A SSB Rx for smaller Drake 2B or K.W.77, similar condition.—Box No. 2935, Short Wave Magazine, Ltd., 55 Victoria Street, London, S.W.1.

Short Wave Magazine

Publications Dept.

New Editions and Reprints, available shortly

RADIO HANDBOOK, by Editors & Engineers of California, reviewed in *Short Wave Magazine*, November 63, p.502.

A Reprint of the 16th edition should be ready on December 1st, and available from us for distribution early January 1964. Price 86/-, post free.

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New Edition of the **RADIO AMATEUR EXAMINATION MANUAL** available January, price 5/6 post free. This is an invaluable aid for those taking the R.A.E.

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MOHICAN Rx V.G.C., recently factory modified Mk. II standard, £25 o.n.o.? (Cambs.).—Box No. 2936, Short Wave Magazine Ltd., 55 Victoria Street, London, S.W.1.

SALE: SSB station, Drake 2B Rx and Q-Multiplier, also K.W. "Viceroy" Mk. II Tx with Dow Key coaxial relay; all excellent condition; £200 o.n.o.? **WANTED**: Webster Bandspanner or similar.—Box No. 2934, Short Wave Magazine Ltd., 55 Victoria Street, London, S.W.1.

SALE: K.W. "Geloso" converter, all bands Top to Ten; first £10 secures. Deliver reasonable distance, otherwise prefer buyer collects.—BRS 25256, 236 Market Street, Bury, Lancs.

EDDYSTONE 874 rack, three 873 cabinets, unused, £5. Labgear W/B multiplier E.5026, £3. Switched pi-turret, E.5023/B, 30s. RF-27 modified 4m., 25s.—G8DT, 18 Newcourt Park, Charlton Kings, Cheltenham.

DX OPERATOR disposing of part of station: DX-100U modified for use with SB-10, £60. AR88D, £37. Panda ATU, £1 10s. Transformer, 2000-0-2000 volts 800 mA, £3 10s. £95 the lot.—G3NFV, QTHR. Tel.: *Ashted 2546 after 7.*

WANTED: In mint condition, Tri-band beam, Mohican, and Collins 75A4 and SSB transceiver. Other top-class equipment considered.—G3ODT, 24 Skipton Old Road, Foulridge, Colne, Lancs.

CLEAN FB cond. HRO, complete with 9 GC coils, p/pack, speaker, manual, £20 lot.—E. Carr, 21 Eastfield Crescent, Woodlesford, Nr. Leeds.

AVO Valve Tester, latest bases, £10 carriage paid; manual, circuit, instructions; checked.—Apply G3OIB, Drax Grammar School, Drax, Selby, Yorks.

FOR SALE: Mosley TA33 Jr. 3-element beam, new in August, £19 o.n.o.?—G3PGL, c/o 305 Lordship Lane, Tottenham, London, N.17.

WANTED: Info. on SX-28 receiver (alignment procedure, circuit, operating instructions, etc.).—P. Lee, G3SPL, 204 Parkdale Road, Birmingham, 26.

MAGAZINES: *Radio Constructor*, Vols. 1-15 (1-5 bound); *Short Wave News*, Vols. 1-8 (1-6 bound); 130 *Short Wave Magazine*; 92 *Practical Wireless*; 68 *Practical Television*; 45 *Short Wave Listener*. Offers?—Parker, 58 Lime Grove, Hayes, Middx.

EXCHANGE: 13ft. speed-boat for 150w. Tx, K.W. or DX-100U.—B. Petrie, 7 Gladstone Terrace, New Deer, Aberdeenshire.

SALE: 150 watt Tx, CW/AM (Apache), £60. 50 watt Tx, K.W. "Valiant," with K.W. p/pack, £25.—Apply G3OFV, Cherry Tree, Colchester.

MOHICAN in good order, with manual, £29. **WANTED**: Eddystone 888 or Hammarlund HQ range Rx. Also cheap AR88, wreck considered.—Woodhouse, Trenoweth, Porthpean, St. Austell, Cornwall.

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SMALL ADVERTISEMENTS, READERS—continued

CR-100 + manual, good condition, £12 or exchange for good R.209. Prefer buyer collects.—Gallafent, 18 New Forest Lane, Chigwell, Essex.

WANTED: SSB Tx and transceiver. Viceroy, Invader, KWM-2 or similar, for use in DX location. **SALE:** *Short Wave Magazine*, Volumes 9 to 16, 1951-1959, 15s. per volume. *R.S.G.B. Bulletins*, Volumes 36, 37, 38—1960-1963, 12s. 6d. per volume.—G3HPW, 21 Brooklyn Way, West Drayton, Middlesex. (Phone West Drayton 4192.)

SALE: Drake 2B Receiver with 2AC 100 kc Calibrator; excellent condition, with handbook, £87; buyer collects.—13 Talbot Road, Skegness, Lincs.

R.107 receiver, good condition, £10 o.n.o.? Will deliver within 50 miles.—G3NHH, 383 Whitton Dene, Isleworth, Middlesex.

FOR SALE: DX-40U plus VFO, good cond., £20. Also B2 Tx/Rx complete, £12.—G3RJB, 5 Powys Walk, Hereford.

FOR SALE: Eddystone 840c, purchased October 1963, £40; no offers.—Fleischmann, 26 Bradley Road, Huntercombe Place, Nuffield, Oxon.

FOR SALE: Minimitter MR44/II Rx, £40 o.n.o.? New Minimitter Top 2-7 Tx, £25. Joystick aerial, £2. New Vibroplex Vibro-Keyer, £7. Nombrex Transistorised Sig. Gen. £5 10s.—I. Sykes, St. Thomas's House, Lambeth Palace Road, London, S.E.1.

FOR SALE: Home-made multi-band transmitter using LG wide-band coupler, 80-10 metres, with 813 in final; no PSU; £10 or nearest offer? Apply Hodgson, 69 Sherwood Grove, Acomb, York, Yorks.

G.E.C. BRT-455A Tx, with 2/RF, 1/Mod, 1/RF meter panel, 1/Mod power, 1/RF power, 1/blower, in units including 2/813's; not working, ideal for building, 560 lbs., £10 o.n.o.? Crystal Calibrator No. 10, new, £4. Q-Fiver, mod output, £4.—Henson, 22 Wayside Drive, Oadby, Leicester. (Phone 3487.)

50 COPIES *Short Wave Magazine*, 1957-62, 30s. 50 *R.S.G.B. Bulletin*, 30s. 60 *Practical Television*, 30s. Postage extra. **WANTED:** Morse Records.—Box No. 2938, Short Wave Magazine Ltd., 55 Victoria Street, London, S.W.1.

888A, late model, speaker, S-meter, manual, £62. DX-100U plus SB-1U, TV1 free, £58. SB-10U professionally aligned with PSU, £34. AR88D, speaker, spare valves, knobs, dial, manual, £36. CR-200 new, 15-560 kc, 4 ranges, PSU, £17. For all this superb equipment accept £195.—Craw, 117 Sea Lane, Rustington, Sussex. (Rustington 3953, 8-10 p.m.)

QSY TO VHF. LG.300, complete all valves, spare 813, £30. Labgear low-pass filter, £4. G4ZU Tribander and 30ft. feeder £10, o.n.o.? Carriage extra.—G3BDS, 279 Oldbury Road, Worcester.

SALE: MR44/II, £35 o.n.o.? Eddystone speaker, 25s. 2/QQV0-3/10, 25s. each, unused, 2/QQV0-3/20A, 40s. each, unused. Pse add p/p.—G3IKW QTHR.

WANTED: Woden UM3; and neutralising capacitor Eddystone type 756 or similar, i.e. E. F. Johnson types. State price and condition.—R. Bennett, G3SIH, c/o 70 Park Lane, Chippenham, Wilts.

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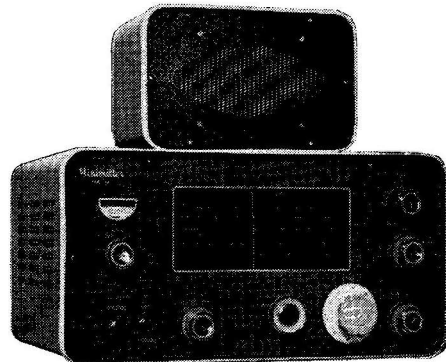
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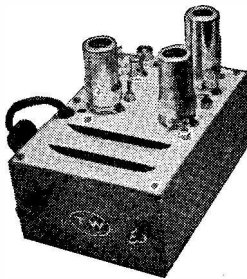
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888 WANTED, must be in tip-top condition. 888 State price, etc. to Box No. 2939, Short Wave Magazine Ltd., 55 Victoria Street, London, S.W.1.

GENUINE McElroy bug key, £3 10s. Vortexion GWA recorder as new (Ferrograph deck), with mike and tape.—G3HSC, 45 Green Lane, Purley, Surrey.

COLLINS 32V2 Amateur Tx, in perfect condx., unmodified, complete with handbook and spare PA valve; nearest £70. American SB-10, £27. Will ship free to nearest major airport.—EI9V, 30 Coolgariff Road, Beaumont, Dublin 9, Eire. (Telephone 374261.)

DRAKE 2B receiver, Q-multiplier, speaker, crystal calibrator; maker's modification for Top Band and four extra crystals for complete 28 mc-30 mc coverage fitted. Little used, absolutely mint, original packing, £105. R.1155N (Top Band model), built-in power supply, speaker and S-meter, £8 10s. T.1131 power supply (new), £2 10s.—G2HCV, 34 Grasmere Avenue, London, W.3.

URGENTLY required, preferably buy, *Short Wave Magazine*, June '62.—Michael Whelan, 44 Syngé Street, South Circular Road, Dublin, 8.

FOR SALE: Radiocraft PS-7, all-band, 2-stage, Preselector, with self-contained PSU. Offers to include carriage, to—Geoff Watts, 62 Belmore Road, Thorpe, Norwich, Norfolk. (NOR 72.T.)

EXCHANGE: Valves, various, 1T4 to QQV0-640; **EWANT:** Components for 200v. 250 mA PSU, silicon rectifiers. Offers/Wants.—27 Roe Parc, St. Asaph, Flintshire.

WANTED: Recent R.A.E. correspondence course. —Barry Cushing, 21 Whyteleafe Hill, Whyteleafe, Surrey.

WANTED: S-meter, complete with plug for Eddystone 640 Receiver.—B. Hubble, 33 Selmans Hill, Bloxwich, Near Walsall, Staffs.

HEATHKIT 2½ in. 'scope, £12 10s. RC Bridge, £8. DX-40U and VFO, £15. Top Band Command Rx, extra internal amplifier, £3 10s. Top Band and 80 CW Tx, internal PSU, £2 10s. Crystal Calibrator No. 10, £1 10s.—G3OZE, 6 Fulford Cross, York.

FOR EXPERIMENTERS. Projection television with lens for 4 ft. x 3 ft. picture; offers? Also R.107, as new, and ATU.—Grist, 31 Wharfedale Gardens, Thornton Heath, Surrey.

WANTED: For field-day working, petrol-electric generator, state price, type, etc. Also CR-100, BC-453 and BC-454 Command Rx; QQV02-6, QQV03-10, 4X150 and base.—G3OXD, 24 Wood Green Road, Winson Green, Birmingham.

SWEDISH AMATEURS still require the following: AR88D, CR-100/8 mod., BC-342, BC-348, PCR3, R.1475, HRO, BC-221, LM-14, etc.; Eddystone Hammarlund and Collins receivers. Immediate payment and collection from your shack within 200 miles London.—Brian J. Ayres, 21 Grange Road, Chessington, Surrey. (Lower Hook 2000.)

FOR SALE: AR88D, brand new, £75. RT-7/APN1, brand new, 50s. Command receiver output transformers, 10s. each. S.27/S.36 output transformers, 15s. each. **WANTED:** AR88 gear train assemblies.—A. J. Reynolds, 139 Waller Road, New Cross, London, S.E.14. (Tel.: New Cross 1443 after 7.30 p.m.)

SMALL ADVERTISEMENTS, READERS—continued

GONSET Transceiver S.76, 6-band with mobile power supply, ideal for desk or mobile; cost £350, accept £160.—Eastell, 9 Prod Lane, Baildon, Yorks.

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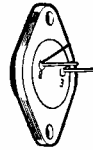
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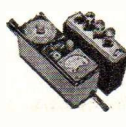
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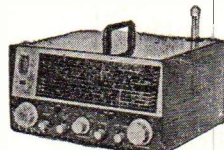
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