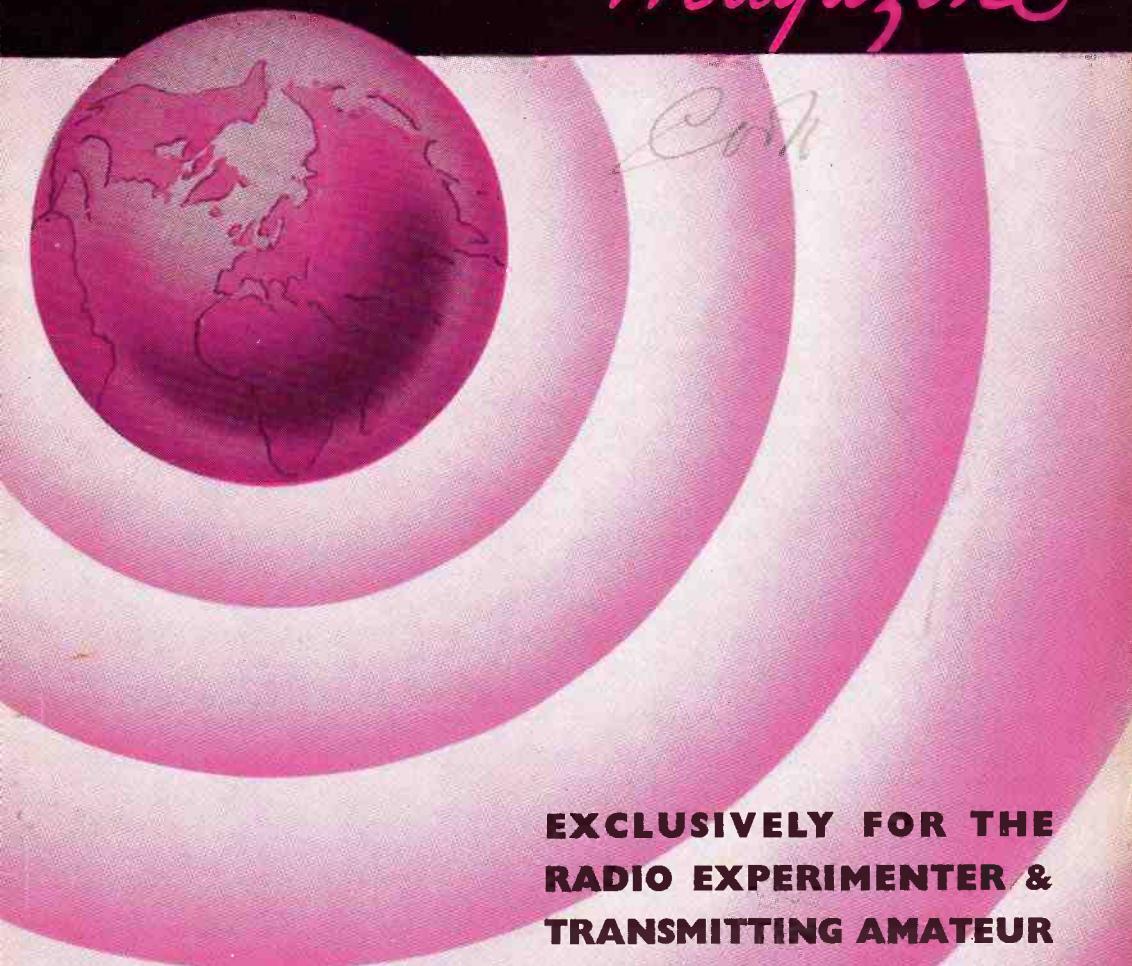


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The SHORTWAVE Magazine



**EXCLUSIVELY FOR THE
RADIO EXPERIMENTER &
TRANSMITTING AMATEUR**

VOL. VIII No. 1 MARCH 1950

H. WHITAKER G3SJ

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VALVE HOLDERS. Ceramic, Octal, 1/-; 10/- dozen, 807, 1/3; 12/- dozen. Johnson lock-in 4-pin U.X., 4/- Brit. 7-pin, 5/- dozen, 813, 6/- British 4-pin ceramic, 1/- each; 10/- dozen.

JOHNSON. Continuously Variable Ant. loading or Tank Coil, 8 turns on 3" diameter ceramic former, with 5" x 2" ceramic end plates, standard 1/4" shaft. Adjustable to zero, 300 watts. Suitable for 10 and 20, at 7/6 each.

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R.C.A. L.F. CHOKE. Potted weight 30 lb., 15hy at 400 mills, 2,000v wkg. XT 222 8b. Size 6½" x 6" x 4", at 20/-, carriage paid; £10 per dozen.

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COLLINS, or Chicago Trans. Corp. Both are identical to same U.S. Sigs. specification. 8hy at 100 mills. Res. 150 ohms. Potted, beautifully finished in grey, at 7/6 each; 72/- dozen.

R.C.A. STANCOR, ETC. Miniature L.F. Chokes. Assorted, at 12/- per dozen.

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R.C.A. HF Chokes, 500 microhenry. Completely screened, 9/- dozen; unscreened at 6/- dozen.

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VOLUME CONTROLS. R.C.A. Centralab, etc., all U.S.A. One dozen assorted, including wire wound, mostly boxed. Long Spindles. 12/-. One doz. as above, short spindles, 6/-.

I.F. TRANSFORMERS. All brand new, mostly boxed, by Hallicrafter, Bendix, National, R.C.A., etc. All are standard normal sized, with cans and trimmers. We have no time to classify. Given away at 20/- per dozen.

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BLEEDERS. A fine selection of one dozen, 50 watts to 250 watts, 5k to 75k, at 12/- per dozen, post free.

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AS ABOVE. 2,500v wkg., mica. A well-assorted dozen at 12/-.

AS ABOVE. 1,000v wkg., mica, 12/- per 100; 500v wkg., mica, 7/6 per 100.

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ELECTROLYTICS. Unrepeatable offer of Mallory 1,000mf 15v wkg, or 2,000mf 15v wkg, at 12/- dozen, £4 per 100. Round metal can type.

CORNELL-DUBILIER. 25mf 25v wkg, Bathtub or Tubular, 1/- each, 10/- dozen.

R.C.A. or CORNELL-DUBILIER. 4mf 600v wkg. Met. Can Oil at 1/6, 15/- dozen.

KELLOGG. 4+4+4+2+1, 750v wkg. Ex-U.S. Navy. In brown crackle metal case, size 7" x 5" x 5", with Dzus lid. If desired the condenser and terminal strip is detachable from the case, leaving a perfect instrument case or similar. One of the best lines we have offered at 7/6 each.

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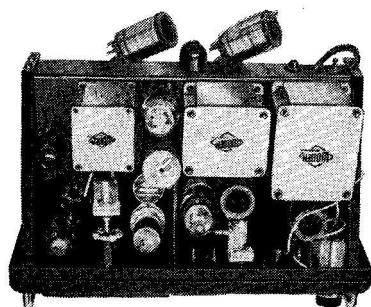
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VALVES. TX, 866/866a, 10/6; 805, 25/-; 832, 16/-; 100th, 25/-; 304l, 39/6; HK257b, 32/6; 807, 5U4, 6/-, or 60/- dozen. 5R4, GY, 4/-, 813, 32/6.

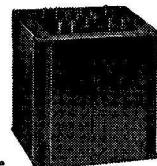
6V6g, 6X5, 6C5, 6J5, 6K7, 6J7, 5/- each, 48/- dozen; 80, 7/6; 6L6 met. R.C.A., 12/6; 12J5, 1/- or 9/- dozen. VR150, 8/-.

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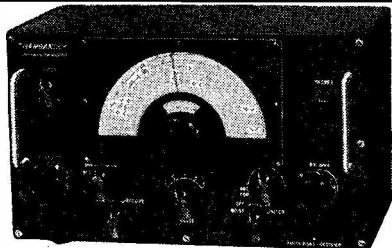
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To clear space in our warehouse prior to rebuilding, we are offering the remainder of our stock of these well-known receivers at clearance price. Freq. range 65-96 Mc/s., 6" S.M. Dial, 10-3v Valves, 3 VR65s, 4 VR53s, 1 VR66, 1 VR54, 1 VR57. I.F. Freq. 12 Mc/s. B.F.O. These receivers are 19" rack mounting brand new in transit cases, with circuit diagram. £4/4/-, carriage paid.

PERSONAL RECEIVERS B.C. 728c

7-Valve receiver with 1-4 valves, R.F. VT173, mixer VT171, osc. VT173, I.F. VT173, det. and audio VT172, output VT174, bias rect. VT174 ; covers 2-6 Mc/s. with 4 push buttons adjustable 2-2-6, 2-6-3-5, 3-5-4-5, 4-5-6-0 Mc/s respectively. Operates from self-contained 2v acc. by 2v vibrator, with 12v vib. for charging 2v acc. from 12v source. Built-in loudspeaker. Carried slung on shoulder. Supplied brand new with valves, vibrators, telescopic aerial, mounting accessories, and instruction book. £8/19/6, carriage paid.

F.M. RECEIVERS B.C. 603

10-valve receivers covering 20-28 Mc/s. Tunable, or 10 channels available by push buttons. I.F. 2-5 Mc/s. Band width 80 kc/s. Power output 2 watts to built-in 5" loudspeaker. Provision for phones. Line up : R.F. 6AC7, Mod 6AC7, Osc. 6L5, 2 I.F.'s, 12SG7's, Limiter 6AC7, Det 6H6, A.F. and B.F.O. 6SL7, AVC 6SL7, output 6V6. £5/15/-, carriage paid.

MAINS TRANSFORMERS

Primary, 200/250v 50 c/s. Secondaries, 460v 200mA, 210v 15mA, 6-3v 5mA. 15/6.
Primary, 200/250v 50 c/s. Secondary, 110v. Rating 60w. Enclosed. 18/6.
Auto. Trans. 230/250v 50 c/s. 100W. Unshrouded, 10/6.

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6H, 200mA, 100 Ω ... 6/- 5H, 120mA, 140 Ω ... 5/- 5H, 250mA, 90 Ω ... 7/6

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Metal cased 2" circular 0/15-600v (500 microA F.S.D.), 6/6 : 0-20A, 0-40A, with hunts, 5/- ; 2" square bakelite cased, 0-1 mA, 8/6 ; 0-5 mA, 6/- ; 0-50 mA, 7/- ; 0-20v, 5/- ; 2½" circular bakelite cased, 0-30 mA 6/6 ; 0-50 mA, 0-100 mA, 0-200 mA, 9/6 ; 0-500 micro amp., 16/6 ; 0-1 mA desk type, 15/- ; 2½" bakelite cased moving iron, 0-20v, 7/6.

LOUDSPEAKERS, P.M.

5", less trans., 9/6, 5", with trans., 11/6 ; 6½", less trans., 11/- ; 10", with trans., 21/-. All brand new boxed, with all speech coils. Post extra.

10-VALVE RECEIVERS R28/ARCS

Covers 100-150 Mc/s. Supplied New with valves (including 4-717A's), 39/6.

ROTARY POWER UNITS

Type 104. 12v D.C. input, outputs 250v 6.5mA, 2.5A. D.C. P.M. Rotary on chassis with cover size 8½" x 4½" x 6½", 6/11 post paid.

Type 87, Input 24v. Output as Type 104, 5/11 post paid.

CERAMIC SWITCHES

2P 3W I Bank 2/-	3P 3W I Bank	2/6
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S.M. DIALS, as used on R.F.26, less Cursor, 3/11

RECEIVERS TYPE 76

150-505 Kc/s in 2 bands. 3 Valves, VR53, ARTH2, VR92. Feeds out on I.F. of 560Kc/s. Spiral S.M. dial, cal. every Kc. New in transit case, 22/6, carriage paid.

A.C.-D.C. AMPLIFIER KITS

Every item required for the construction of a famous maker's 20 watt A.C./D.C. amplifier. Employing 8 valves, EF37 high gain stage, into EF37 triode connected, transformer coupled to output stage using 4-CL33's parallel push pull. Rectifiers 2-UR3C. Two inputs, low impedance (moving coil P.U.'s, etc.), via triple shielded trans., to first stage, high impedance (tuner units, xtal P.U.'s, etc.), into second stage. Required inputs for full output, 1 millivolt low imp., 0.5v R.M.S. high imp. Output by large O.P.T. to 10 or 15 Ω . Separate top and bass cut switches. Chassis and case, black crackle and chromium, size overall 15½" x 7½" x 8½" including carrying handles. Chassis isolated from mains. First class components throughout, including Partridge Transformers and Choke. Supplied in kit form, complete with all components, chassis (drilled), case, all valves, and circuit diagram. £13/13/-, carriage paid.

MEDIUM WAVE PERSONAL RECEIVERS

3 valve medium wave dry battery operated receiver, housed in smart bakelite box, size 7" x 6½" x 5", with plastic carrying handle. T.R.F. circuit, using 3 I.T.4 valves, with reaction. Output to pair of lightweight H.R. phones, self contained. Frame aerial in lid, provision for external aerial, S.M. dial. Powered by self contained dry batteries, 1-W1435 and 2-U2's. Supplied brand new, with valves and batteries. Open the lid and it plays. Covers whole M.W. band. Purchase Tax paid. £3/19/6. Not ex-Govt. surplus.

AIRCRAFT RADIO RECEIVERS TYPE CRV. 46151

6 valve receivers, covering 195 Kc/s-9050 Kc/s in 4 bands, 195-560, 560-1600 Kc/s, 1-6-4-5 Mc/s, 4-5-9-05 Mc/s, switched. R.F. mixer, 3-I.F.'s, det. and output, using 4-12SF7's, 1-12SA7, 1-12A6 (output). S.M. dial calibrated in Kc. Size 8½" x 7" x 16". Provision for aerial or loop. Powered from 28v self-contained dynamotor. Supplied with valves and dynamotor, used, but O.K. £5/19/6, carriage paid.

MANSBRIDGE CONDENSERS

4MFD. 1,000v WKKG. 5" x 4" x 1½", 3/- 6MFD. 2,000v test, 5½" x 4" x 1½", 4/- 3MFD. 2,500v test, 7" x 3½" x 2½", 2/6. 2MFD. 2,500v WKKG. 6" x 6" x 2½", 3/6. Postage extra please.

ANNOUNCING THE £15 T/V FOR THE MIDLANDS

Constructors in the Midland TV Area will be pleased to learn that the data for our Mk II Televisor for operation on the Sutton Coldfield frequencies is now available. All constructors of this Televisor who have not yet received the information should write in quoting date of purchase and invoice number, when the full details will be supplied gratis. This Televisor, many hundreds of which are in service, is designed round two Radar Units which cost only 26/- the pair. One unit is an Indicator containing a VCR 97 C.R. Tube, and the majority of the valves and components, and the other unit is a ready made Vision Receiver which only requires modification for the TV Frequencies. Use of this latter item, which was made regardless of cost to a planned lay-out, eliminates many of the headaches experienced by those who have attempted the construction of a Vision Receiver from scratch. The Constructional Data is most detailed, with photographs, parts lists, circuit diagrams, etc. and costs only 7/6, or is supplied gratis with the two Radar Units. Alternatively, it may be purchased, and the cost will be credited against the subsequent purchase of the Radar Units within 14 days. A fully detailed price list shows that the total cost is £15 4/9. Please note that orders for the Radar Units should include an additional 12/6 carriage costs, plus 10/- deposit on packing case.

For constructors embarking on other circuits we can supply a wide range of component parts, many of which are listed below:

RECEIVERS R1355 complete as specified. Brand new condition. Only 55/- (carriage 7/6).

RF UNITS TYPE 26, specified for INEXPENSIVE TELEVISION are now all sold, but we can supply one of the other RF Units with full details of modification to cover the TV frequencies. Only 25/-, brand new, in maker's carton. (Postage 1/6.)

RF UNITS TYPE 25 specified for London Area Station, 17/6 (postage 1/6).

INDICATOR UNITS TYPE 6. The indicator unit specified for "Inexpensive Television," this being complete with the VCR 97 Tube and valves. BRAND NEW IN MAKER'S CRATES. ONLY 90/- (carriage 7/6).

TRANSFORMERS for the above TV have been specially made as follows: Time Bases and Vision Transformer, 350-0350v 160 ma 5v 3a, 6-3v 6a, 6-3v 3a. ONLY 38/- . Sound Receiver Transformer 250-0-250v 100ma, 5v 3a, 6-3v 6a. ONLY 27/6. EHT transformer for VCR 97 Tube 2-0-2v 1-1a, 2-0-2v 2a, 2,500v at 5 ma, 30/- (postage 1/6, per transformer).

MAGNIFYING LENS for 6" CR Tube. Brings up the picture size to approximately that given by a 9" tube. ONLY 25/- (postage 1/6).

SMOOTHING CHOKES. 10h 80ma, 8/6 ; 3h 200ma, 6/- (postage on each 9d.).

EHT CONDENSERS. 2,500v 1 mfd oil-filled tubulars, 2/6 (post 3d.); 3,000v 1m block paper size 3½" x 2½" x 3½" (inc. terminals), 4/6 (post 9d.).

VALVES, types 6V6, 5U4G, 6J5, 6AC7, 6SN7, VU 120, VU 111, 7/6 each (postage 9d.).

CO-AXIAL CABLE, 75-80 ohms, 1/3 per yard.

PYE CO. AXIAL, plug and socket, 1/- pair, or 8d. ea.

SPEAKERS. 10" Truvox PM, less transformer, 17/6 (postage, etc., 2/6).

CONDENSERS. 2pf to 1 mfd, mica silver mica, or paper 8d. each.

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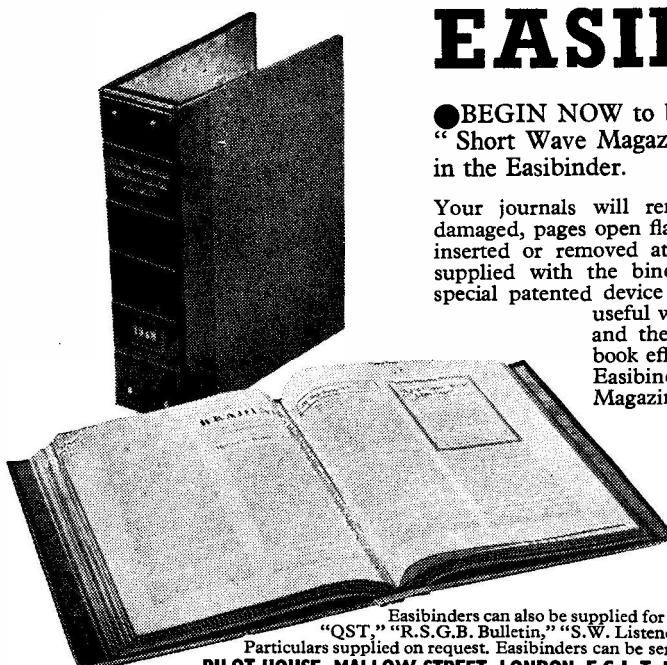
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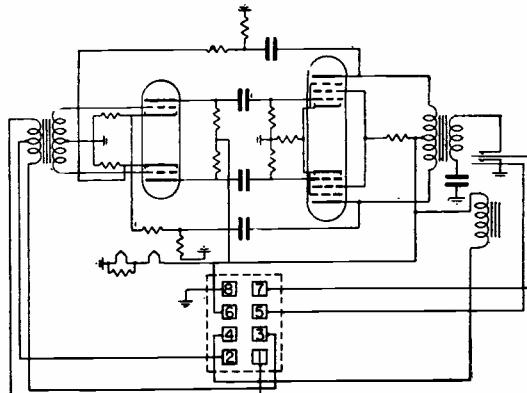


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Covering sizes 0-6 B.A. and with double ended wrench as illustrated. A really good set which will help you with those nuts in awkward corners, price 5/- complete.

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50 mfd. 50v.	1/9
10 mfd. 25v.	10d.
2 mfd. 450v.	1/-
4 mfd. 450v.	1/3
8 mfd. 450v.	1/11
16 mfd. 450v.	2/8
8 x 8 mfd. 450v.	3/4
8 x 16 mfd. 450v.	3/4
16 x 16 mfd. 450v.	3/9
16 x 8 x 24 mfd.	4/2
8 mfd. 500v. BR.850	2/6
16 mfd. 500v. BR.1650	3/6

PRE-AMPLIFIER**MODEL K**

The above is the circuit diagram of pre-amplifier model K. You will notice that the circuit includes two double valves, push-pull input, and push-pull output transformers, a relay, a choke, and numerous small resistors and condensers. The whole thing is complete with valves wired up and enclosed in a metal case size approximately 5½in. x 4in. x 4in. You will readily appreciate that this little unit will fit in almost any cabinet, including table models. These units are very well made by a famous American company, originally intended for Forces use, to increase the output of low gain microphones and pick-ups. We have a fair quantity available, all new and unused, the price is 17/6 each and as this is the equivalent of a 4-valve push-pull amplifier, it is of course enormous value. We anticipate a big demand, so please order by return.

Our latest purchase of ex-Government material includes a batch of RADAR Units, type 64. Each unit contains :—

2 VR91's, the popular EF50.

1 VT60A, the always useful 807

1 CV73, the television output valve now in great demand, KT44, Pen 46.

2 CV54's, high voltage rectifier, V960, will rectify 2.5 KV at 60 ma.

1 CV85, an enclosed triggered spark gap valve, type V2023. A steel case, size 21in. x 8½in. x 11½in. high, containing a chassis and framework on which are mounted all the valve bases for the above, 8 PYE sockets, 3 high ohmage relays, 6 paper condensers, 1 metal rectifier, 3 potentiometers, 1 ON/OFF toggle switch, 1 .05 mfd. x 3-500v. condenser, 1 .5x.5x2.200v. condenser, 30 assorted resistors, ½, 1, 2 and 3 watts, paxolin resistor panels, plus various other sundries such as useful clips and mounting brackets, etc.

Whichever way you look at this, the value of the goods is terrific.

THE PRICE OF THE UNIT (including valves) is 18/9, plus 5/- carriage, as these units weigh nearly 40 lbs.

TRANSMITTING AND SPECIAL VALVES**ALL BRAND NEW IN ORIGINAL CARTONS****MOSTLY AMERICAN MAKE**

813	47/6	866A	10/6
6L6	10/6	6A3	12/6
TZ40	27/6	CV57	30/-
35T	25/-	VR150	12/6
5Z3	13/6	6N7.....	6/6
807	7/6	VS68 (STV280/40)	
2A3	9/-	VU508 (CV1508)	
8011	18/6	PT15 (VT104)	
1625	5/-	RK34	
832	16/6	GU21 (CV5)	
		VT25 (DET25)	

Many other types available, including Magnetrons, Klystrons, Thyratrons, etc., etc. Send us your enquiries.



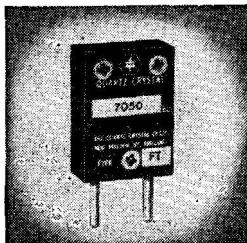
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These crystals are now available in the fundamental frequency range from 15 Mcs. to 27 Mcs. They are overtone type plates designed for operation at series resonance in low power transmitters, and in v.h.f. receiver oscillators, in which the i.f. section of the receiver is tuned. The Squier circuit is especially recommended, and full circuit details will be found in "Q.S.T." for Oct., 1948, and "Proceedings R.S.G.B." Summer, 1949. Maximum r.f. volts across the crystal should not exceed 15 volts r.m.s., and the h.t. volts at the anode of the c.o. valve should not exceed 150.



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The crystal is mounted in our type F miniature mount, which is directly interchangeable with the U.S.A. pattern FT243. Two units, back to back, plug in to the standard International octal valve socket.

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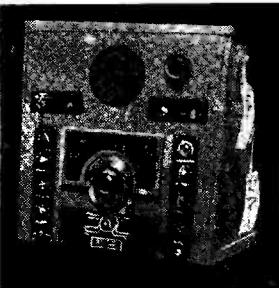
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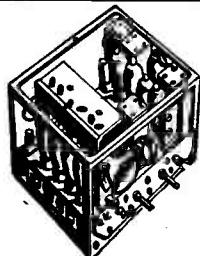
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Standard rack panels (units fully enclosed), mounted in a small open rack.

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16" x 9" 11/6	18" x 12" 16/9
18" x 10" 12/9	

CONDENSERS. BATHTUB. 1pf 1000v. oilfilled, 1/3 each. By Solar, 4 pf 500v. paper, metal case, by S.T.C., 3/3. Only few left.

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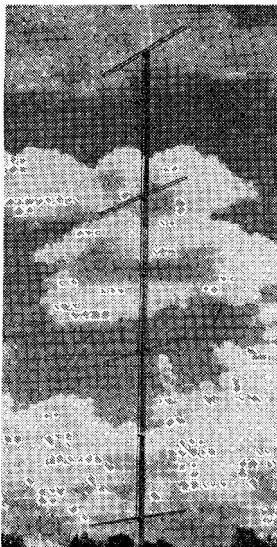
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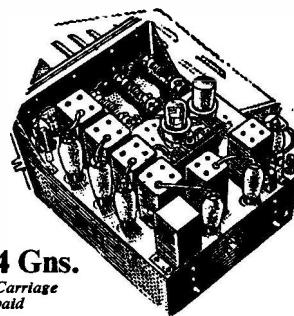
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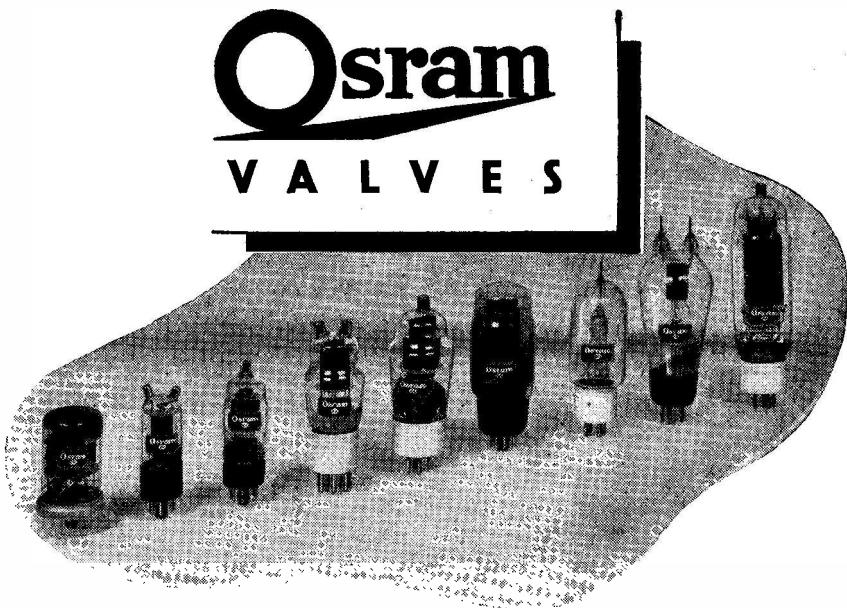
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SHORT WAVE MAGAZINE

FOR THE RADIO AMATEUR & AMATEUR RADIO

Vol VIII

MARCH 1950

No. 80

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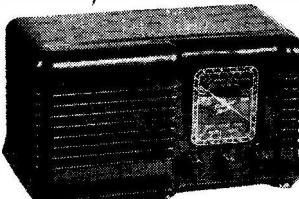
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SHORT WAVE MAGAZINE

FOR THE RADIO AMATEUR AND AMATEUR RADIO

E D I T O R I A L

Expansion

While we always like to think that readers first search eagerly through the SHORT WAVE MAGAZINE to see what is IN it, on the present occasion we also hope that they will pause a moment to notice how it looks.

For this being No. 1 of Volume VIII—the fifth in the post-war series—we have introduced a number of changes in size, layout and appearance which we think (and we hope you agree) add up to a better job. This is in line with our firm resolve and constant effort to give readers something more for their money. We are often told, and not only by readers at home, that the SHORT WAVE MAGAZINE already represents “the best value for money”—a compliment we appreciate and hope to continue to deserve.

Clearly, anything that improves the MAGAZINE in this way must add to the already heavy cost of production. Thus, if the cover price is to be kept down, the limit is set not by what we would like to do but by what the economics allow.

As an independent undertaking, the SHORT WAVE MAGAZINE must stand on its own feet and its success is determined entirely by the policies by which it is animated. The only backing we have is that of the satisfied reader—and even at that we would be fortunate to please most of the people for all of the time. But in the last four years we have enjoyed such support to an increasing degree, and it has served as a powerful incentive to improve in every way possible.

For us, this will be a year of great opportunities to increase our circulation at home and abroad. If our expectations are fulfilled and our efforts rewarded, it will be signalled to our constant readers by further improvement in the scope and range of the SHORT WAVE MAGAZINE and to our good friends the advertisers by an increasing volume of business.



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DUAL PURPOSE MODULATOR

**Audio Output at Two Levels—Speech Clip and Low-Pass Filter—
Self Contained for Power**

PART I

By J. N. WALKER (G5JU)

This is a complete modulator assembly, the fourth in our series of detailed constructional articles, designed and built to Magazine specification. Essentially, it comprises two separate, self-contained units: A speech amplifier sub-modulator giving up to 30 watts audio output, which can be operated alone or as a driver for a high-power push-pull AF stage capable of 100 watts of audio. The units can be built separately, according to requirements, and incorporate the latest techniques, ensuring a performance up to the best standards in amateur band telephony working.—Editor.

MANY amateurs must have felt the need for a modulator capable of giving high or low audio output with the minimum of adjustment. It is neither economical nor reasonable to build a high-power modulator and press it into service with any of the several transmitters usually to be found in an amateur station, and often operating at widely varying power levels. When this is the case, difficulty often arises in matching the load impedance of the modulator satisfactorily to that of the RF power amplifier and only too often it becomes necessary to resort to a compromise arrangement of transformer tappings. Two separate output stages, each with its own matching transformer, give much greater flexibility and generally improved performance.

From another point of view, the amateur using comparatively low power requires a modulator suitable for that power and preferably occupying not too much space. It will be a distinct advantage if, at a later date when higher power is employed, the pre-amplifier and driver stages in the original amplifier can continue to be used, with an additional stage giving increased audio output.

It has often been emphasised that not only is there no point in using high power for local and semi-local contacts but it is advisable to reduce input power whenever circumstances permit, in order to keep interference on amateur bands to a minimum.

General Design

For the foregoing reasons, the present modulator design has been divided into two major sections. The first comprises what is in effect a complete unit in itself, capable of delivering up to 20 watts of audio with very little distortion and up to 30 watts with

reasonably low distortion. It includes peak clipping and a low-pass filter—the latter is essential with peak clipping and highly desirable without. Both refinements add to the intelligibility of telephony transmission, particularly when conditions are difficult, and a modern modulator cannot be considered complete if they are omitted.

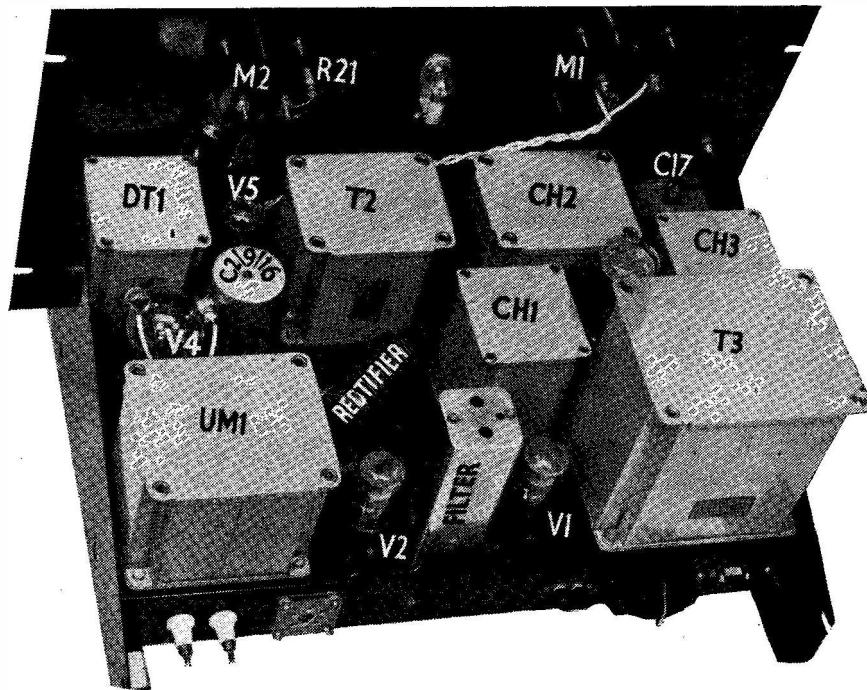
Although it does not leave much room to spare and calls also for care in the layout, it has been found possible to construct the low-power section on a single chassis, thereby retaining the advantage of compactness. If preferred, there is no reason why the power supply components should not be separated and fitted to another chassis, thereby simplifying construction to some extent.

A switch is fitted to this first section to enable the output from the driver valve to be fed to another chassis, on which is built the high-power output stage, complete with the necessary high voltage power supply.

This latter unit delivers up to 100 watts with less than 5 per cent. distortion and will give a maximum of 120 watts on the rare occasions when this is necessary.

Two important design features centre around the valves used in the output stages. In this country at least, comparatively little notice appears to have been taken of the capabilities of the small twin beam tetrode in audio frequency service. A valve of the Mullard QQVO4-20 type with 400 volts on the anode and operated under conditions approaching Class-AB2 will give over 30 watts of audio power. Further, the valve itself takes up little room on the chassis and lends itself to a compact layout.

The peak-to-peak grid voltage swing required is approximately 60, representing an



Plan view of the low-power chassis, with main items identified

input driving power of 0.36 watt. A pair of Mullard EL31 beam-power tetrodes, when operated under Class-AB conditions, require rather less grid swing for full output and, since grid current does not flow at any portion of the cycle, no actual audio power is required. EL31 valves are therefore employed in the high-power unit. The 6N7 driver valve gives adequate output when driving either stage.

Circuits in Detail

The first valve in the pre-amplifier is a Mullard ECC33 double triode, the two sections being operated in cascade and giving adequate gain when used with either a crystal or dynamic microphone. The connections in Fig. 1 are for a crystal type—if a dynamic microphone is employed, it is only necessary to connect the matching transformer and apply the secondary input across R1 and chassis. The first triode section operates at full gain and a gain control is interposed between it and the second triode section.

Then follows a peak clipper employing two Westectors suitably biased to conduct on both positive and negative peaks of a signal, the amplitude of which exceeds approximately 4.5 volts.

The removal of the irregular peaks which

occur in speech waveforms permit higher gain being used in the input circuits, with a consequent higher general level of modulation. Without the limiter, it would be necessary to keep the depth of modulation to a low value if over-modulation on peaks was to be avoided.

The clipper circuits operate at a fairly high impedance and WX2 Westectors are suitable. They possess an advantage over a double-diode valve in that there is no possibility of hum being introduced at this stage.

The low-pass filter performs two useful functions. The action of the clipper inevitably introduces high harmonic frequencies, which (if allowed to modulate the outgoing carrier) would cause serious interference on frequencies removed 10 kc or more from the centre carrier frequency. The filter also attenuates considerably all frequencies above 3500 cycles normally present in the speech waveform and restricts the bandwidth occupied by the outgoing signal with, if anything, an increase in intelligibility.

The input impedance of the filter is 1,000 ohms and, for the unit to function correctly, it is important that proper matching be provided between the circuits.

A simple and convenient method of transforming the high output impedance of the

clipper circuit to the low impedance of the filter is to interpose a cathode follower, operating under proper conditions. The first triode section of the second valve (V2) is this cathode follower. After passing through the filter, the signal is applied to the second section of V2, the amplitude being controlled by potentiometer R17. The output of the second half of the valve is applied to the driver valve V3, a Brimar 6N7, which is employed as a self-balancing push-pull amplifier. The primary of the driver transformer is connected across the anodes of V3.

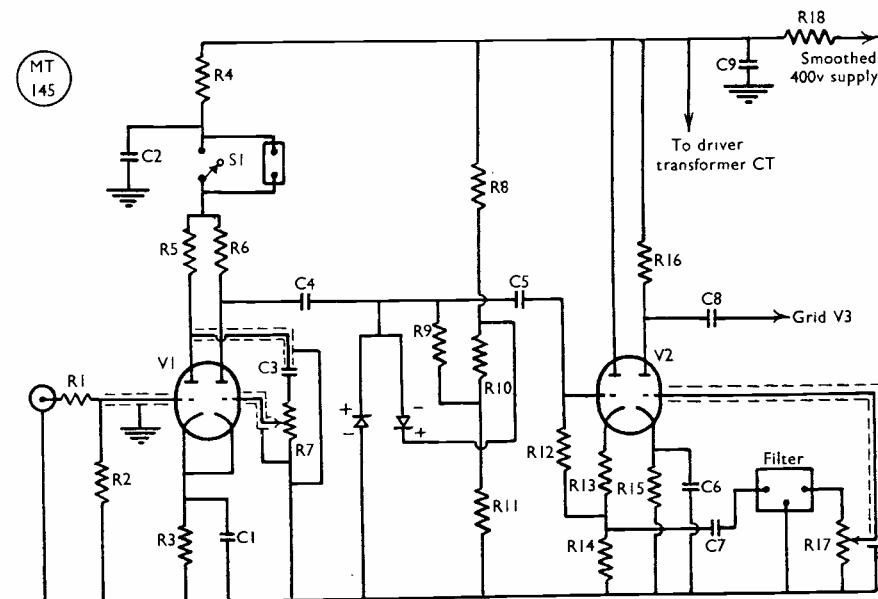
The secondary terminals of the driver

transformer are connected to a four-pole, three-way switch. Two poles of the latter apply the signal voltage either to the grids of the QVVO4-20 valve or to the grids of the EL31 valves, via the five-pin plug and socket. A third pole automatically connects the secondary centre-tap of the driver transformer to the appropriate bias potentiometer. Between the centre tap and chassis is permanently connected a 0.1 mA milliammeter in series with a 100,000-ohm resistor. The meter acts virtually as a 0-100-volt voltmeter and indicates the value of the bias voltage. High accuracy is not important since the bias value

List of Parts and Values

DUAL PURPOSE MODULATOR

Note.—This List comprises parts required for the equipment complete.



PREAMPLIFIER STAGES OF MODULATOR

Fig. 1. Circuit of the preamplifier stages of the Dual Purpose Modulator

is read in conjunction with anode current, but it is well to use a resistor of close tolerance—say \pm 2 per cent. or better. The fourth pole of the switch transfers the 400-volt HT supply from the anodes (and screen) of the QQVO4-20 to the screens of the EL31 valves. To ensure that bias is not accidentally removed from the EL31's whilst HT is applied to the anodes, resistors R22 and R23 are included. A similar precaution is unnecessary with the QQVO4-20, since HT is removed simultaneously with grid bias when the switch is operated.

Low-Power Output Stage

Voltage stabilisation of the screen grid of the QQVO4-20 is essential if maximum power output and low distortion are to be realised. The VR150/30 stabiliser is fed from the 400-volt line through the series resistor R24.

A stabiliser of the VR150/30 type is supposed to possess a low AC impedance, but, despite this, an oscilloscope showed that an appreciable audio-frequency voltage was developed at the screen grid when the QQVO4-20 was being driven. The addition of C11 removed this voltage.

It will be noticed from Fig. 2 that meter M1 (FSD 200 mA) reads the total of anode, screen and stabiliser currents. The reason for this is to enable the meter to be used also to

read screen current to the EL31 valves, necessitating placing the meter in the HT supply lead to the switch. The ability to compare screen and anode currents of the EL31's has been found a useful feature, of which more later.

Screened wiring is employed for all grid connections and since such wiring in itself tends to discourage the production of parasitic oscillation, no anti-parasitic resistors have been found necessary.

A high voltage condenser is wired across the secondary terminals of the output transformer, to assist still further in the suppression of frequencies beyond 3,500 cycles.

Bias Supply

Two different bias voltages are required for the two output stages and it has been considered worth while incorporating a mains-derived bias supply. The smoothed output from a selenium rectifier is applied to two branches, each consisting of a fixed resistor and a potentiometer of the wire-wound type. Greater current is permitted to flow in the arm from which bias voltage for the QQVO4-20 is derived, so that a higher voltage is developed across the potentiometer.

Since the required bias voltage is small the resistance between the moving arm and

chassis is kept to a low value, an important point when the output stage operates under Class-AB2 conditions. The AC impedance is reduced by means of a high capacity by-pass condenser (C14), another of which (C15) is to be found in the branch feeding the EL31's.

Power Supply

The power supply for the low-level stage follows standard practice. Choke input smoothing is used in conjunction with a Woden 500-0-500 volt transformer and a Brimar 5R4GY rectifier valve, giving an output of 400 volts or just under. HT for the earlier stages is derived from the same supply, after passing through additional smoothing and decoupling. When the high power input stage is in operation, the 400-volt supply is used to provide screen voltage for the EL31 valves.

High-Power Unit

To secure 100 watts or more audio power from a pair of EL31 valves calls for an anode voltage of 800. This is provided by a Woden

1000-0-1000 volt transformer and a pair of Mullard RG1-240A rectifiers, followed by a single stage choke input filter. Separate filament transformers are employed for the rectifier and for the output valves, as shown in the circuit diagram.

The application of voltage to the anodes of the mercury vapour rectifiers must be delayed a minute or so from switching on and this function is accomplished with a Varley Thermal Delay Switch, the heater of which is across the 6.3-volt supply and the contacts in series with the primary of the high voltage transformer. This switch is admittedly operated under ratings somewhat in excess of those recommended by the makers but it has proved quite reliable in service.

A moderate amount of resistance in the grid circuits of the EL31 valves is not detrimental to their operation and, because of high sensitivity of these valves, it is deemed advisable to include grid stopper resistors (R30 and R31). Similar resistors, but of low value, are fitted close to the screen grid tags. As before, a "building out" condenser is connected across the output transformer secondary, but

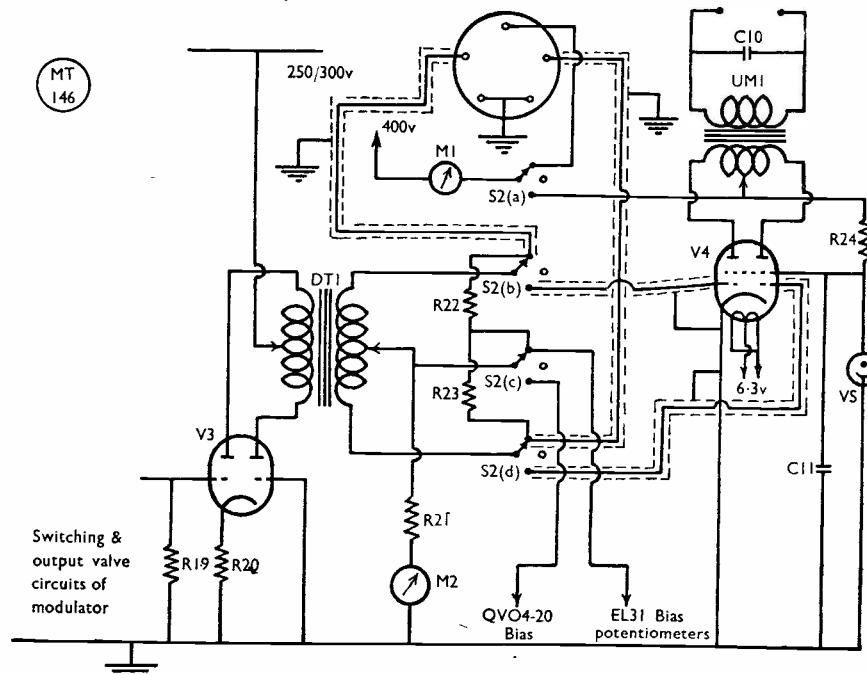
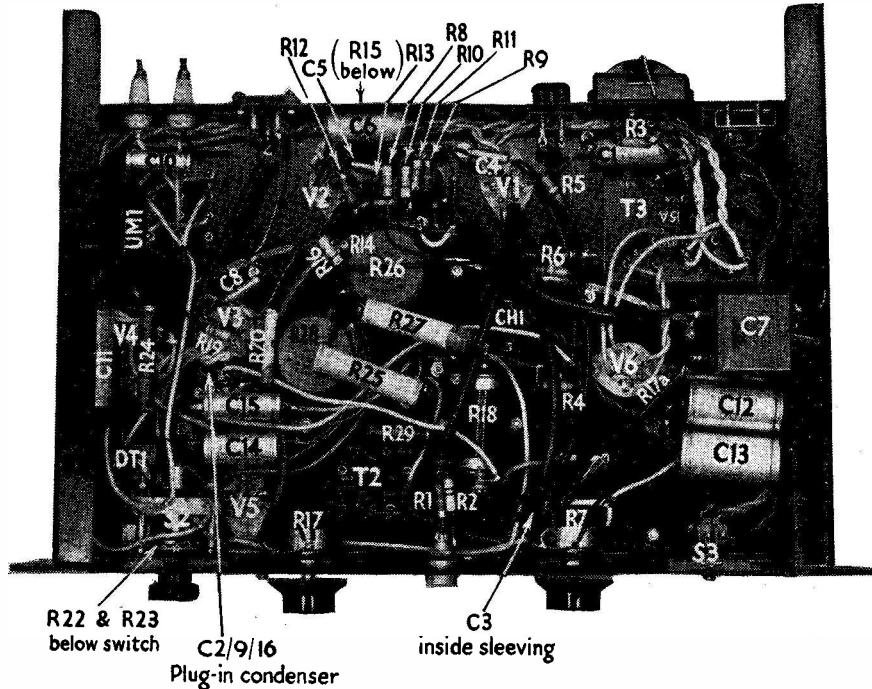


Fig. 2. Circuit of the driver and output stages, showing switch connections. Audio can be taken off at two levels, 30 and 100 watts, from the completed assembly



Under-chassis view of the low-level deck, indicating the placing of most of the parts

this time it is necessary to employ a mica type with a high working voltage.

A meter is included to read the anode current. Resistors R34 and R35 are there simply to prevent the reservoir condenser C19 holding a charge. The valves draw a standing current which renders unnecessary the provision of a high wattage "bleeder" resistor.

CONSTRUCTION OF LOW-POWER STAGE

The chassis and panel appertaining to the low-power unit have been annotated "A" and those for the high-power unit "B."

Full details of the various holes required are given in Fig. 4. These are based on the transformer and chokes being mounted with the connections beneath the chassis—obviously, a good deal of work will be saved if above-chassis connections are substituted but the finished appearance is not so good. To those without facilities for making large holes, it will be a good plan if possible to enlist the services of a "metal basher," to do the preliminary cutting out and drilling.

The layout adopted in a compact amplifier is important because of the necessity of avoiding hum pick-up in the early stages and

in the driver transformer. With the layout given in the drawings the output is free from hum. It might be mentioned here that a contributory cause of this is the use of a centre-tapped heater supply, with the heater leads twisted and kept to the sides of the chassis, well away from "hot" grid and anode wiring.

It will be seen that the two double-triode, pre-amplifier stages are at the rear of the chassis and well clear of other parts. Between them is mounted the filter unit. The power supply units are grouped to one side and the driver valve, output valve and output transformer grouped on the other side of the chassis.

In the centre of the chassis are the bias supply components—the selenium rectifier is fitted above the chassis to permit better ventilation. The spindles of the power potentiometers project several inches and are accessible without much difficulty for adjustment. Once the amplifier has been put into service, only rarely will such adjustment be necessary, for which reason it has not been considered worth while mounting the bias control potentiometers on the front panel.

All other controls (mains switch, gain

controls and selector switch) are brought out to the front panel. Also, below the bias voltmeter is fitted a switch which cuts HT to the first valve, to "kill" the amplifier during periods of reception. In parallel with this switch is a two-pin socket (on the rear chassis wall) to enable the amplifier to be controlled from a remote switch or possibly through the medium of a relay.

The other parts fitted to the rear are the mains input plug, lead through insulators for the modulator output and the five-pin socket from which an interconnecting cable is taken to a similar socket on the other (high power) chassis.

Room has to be found underneath the chassis for a large number of small components. The appropriate photograph has been annotated to make the placings of the various items easier to follow. Many of the small resistors are held in the wiring—others are held by tag strips.

Small Points in Detail

To save space and to make replacement (if and when necessary) easy, condensers C2, C9 and C16 are incorporated in a single plug-in unit, fitted, because of space considerations, near the driver valve.

The "Metalmite" coupling condensers, being physically small and light, can be held in the wiring well clear of other components and wiring, thereby minimising undesirable coupling and pick-up. The values have been

chosen to give a certain amount of low frequency attenuation, which, apart from other issues, relieves the output transformer (and, incidentally, the driver transformer) from handling a large amount of power at low frequencies—power which contributes little or nothing to the actual intelligibility.

Screened wiring (insulated overall with PVC sleeving) is employed for all grid and anode wiring of any length—for example, between the gain controls and the valveholders. Because the filter operates at low impedance, screened wiring to the input and output circuits is not essential although it is still desirable. Good earthing of the braided screen is important. Short lengths of $\frac{1}{4}$ -in. diameter insulated coaxial cable are suitable and convenient.

The metal of the chassis is not relied upon for earth returns. Copper braiding is run between various points along the chassis and earth returns made to this.

Additional insulation (PVC sleeving) is provided where the anode leads to V4 pass through the chassis—rubber grommets may be employed with advantage.

Holes (not shown in Fig. 4) are required for the anode leads to V4 and for the leads to the panel light. Also two small holes for connections to the metal rectifier—these leads are soldered on before the rectifier is bolted in position.

Tag strips are employed as follows :

Single-way: 2, R24 (also one end C11).

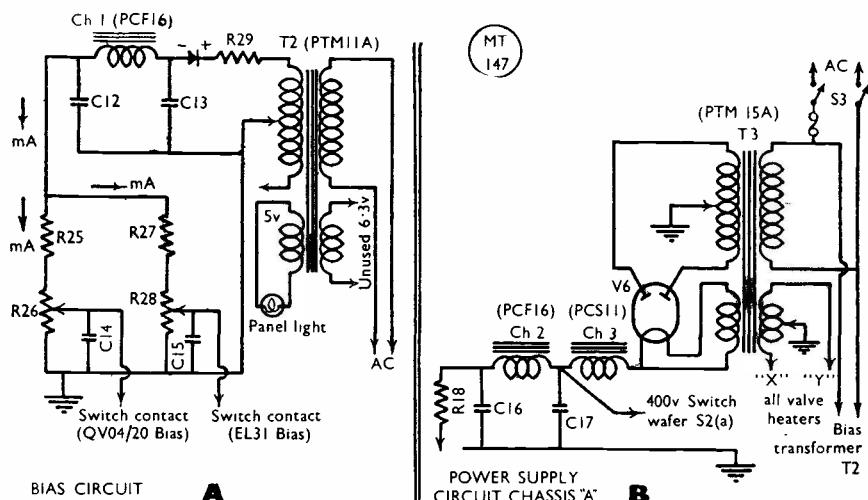


Fig. 3. Bias supply circuit A, and B power supply for the low-power modulator

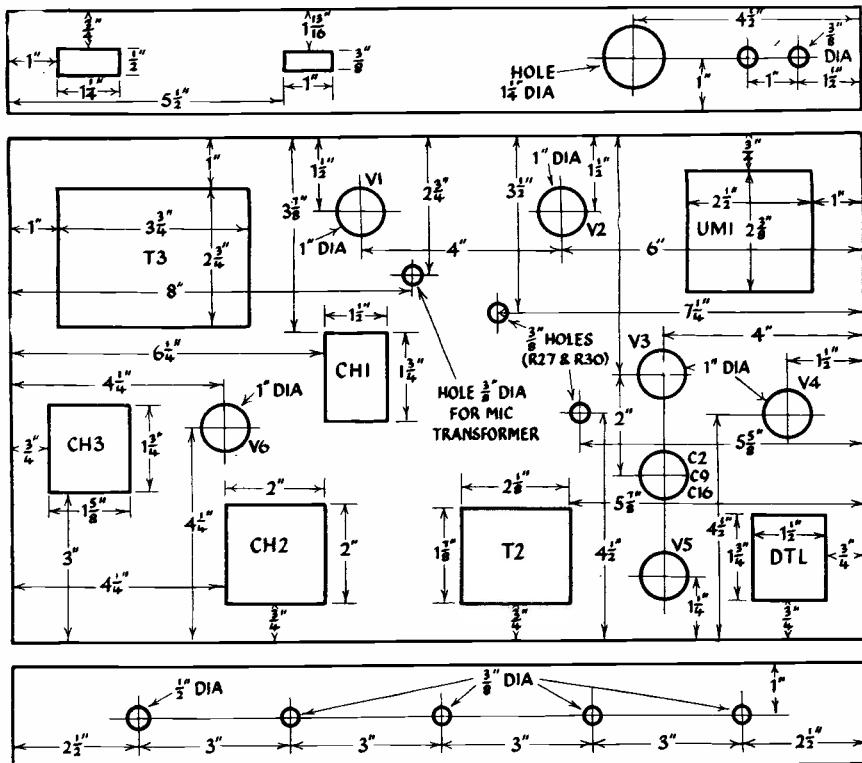


Fig. 4. Chassis construction details for Unit A, the low-power modulator

Three-way (centre earthed) : 1, R3/C1 ; 1, R15/C6 ; 2, C14 and C15 ; 2, C12 and C13 ; 2, R25 and R27 ; 1, R29 ; 1, R4.

Five-way (centre earthed) : 2, Supporting Westectors, R9, R10, C4, C5, etc. ; 1, HT connections V1, V2, R5, R6, etc.

The panel light is connected to a spare LT winding on the bias transformer and hence automatically indicates (as also does the voltmeter) that bias is present—an important point.

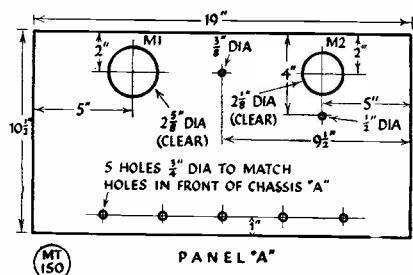
Part of the ceramic switch wiring should be carried out *before* the switch is bolted in position, otherwise some of the tags will be difficult of access.

A fully screened input socket is employed and because of the high gain, this is essential with a crystal microphone. It is permissible to substitute an ordinary plug and jack when a moving coil microphone is used.

The Filter Unit

The filter has two sections, each of the "T" type, with constants which result in high attenuation of frequencies beyond 3,500 cycles. The design is eased by arranging that no direct current flows through the filter and this also enables the filter to be made up in compact form—it is housed in a can of the size used for large IF transformers, the can acting as an electrostatic screen.

Because condensers and inductances of critical values are required, it would be a difficult matter for the average constructor to put together a filter with any assurance (in the absence of elaborate testing equipment) that it would function correctly. Fortunately, a manufactured article is available from John Factor, Ltd., which conforms to the requirements and performs excellently. The filter unit can be seen in a photograph of the low-level



Panel layout arrangement for the low power chassis.

chassis, between the two valves at the rear of that deck.

When coming to test the modulator, the effect of the filter will be very marked. The audio output is well maintained up to 3,500 cycles but beyond this it falls off rapidly. For this reason, the time-honoured test of whistling into the microphone will produce what would otherwise be disappointing results—with a high pitched whistle, the audio output is small irrespective of the settings of the gain controls !

(Part II of this article, describing the construction of the 100-watt amplifier and the testing of both units, follows next month.)

OSCILLOSCOPE CHECKS

In DSB and SSB Transmission

By H. C. WOODHEAD (G2NX)

THE cathode-ray tube is one of the most useful tools in the hands of the radio engineer to-day and, once its operation has been understood, it can be used for a variety of tests which cannot be carried out in any other way. The interpretation of the patterns obtained requires a certain amount of familiarity with the resultant forms of harmonic motion in two different planes, known to generations of sixth-form schoolboys as "Lissajou's Figures"—but it is not at all difficult.

For checking SSB transmissions oscilloscopically, one must also have a clear conception of the various conditions involved in order to be able to interpret the figures observed. It is therefore proposed to review the difference between SSB and DSB. Taking once again a carrier of 50 kc modulated normally (DSB) by an audio frequency of 1,000 cycles, the resultant will be the original carrier plus two side frequencies separated from it by 1,000 cycles on either side. For lower frequencies of modulation the side frequencies would be closer to the carrier and for higher ones correspondingly farther away. The spaces occupied by these frequencies are called sidebands.

If we represent the carrier as a vector rotating counter-clockwise 50,000 times a

second, then the lower sideband will be represented by another vector rotating somewhat slower, in fact 49,000 times a second, and the upper sideband by a third vector rotating at 51,000 times a second. Now all this may sound very complicated, but there is just one thing about the picture that is invariable and that is the carrier vector which is rotating 50,000 times a second.

First Principles

It will greatly simplify things, therefore, if we can imagine ourselves to be rotating counter-clockwise at 50,000 times a second also, for then the carrier vector will appear to us to be stationary and the two sideband vectors to be rotating in opposite directions 1,000 times a second, as shown in Fig. 1. The carrier, in this form of transmission, is constant in frequency and level and does not therefore serve any useful purpose as far as the conveyance of intelligence is concerned. But it does serve as a "standard" against which the frequency of the sidebands is compared in the receiver, thus producing the difference frequency, which is the same thing as the original modulating audio frequency. Since the carrier takes up half the power of the signal and each sideband a quarter (for 100 per cent. modulation) it is obviously an economic proposition to dispense with the carrier if possible and transmit only one of the latter.

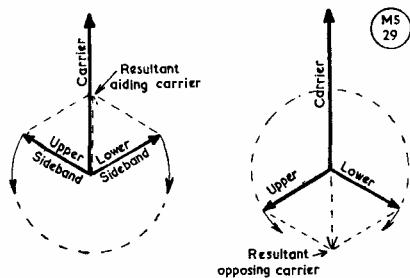


Fig. 1. Vector Diagram of a Double Sideband, 100 per cent. modulated carrier

In this form of single-sideband transmission, the frequency radiated is equal to the sum (or difference) of the unradiated carrier and the modulating frequency. In speech it will consist of a band of frequencies to one side of the unradiated carrier, corresponding to the width of the audio band being transmitted, as has been explained earlier (*Short Wave Magazine*, July, 1949).

Once the idea of the "frozen" carrier is grasped, so that the sidebands rotate in opposite directions, the vector diagrams shown with this article will be understood. They show the various conditions of vectors existing throughout one half-cycle of audio modulating frequency at intervals of 30° ; the carrier (if any) and sidebands are shown in thick lines and the resultant in thin lines. In the next column is given the appropriate figure obtained when the radio signal is applied to

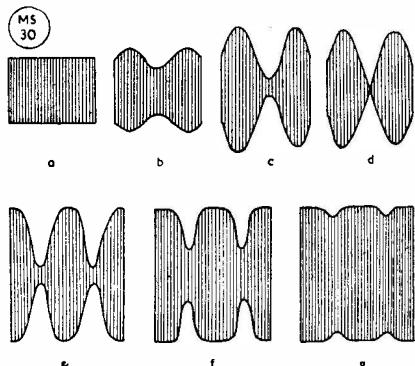


Fig. 2. Oscilloscope Patterns of carrier with increasing proportions of single sideband from (a) to (g)

- (a) Plain Carrier
- (b) 100 per cent. SSB Modulation
- (c) Limiting on peaks of envelope

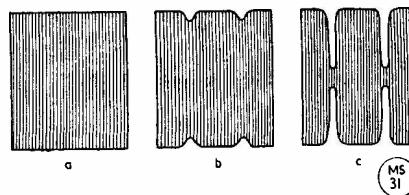


Fig. 3. Effects of limiting on a carrier and one sideband with modulation increasing in level from (a) to (c)

the Y plates of a CRT at the same time that the modulating audio frequency is applied to the X plates. For DSB this produces the familiar trapezium of modulation and two conditions of this are shown with a slight difference in the phase of the audio tone. The second is often encountered and may cause confusion unless it is recognised as being similar to the first with slight audio rotation. It will simplify the interpretation considerably.

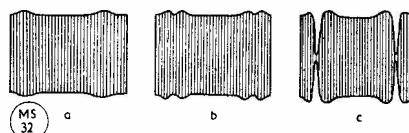


Fig. 4. Instability and overloading on SSB with carrier

if the figures shown in this column can be visualised as transparent cylinders rotating about a vertical axis with change of audio phase. Thus the DSB case becomes a cylinder cut obliquely at either end, and the SSB ideal case is a cylinder which always presents the same shape no matter what the phase of the audio frequency.

In the last column is shown the figure

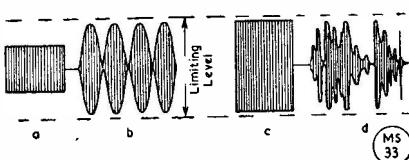
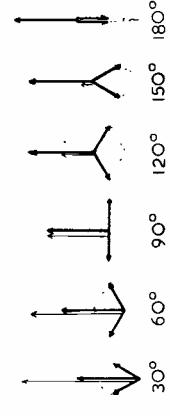
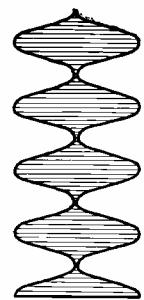
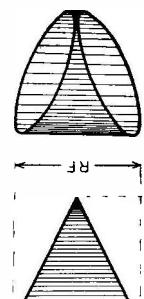
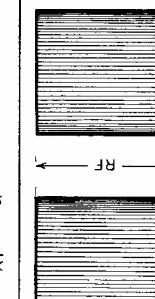
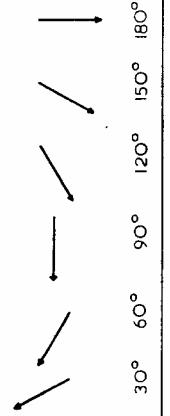
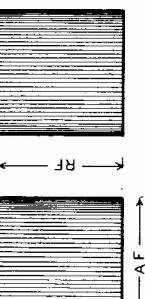
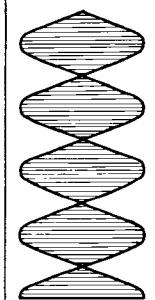
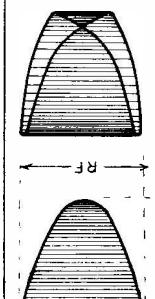
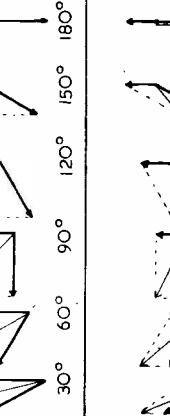
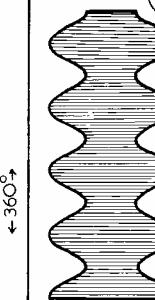
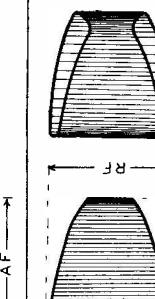
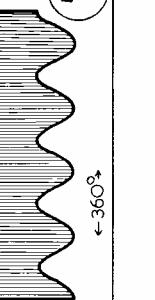
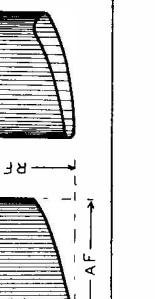
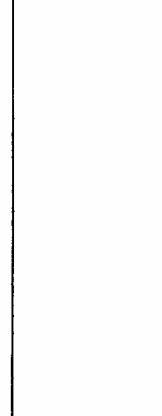


Fig. 5. Line-up figures for SSB working
 (a) Carrier level set to less than half limiting value
 (b) Tone applied to give 100 per cent. modulation for carrier working
 (c) Carrier removed and tone increased to give the same peak signal as at (b)
 (d) SSBSC speech to give the same peak signal as in (c)

System and Signal	Vector changes throughout one half cycle change of modulating audio frequency	Oscilloscope patterns of final RF against modulating audio frequency for two conditions of audio phasing	Oscilloscope patterns of final RF against modulating audio frequency for two conditions of audio phasing	Oscilloscope patterns of final RF against a linear time base	Oscilloscope patterns of final RF against a linear time base
<u>DSB</u> 100% Mod	 <p>0° 30° 60° 90° 120° 150° 180°</p>	 <p>↔ 360°</p>	 <p>↔ 360°</p>	 <p>↔ 360°</p>	 <p>↔ 360°</p>
<u>S S B S C</u> Ideal Condition	 <p>0° 30° 60° 90° 120° 150° 180°</p>	 <p>↔ 360°</p>	 <p>↔ 360°</p>	 <p>↔ 360°</p>	 <p>↔ 360°</p>
<u>SSB</u> 100% Carrier	 <p>0° 30° 60° 90° 120° 150° 180°</p>	 <p>↔ 360°</p>	 <p>↔ 360°</p>	 <p>↔ 360°</p>	 <p>↔ 360°</p>
<u>SSB</u> 50% Carrier	 <p>0° 30° 60° 90° 120° 150° 180°</p>	 <p>↔ 360°</p>	 <p>↔ 360°</p>	<p>↔ 360°</p>	<p>↔ 360°</p>

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28

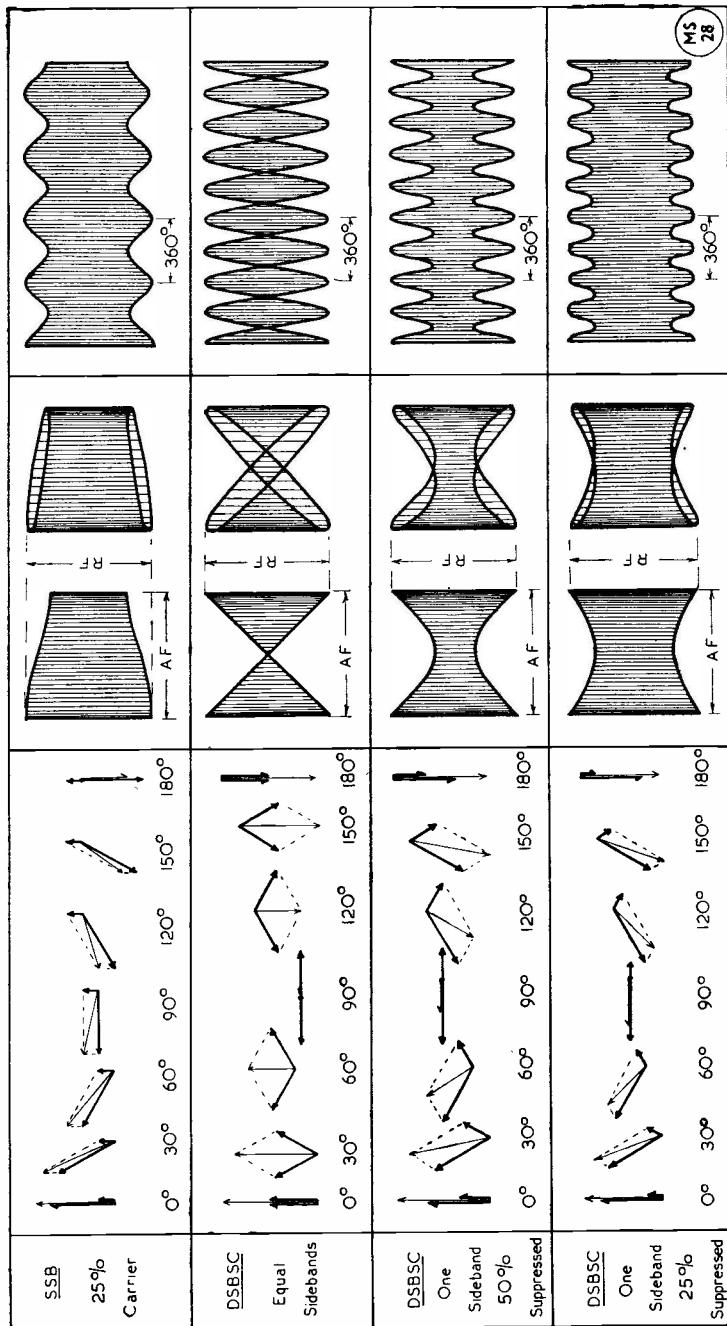


Table of Vector Diagrams and Oscilloscope Patterns illustrating various forms of modulation from Full Double Sideband to full Single Sideband, with partial carrier and with partial sideband suppression. (For details see text)

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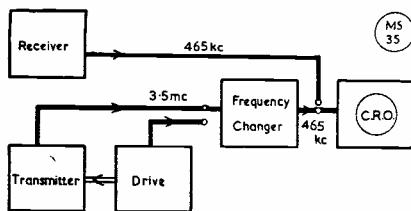


Fig. 7. Block schematic of set-up for checking waveform of transmitted or received signals on an oscilloscope provided with a 465 kc input

obtained against a linear time base. A careful study of these figures will show how the proportion of unwanted sideband can be measured and some idea obtained of the form of the final signal and the effectiveness of the SSB filter by varying the audio frequency and noting the change in the oscilloscope figure.

SSB Condition

After the initial SSB line-up there may be some difficulty in adjusting the reinserted carrier level so as to produce a satisfactory signal for normal reception. This may, for example, be due to too much reinserted carrier. The oscilloscope will soon indicate what is wrong, for in starting with carrier on and gradually increasing the audio level the figures shown in Fig. 2 should be obtained. It will be seen that up to (c) the sideband is less than the carrier ; at (d) they are equal in level, representing 100 per cent. modulation ; at (e) the sideband is greater than the carrier ; at (f) limiting is reached ; while at (g) the modulation has almost been suppressed by it. The best condition to work is between (a) and (d).

If the drive is saturated with reinserted carrier to start with the successive figures may follow the patterns shown in Fig. 3 without ever forming the standard pattern of Fig. 2 (d) at all. A tendency to instability may be revealed as shown in Fig. 4, in which the position is somewhat obscured by severe limiting. It is as well to find the limiting level as indicated at Fig. 2 (g) and reduce the carrier below this to allow ample margin. It should then be reduced to one-half this value (as shown on the tube) to allow for modulation. When the carrier has been removed for SSB proper, the speech level may be increased to the point where the sideband peaks reach the double-carrier level. The relative levels are clearly indicated in the successive patterns of Fig. 5.

The application of the ordinary CRO to the testing of SSB is not very simple, but if the

former has been adapted (or a unit added) to enable it to be used on the receiver IF channel for the examination of incoming signals, it can be employed also in conjunction with the receiver to test the signals in the drive unit. The author favours such an arrangement but used with a separate frequency changer as shown in the schematic diagram of Fig. 6.

The oscilloscope itself is provided with an internal amplifier, giving deflection on the Y-plates, and is fed from a co-axial input. All the circuits are fixed tuned to 465 kc. The arrangement is very convenient for plugging into a 75-ohm output from the final IF stage of the receiver for examining wave-form of incoming signals. The frequency-changer unit of Fig. 6 is quite simple, consisting of two SP61's. The first is an oscillator which is switched to cover the bands required, including one for 3.5 mc which is used in an

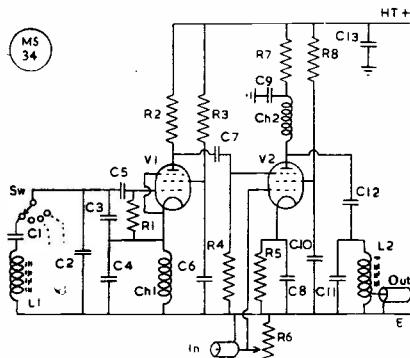


Fig. 6. Circuit diagram of frequency changer for use with an oscilloscope for checking transmitted wave-form

Table of Values

Fig. 6. The FC test circuit described by G2NX

C1	= 10 μF , ceramic
C2, C3	= 50 μF , ceramic
C4	= 100 μF , ceramic
C5	= 15 μF , ceramic
C6, C8, C9	
C10, C13	= .01 μF , mica
C7	= .001 μF , mica
C11	= 500 μF , mica
C12	= .005 μF , mica
R1	= 50,000 ohms, $\frac{1}{2}$ -watt
R2, R3	= 20,000 ohms, $\frac{1}{2}$ -watt
R4	= 100,000 ohms, $\frac{1}{2}$ -watt
R5	= 220 ohms, $\frac{1}{2}$ -watt
R6	= 1,000 ohm potentiometer
R7, R8	= 1,000 ohms, $\frac{1}{2}$ -watt
L1	= To tune 3.5 mc
L2	= To tune, with C11, to 465 kc
Ch1	= Choke for 3.5 mc
Ch2	= Choke for 465 kc
V1, V2	= SP61
Sw	= Range switch

early part of the drive. The second is the frequency changer, having signals applied to the control grid and the oscillator (differing by 465 kc) to the suppressor grid.

The signal is taken to the co-axial input from a pick-up loop in the transmitter and a level control is included. The anode of the second valve is tuned to 465 kc and provided with an output at 75 ohms impedance for connecting to the oscillosograph. The arrangement of the test set-up is shown in Fig. 7.

It will, in general, be found advisable to have this equipment in operation during transmission until experience is gained in the adjustment of the respective carrier and speech levels. In any case, a speech-level meter is almost essential to prevent overloading (especially when carrier is being transmitted

for calling purposes) for it is very easy to degrade the quality of the transmission by over-modulation in this condition. When using completely suppressed carrier, however, it will be found that there is much more latitude and that the speech level can be much higher before appreciable distortion becomes apparent due to overloading, and in practice the level in this condition may be such that peaks go beyond the limiting point. They will, of course, be cut, but, provided ample carrier is reinserted at the receiver, the result is not such as greatly to impair the quality. If the conditions shown in Fig. 5 are adopted for general line-up in the first place, the speech level may subsequently be increased beyond that shown in Fig. 5 (d) in accordance with experience and reports of reception.

COAXIAL CABLE MEASUREMENTS

Methods of Determining Electrical Characteristics

By N. DAVIS (G6TV)

A DIFFICULTY frequently encountered by amateurs who have purchased supplies of Government-surplus coaxial cable is the complete absence of reliable data concerning the characteristics of the cable and of means of identification which would facilitate enquiries through trade channels.

Most experienced amateurs find that they can estimate the characteristic impedance and also the propagation velocity constant of a cable by simple inspection but even they will usually admit that, in view of the difficulty in making a standing-wave ratio measurement on a coaxial line, they would much prefer to have accurate information on its constants before putting it into commission.

With regard to the method of measurement to be described in this article, the author makes no claim of originality as the principle involved is quite well known but as its application requires very little constructional work or apparatus which is not readily available in the most modest of junk boxes, it is surprising that it is not more widely used.

Do not be deterred by the formulae in this article. It is a useful and interesting practical discussion on the experimental methods by which the characteristics can be arrived at of those "unknown" lengths of surplus RF cable, and also shows how matching lengths and velocity factor can be calculated.—Editor.

Theory

If a section of transmission line less than a quarter of a wavelength long and short-circuited at its far end is connected to an RF source, it will present a load consisting mainly of inductive reactance. In the case of a coaxial line which is in reasonably good condition, it can be treated for the purpose of calculation as "loss-less" and ignoring the R term, the input impedance will be a pure reactance X_{sc} , equal to $+jZ_0 \tan \theta$, where Z_0 is the characteristic impedance of the cable and θ is the phase change along its length; i.e., $\theta = (\frac{360L}{\lambda_0})^\circ$ where L is the physical length of the cable in metres and λ_0 is the wavelength in the cable. (Fig. 1a.)

Similarly, the length of cable, if open-circuited at its extremity, will present an impedance which is almost entirely capacitative reactance, given in ohms by the expression $X_{oo} = -jZ_0 \cot \theta$, where θ is, as before, the phase change along the cable in degrees. (Fig. 1b.)

If a tuned circuit (Fig. 2a) having a valve-voltmeter or other sensitive resonance indicating device associated with it, is coupled to an oscillator of known frequency, the effect

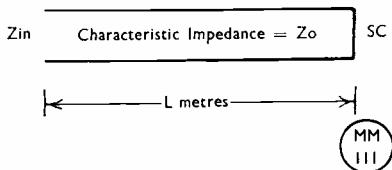


Fig. 1 (a). Closed-end line. The "input" impedance Z_{in} is calculated from

$$Z_{in} = jZ_0 \tan \theta, \text{ where}$$

$$\theta = \left(\frac{360L}{\lambda_c} \right)^2$$

λ_c = Wavelength in cable under test.

of connecting across the tuned circuit the specimen of coaxial cable will be to change the LC value of the circuit and therefore, in order to restore resonance with the oscillator, the tuning condenser will require to be readjusted.

Method

By carefully noting the *change in tuning capacity necessitated by the connection of the cable*, the reactance of the latter can be calculated. It will be seen that since the open-circuited cable presents a capacitative reactance, the tuning condenser of the LC circuit will have to be set to a smaller value in order to achieve resonance. When, however, the short-circuited cable is connected, its inductive reactance, being in parallel with that of the coil, will lower the total inductance of the circuit and, in order to restore resonance, the setting of the tuning condenser will have to be increased.

When the reactance of the cable, both open-circuited and short-circuited, has been ascertained, the characteristic impedance may be determined by calculating the geometric mean of the two reactances : i.e., $Z_0 = \sqrt{X_{oc}X_{sc}}$ ohms. This is obviously true since the product of $jZ_0 \tan \theta$ and $-jZ_0 \cot \theta$ is Z_0^2 .

Practical Considerations

Before commencing to search through the junk box for suitable components it will be necessary to have some idea of the frequency at which the measurements will be made. The use of VHF gives rise to a number of practical snags but, on the other hand, the lower the frequency used, the greater the length of the cable which must be employed, since it is advisable to work with a specimen not far short of a quarter-wave in length.

The writer generally uses a frequency of 20 mc and finds that in the case of coaxial cable having a solid dielectric, a length of

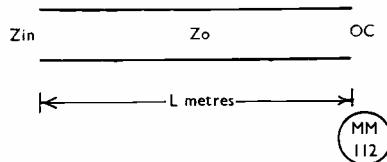


Fig. 1 (b). Open-ended line. The "input" impedance Z_{in} is obtained from $Z_{in} = -jZ_0 \cot \theta$, where values for θ and λ_c are as in Fig. 1 (a).

6 ft. 6 in. is quite satisfactory. Transmitting amateurs who are all set to go on the new 21 mc band will have an accurately calibrated RF source already available and for them it will only be necessary to construct the tuned circuit and arrange for a sensitive resonance indicator. The calibrated variable condenser may present some difficulty but by choosing a good quality S.L.C. of known maximum capacity, preferably about 100 $\mu\mu$ F, it should be possible to find some one with a capacity bridge who will undertake to measure the minimum and so permit a calibration curve to be drawn. Although the use of a larger capacity tuning condenser will sometimes simplify later calculation, it is unwise to assume that its law will remain linear over its range and calibration becomes more difficult.

With some specimens of cable it will be found that, in the open-circuited condition, the capacity thrown across the tuned circuit is of the order of several hundred $\mu\mu$ F and, without a modification to the simple circuit shown in Fig. 2a, resonance cannot be restored. At first sight it would appear that the difficulty would be overcome by shortening the length of cable used for test. Unfortunately, however, it usually means that the trouble is merely transferred to the short-circuited cable measurement.

The modification (shown in Fig. 2b) consists of the inclusion of a 100- $\mu\mu$ F fixed condenser between the inner conductor of the cable and the connection to the tuned circuit. This series condenser should be short-circuited by a switch when it is not actually required. It will be advisable to check the accuracy of the fixed condenser and, if necessary, to include a trimmer, pre-set to make the combined capacity exactly 100 $\mu\mu$ F.

Construction

The coil and condenser should be mounted on any small chassis, that used by the writer being 6 in. square. The coil for 20 mc consists of two turns of No. 20 SWG diameter spaced and wound on a 1½-in. diameter paxolin former. A single turn is loosely coupled to

one end of the coil and taken to a socket for connecting to a valve-voltmeter or crystal-microammeter resonance indicator, whilst a single turn loosely coupled to the other end of the coil is connected to a socket for link coupling to the oscillator.

The Pye plug in the lower left-hand corner of the panel (see photograph) is used to connect the specimen of cable across the tuned circuit and the switch immediately above it is to short-circuit the series condenser with trimmer seen at the rear of the chassis.

Operation

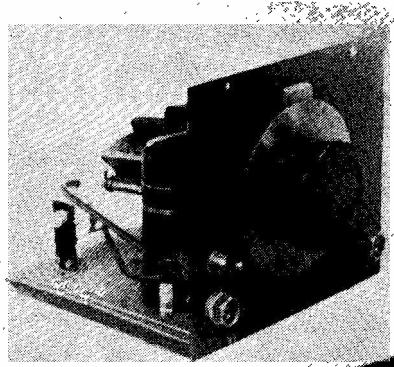
Set the oscillator (or transmitter) to the precise frequency at which the measurements are to be made and connect the coupling coil of the test circuit to it. Tune the circuit to resonance as indicated by maximum reading in the associated meter and note carefully the setting of the tuning condenser. Plug in the correct length of coaxial cable—having short-circuited its far end—and with the series condenser switch remaining in the "on" position, *i.e.*, condenser short-circuited, retune circuit to resonance. This should be found with a larger value of tuning capacity than before and the exact reading of the condenser tuning dial is again carefully noted. (If by any chance the main tuning has to be decreased in order to restore resonance, the specimen of cable is more than $\frac{1}{4}$ -wavelength long.)

Now remove the short-circuit from the far end of the cable and again tune circuit to resonance. If no indication of resonance can be found, or if the resonance indicator only commences to read as the tuning condenser reaches its minimum capacity position, switch in the 100- μF series condenser and again try to restore resonance. When this is accomplished, the condenser setting should be noted together with the fact that the series condenser had to be used.

Calculation

Set out the figures obtained, in tabular form, as shown in the accompanying panel.

Column No. 4 will need completion in the case of the open-circuited cable test only if the 100- μF series condenser was included.



The finished appearance of the test unit of Fig. 2 (b).

In this case, the true decrease for the Col. 4 figure should be calculated from the formula :

$$C_{oc} = \frac{100A}{100-A}$$

where C_{oc} is the true decrease in capacity and A is the apparent decrease noted in column 3 of the table.

When this has been completed, calculate the characteristic impedance of the cable from the formula :—

$$Z_0 = \frac{10^4}{2\pi f} \cdot \frac{1}{\sqrt{C_{sc} C_{oc}}}$$

where Z_0 is the characteristic impedance
 f is the frequency in mc
 C_{sc} is the increase in μF with cable short-circuited
 C_{oc} is the true decrease with cable open terminated

Example

The figures shown in the above table were recently obtained when testing a 1.52-metre length of coaxial cable which had a solid dielectric and a single-strand inner conductor.

Since the measurements were made at a frequency of 20 mc, $\frac{10^4}{2\pi f}$ was taken as 7964 and the calculation reduced to

$$\sqrt{\frac{7964}{33 \times 177.8}} = 104 \text{ ohms}$$

(over)

Resonance at (say) 20 mc

	1 Tuning condenser setting	2 Capacity in μF	3 Apparent decrease or increase	4 True decrease
Without cable	41.8°	138		
With cable (shorted)	57.5°	171		
With cable (open-ended) and series C used	11.5°	74	33 μF - 64 μF	177.8 μF

Propagation Velocity Constant

When it is required to use a length of the coaxial cable as a resonant stub—for example, in the construction of some form of balance/unbalance converter—the propagation velocity constant must be known before the correct length of cable can be ascertained. Due to the presence of an artificial dielectric, the wave velocity in the cable will be less than in free space, being related to it by a factor which is known as the *propagation velocity constant*. At a frequency of 20 mc, for instance, the free-space wavelength would be 15 metres but if the propagation velocity of the cable were 0.5, the wavelength in the cable would be only 7.5 metres. This factor is equal to $1/K$ where K is the permittivity of the dielectric and may, therefore, be calculated when K is known. It usually happens that K

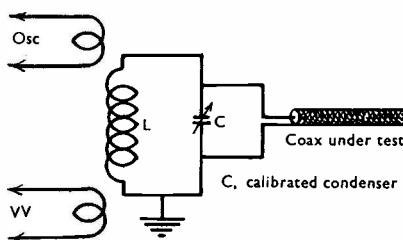


Fig. 2 (a). In this circuit, Osc is the coupling to an oscillator at a specified frequency and VV the valve voltmeter or other indicating device.

is not known; to complicate matters still further, the inner conductor may be supported by a "star" (cross-section) insulator, thus giving the effect of a mixed dielectric the "K" of which it is almost impossible to estimate.

(For those who may have wondered about that "6-ft. 6-in." for a quarter-wave on 20 mc, it can be assumed that K will not be better than 0.5, which makes the electrical quarter-wave a physical one-eighth-wave. Hence, a "free space" quarter-wave on 20 mc (3.4 metres) is about half that for the purpose of these particular tests on coax cables.)

For these reasons it is usually considered desirable to measure the propagation velocity constant and the apparatus suggested for the measurement of characteristic impedance will enable this constant to be determined with a high degree of accuracy. It should be pointed out at this stage that if the Z_0 of the cable has been measured in the manner described, the propagation velocity constant can be calculated from the figures already obtained but the accuracy of the answer is not likely to

compare favourably with that obtained by direct measurement.

By way of example, consider the figures quoted for the specimen of cable referred to earlier in this article. It was found that the connection of the length of short-circuited cable to the test circuit necessitated an increase of $33 \mu\text{F}$ in the value of the tuning condenser in order to restore resonance.

From this it follows that the reactance of the short-circuited cable was $1/2\pi FC = 241$ ohms, but, as previously stated, the reactance of a short-circuited cable, X_{sc} is also given by $jZ_0 \tan\theta$. Therefore, $241 = 104 \tan\theta$ and $\tan\theta = 2.3$, the angle θ being equal to $66^\circ 30'$.

Since $\theta = \left(\frac{360L}{\lambda_0}\right)^\circ$ and length of cable was 1.52 metres we have $66.5 = \frac{360 \times 1.52}{\lambda_0} \therefore \lambda_0 = 8.23$ metres and the propagation velocity constant = $\lambda_0/\lambda = 0.55$.

Direct Measurement

The system to be described depends upon the fact that the input impedance of a quarter-wavelength of short-circuited transmission line is very high (theoretically infinite) and purely resistive. The aim is to ascertain the *physical length* of cable which behaves in this manner and to compare the figure so obtained with the calculated quarter-wavelength in free space, the ratio of the former to the latter being the propagation velocity constant.

Procedure

Assuming that a length of cable, short-circuited at its extremity and less than

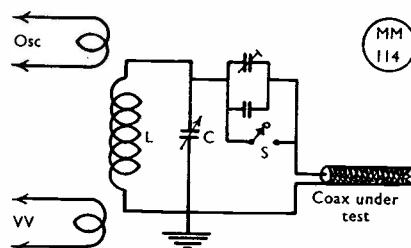


Fig. 2 (b). The modified circuit, explained and discussed in the text.

$\frac{1}{4}$ -wavelength long is already to hand, switch on the oscillator and tune the test circuit to resonance as indicated by maximum reading in the valve-voltmeter or crystal detector microammeter. Make sure that the series condenser remains shorted out and plug in the cable.

Retune to resonance and note the change in condenser setting.

Increase the frequency of the oscillator and again tune the circuit to resonance, both with and without the cable connected. The difference between the two condenser settings should now be smaller. Continue to adjust the frequency of the oscillator until there is *no difference* between the condenser settings for resonance with and without the cable connected.

Measure the frequency of the oscillator and calculate the quarter-wavelength in free space. Now measure carefully the length of the cable and calculate the propagation velocity constant which will be equal to

$$V_c = \frac{\text{Length of cable in metres}}{\text{Quarter-wavelength (free space)}}$$

Alternative Method

The main objection to the method described above is the necessity for a stable VFO and an accurate wavemeter. For amateurs who prefer to use crystal control, the alternative is to start with a length of cable which is known to be

more than an electrical $\frac{1}{4}$ -wavelength long and to shorten it by degrees until its connection across the tuned circuit makes no difference to the condenser setting for resonance.

Apart from the fact that the floor tends to resemble that of a barber's shop on a Saturday afternoon, there is little to choose between the two methods !

Conclusion

Although the writer has referred throughout to coaxial cables it should be apparent that the same methods may be used with balanced-twin types of transmission line in which the presence of a plastic dielectric makes calculation from simple transmission line formulae impossible. The only modification to the apparatus required for this purpose is the removal of the ground connection from the end of the tuned circuit and the adoption of a more symmetrical lay-out. The measurement of other constants such as attenuation, although not covered by the present article, is by no means outside the scope of the average amateur.

BASIC CRYSTAL CALIBRATOR

100/1000 kc Sub-standard Oscillator

By J. H. HUM (G5UM)

NO amateur who reads the terms of his licence can remain unaware that the law demands the use of a "Quartz Crystal Resonator" in every British amateur transmitting station. It is known that many operators derive some comfort from the fact that they possess crystals for various working frequencies in the amateur bands and therefore by this token are—or should be—within the terms of the licence. That is true enough, provided these crystals alone are used, and any other form of transmitter drive, such as VFO, is eschewed.

But under modern conditions the VFO is practically universal, in which case a crystal on an operating frequency is inadequate as a means of calibrating it. A crystal-controlled frequency sub-standard is not merely desirable but is in fact essential, and the writer knows a number of instances where amateurs using VFO's but no crystal resonator have landed

If you are VFO and do not feel the need for a crystal reference frequency—and you have not yet had a station inspection by the GPO—you may not be worrying much about a calibration sub-standard. If so, read this article and get yourself within the terms of Clause 3 of your licence!—Editor.

themselves into trouble.

Numerous designs for crystal-controlled sub-standards have been published at various times, but nearly all of them seem to aim at such an ambitious specification as to intimidate the new licensees who are coming on the amateur bands in their hundreds every month. Indeed, the recent G3-plus-3 may be excused for saying to himself: "If a frequency meter is as complicated as all that I will make one later on when I have time"—which, unless he is exclusively rock bound, means that he is contravening the terms of his licence.

A crystal calibrator is such a simple piece of equipment that it can be built in a couple of hours and should, in fact, be completed before ever a VFO is admitted into the station. Although fundamentally a single 100 kc bar in a conventional CO circuit is adequate, the value of a calibrator does increase enormously if a 1000 kc crystal is included as well, the two being switchable. If at the same time an anode coil of appropriate frequency is brought into circuit the final arrangement will be as depicted in the diagram.

(over)

Construction

The crystals can be obtained from advertisers in this *Magazine* and are also available on the surplus market. Each of them goes to a separate point on a Yaxley-type wafer switch, and two other points on the same wafer bring into circuit the respective anode coils. Since most Yaxley wafers come in 3-contact form the constructor may desire to use the third contact to break the HT and thus mute the calibrator. It is preferable to incorporate a separate HT switch, once again in the interests of greater flexibility.

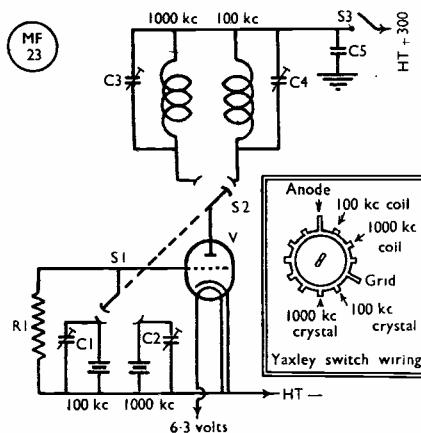
Coils for frequencies as low as those used in the crystal calibrator may present problems to constructors who are used to thinking of coils as having only a few turns. There need be no such problems; a 100-kc coil consists of nothing more than an ancient 110-kc IF transformer (one winding of)—a component which many a radio dealer will be only too pleased to give away! As obtained, this particular IF coil already included one of the old-fashioned flat porcelain trimmers across its ends. This was retained just to bring the coil nearer 100 kc.

Similarly, it is possible to use an old medium-wave broadcast coil for the 1000 kc inductance. Failing this, 120 turns of fine wire wound on a 1 in. dia. former and tuned by a midget 100 $\mu\mu$ F condenser will resonate somewhere near 1,000 kc. There are two methods of determining when the coil-condenser combination is at about 1,000 kc: Tune a broadcast receiver to 300 metres with the coil-condenser in the aerial circuit used as a wave trap so that any signal coming up on 300 metres on the broadcast receiver scale is attenuated when the coil-condenser-wavetrap is tuned thereto; even more simply, a reacting detector tuned to 300 metres will stop oscillating when the 1,000 kc coil-condenser combination is tuned to resonance and held near the reacting detector's grid coil, on the absorption wavemeter principle.

On these low frequencies the type of valve used is not critical. Nothing could be simpler than a 6J5, as shown herewith. But if the constructor does not object to the few extra components needed by a pentode, then an EF50 or 6F12 would be even better, and would undoubtedly provide readier oscillation. A 100 kc crystal, owing to its sheer physical inertia, is often difficult to start, though it will always do so if the HT voltage is kept fairly high. The writer uses 300 volts on the 6J5 in his own calibrator.

Calibration

Undoubtedly the best stations on which to calibrate an instrument such as this are the B.B.C. Light Programme on 200 kc and WWV on numerous frequencies over the short-wave



The calibrator unit described by G5UM. Values are given in the table

Table of Values

Circuit of the Calibrator as described

$C_1, C_2 = 35 \mu\mu$ F, trimmer
$C_3 = 100 \mu\mu$ F, midget variable
$C_4 = 100 \mu\mu$ F, midget variable (see text)
$C_5 = 0.1 \mu$ F
$R_1 = 500,000$ ohms, 1-watt
$S_1, S_2 = \text{Single-wafer Yaxley}$
$S_3 = \text{Bulgin on/off}$
$V = 6J5$

spectrum. Yes, even a sub-standard such as this needs calibrating! For when each crystal is switched into circuit in turn to beat against a transmission of known frequency a slight heterodyne may be detectable, resulting from the effect of the circuit constants on the calibration of the crystal itself. Such a heterodyne can be removed by adjusting the trimmers C1 and C2 until the signal produced by the calibrator in an adjacent receiver is "spot on" with the standard frequency being received from outside.

(Need we just remark that the B.B.C. standard frequency transmission on 200 kc cannot conveniently be used to check a 1,000 kc crystal!)

The amount of signal picked up will, of course, depend on the gain of the adjacent receiver and on the effectiveness of the screening of the calibrator. The writer's calibrator employs a small metal chassis and a front panel but no box, and it produces 100 kc pips up to 30 mc and 1,000 kc pips up to 80 mc. If calibration points are required at frequencies higher than these the radiation from the calibrator needs to be increased by connecting a few inches of wire to its anode circuit to act as an "aerial."

Finally, the constructor is strongly recom-

mended to build his crystal calibrator entirely separate from any other gear in the station—though it can, of course, employ a power supply common to other equipment. It is

folly to incorporate a permanent piece of equipment such as this into a VFO or receiver which, though permanent this month, may be decidedly not so next month!

BCI SUPPRESSOR

A Simple Series Trap

By G. C. EYRE (G8OJ) and W. D. MANSON (G8PW)

THE units as described here and fitted by the authors in local BC receivers are quite simple and easy to construct. So far, they have proved effective in all cases and irrespective of the type of set in use, superhet or straight, and whether CW key clicks or telephony breakthrough was experienced.

They consist essentially of a pack of four tuned circuits connected in series which can conveniently be mounted to the rear of the affected BC set. If operation is on, say, 7, 14 and 28 mc, the circuits are tuned to these bands and so prevent high signal voltages reaching the detector of the BC receiver.

The other tuned circuit covers the new 21 mc band, which it is said will be made available to us in due course.

Construction

A visit to the local radio surplus store resulted in the purchase of a quantity of small coil formers and twin ceramic trimmers at a reasonable outlay. The capacity of the trimmers obtained are about $5\text{-}35 \mu\text{F}$ and the dimensions of the formers $\frac{1}{2}$ in. by 3 in. long. When wound, the coils are mounted upon small ebony washers and secured by two nuts and bolts to a paxolin strip which measures roughly $4\frac{1}{2}$ in. by 3 in.

The strip also accommodates the trimmers necessary to tune the coils to the frequencies in use at the station.

Coil windings are as follows: 7 mc, 30 turns; 14 mc, 22 turns; 21 mc, 16 turns; and 28 mc, 12 turns—all close wound. A thin coat of clear varnish applied immediately after winding will help to keep the turns in position.

Adjustment

When completed a rough and ready check for frequency can be made by hooking the unit in series with a length of insulated wire 18 ft. or so long and connected to the aerial terminal of the station communication receiver; the trap to be placed as near to the

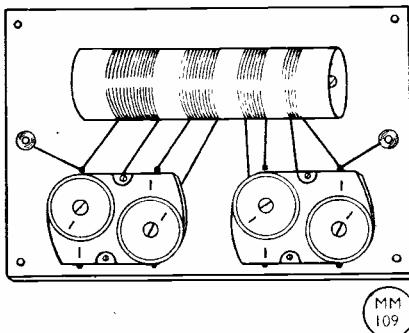


Fig. 1. The construction of the unit suggested by the authors.

terminal as possible while allowing for easy adjustment.

Tuning the trimmer across the appropriate coil will have the effect of decreasing the strength of the signals. Should the receiver be fitted with an S-meter this will take a pronounced dip if the trap coil is tuned in on a strong signal, indicating that the coils have been wound correctly and are covering the required bands.

With the co-operation of a colleague at the transmitting end, adjustment of the trap when placed in the aerial of the local BC set then becomes a simple operation, the requirement being only to tune the coil corresponding to the frequency of the transmission so that it is removed from the BC receiver. This is repeated for each band covered by the trap and should in the end give effective suppression without affecting the performance of the receiver to any noticeable extent.

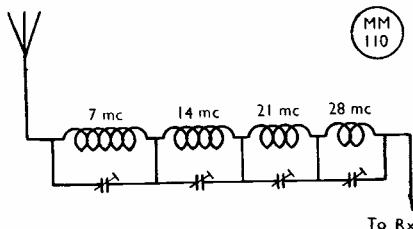
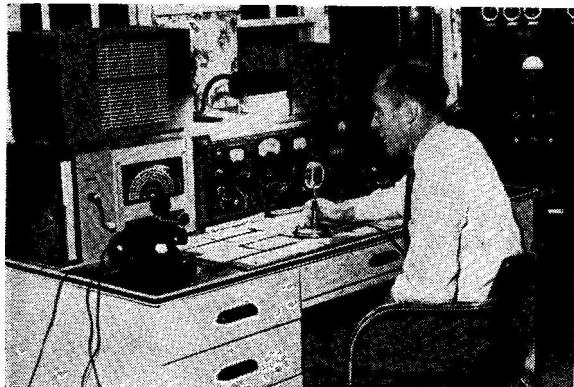


Fig. 2. Electrical arrangement for a series wave-trap, with a stopper circuit for each working band. Very good suppression can be obtained, as described in the article.



DX

COMMENTARY

CALLS HEARD, WORKED & QSL'd

THE general trend reported last month continues ; the high-frequency bands are more and more unreliable, while the seekers after DX on the LF bands are being rewarded for their patience (and, believe us, they need it !) The curious feature about this steady change in conditions is that, on the whole, 28 mc remains in better shape than 14 mc ; it has produced quite a lot of interesting DX, particularly from Asia and Africa, although it is also wide open most of the time in the East-West direction (except for W6 and 7, which are conspicuously absent this winter).

QSL Corner

When making the chance remark, two months ago, about certain countries that didn't QSL (to us), it was not realised how much interest really was taken in the QSL situation. This month there are no fewer than twenty letters on this subject, which we summarise for you herewith. One of the luckiest of all was G3CWW (London, N.W.4), who had an airmail QSL back from KM6AH, 'way back in April, 1948. He seems to be the only one. Luxembourg has produced a mixed bag ; EI8J (Dublin) has seven LX cards (and an HH). G3AGQ (Benson) has three, and, not being a DX man, didn't even realise they were rare. G3GEX (North Harrow) had his card to LX1ZA returned "unknown."

Now this business of EA9AI, whom we described as almost impossible to work. G2FYI (Bristol) has never heard him come back to anyone and says he thinks EA9AI

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

must be "some kind of a beacon" ! Next letter is from G2WW (Penzance), who has worked that same EA9AI four times and has three cards from him. G8KU (Scarborough) has worked him twice and has two cards. G2BBI (Westcliff) has had a QSO and QSL, likewise.

G3DO (Sutton Coldfield) reports cards from HH1HB, HH2CW, HH2X, HP1TS, YN1LB and ZP8AC. G3ATU (Roker) mentions airmail QSL's from CR6AI, FK8AC, KA1NL, KP6AA, VP8AI, VR2BD, and 5PL, VU7AF and W6NVN/KW6. G2WW has them from HP1BR, YN4CB, YS3PL, ZP3AW and sundry YO's and YU's ; with 177 worked, he has 154 confirmed.

G3AIM (Liverpool) reports an airmail from HH2W and two by registered airmail from ZP9FA ! G2DP (Thornton Heath) has them from EA9AI, HH2CW and 5PA, and three ZP's. G6YQ (Liverpool) collected from HH2BL and 2CW, HP1BR, VP7NU, ZP3AW and 3BL. GM3CSM (Glasgow) has cards from FM8AD and HH2BL ; and G2BBI got a QSL from F9QU/FM8 confirming a contact that he made with FM8AD ! G3CQF (Bradford) had a card back from CR4AF, although he doubted his credentials at the time.

G2HIF (Wantage) suggests that the only way to squeeze cards out of some rare DX stations is to catch them when newly licensed

--but then, often, they haven't got them printed ! We close this narrative with a perfect example of a station with *no* interest in QSL's. G3BRK (Chislehurst) had occasion to QSP a personal message to a certain operator, which he did on one of his QSL cards. Some time later, in a QSO, he was told that this message had never been received because the card was "probably put aside unread, with the others." Such a detached outlook may be worthy of praise, but that's not the way 'BRK looks at it.

Republic of San Marino

Consensus of opinion about M1B (worked on CW last month by G5MR and others) is that there certainly *is* a genuine station with that call, but that he works on phone only. G2BBI, G3CGE (Southampton) and G6WX (Coventry) have all got his card. The CW joker giving his QTH as "Snt Marino" is regarded by most stations as phoney. In fact I1AHV told G3GEX that he was, definitely.

Top Band News

Lots of Transatlantic contacts have been made in the last six weeks, but so far very few details have been reported. One of the most successful was G2PL (Wallington), who worked W1BB, 1EFN, 1OE, 1PLO, 3IV, 3LII, 4NNN and EK1AO. He also worked W1BB on phone both ways, and wonders if this is the first G/W phone contact on the band.

G2YS (Chester) suggests that 1950 may be remembered as a Vintage Year for 1.7 mc. Contacts with VE1EA and EK1AO have given him three continents with, as he says, HZ1KE lurking round the corner for a fourth. It only wants some enterprising feller in PY or VP3 to put the nearer parts of South

America on the air, and five might be a possibility. 'YS continues to lead on Counties Worked, with his fine score of 53 counties and 12 countries.

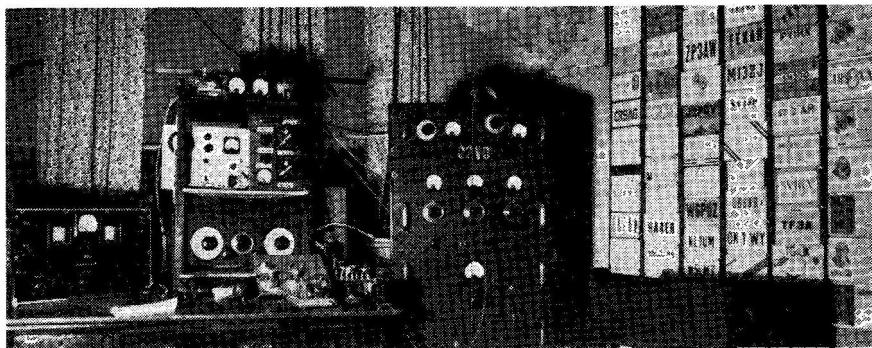
G6ZN (Horbury), using his "QRO" of 3 watts, had a near miss with W1BB, who came back twice with "QRZ G6?N"; very hard luck, but, at the same time, mighty good going. 'ZN has worked seven OK's and EI6F, and is proud of a contact with Sussex at noon, with 559's both ways.

GM2HIK (Forfar) knocked off **EK1AO** and **HB2IW** on January 22, and claims the first GM/EK and GM/HB contacts on the band. **G3BTP** (Langley) worked the same two stations. **G6HD** (Beckenham) joins the Counties table with a score of 51 and 11; **G2AOL** (Otford) started on the band in November and already scores 49 counties.

G8IP (Hampton) says he "wrapped some wire round the house and garden" and, with seven watts, worked nine countries in one operating session. G3AGQ finds the band so interesting that he has no wish to leave it. As he says, queues form, but they do stay QRX until you have finished. He finds a half-wave aerial much better and has worked GC, GI and four OK's.

Another QRP-wielder is G2AJU (Ipswich), with 2 watts maximum to a 132-ft. Marconi, and a score of 40 and 10. He asks us not to clutter up the band by encouraging the big DX boys up there! And he adds, as a bit of gossip, that certain stations hunting W's put in stronger signals than GNF, although farther away . . .

GD3UB (Ramsey), much sought after on 1.7 mc, entered the recent Contest and says that operating was first-class. He only had to make one repeat in 138 contacts, and says that stations just stepped on to his frequency,



G2VD, Watford, Herts, was leading G in the 1948 CQ DX Contest and also holds the WAS and DXCC awards, among other certificates. The receiver is an HO129X and the TX runs a pair of 35T1's in push-pull. G2VD is a performer in all the DX contests and always stands high in the Achievement Tables.

worked him and moved off again, "just like bees going from flower to flower." (We wouldn't exactly call "Uncle Bob" a flower, but let it pass.) Finally, G3EJF (Lancs) makes a plea for Top Band activity in some of the rarer counties, such as Hunts., Rutland, Westmorland and the remote parts of GW and GM.

And just as this issue was going down, EK1AO wrote us to confirm 1-7 mc QSO's with the following, all on January 22 : EI6F, G2HW, 2PL, 2YS, 2YY, 3BTP, 3FSX, 3GX, 3YF, 4AK, 4NB, 5UM, 6AB, 6BQ, 8NF, GM2HIK and GW3CDH. Four countries for him and a nice contact for the stations he worked.

DX on Eighty Metres

The 3.5 mc enthusiasts have still been raking in the good things, chief surprise being the way the ZL's continue to romp in nearly every morning. Between Christmas and the end of January G6ZO (Edgware) had worked 21 different ones and only missed out on one

single morning. Here is the story from the other end, as received from ZL1MB via ZL1MP : During the past month ZL1MB worked G2PL, 6GM, 6ZO, GW3ZV and GW5SL. He thinks his QSO with the latter station on January 11 was the first ZL/GW on Eighty. 1MB has also worked W6, W7, W1, W4, W9, VE1, VE7 and KH6. On February 8 ZL1CI heard VP4TAQ working W7JC at 0700, and CR1OAA working VR2BU at 1200. ZL1CI has also worked LU3EL.

W2QHH (Hamilton, N.Y.) is a well-known exponent of QRP on the band. His maximum is 35 watts, but most of his DX was worked with 17 watts to a 6L6. Nice ones in the log are VP5BD (Cayman Is.), VP5BF (Caicos Is.), FM8AD, TG9RB, YS1ZG and some KZ5. KH6 and ZL, to say nothing of ZS5YF. 'QHH says a score of 100 countries on 3.5 mc is quite possible, as he knows of that number of countries that have been active on the band. His own score is already 65, and he is still gunning for HA, LU, MI3, MP4, SV and YO—to mention a few possibles.

G3FGT (Birmingham) has worked KP4HU, KV4AA, VO4AJ, CT, HA, SP and YO on CW, and has heard FM8AD (1930) and MI3SC (1830). He bewails the particular menace, in the mornings, who calls CQ ZL for hours, works one and immediately starts to CQ again. (Don't we all say things about these types?) G2AOL put in a nice piece of QRP by working W4NNN with an input of 3.2 watts to a 6C4 *doubler*—"helped across" by G3PU.

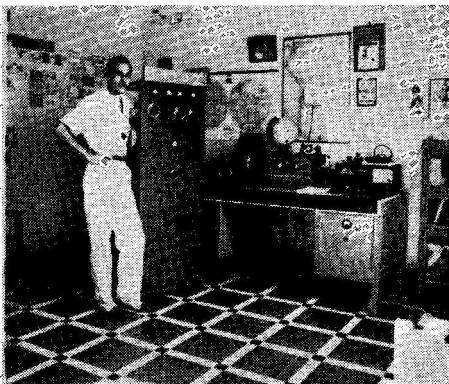
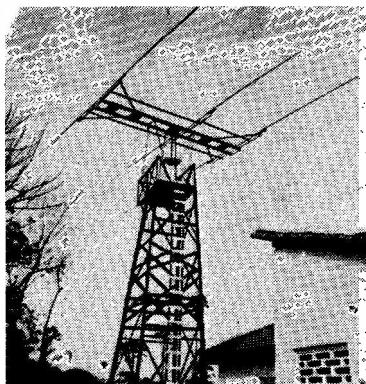
Forty Filling Up

No lack of 7 mc news this month, although the band is in a sorry state with commercials, broadcasters, gramophone experts and all those dear people who have managed to modulate a T2 carrier with a vacuum-cleaner. Hats off to those who managed to dig through all this lot and emerge with some nice shiny DX. G5FA (London, N.11) worked AP5B and UL7KAB for two new ones, plus EA9, HZ, KP4, KV4, TA, W6 and 7, and ZL. G6BB (London, S.W.2) found CT3AB, EA9BB, KV4AA, LZISP, MD7DC, MP4KW, VP6CDI and VK and ZL. G8IP came out of it with AP5B, KZ5IP, MP4KW, VQ3, VQ4, ZD4 and ZS, but despairs of ever raising KV4AA.

Best for G6BS (Cambridge) were AP5B, KH6IJ and 6PL, VP6CDI, ZE2JN and ZS's. G3BDQ (St. Leonards) managed HZ, KZ5, MD7, MP4, PY and ZS. G3COJ (Hull), having his annual "go" during the VHF off-season, emerged with HZ1CK, MD7DC VS1BX, ZD9AA and a ZS (all between 1900 and 2030).

G8KP (Wakefield) decided to have a thrash

TOP BAND LISTING		
Starting August 1, 1949		
Station	Counties	Countries
G2YS	53	12
G6AB	51	12
G6HD	51	11
GM2HIK	50	11
G6ZN	50	10
G2AOL	49	10
G3GDW	46	8
G4LX	45	9
G5XF	45	8
G3AGQ	44	9
G3EJF	43	7
G3BTP	42	11
G2AJU	40	10
G8NF	38	10
GW3CBY	38	8
G3ATU	37	8
G3BEX	37	7
G3FZW	37	6
G2ABT	36	6
G3FGT	34	8
G2CZU	34	5
G2BON	33	7
G3NT	28	4
G3ALE/A	28	4
G3GGN	14	5



The HK's are pretty reasonable DX in anybody's language. This is the outfit of HK1DZ, Barranquilla, Colombia, who has a very nice station

on the band, using one half of his 14 mc dipole, end-fed, and worked such DX as EA9, KG6 (1440), KP4, KV4, LU, PY, UF6, VP6, VQ3, VS1, VS6, W7 and ZD9—the latter coming back to a CQ. Fifty countries in three weeks with half a 14 mc dipole, and here is 'KP complaining that he only has a 35-ft. garden !

G3FXB found the band quite good, what with EA8, EA9, MP4 and TF, but G3GEX says it has deteriorated badly since before Christmas, even the mighty W1BOR being quite a bit down. G2WW had yet another Delaware contact (with W6ZWL/3), followed by W6BVM, WØ's and EA8BC. G6AT (Hampton Hill) winkled out AP5B, VE7VC, VK7JB, VP6CDI and VS6AX ; he now enters the Four Band Table on the strength of a solitary QSO on 28 mc. G3AKU raised most of the aforementioned DX and has also heard VK, VS1, VS6 and YI in the early evenings.

G3DRN (London, S.W.20) describes himself as "a 7 mc plodder with a 6L6 PA," but managed to raise HZ1CK with it. His pet aversions, for the record, are (a) the SM who answers a longish CQ DX at 0400 on a very cold morning ; (b) the G who persists in sending doubles when signals are 589 both ways ; and (c) the other G who says "RRR solid FB OB" and then folds up completely when asked "QTR ?"

Bugs and Other Insects

Pause from DX while we clear the throat and think beautiful thoughts about Operating. Last month's remarks about G3's and GSM's brought back a stinger from G3GEX, who asks "What about the G6's who can't send a figure 6 on *any* type of key?" And

GW3AHN (writing from London, S.W.20) says that "SM," instead of "3," does at least represent the right characters in the right order, which is preferable to the strings of uncountable dots representing S, H, or 5 that one hears from certain bug-wielders. Too many of the latter, he says, cover up mistakes by sending at breakneck speeds, and he was only converted to a bug himself by hearing the perfect sending of a certain G who *does* know how to handle one.

At the risk of calling forth more rudery, might we say that many really good bug operators are not even suspected of using the device at all? If it gives itself away as a bug, then it is not being well handled. As a tail-piece we might mention (for no reason at all) that W1FH has worked more countries than anyone else in the world, but we've never yet heard him send an H with less than six dots. Maybe that's what gets them! (Arabackle says "Why not see if the QSL Bureaux have any cards for G6Q6 ? Might be missing something.")

The 14 mc DX

Mighty thin report on 14 mc this month—seems almost as if conditions have been poor. G3ATU added two with PJ5TR and FY8AA, and nearly lost the latter owing to the tactics (see also last month) of a W1. G2WW found ZD8B during BERU, calling away and apparently not getting replies. So he worked him. WW has heard that VT1AB claims to be genuine, in Kuwait. Regarding FB8XX, on Kerguelen, he says the spivs have been hard at work on him ; and it is hard luck on the operator who would like to behave, because he has only a very slender chance. The trouble is that most of these rare DX

FOUR BAND DX

Station	Countries Worked					Power
	14 mc	7 mc	3·5 mc	28 mc	Total	
W2QHH	178	46	65	92	186	35
G3ATU	175	70	26	100	183	10/150
G6BS	175	109	28	4	181	150
G2WW	168	46	21	99	177	150
G2AVP	162	55	28	32	169	25/120
G2VD	161	60	28	98	168	150
G3DO	158	37	23	103	189	150
G3AKU	131	59	30	56	147	100
G8KU	131	43	9	65	145	50/120
G5FA	127	95	19	67	144	35/150
G8VB	124	49	52	61	144	120
G5WC	119	50	1	12	121	45
G8IP	115	42	13	66	132	3/150
G3FNJ	114	45	24	71	135	150
G2YS	113	30	23	31	125	150
G2FYT	112	15	5	30	118	?
G8QX	111	18	12	73	131	150(P)
GM6IZ	110	2	5	32	114	100
G6BB	108	54	25	45	123	10/85
G8VG	107	54	22	26	122	60/75
G3ACC	104	13	21	6	113	150
G8PW	100	55	6	46	110	25/100
ZB1AR	94	41	29	43	106	100
G2HKU	93	36	1	12	103	30
G3FGT	85	33	28	41	102	25
G6AT	84	42	20	1	90	100
G2DHV	83	21	19	4	88	25/60
G2BJY	82	24	4	101	134	25
G6TC	82	43	11	17	94	20/75
G2VJ	79	13	4	55	99	?(P)
GW3CBY	46	28	18	10	60	15/30
G3FXB	43	37	19	11	57	25
G2HIF	42	9	6	94	108	150(P)
G3EIZ	39	23	36	15	54	25
G3BOC	32	24	17	64	75	50

stations do *not* use QLM-QML procedure, and don't even make it clear when a QSO really is finished.

G3BDQ has done quite well, with MP4, VE7, VP6, VS1, 6 and 9, VQ3, ZD4 and ZE. G3FGT has pulled in KP4, MD2 and 7, VQ4, VS1 and the Africans. He heard YI3DYN and ZK1F on the same frequency, and called them alternately without result. We rather think YI3DYN is genuine, but should be very sceptical about the other one.

Incidentally, can anyone enlighten us about TZ1J, heard at about 1600 on MCW? He called CQ DX, was replied to by practically all the world, and went back to several W6's, all of whom he appeared to know by name. He said his own name was Chang. (Probably the story will be common knowledge by the time this appears, but at the time of writing it is a mystery. Maybe it's just the new Chinese prefix.)

G3COJ says that "M1D," on phone, is said by the Italians to be phoney and probably in, or near, Rome. CRIQAA, on the other hand, is supposedly genuine.

The Ten-Metre Band

By the way, there have been several references already to MP4KW. Practically all our 28 mc correspondents have worked him. Let us make it quite clear that the call-sign was assumed, for BERU purposes, by Ken Ellis of HZ1KE, and that MP4KW was *not* in Oman or Bahrain, but in Saudi Arabia.

G3AWP (Bournemouth) has been mainly active on 28 mc phone, and his reaction to it, even now, is that the DX is "just too easy" with P/P 807's and a 3-element rotary. To prove it he lines up CR5UP, CT2AE, FF8AH, HC1OY, HK1DZ, HZ1KE, OA4CL, ZC6DZ, ZD1FB, ZP3AW and ZS3O. GM3CVZ (Kirkcaldy) uses the indoor beam with bent elements, recently described in the *Magazine*, and is delighted with it; he offers FE8, VQ3, VQ5, VS6, ZD2, ZE and ZS9 to substantiate.

G3AIM has worked KZ5, VQ3 and XZ on CW, with DU, FF, HC, HH, MP4's and VP2 on phone. G2BBI is only active on Saturday and Sunday afternoons, which he spends looking for Montana and Wyoming, both badly wanted. G3FXB worked HR1RL and would like his full QTH. G2HIF collected CT2AE and MP4BAO for two new ones. G3FGT winkled out KP4, MP4, VK7, VQ5, VS9, TA and W7, and G5FA contributes AP5, SV, VS9, VU, XZ and ZS.

G2BJY (West Bromwich) put his 25-watter's score up to 101 on the band with ZS3O, and also found most of the others, including VS6JH, who is our friend G2FSR (see note later). G8IP found things poor on the whole, but has been using a ground-plane aerial which, while it makes local noise worse, has

reduced the signals from local stations to a very pleasing degree.

From all the foregoing you will gather that Ten has not produced any startling new DX but a nice steady stream of stations that are well worth working (unless you are so blasé that nothing but a new country is worth a QSO).

Miscellany

G3GEX and others lament the fact that although EA7 is (apparently incorrectly) listed as Rio de Oro, all the EA7's one finds are apt to be firmly inside Spain; EA7 is in fact allotted to Andalusia (see later). G8PW (Manchester) says that some of those who moan and groan should be in his position—living ten miles from the shack, in digs, owing to the housing shortage. He only gets on the air for about four hours a week.

"Points of view" reported by G2HIF : (i) A G station saying "These ZB1's who persist in ragchewing with G-land should go somewhere else and not clutter up the DX"; (ii) A ZB1 saying "These stupid DX contests fill the band so full of G's that one can't get a decent QSO."

G2AKR (Manchester) says that ST2KR has asked him to make it clear that ST2ET, 2GE, 2KR, 2RD and 2RL should be added to the list of active ST's recently published. (And ST2SP is another one.) G3FGT has managed to pass his Century after nine months on the air, and is (justifiably) quite pleased about it.

G3ECX (London, S.E.12) has just enrolled the first member of the "CQ Century Club," having heard UP2KBC call CQ VK 122 times. He was replied to by an SM and an I, and worked the latter. 'ECX adds, on the subject of CR4SS, that some Paris amateurs have D-F'd him and think he is in Tunis.

G3GCY is ex-VS1CT, and is holding cards for VS1CB and ICR. Will they please contact him at 57 Abbots Way, Beckenham, Kent? VQ4CUR and VQ1CUR have now passed into the past, Capt. Harry Thomas having returned home at long last to G2CUR. All those waiting for VQ1 cards will get them; he has them printed, but is waiting for his logs to be returned from Kenya. In the same vein, ZB2G (Gibraltar) is now QRT, but outstanding QSL's will be dealt with. MD2B is likewise closed down, and the operator, Capt. G. W. Carpenter, is awaiting his G ticket "so as to start sticking flags in a map again."

G3EAP (Sheffield) is pleased with a QSL from UB5BV for a phone contact on Ten—the UB5 using "Western type" gear with an AR88, an 813 and everything—but he refused to be drawn into a chatty QSO. G2NS (Southbourne) says "Do I get a prize?"—he having listened round on Twenty for four

hours heard PX1Z/MM, CI3DC, IS1FIC, LB5LB, SL5CB and "two Red Russian commercials from White Russia."

G6KR (Shrewsbury) is among those who feel that too much of the cards-and-points business may kill the interest of those not so competition-minded, since the others succeed

SHORT WAVE MAGAZINE FIRST "DOZEN DX" CONTEST FOR UNITED KINGDOM STATIONS ONLY

1. The Contest will take place over two three-hour periods, 2200 Saturday, March 25 to 0100 Sunday, March 26, and 1700 to 2000 Sunday, March 26.

2. Only the 14 mc amateur band shall be used. CW stations to operate between 14000 and 14150 kc, and Telephony stations between 14150 and 14400 kc.

3. Any number of contacts may be made during the six hours of the Contest, but in forwarding the log, only the twelve best contacts are to be claimed. These are to be decided on the "Points Value" figures for the various Countries of the World, as given on pp. 842-843 of the *Short Wave Magazine* for January, 1950.

4. No DX station may be worked more than once to count for points during the whole period of the Contest.

5. Each station chosen for scoring purposes is to be logged as follows : (1) Times of start and finish. (2) Station Worked. (3) Country. (4) Frequency of Station Worked. (5) Frequency of Own Station. (6) Incoming Report (RST or RS). (7) Outgoing Report (RST or RS). (8) Points Claimed.

6. Contacts may be made on CW or Telephony. CW/Telephony or Telephony/CW contacts may also be claimed for scoring purposes.

7. Entries are to be in the Editor's hands by April 4, 1950.

8. All entries are to be accompanied by a copy of the following declaration, signed by the entrant :

*"I certify that my station was operated throughout this Contest by myself, and that all conditions of the station's amateur licence were fully observed. I also declare that the log is a true and correct statement of my twelve best contacts during the period of the Contest. I agree that the decision of the Short Wave Magazine Contest Committee will be accepted as final. . . .
Signed*

in giving the impression of wanting to hog the air. Well, the quick answer is that there is still room for everybody, whatever their interests, and it is also true that there are a great many amateurs happily working DX who never enter a contest.

Those EA Prefixes

Just as we thought we had got the prefix situation buttoned, in comes a helpful letter, complete with neat sketch map, from EA1BZ (Torrelavega). Commenting on the list appearing here in January, he says there is "a little mistake in regard to the EA prefixes." EA7 is allotted to Andalusia, *not* Rio de Oro (American papers, please copy); Rio de Oro has never been given a prefix, which might be either EA9 (officially) or EA8 (logically) if and when one is allotted. EA8 is used for the Canary Islands only, and Spanish Guinea at present has no prefix; it might be EA9 but could be EAØ, and Joaquin remarks that he is expecting an amateur to show up in Spanish Guinea using EAØ. So sort that out! Incidentally, his map shows EA1, 2, 3, 4, 5, and 7 allotted to the mainland of Spain, EA6 to the Balearic Islands, EA8 to the Canaries,

and EA9 to Spanish Morocco. Nothing else has been laid down officially,

W.A.E.C.?

It looks as though we really shall have to offer a Worked All English Counties Certificate. The demand is growing—not so much for home consumption as for DX stations. G3AKU, who lives in a "rare" county (Hunts) is naturally in favour. G3CGD comments on our remark last month ("Who ever has any trouble working W's?") and says we should try it with 5 watts, a garden 10 ft by 15 ft, and three or four storey buildings all round. So he would welcome lots of W's chasing after a WAEC!

We suggest that a WAEC Certificate should be available to G's for 1·7 mc only, and to all other countries for any *one* band, but not a mixture of bands.

The "Dozen DX" Contest

Get ready for March 25-26; you will see full particulars in the box herewith. And don't forget the declaration (Rule 8). We have already been assured of quite a lot of support for this first effort, and any rare DX showing its head should be well and truly pounced upon. G5YN (Salisbury) says it is the ideal contest for the married man only home for a limited time, for whom the Marathon type is "most exhausting." It should, he says, bring out the best in a really patient DX man with a good nose for the rare station. G3BI (Seer Green) is back after some months, complete with a WAZ, and he enters the lists again. He, too, likes the "Dozen DX" idea and intends to have a go.

News from Overseas

ON4AZ (Antwerp) wants us to publish the rules of all the forthcoming DX Contests. We find that an almost impossible task, unfortunately. But 4AZ is right when he says "the vast number of amateurs work in them, not to win, but to work DX which is more plentiful during Contests." HB9DY and HB9REP have been readers ever since the war, and take their DX on phone only, with a score of 108 to date. They won the HB section of the ARRL DX Contest last year, and hold WBE, 28 mc WBE, WAC and BERTA. For WAS they are missing on Wyoming only.

ZD4AM (Tafo) hasn't thought much of 14 mc conditions, although he has collected quite a few new ones. He says that HP1BR shot him a card by air mail in no time. (Well, we mean to say, when you're a ZD4 . . .) Harold says QRP men can take heart from a little unrehearsed feat of his, in which he made WAC on 14 mc in two hours, using 15 watts. Times, 1847-2047 GMT. He adds

ZONES WORKED LISTING

POST WAR

Station	Z	C	Station	Z	C
Phone and CW					
G3DO	40	189	G2AKR	35	123
G3ATU	40	183	GW3AHN	34	129
G2WW	40	177	G3ACC	34	113
G2AVP	40	169	G6QX	34	112
G2VD	40	168	G3FDV	34	100
G3BI	40	162			
G3AKU	40	147			
G3FNJ	40	135	G2FYT	33	118
G8IP	40	132	G3FGT	33	102
G5MR	40	124	G6AT	33	90
ON4AZ	39	156	G6TC	32	94
G8KU	39	145	GM3CVZ	31	93
GSFA	39	144	G2DHV	31	88
GM3CSM	39	139	G2HKU	30	102
G3DCU	39	138			
G3CNW	39	130			
G6BB	39	123			
G3BNE	39	116			
G8VB	38	144			
G6WI	38	128			
G3CVG	38	124			
GM6IZ	38	124			
G2BJY	37	134			
G3AWP	37	123			
G5WC	37	121			
G3BDQ	37	120			
G3AIM	37	120			
G2YS	36	125			
ZD4AM	36	118			
ZB1AR	36	106			
Phone only					
G3DO	37	151			
G2WW	36	125			
G6WX	36	121			
G8QX	35	131			
G2VJ	34	99			
G2HIF	32	108			



VQ2DH, Livingstone, Northern Rhodesia, started in July, 1947, and now runs 100 watts to a pair of 807's for operation on all bands 6-40 metres ; the early stages are 6J5-6J5 Franklin VFO into 6V6-6V6-6L6. Receivers are a BC-348, much modified, and an HQ120. This equipment last year won him the N.R.A.R.S. trophy for DX operation, when the aerials in use were a 66-ft. centre-feed for Forty and Twenty, a folded dipole on 14 mc, and a 3-element beam for Ten. By the end of October, 179C in 37Z had been worked, with 147C confirmed.

that 7 mc G's are now so commonplace that he doesn't send lists of Calls Heard any more.

VS1BQ (Singapore) says rebuilds are no fun when you can't pop round the corner for coil formers, split-stator condensers and the like. He now has a 150-watt ticket and is out for something bigger and better than his 20 watts to an 807.

VS6JH, previously mentioned, is G2FSR, now in Hong Kong (QSL via Box 541). As John says, he now has to suffer the onslaught of numerous eager W stations when he calls CQ Europe. But one of his first contacts was AC3SQ, who has already QSL'd. ('SQ runs 12 watts on 14100). Stuff like KC6, KJ6 and KW6 is easy in Hong Kong, although conditions on the whole are poor, VS6 being at the bottom of a well—surrounded by hills 1,500 to 2,000 ft. high. Keep it quiet, but VS6JH hopes to be VS5JH, some time. We shall sell his frequency, or raffle it !

Also from Hong Kong, **GM3ANO** (H.M.S. Jamaica) says it is pathetic to listen to three VS1's, one VS2 and several VK's replying on 7 mc to G's, who don't come back. He has been receiving very solid signals from several G's, mostly between 1900 and 1930 GMT.

Noel Roberts (ex-VK9NR and VK5NR) is now ZL3OZ, but doesn't expect to be there very long. He is hoping for a transfer to the islands, probably Samoa. The only active station on Norfolk Island is now VK9RH.

F3HK (Louveciennes) advances a few ideas for contests. He thinks GM6IZ's formula

(p. 757, December 1949), although intended to make us laugh, contains some sense. At any rate he would welcome a multiplier derived from the square root of the input, giving 1 for a kilowatt, about 2.5 for 150 watts, or 6.3 for 25 watts. But he is not in favour of any limitation of equipment, because "a clever fellow may succeed in piping *all* of the precious juice into a simple Zepp, and get good results, when another man will lose some 80 per cent. in feeders and what-nots, and make a poor show of himself with a splendid (and wrongly-adjusted) 4-element beam." He would also like to see a contest without the "sixty-contacts per hour look of the big international events," in which one had to transmit, perhaps a complete phrase out of DX Commentary, preferably with plenty of call-signs in it. Finally, a multiplier of ten for the use of SSB telephony ! Now, now, 'HK, you've made us start thinking again !

And that's about the lot this trip. So much gen. from the readers that we've hardly had time to say anything ourselves ; but that's probably a Good Thing. Please note that next month's deadline is first post March 14 ; and, for Overseas readers, the following month's date will be April 11.

So now—good luck in the "Dozen DX" do ; we shall have a formidable array of listeners checking up on you, and everything that happens will be reported, so keep it clean but find that DX somehow. Until next month, 73 and Good Hunting.

SIMPLE QRP Tx

"The Breadboard Special"

By P. SHORT, M.Sc.(Eng.),
A.M.I.E.E., (G3CWX)

THE simple CW outfit described here can be built on the kitchen table in a few hours. Nevertheless, it comprises the four essentials: A power pack, an aerial coupler, a transmitter and a keying circuit, all in one assembly. Being small and inexpensive it solves for old hand and beginner alike the problem of how to get on the air with limited resources, or how to stay on when the main transmitter is under construction, repair, reconstruction, or maybe just refusing to play. It will feed into almost any piece of wire used for aerial. After reading so many articles on VFO's, transmitters, power packs and aerial couplers all considered as separate units involving no end of metal work the beginner may find it a relief to sit down at the kitchen table and build one complete job which will get him going—and keep him going.

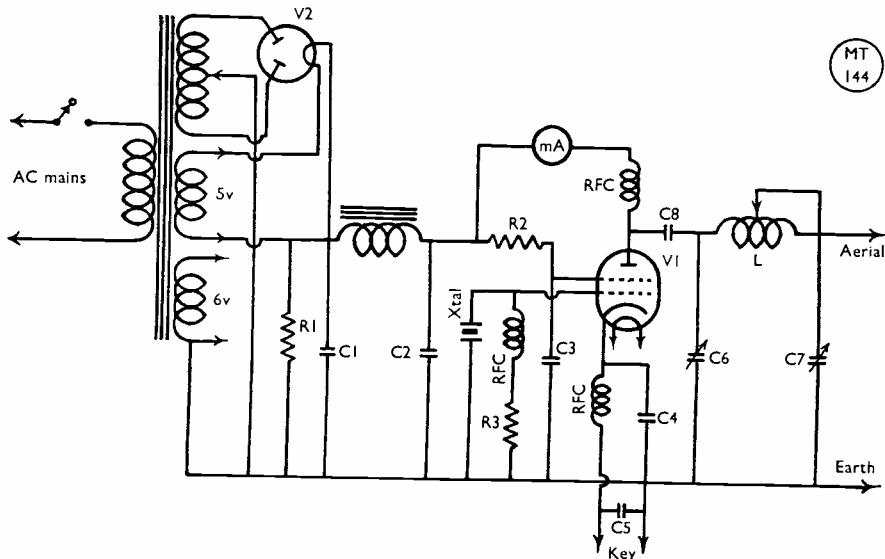
Circuit

The general arrangement is the familiar single crystal oscillator using a 6L6—though a 6F6, 6V6 or glass equivalents could be

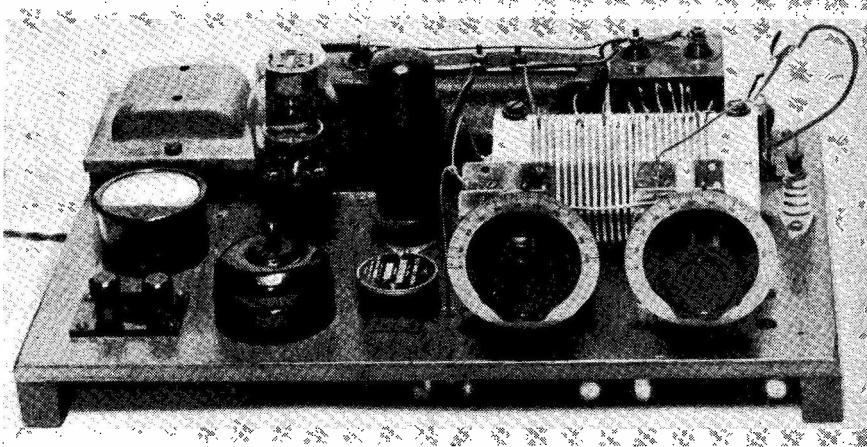
In these days of table-top cabinets and smart rack-and-panel stations, it is sometimes forgotten that the humble baseboard layout is a quick and easy way of getting on the air. Utility without beauty, perhaps, but 25 years ago it actually was a half-crown breadboard that made the best foundation for a one-lung perker, as many an Old Timer will remember.—Editor.

substituted. The oscillator circuit depicted is strongly recommended for good keying in this transmitter, and with it the extra complication and cost of a separate amplifier stage are unnecessary. The tuning coil shown is for the 3.5 mc band or, with part shorted out by a clip, for the 7 mc band.

For simplicity, the oscillator is not arranged to double frequency and a crystal for the band in use is necessary. The crystal holder can be an octal socket for $\frac{1}{2}$ -in. pin spacing, or an American five-pin valveholder for $\frac{1}{4}$ -in. pin spacing—though a holder with a couple of sockets knocked into an odd scrap of insulating material is indicated in the photograph. Components below the baseboard are suspended in the wiring. The large tuning coil was used mainly for feeding little aerials shorter than a quarter-wavelength, in which case the less the HF resistance the better. Small coils with thinner wire are otherwise quite acceptable. An earth connection is unnecessary when a wire about half a wavelength or a full wavelength long is attached to the aerial terminal, but desirable when three-



Circuit of the one-valve-with-rectifier transmitter described by G3CWX and illustrated herewith. It can be knocked up very quickly and would serve as a very useful stand-by



This is how the knock-up transmitter described by G3CWX appeared when completed—as he says, it is intended as an emergency stand-by, with appearance as a minor consideration

quarter wavelength, quarter wavelength and shorter wires are used. The voltage across the filter condensers rises to 500 when the key is up, so the thoughtful may like to have an earth connection anyway, and to cover the projecting terminals of the filter condensers and choke. The author uses old 4 μF paper condensers (his are only 400-volt working, nominally!) but some prefer the shorter-lived 500-volt electrolytics.

Construction

The whole device is built on a piece of wood (breadboard of the old days) because that is the easiest way. Most people have a few woodworking tools about the house, or can borrow them, and even if the holes have to be bored with a red-hot poker that fact need not appear during a QSO. The bits and pieces required for the construction can mostly be found in other people's junk boxes. The variable condensers have earthed rotors and

can be tied to the baseboard by brackets or small eyebolts.

Setting Up

Those unfamiliar with the pi-section output circuit will probably do best to start at a quiet time with the aerial attached and the variable condenser on the aerial side at maximum capacity. Tune the other variable condenser for minimum anode current, then decrease the first condenser from maximum a little and retune; this process is repeated until a point is found where the desired coupling to the aerial is obtained, as shown by an increase to the required value of the minimum or no-load anode current. Anode inputs of the order of 50 to 60 mA (roughly 20 watts) are recommended. The design is intended for break-in working with separate aerials on transmitter and receiver, but a SPDT switch screwed on the baseboard will take care of aerial change-over if only one aerial is used.

There are no possibilities of expanding this transmitter into something more ambitious, bar trying to convert it into an oscillator-doubler, and constructing it more tidily than the writer has found necessary. Those who have tried elementary transmitters without much success, and even the 150-watt or VHF practitioners who want a standby 3.5 or 7 mc job but have never got much joy from a keyed crystal oscillator, are strongly recommended to make up this one before they go any further. It can be stowed in an odd corner till the time when it is wanted to keep them on the air—which it will do even if the main aerial is down and it has to feed into a curtain rod or the XYL's galvanised clothes line. Try it and see.

Table of Values

Circuit of the Transmitter Complete

C1, C2 = 4 or 8 μF , see text

C3 = .01 μF

C4 = 100 μmF mica

C5 = 0.5 μF

C6, C7 = 500 μmF variable

C8 = .01 μF mica, high test

R1 = 1 megohm, 1 watt

R2 = 15,000 ohms, 1 watt

R3 = 22,000 ohms, $\frac{1}{2}$ watt

RF chokes—Normal Value

Smoothing choke—20 henry, 60 mA

Coil—25 turns No. 16, $3\frac{1}{2}$ in. long, on 2½-in. dia former.

Mains transformer—Broadcast receiver type, secondaries 350-0-350 volt, 60 mA, 5 volt 2 amp., 6 volt 1 am

V1 = 6L6

V2 = 5Z4G or similar

Milliammeter 0-150 mA.

NEUTRALISING LIVE

With HT On

By R. W. ROGERS (G6YR)

HERE are several well-known methods of carrying out the neutralisation of an RF power amplifier—such as the use of a loop and lamp, checking the grid current for dips whilst swinging the anode tuning condenser, and measuring the RF in the anode tank circuit by means of a sensitive indicator. All these methods are useful, but all suffer from the disadvantages that they require the HT voltage to be removed during adjustment.

The following is a description of a simple method, which does not seem to be generally known, in which the stage is neutralised *under operating conditions*.

Method of Adjustment

To begin with, if we assume that a PA has already been neutralised, a study of the anode and grid milliammeters will reveal the fact that as the anode tank is tuned around resonance, both anode and grid meter readings will vary. If neutralisation is perfect at the setting for minimum anode current, the grid current will be at its maximum and the

slightest detuning of the condenser either way will cause an increase in anode current and a decrease in grid current.

If the stage is the slightest amount off neutralisation, the tank condenser setting for minimum anode current will not coincide exactly with the setting for maximum grid current, the difference between the two tuning points affording a rough indication of the amount by which the neutralising condenser must be altered. The meter readings can also be taken to indicate whether the neutralising condenser setting is too high or too low.

If the tank tuning is first adjusted for anode current dip, it is necessary slightly to increase the tuning setting in one case and reduce it in the other to obtain a maximum grid current reading.

Advantages

The whole neutralising operation is much simpler than it sounds and can be carried out in a fraction of the time it takes to describe. The accuracy of the indication obtained is very high (much higher than with a loop-and-lamp, or watching for flicks on the grid meter), no extra equipment is required, and as the neutralisation can be checked while the transmitter is in full operation, the method is very suitable when changing bands, as the exact setting may vary slightly from band to band. This is particularly advantageous when the neutralising adjustment is brought out to a panel control (an arrangement favoured by the writer).

BK KEYER

Easily Adaptable Circuit

Devised by

A. P. KERFORD-BYRNES (G6AB)

HE original method of keying the transmitter at this station was by having the key in circuit with the cathode of the oscillator. When this was changed for a semi-automatic type of key the writer found that he was obtaining far too many shocks for his peace of mind when making adjustments to it. In the interests of safety it was therefore decided to key the transmitter by means of a relay. After making this wise decision, it was thought that if a relay had to be used then let it have more than just one function—why not adopt break-in operation? A little unit has been

constructed to enable this to be done in a very simple manner. To avoid complications it was decided to use a separate aerial for the receiver, which simplifies matters quite a lot.

A mains transformer equipped with a 12-volt secondary was found and an old metal rectifier which had originally seen service as part of a trickle charger was also unearthed to provide LT for the relay; this was a surplus component of 75 ohms which is fitted with three pairs of contacts, two of which "make" and the remaining pair "break" when current is passed through the energising coil of the relay.

Obviously one of the "making" contacts was ideal for keying the oscillator. Let us call this pair of contacts "A". The thing was then hooked up roughly for test but it was found that clicks were bad, so a filter was incorporated with a couple of RF chokes and a small condenser which successfully overcame the trouble. As might have been expected, when listening close to one's own frequency

Table of Values

Break-in Keying Unit

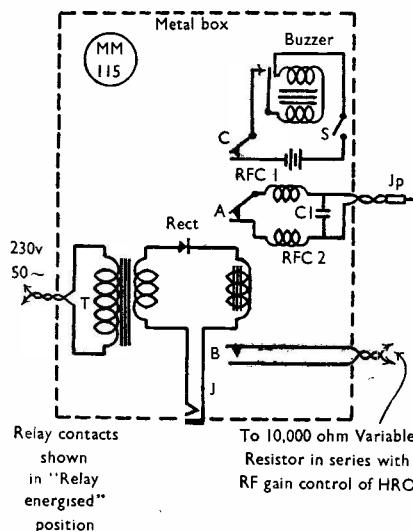
C1	= .005 μ F, mica
T	= Mains transformer, 12v secondary
Rect	= Metal rectifier, 12v 1 amp
Ry	= P.O. type 75-ohm relay (<i>see text</i>)
Buzzer	= High note for monitoring
S	= On-Off switch
X	= 3v lamp battery
J	= Jack for key
Jp	= Plug to keyed circuit
RFC1, RFC2	= 2.5 mH RF chokes

the beat in the headphones was far too strong for comfort, so the next step was the muting of the receiver, in this case an HRO.

Application

A $\frac{3}{8}$ -in. hole was drilled in the side of the HRO cabinet, above the aerial and earth terminals, with a 10,000-ohm variable resistor mounted through this hole and connected in series with the existing RF gain control on the receiver. A pair of wires was taken and shunted across this variable resistor at one end and connected to the two contacts which "break" when the relay was energized. Let us call these contacts "B". It will now be observed that when contacts "B" are opened, i.e., in the key-down position, additional resistance is thrown into circuit, thus muting the receiver. A fixed resistance of 5,000 to 10,000 ohms could be used instead of the variable one, but the latter was used here as it enables the pick-up to be adjusted to suit one's personal taste. It was now found that when the paddle of the key was pushed to the left, the relay was energised, contacts "B" opened, muting the receiver a fraction of a second before contacts "A" were closed putting the transmitter on the air, and when the paddle was released, contacts "A" opened a fraction of a second before contacts "B" closed, thus shorting out the muting resistance. This, of course, is the ideal sequence of events.

Now this arrangement is fine when working a station on or very close to one's own frequency. But when in QSO with a station some 50 kc away one can only hear very faint clicks in the headphones which are not so easy to monitor as a high-frequency note. It was therefore decided that the remaining pair of contacts (let us call these contacts "C") might as well earn their keep so a high-note buzzer (also from the junk box) was brought into use and energised by a 3-volt cycle lamp battery in circuit with contacts "C" of the relay. Thus, when listening away from one's frequency one can hear the note of the buzzer —so the unit provides for all contingencies. An on-off switch was also placed in series with contacts "C" to enable the buzzer to be thrown out of action if desired.



The break-in keying unit described by G6AB. The high note buzzer allows for monitoring the keying when listening off the transmitting frequency

This keying circuit can be made up into quite a compact little unit, preferably a metal cabinet which should be earthed, with the jack socket for the key or bug and the buzzer on-off switch brought out to the panel; constructors will find it well worth the small amount of space it occupies on the operating table. Providing transmitters are keyed in the oscillator circuit the unit when once built up can be used for operating break-in on any transmitter in the station, as it only necessitates plugging the jackplug Jp. into the keying socket of the transmitter which is to be put on the air. The complete circuit of the unit is appended herewith; it can easily be built up in an evening, and readers who have yet to experience break-in operation will find that they have a very pleasant surprise in store for them.



GET IT REGULARLY

May we remind casual readers that the *Short Wave Magazine* is obtainable regularly and on time (despatch on publication day) by direct subscription. A year of twelve issues —nearly 1,000 pages of direct and lasting interest to every radio amateur—costs but 20s., post free. Order, with remittance, on the Circulation Manager, *Short Wave Magazine*, Ltd., 53 Victoria Street, London, S.W.1.

VHF BANDS

By E. J. WILLIAMS, B.Sc. (G2XC)

Activity and Conditions—

Stacked Arrays vs. the Yagi—

Station News and Comment—

About Achievement Tables

CORRESPONDENCE this month has shown a wide variation of opinion on those two subjects, Activity and Conditions, which feature so often in this column. First letter to be opened said, "Activity has been quite good considering all things," while letter No. 2 read, "Activity generally has been very low." True, one of these came from within thirty miles of London, while the other was 150 miles from the metropolis, and there is no prize for guessing which is which! Assessment of conditions has been equally at variance, several of you contending that conditions have been excellent, while others feel they could hardly have been worse.

On the question of activity, your conductor's personal observations have shown that on most evenings a dozen or more stations in South-Eastern England have been on 2 metres, and there has also been something to work between 1900 and 2000, and after TV. Although wishing to do everything possible to encourage VHF activity, it is felt that it is unreasonable to condemn (as some correspondents have been doing) the VHF man who stays off the air during TV hours in order to grope for the picture himself on his new home-built receiver. Similarly, it is surely unreasonable to expect any operator to be on the band *every* night—though it is also true that many people have the Rx on and listen round at intervals to see if anyone *else* is transmitting. These points are touched on here because quite a number of our regular correspondents seem to forget that a radio amateur can have other interests in life besides Amateur Radio.

Regarding the other side of the matter, namely, Conditions, some of those who proclaim their general excellence base their

claim on the consistent maintenance of a daily schedule, while others just "feel" that conditions were good. The latter hardly provide scientific evidence, while results obtained by the former may be somewhat misleading. Most operators find there are certain directions in which they can work much more easily than in others. In these directions it may be possible to send and receive 145 mc signals up to distances of a hundred miles or so without the aid of abnormal tropospheric bending, particularly where high-gain aerials and open locations exist. This will tend to make such a path less useful as a criterion of conditions and it will be misleading if it is used as a guide to conditions existing on other paths, on which the DX depends entirely on tropospheric reflections and refractions.

So to those in the North and West who have complained of lack of signals from London and the South, it is suggested that conditions may have been poorer than you thought; at any rate, assurance can be given that there have been signals on the band every evening, and on some evenings activity has been quite lively.

Aerials

The discussion on the relative merits of the multi-element collinear stacked arrays and the Yagi beam has subsided in recent months, but some comments by W2PAU in his VHF column in *CQ* for February 1950 may be of interest. "In a recent survey of UHF TV signal propagation by the RCA Laboratories it was demonstrated that, in a fairly large percentage of the receiving sites tested, high-gain aerials actually provided less input to the receiver than much lower-gain aerials. It seemed as though the sharp high-gain aerial was discriminating against some of the signals which arrived from slightly different directions than the main wave, and neither the direct wave nor any of the echo signals seen by the sharply directional array was as great as the composite sum of all the signals picked up by the less discriminating (and hence, lower gain) array."

A less discriminating array need not, however, be a lower gain array. It is all a

matter of the plane in which it discriminates. The colinear stack has a high degree of discrimination in the vertical plane, but poor in the horizontal. Hence, from an azimuth point of view the high-gain properties of such an array are associated with poor discrimination and signals arriving by indirect routes will be accepted almost equally well as the direct-route signal and this may well increase the sum signal strength received. In addition, the multi-path propagation would tend to minimise the effects of fading.

Is this in fact the explanation of the two claims which have been made for this type of aerial during the past year, namely, that its gain is much greater than expected, and that it reduces fading?

While on the subject of aerials it is with considerable regret that your conductor must confess that the recent gales swept away the feeder to the four-over-four at G2XC and, hence, the fortnight or so of no activity from Portsdown. Others appear to have been luckier, G3EHY (Banwell) had a window blown in and the glass roof of his sun balcony removed on February 2, but his beam survived!

Station News

From North of the Border, GM4QV (Bonnyridge) reports little activity on Two, but says the West of Scotland group are busy on 420 mc. For 2-metre work he has erected a "city-slicker" (*OST* November 1949) and on reception this appears to be an improvement on the previous Yagi. He comments that it makes an excellent bird-perch, and says it is rather alarming to watch a crow land on the top folded dipole element and bend it 15 degrees or so.

From Wales, GW2ADZ (Llanymynech) bemoans the lack of signals on Two; he puts the blame mainly on activity. So far as conditions were concerned the G3EHY schedule has failed once or twice, but otherwise GW2ADZ considers conditions to have been good. The schedule failed completely on February 2, and was only one-way on the following three days, G3EHY being RST559 in Montgomery but unable to hear GW2ADZ. On other occasions signals have been stronger in the opposite direction. Experimental work at Llanymynech has included some tests on a 6J6 push-pull oscillator in the receiver, and GW2ADZ fully recommends this on the point of frequency stability. DX has been around 100 to 150 miles, but he asks where are the usual London stations, G2AJ, G2NH, G3BLP, G5MA and G6VX? And why the dearth of activity in Hull?

In answer to one of GW2ADZ's queries, G3BLP (Selsdon) has been busy building a new converter, but having got it working has



General idea of the G2FKZ/P 420 mc beam, in use on August 21, when ten 70 cm stations were worked or heard from a site near Wantage, Berks. The aerial is resonated by the stub arrangement on the right.

found conditions so bad that he has been unable to form any opinion on its merits. Around Christmas when conditions were rather better, G3BLP managed to work G3AUH/A in Derbyshire. G2CIW (Romford) has also been experimenting with converters, and has been finding conditions definitely poor. Except for a few of the very cold nights, G2CIW has been active but has worked little beyond the 100-mile mark since the middle of January; he has increased his power to 80 watts.

G8IP (Hampton) is one of those who think the band has been open quite often but that activity in the right places has not been there to take advantage of it. His best DX during the month was G3ABH (Poole) and G8SY (Cambridge). He says it is as difficult to work Cambridge from his QTH as to work Hull. (Not quite! There is some activity in Cambridge!) He asks for a full-blooded campaign to prove the band is worth staying on during the winter. (What about a schedule GW2ADZ/G8IP?)

G3FXG (Clapham) has worked 100

TWO-METRES

ALL-TIME COUNTIES WORKED LIST

Starting Figure, 14

From fixed QTH only

Worked	Station
43	G3BLP
40	G2AJ (225), G5MA, G5WP
39	G2OI (111)
38	G2IQ, G2NH (212)
37	G3ABA (112)
36	G5BY, G6NB (167)
35	G3APY, G5GX, GW2ADZ
34	G2XC (215), G3CUJ, G4DC (188)
33	G3EHY (111)
32	G8WW
31	G2KG (110), G2XS (121), G4LU
30	G4AU (123), G4HT (166)
29	G3DMU, G5RP (114)
28	G2HDY, G5BD, G6VC (102)
27	G2CTW (165), G3BKQ, G3DAH, G3JU, G8QX, G8SM (106)
26	G2RJ, G5MI
25	G2AXG, G6PG (109), G6WT
24	G3CGQ, G3VM, G5NF (111), G3FXG (100)
23	G2CPL (101), G2NM, G3BOB, G8IP (138), G8QY
22	G3WW
21	G3CCP, G6UH (130)
20	G3FD, G8KZ
19	G3EJL, G5ML
18	GM3OL, G6DT
17	G3AUA
16	G8IL, G8KL
15	G2ANT, G2FLC, G3AKU, G3CWW, G3FIJ, G4RK
14	GM3BDA, G3BW, G6LK

NOTE : Figures in brackets after call are number of different stations worked.
Starting figure, 100.

stations in 24 counties since he started on Two last October. Of these, 50 have QSL'd ! For the past few weeks G3FXG has been in hospital for an operation, but it is good to know that he is progressing well and hopes to be back on by the time this is in print. The line-up will be the same, but a 3-over-3 beam is under construction. The present beam is 10 feet above house roof level, but not as high as an adjoining school. He hopes to be on 420 mc in the not too distant future.

G4HT (Ealing) has replaced his 3-over-3 with a 4-over-4 and is trying an RF27 with a 6J6 ahead. Comparison receiver is the 1132A with a 6J6 pre-amplifier. The modification to the RF27 was done by G3GFN, and uses the second harmonic of the oscillator. So far, G4HT has been impressed with its results on strong signals, but is reserving judgment on how it handles the weaker ones. But he has heard GW3EJM on it. For working South-East a 2-ele. delta-matched beam has been placed outside the bedroom window, but the old 67-ft. wire is still best for the South-West. From G4HT comes news that G8QC (Chalfont St. Peter, Bucks) has an 8-ele. stack in a good location and has worked 53 stations, in a fortnight or so. Others active are G3EEI (Kingston), G3SM (Harrow), G5QB (Kensington).

Farther west, G8IL has been regularly active in Salisbury, while G4RX of Bridgwater (incorrectly recorded as G4RK last month—sorry) sends a list of calls worked as evidence of his activity. G3EHY (Banwell) continues to be regularly on and considers conditions to have been consistently good. He found January 10 exceptional and worked some Lancashire stations, whilst January 13 to 15 was an excellent period for East-West working. G2XC was heard well on January 12. (Unfortunately G2XC felt tired and retired early and no QSO resulted, in spite of much calling by G3EHY !) Reference G4HT's comment last month, G3EHY remarks that he often hears him and calls, but so far, in vain. G3EHY calls CQ daily at 1430 with the beam South-East ; he hopes for a revival of interest and activity as the spring months approach.

In the Eastern counties, G3AVO/A (Lakenheath) sends a line to assure us he is still alive, but that his gear is in the course of a large scale rebuild. A new converter, using the Wallman cascode circuit, forms a major feature of the work. The Tx is planned to have a 3E29 PA and a tuned line tank circuit. Quite a number of new stations have been heard on the band, and G3AVO himself hopes to be there again by the time this appears.

G3VM (Norwich) has continued his daily schedules with G2CPL (Lowestoft) and GW2ADZ but otherwise has found little on

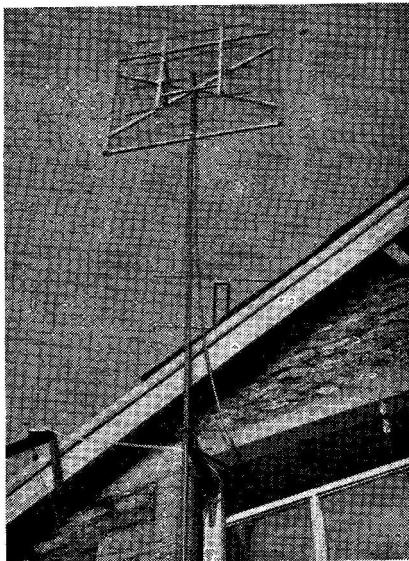
the band. The path to Montgomeryshire is very variable, but reports obtained show, says G3VM, that lack of signals is not entirely due to conditions. However, if your conductor may interpose a word at this point, the beam at G2XC spends a large portion of its active hours pointing right at G3VM, and in spite of that G3VM has not been heard in Portsmouth, nor G2XC in Norwich for very many weeks now, so it would also seem that conditions have not been outstandingly good either. G3VM also is puzzled at the number of Cambridge stations reported active in February *Short Wave Magazine*, saying that he never hears them. Well, four out of the five stations there mentioned were inserted as the result of personal observation at G2XC! It must be those highly directional beams! In more cheerful vein, he tells us that some new stations will be heard before long—G2YU, G8QR and a call yet to be allotted by the GPO. G3VM is building a 100-watt Tx.

Once more returning to Cambridge, news comes from G2XV that G2AIQ, G2CNT, G2FJD, G2XV, G3CJY, G4MW and G8PB are fitting up equipment for 420 mc; they hope that any 70 cm beams available elsewhere will occasionally be turned their way.

Others who have reported active this month have been G2XS (King's Lynn) and G3ABA (Coventry). In addition, it must be said how glad we all are to hear G6LK (Cranleigh) back on the band once more.

Records

Last month in this column the opinion was expressed that the G2BMZ/PAØEO contact of January 1, 1950, might be a record for the two-metre band, so far as British stations were concerned. This has now been established as correct. The exact grid references of G2BMZ and G5BY were obtained, and also the latitude and longitude of PAØEO and PAØZQ, the two Dutch stations concerned. The distance PAØZQ-to-G5BY was found to be 380 miles, and that between PAØEO and G2BMZ 384 miles. These are believed to be correct to within a mile. Readers will notice that the figure for the earlier record is ten miles shorter than that previously quoted in *Short Wave Magazine*. This is due to the original figure being approximated, as the exact QTH of PAØZQ was not known. Congratulations to the two new holders of the record. At the same time, it must be said that there is little doubt that the first holders, G5BY/PAØZQ, will not allow this new record to go long unchallenged. As a matter of interest the inter-British Isles two-metre record is 335 miles (approximately) between G3BLP and GI2FHN.



The 420 mc array at G5RP, Abingdon, Berks—eight elements with a reflecting curtain.

The Tables

In the course of some suggestions regarding the new "Best 20 of the Month" Table which it is hoped will make its first appearance in the April *Short Wave Magazine*, one of our regular correspondents expresses the hope that this table will be of more scientific value than the "Counties Worked" tables. It has always been realised by both the Editor and your conductor that the Achievement Tables have little, if any, scientific value in themselves, except in so far that they provide good evidence of the DX capabilities of the frequencies concerned. Their real value is that they are an incentive to activity, and as a result of that activity observations of scientific value can be made. The individuals whose callsigns appear in the various tables may or may not have an interest in radio as a science, but to make a good showing in the tables they are compelled to go on trying to increase efficiency—and so Amateur Radio progresses. A healthy spirit of competition is a good thing. It is with these ideas in mind that all the Achievement Tables in "VHF Bands" have been introduced, and this new table is no exception.* The need for a new yardstick

* Nor can it be argued for one moment that the present high standard of British amateur VHF technique is not directly due to the policies consistently maintained in the presentation of this feature.—Ed.

to measure two-metre DX arose from the fact that many VHF men thought the dice too heavily loaded against them in the Counties race, and further, that many of those at the top of the tables were showing some signs of loss of interest. It was *not* thought that "Best Twenty" would be of abnormal scientific value, and when last month comments on the rules were invited, it was mainly with the idea of making things fair to all. Looked at from the QTH of G2XC the rules appeared satisfactory, but they might appear very different from, say, GW2ADZ or GM4QV. It has been suggested that there should be no restriction on repeat contacts with the same station. The rule which required a period of seven days to elapse before a second contact with the same station could be counted was introduced to overcome the possibility of a station with a DX schedule at 150 miles or more coming up each day for about 15 minutes to make his contact, and then going off the band again. This would certainly not provide the activity that was sought. Another point which must be watched in inaugurating any DX competition is that local contacts are not completely discouraged. There have been complaints of that sort of thing on previous occasions, and your conductor is not unaware that there are many 2-metre stations which are operating in very poor locations from a VHF point of view, or where the provision of a good outside aerial is impossible. These operators must be considered. However, for the March "Best 20 of the Month" you may work the same station on as many days as you wish, but not more than once on the same day, reckoned 0600-0600. Send in the list of the 20 best 2-metre DX contacts you make during March, giving the distance in miles, and see that it reaches us by April 13.

TWO METRES

COUNTIES WORKED SINCE SEPTEMBER 1, 1949

Starting Figure, 14

Worked	Station
32	G3BLP
31	G2AJ, G2XC
28	G4HT
27	GW2ADZ
26	G2OI, G3ABA
25	G2CIW, G2XS
24	G3FXG, G6NB, G6VC
23	G3EHY
20	G3VM, G5UD
19	G3EJL
19	G2CPL
16	G3CGQ, G8IL
14	G3CWW, G3DCC

Note : Scoring for this Table is cumulative, and it will run for one year to August 31, 1950.

In Conclusion

This month your conductor has expressed his personal opinion on a variety of subjects. It is extremely unlikely that you will have agreed with all, or perhaps any, of them. If you have disagreed, please write and say so. It will all add to the fun next month! And the latest date for letters, reports and all the news is March 16 and the address E. J. Williams (G2XC), Short Wave Magazine, 53 Victoria Street, London, S.W.1.

TWO-METRE ACTIVITY REPORT

G3EHY, Banwell, Somerset.

WORKED: G2DSW, 2HDY, 3BLF, 3CSC, 4AP, 4GR, 4RX, 6CB, 6JK, 6VX, 6XM, 8IL, 8KZ, 8SB, GW2ADZ, 3EJM.

HEARD: G2XC. (January 7 to February 7.)

G4RX, Ashcott, Somerset.

WORKED: G3EHY, 3FMO, 4GR, 5BY, GW2DUR, 3EJM, 3FSP, 5SA.

HEARD: G3AVF, 5QA, 5TP, 8IL, GW2ADZ, 8SU.

G8IL, Salisbury, Wilts.

WORKED: G2CIW, 2DSW, 2MV, 2NS, 2XC, 2WJ, 3ABH

3BHS, 3CGE, 3EHY, 3EJL, 3FAN, 3FD, 4HT, 4MW, 5IB, 5TP, 6JK, 6LK, 6VX, 6XM, 6WT, 8KZ, 8LY.

HEARD: G2BMZ, 2FJD, 2MC, 3AVF, 3FXG, 4RK, 4DC, 5BY, 6CB, 8QC. (January 11 to February 6.)

G4HT, Ealing, Middlesex.

WORKED: G2AIQ, 2ANT, 2CUA, 2WS, 2XC, 2XS, 2KV, 3ABH, 3AMP, 3CGO, 3DYV, 3EEI, 3ENS, 3FAN, 3SM, 3WW, 4MW, 5QB, 5US, 6LK, 6WW, 8IL, 8SY.

HEARD: G2CPL, 3EBW, 3EHY, GW3EJM. (January 10 to February 7.)

GW2ADZ, Llanymynech, Montgomery.

WORKED: G2CPL, 3BLP, 3DNP, 3EHY, 3VM, 5BM, 6CB, 6LK, 6XM, 8KL, GW3EJM.

HEARD: G3FOD, 4HT, 5CP, 5TP, 6VX, 6WT. (January 18 to February 7.)

G2XC, Portsmouth, Hants.

WORKED: G2AHP, 2ANT, 2CIW, 2MC, 2NM, 2WJ, 3BHS, 3DEP, 3DSW, 3FAN, 3GBO, 4HT, 4MW, 5MA, 5PY, 5US, 6CB, 6LK, 6OT, 6UH, 8IL, 8IP, 8KZ, 8LY, 8SM.

HEARD: G2BMI, 3QK, 5LQ, 5TP, GW3EJM. (January 12 to February 1.)

Portrait Gallery

G2KF

JACK PARTRIDGE of G2KF (now active from Edenbridge, Kent) is one of the band of Old Timers who really made history. He first became interested in "wireless" in 1911, when, with a crystal detector and slider-tuned coil, he listened to Cleethorpes and Poldhu. Shortly after this he had a spark transmitter going on 1,000 metres. All this gear was impounded in 1914.

For five years G2KF was silent while Jack served in the R.N.A.S. and R.F.C., but the station was built up again in 1919. From then onwards he took part in the listening tests for Transatlantic signals, and the transmitter was in use once more, with French "R" valves. In December, 1923, he made the *first* two-way contact between Great Britain and the U.S.A., working UI MO (Hartford, Conn.) with 100 watts on 109 metres.

A long series of records followed, including the second contact with New Zealand (1924) during which G2KF passed messages from the Prime Minister of New Zealand to G2SZ (who had made the first contact).

Other milestones in the long story of G2KF were the listening tests for KDKA (1924), a contact with the famous GHH at Mosul (1925), following the course of the ill-fated R.33 across the North Sea when she broke



away, handling messages from WNP on an Antarctic Expedition, and making the first 20-metre tests with the U.S.A. (1925).

It was as early as 1925, too, that G2KF was in touch with H.M.S. *Durban* (GFUP) in harbour at Hong Kong.

The old transmitter used for the first Transatlantic was a TPTG with two AT40's, later replaced by a Mullard 0.150. At the time that contact took place the previous best DX had been with Nice, Brussels and Leyden !

G2KF still works everything from Two to the Top Band with undamped enthusiasm. He is by profession a radio engineer, having served during the last war with the Communications Department of the Foreign Office. Long may he continue !

CRITICISM AND REPLY

Two readers have been rather severe with us about what, in effect, they call our disregard of the TVI factor in certain of the transmitter designs recently published—and though only two have actually written, it is a fair assumption that a great many more think the same.

The answers are that there are still only a relatively small number of all the amateurs reached by this *Magazine* who are under the menace of TVI ; that only a small proportion of those would want to build a design exactly as specified ; that to make all our designs TVI-proof at the present juncture would complicate them needlessly for the majority ; that *any* transmitter can be made TVI-proof by a careful study of the literature on the subject ; and that we have already published what is probably one of the best practical articles yet to have appeared in print on TVI suppression. We are glad to have been given

the opportunity of saying all this, as the factor of TVI had certainly not been either forgotten or disregarded in preparing these designs.

WORKING DX

In order to help those aspiring to DX achievement, particularly operators recently licensed or who have not been long on the air, we have produced the *DX Operating Manual*. This sets out to inspire the beginner and guide the uninitiated—in other words, it tells you all you want to know about DX operation, so far as that is possible in print. Well produced, of 36 pages and seven chapters each complete in itself, the *DX Operating Manual* also contains country lists, alphabetically by prefixes and countries, showing Zone location in each case. The *Manual* costs but 2s. 8d., post free, of the Circulation Manager, Short Wave Magazine, Ltd., 53 Victoria Street, London, S.W.1.

MODIFYING METERS

New Values for Old

By W. FARRAR, B.Sc. (G3ESP)

MANY amateurs nowadays are buying items of equipment on the surplus market. Some of these contain meters made to read various voltages and currents, and may not have immediate application in one's equipment. For example, a meter designed for 0-40 volts DC is not particularly useful in the average amateur station, this being reflected in the fact that a meter of this class is sold at rather lower price than those with more regular scaling. The aim of this article is to show how almost any moving-coil instrument, whatever its original range, whether it be in volts or milliamps, can be modified to suit the user's own requirements.

First, it must be stated that all moving-coil meters have one thing in common, to wit, the moving coil. This is usually of low resistance, and requires very little current through it to swing the meter needle to full scale deflection. To make the meter useful for high currents, the coil has a much lower resistance shunted across it, which takes most of the high current, leaving just a little to pass through the coil and move it. To make the meter suitable for reading volts, a high resistance is put in series with the coil, so that when the whole is placed across a source of high potential, a small current passes through the meter, sufficient to turn the coil and needle. Therefore to modify a meter, it is necessary to alter the series of shunt resistor, and change the meter scale.

Opening the Case

Almost all meters in signals and radar equipment are used with the faces in a vertical plane, and some do not read true if used in other positions. Therefore when the meter deflection is being tested, one should make sure that the meter is mounted in the right plane. The first step in the modification is to remove the instrument from its case. Near the back edge will be found (usually) three tiny screws, which must be taken out with a small instrument screwdriver (and put in a safe place!). In some models, one or more of these screws might be sealed in, whereupon it is necessary first to dig out the obstruction (the blade of the small screwdriver is suitable for this). The meter is then withdrawn from its case, care being taken to pull it *straight* out, as any twisting motion might damage the "set zero" adjustment. The appearance should be

It is often supposed that meter modification is a matter of accurate test instruments and tedious calculation. This article shows how those meters with odd range markings, so often encountered in surplus equipments, can easily be modified by cut-and-try to cover the ranges useful in amateur working.—Editor.

similar to that shown in Fig. 1. If the instrument is a voltmeter, resistor A will not be included. If it is a current meter, resistor A (usually a small solenoid of wire) will be there, and at B there might be another small solenoid. For clarity, perhaps it would be better to describe an actual modification recently performed by the writer. In this case it was desired to change a 0-150 mA meter to read 0-15 mA, and the procedure was as described below.

Making the Shunt

Both solenoids A (shunt) and B (series) were fitted, and the first step was to disconnect the shunt A using sidecutters. The full scale deflection was then checked by putting the milliammeter in series with a multi-range meter, HT battery and variable resistor (Fig. 2). The resistor was set for minimum current, and the tapping on the battery increased until the meter needle was deflected some way up the scale. Then the resistor was adjusted until the milliammeter was at full scale deflection, and the current read off on the multi-range meter. It was 4.4 mA. Thus, to make the meter read up to 15 mA, it was necessary to put a low-resistance shunt across the terminals, where the original shunt had been. It is possible in these cases to find the resistance of the meter movement and calculate the value of the shunt, but due to the low values involved, special measuring gear would be required and the trial-and-error method serves just as well.

The writer's multi-meter has its millamp ranges in multiples of 10, so instead of setting it to 100 mA to read the required 15 mA, it was set to 10 mA, and the meter being modified was changed until the needle pointed to 100 on the original scale, i.e. 10 on the new scale. The manufacture of the new shunt proceeded in this way: In the absence of any actual resistance wire, a few odd lengths of fine copper wire retrieved from old BC coils and transformers were tried for size by holding them in turn across the meter terminals and seeing how the deflection was affected. Success was achieved at the third try, when with the multi-meter needle exactly on 10 mA, the other meter's deflection was a little too high, indicating that the shunt was a bit on the large side. The length of copper wire in the shunt was about 25 yards, so it was bared at yard

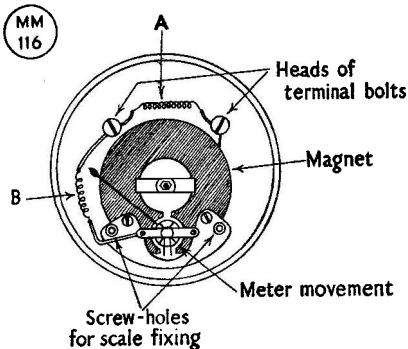


Fig. 1. Drawing suggesting general internal arrangement of a moving coil meter (scale removed). For details of items A and B see text

intervals and tried again until the deflection became a fraction low. Then the wire was bared between the last two points and it came just right. The surplus wire was cut off, and the 20 yards or so remaining was coiled up round a high-value resistor (this being a convenient former), the ends of the shunt being soldered to the wire ends of the resistor and the turns held in place by means of waterproof adhesive. The resultant shunt was physically too large to be accommodated in the meter housing, so it was fitted externally. Rescaling the meter was easy in this case. The original was marked 0-30-60-90-120-150. As the new full scale deflection was 15 mA, the original figures were modified by scratching off the zeros with a penknife.

Reassembly and Scaling

The final operation is to put the meter back into its case. If the "set zero" adjuster has not been moved, the case will go together without difficulty, provided the screw holes in the back of the case line up with the corresponding holes in the shell of the case.

The above example should cover the changing of almost any current meter from one range to another, except for re-scaling. If the new scale bears no relation to the original, it must first be removed. It will normally be fastened by two small screws, one each side of the meter movement. Removal of one is simple, but while removing the second the scale must be held firmly to prevent it from tilting and possibly bending the meter needle. A piece of white paper is cut to the same size as the meter face, and stuck over the original markings. When dry, a new arc is drawn across it in Indian ink corresponding to the original. The meter face is then replaced, care again

being taken not to damage the delicate needle. With the new shunt in position, and the meter connected up as in Fig. 2, the variable resistor is adjusted until the meter needle is at full scale. The corresponding current is noted from the multi-meter, and a faint pencil mark made in line with the needle. This is repeated with lower values of current at suitable intervals. The meter face is again removed, and the scale inked in permanently according to the pencil marks and numbered as required. The face is then replaced and the meter reassembled in its case.

Other Possibilities

If a voltmeter is to be changed to a current meter, the resistor between one terminal and one side of the movement should be taken out, and the circuit remade with a piece of wire. Manufacture of an appropriate shunt then proceeds as described earlier.

To change a current meter to a voltmeter, or to change the range of a voltmeter, all internal resistors and solenoids are stripped off, leaving just the meter movement connected to one of the terminals. Between the other side of the movement and the other terminal a large-value uninsulated carbon resistor is placed and the meter connected across a suitable DC source in parallel with a multi-meter switched to the requisite voltage range. If the meter reading is low, the resistor needs reducing in value by an amount depending on the meter needle deflection. For example, if the deflection is only to one-third of full scale, then a resistor approximately one-third of the value should be substituted. A value of resistor will soon be reached where the meter needle goes to full scale for a voltage slightly less than it is wished to measure. Alternatively, when placed across the required voltage, the needle is just beyond full scale deflection. The resistor then needs increasing

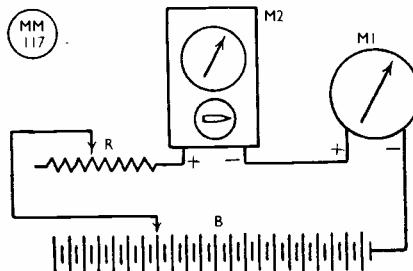


Fig. 2. The set-up for testing and calibrating a current meter. B, 120-volt HT block with variable taps ; M1, meter under modification ; M2, multi-range test meter ; R, 10,000-ohm variable resistor ; for high currents a lower value is required

in value slightly, and to do this the carbon is gently filed away from the sides of the resistor until the deflection is precisely what is wanted. This resistor is then permanently tucked away in the meter case, the face is rescaled and the meter reassembled.

During any of these operations, care must be taken not to damage the needle or the meter

movement, both of which are extremely delicate. Also, when soldering shunts or wires in position, the job must be done as quickly as possible so as to avoid possible damage to the meter through overheating. Bearing these points in mind, it should be possible to change meters around with a minimum of trouble and a maximum of success.

PUSH-BUTTON SEND/RECEIVE

Single Knob Change-Over

By P. GRAHAM (G3CBP)

There are many ways of changing over from Send to Receive. Some run round doing things with crocodile clips on lengths of wire, others must throw a long line of tumbler switches in a sequence known only to the operator, while many have a slick one-knob relay system of their own devising. Here are some suggestions for those still at the croc-clip-and-tumbler stage.—Editor.]

THIS article is intended to be of interest to those who are troubled by having more than one switch to operate when changing over from send to receive, and vice versa.

With the previous transmitter at the writer's station, it was necessary first to switch off the exciter and final; secondly the modulator; thirdly to change over the aerial from send to

receive, and then turn up the RF gain on the receiver. All this took time, and when the operation was completed, the other chap had nearly finished his remarks.

A short while ago it was decided to rebuild the gear and to make it completely relay-controlled, so as to have all the previously-mentioned jobs done by pushing a button.

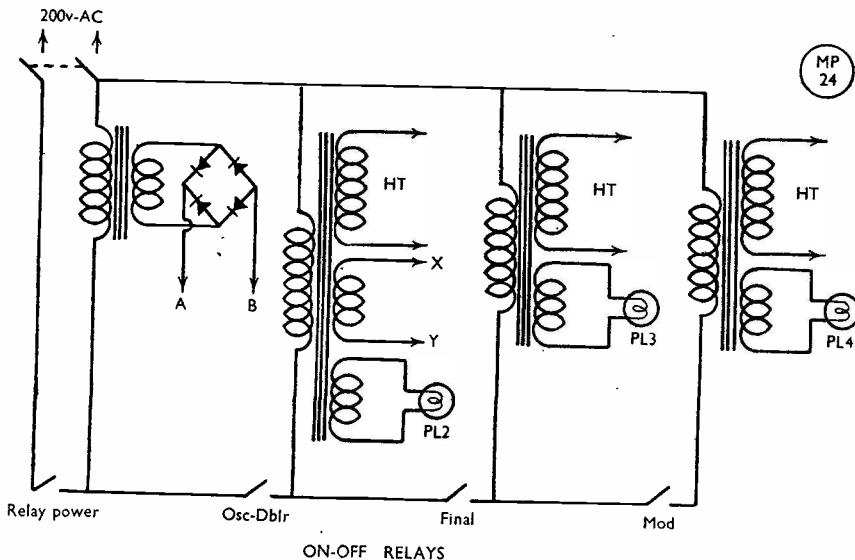


Fig. 1. The power supply switching arrangement for the circuit suggested by G3CBP

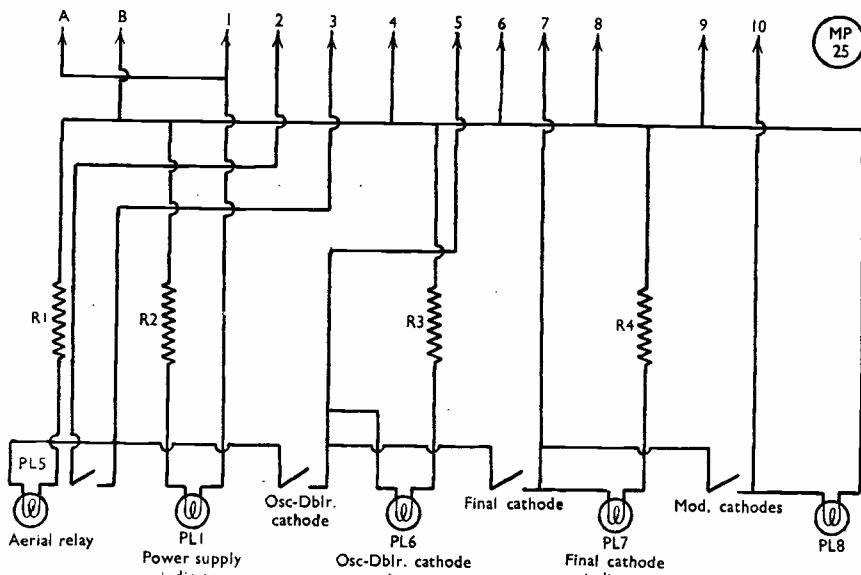


Fig. 2. Connection diagram. A-B, 24-volt DC, 1.5 amps; 1-2, push-button; 3-4, aerial relay; 5-6, oscillator-doubler cathode relay; 7-8, PA cathode relay; 9-10, modulator cathode relay

With the original outfit, the final plate voltage could be switched on accidentally before drive had been applied—with the result that the parallel 807's in the PA went red in the face and nearly vaporised. With the new rig there was to be some foolproof method of avoiding this.

Switching Arrangement

After a study of the power and relay switching circuits suggested here it will be seen that it is impossible to apply power to the final until the relay and oscillator supplies have been switched on. And not until the final is alive is it possible to switch on the modulator power supply. As far as the relay side is concerned, all relays are controlled by a push-button. When this push-button is pressed the aerial and receiver blocking relay can be operated. When this relay is made the oscillator and doubler cathode relay is ready for operation. The final and modulator cathode relays are then available. When all relays are on, the breaking or making of the cathode circuits rests with the push button.

In this way then, there is some measure of safety and no danger of ruining the 807's due to lack of drive. The modulator always has

a load to work into and there is no sparking inside the receiver due to the aerial still being connected to it when transmitting.

Four relays are used, all being of the 24-volt type, three being simple SPST and the remaining one a DPST. This latter transfers the aerial from "receive" to "send" and blocks the receiver. The other three relays were from a modulator unit belonging in the SCR474N. Six-volt pilot lamps were used throughout, 75-ohm resistors being wired in series with each to drop the unwanted 18 volts.

The relay power supply unit was made up of two surplus 24-volt input, 200-volt output type transformers, wired the other way round. These were placed in parallel as the current available from one alone was not sufficient. A 12-volt 3-amp. metal rectifier completed the pack. The push-button switch is of the push-once, On, push-again, Off, type and was obtained from an electrical shop.

This system has worked well and there were no snags in construction. The final cathode relay has a slight delay on the oscillator and doubler cathode relay so that by the time the final plate circuit is completed the drive has been applied.

Here and There

Index Herewith

As we step off into a new volume of the *Magazine* with this issue, every copy has had inserted as a loose supplement the Index to Vol. VII, which was concluded with the last issue. As in previous years, this Index is very complete and is an indication of the wide range of Amateur Radio interests covered in the *Short Wave Magazine*. The main subject headings alone number nearly 100, the work of over 70 different contributors, many of whom have seen their first efforts in print in the *Magazine*. We have always encouraged and welcomed material from new writers.

Surplus Equipment Data

We were very glad to see the comprehensive list of British and American ex-Service gear on which Clydesdales can supply theoretical diagrams with values—and, in some cases, conversion data. Some 60 different items are shown covering equipments generally available from surplus sources.

Radio Exhibition—1950

It is officially announced that the 17th National Radio Exhibition will be held at Castle Bromwich, Birmingham, during the period September 6-16 next. This is certainly giving the Midlands a look-in on one of the most important Exhibitions of the year; the first "Wireless Show" was at the Horticultural Hall, London, in 1922, subsequent exhibitions being held at the White City and the Albert Hall before Olympia became the regular venue in 1926.

Not Too Bad

Pursuing the theme of "where we turn up," in a recent letter VS6JH (G2FSR) mentions that the *Magazine* is available on Hong Kong bookstalls about six weeks from the date of publication. Actually, this represents fairly good delivery having regard to the channels of communication and the fact that they are all on the surface.

New Soldering Iron

The Adcola is a very neat lightweight iron intended for quick work in the radio field. Designed for 25-watt loading, for either low tension or normal mains supply, it is available with "pencil bit" fittings in two different dia-

meters to choice, and in a third style with detachable bit for which replacements can be provided. A generous length of light three-core cable is included and the handle incorporates a U-hook for stowage when the iron is hot (or not in use). Prices range from 22s 6d. to 30s. for the model with the $\frac{3}{16}$ -in. detachable bit.

Local Interference

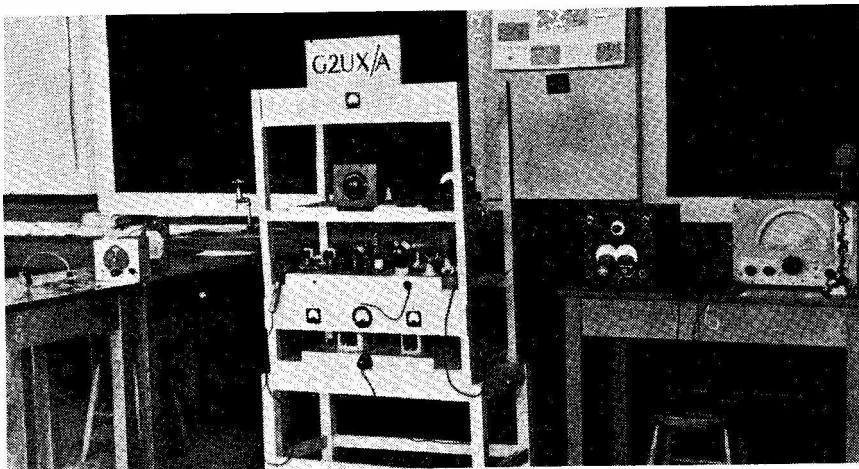
Talking BCI the other day, someone remarked that the worst case he had ever heard of was that of the QRO operator who modulated his neighbour's electric fire (this is not so improbable as it sounds, incidentally!). However, it was capped by somebody else who told how a neighbour of his had once complained of getting his phone on the grand piano. No questions, please!

Log Book Note

A new log book is now being offered by Webbs of Soho Street. It consists of 140 ruled pages in a paper cover, with space for 3,500 entries. The column headings cover all usual requirements, and the paper takes ink well. The price is 3s. 4d., with a reduction to Clubs of 8d. a copy on quantity orders of not less than twelve.

Standard Frequency Transmissions

The Department of Scientific and Industrial Research announces that with effect from February 1 an experimental standard frequency service of high precision was put into operation to improve calibration facilities in the European Region. Transmission is from the GPO's Rugby station, with monitoring at the National Physical Laboratory. Since this service is experimental and exploratory, and the possibility of mutual interference between WWV and MSF has to be considered, the times (GMT) and frequencies are at present restricted to : 60 kc (1029-1045); 5 mc (0544-0615); 10 mc (0629-0700). The D.S.I.R. announcement, while regretting the inconvenient times at which the HF transmissions are being made, asks for reports on them to The Director, National Physical Laboratory, Teddington, Middlesex, with particular reference to interference from WWV. All MSF's transmissions are being made with an input of 10 kW, and the calibration accuracy is within two parts in 100 million.



(Eastern Commercial Photographs, Great Yarmouth

The other man's station G2UX/A

Here is another unusual entry for this feature—the station operated at Wymondham Secondary Modern School, Norfolk, under the guidance of G. Edwards, G2UX, Chapel Street, Barford, nr. Norwich, who is science master at Wymondham. Finding that the design, construction and operation of an amateur station not only captured the interest of a large number of potential "second operators" but also helped considerably with school work on the physics side, G2UX/A has been established in the science laboratory as an active station.

The transmitter as shown was built by the boys under the supervision of G2UX, and runs tritet/CO 6V6-807, linked to an aerial coupling unit, into a 136-ft. end-on wire. Auxiliary apparatus, all school-built, includes a modulation monitor, wavemeter and tuning loops. The transmitter is modulated by grid control, after the circuit suggested by G3BNE in the September, 1948, *Short Wave Magazine*. Though the general design has been kept simple, the rack allows plenty of space for future development.

Receivers are an R.1116A and a 9-valve superhet, and frequency checking is by a commercially built heterodyne wavemeter with 1000 kc bar.

Operation is on CW and phone, mainly in the 7 mc band, and there is never any shortage of 2nd operators when G2UX/A is on the air. They QSL 100 per cent. and as G2UX puts it "QSL cards have once more assumed a new

importance for me, even local G's; the exact location of the station worked and all details on each QSL received are matters of vital interest to the boys, who are very proud of the G2UX/A collection." Their keenness has revived all his own early enthusiasm, G2UX himself being an OT of 1929 vintage.

Arising from all this, and as it is known that some other schools are active on the same lines, the possibility of establishing a Schools Net is suggested by G2UX. This could be operated on 7 or 3.5 mc during week-day afternoons, which are anyway quiet periods for the generality of amateurs, who would not be inconvenienced by it. He would like to hear, at the address above, from those who might be interested. For ourselves, we would say that to encourage activities of the kind outlined here is to sow the seed of Amateur Radio on very fertile ground. G2UX and those of his colleagues so engaged are to be congratulated on their enterprise and admired for what they are achieving.

SOME VK FIGURES

The Australian P.M.G. has announced that "authorised civilian radio stations" total 7,354, of which 2,754 (only) are licensed amateurs. Two hundred stations have been approved for business concerns, 2,400 for the police, ambulance and electricity undertakings and similar organisations, and 650 in what are called "outback areas." (From *Australian Radio and Television News*, December 1949.)

NEW QTH's

This space is available for the publication of the addresses of all holders of new U.K. callsigns, as issued, or changes of address of transmitters already licensed. All addresses published here are reprinted in the quarterly issue of the *Radio Amateur Call Book* in preparation. QTH's are inserted as they are received, up to the limit of the space allowance each month. Please write clearly and address on a separate slip to QTH Section

G2AZC	E. L. Wills, 17 Cowick Lane, Exeter, Devon.	G3FTJ	F. Bilsberry, 37b Married Quarters, Hilton Road, R.A.F. Station, Martlesham Heath, Woodbridge, Suffolk.
G2BPJ	P. H. Wade, 46 Cottage Road, Leeds, 6.	G3FUQ	R. C. Mosley, 254 Main Road, Duston, Northampton.
G2CBS	L. G. Thompson, 11 Buckingham Road, Doncaster, Yorkshire.	GM3FVX	W. Forsyth, 37 Ferry Road, Renfrew, Scotland.
GM2FWK	R. V. Smith, 12 Clifford Street, Glasgow, S.W.1.	G3FXI	P. H. Cardwell, 196 Liverpool Road, Birkdale, Southport, Lancs.
G2HMA	R. A. Wilkie, 167B St. Mary's Road, Moston, Manchester, 10, Lancs.	G3FXV	D. Golding (ex-ET3AB), 7 Pretoria Road, Southsea, Hants.
G2IC	G. A. Chapman, Chamonix, St. Mildred's Road, Westgate-on-Sea Margate, Kent.	G3FYX	R. Emery, 21 Brighton Road, Redland, Bristol, 5.
G3AJK	J. A. Earland, 59 Eaton Rise, Ealing, London, W.5.	G3FYZ	G. Williamson, 351 Whitegate Drive, Marton, Blackpool, Lancs. (<i>Tel. : Marton 0819.</i>)
G3AZU	H. Sutcliffe, 91 Cleckheaton Road, Low Moor, Bradford, Yorkshire.	GW3FZZ	R. Phillips, 11 Conduit Place, Port Talbot, Glam.
G3BLA	R. R. B. Snee, Ewer Farm, Damases Lane, Boreham, near Chelmsford, Essex. (<i>Tel. : Boreham 243.</i>)	G3GAO	L. J. Avery, 13 Fore Street, St. Marychurch, Torquay, Devon.
G3CGT	C. Gant, 37 Wibbersley Park, Flixton, Lancs.	GM3GBM	J. G. Colyer, Woodside, Aberdour, Fife.
G3COK	F. Bateman, c/o T. N. J. Archard, Marton, Stoke Road, Stoke St. Mary, Taunton, Somerset.	G3GBQ	J. Y. Jones, 17 Station Road, Albrighton, Wolverhampton.
G3DGN	G. I. Turner (ex-VS7IT), 9 Merryhills Drive, Enfield, Middlesex.	GD3GCE	P. Gordon, Dormer House, Walpole Drive, Ramsay, Isle of Man. (<i>Tel. : Ramsay 3342.</i>)
G3DUI	H. Osbaldeston, 40 The Acre, Glossop, Derbyshire.	GI3GCL	J. R. Donaldson, 123 Somerton Road, Belfast.
G3DYB	T. Lloyd Davies, 96 Trentham Road, Longton, Stoke-on-Trent, Staffs.	G3GCR	E. J. A. Miles, 216a High Street, Cheltenham, Glos.
G3DZX	F. C. Bailey, 7 Edenhall Road, Quinton, Birmingham, 32. (<i>Tel. : Woodgate 2576.</i>)	G3GDW	L. H. Webber, 43 Lime Tree Walk, Newton Abbot, Devon.
G3EAD	S. E. Pritchard, 15 Curzon House, Saltdean, Brighton.	G3GDZ	A. W. Millet, 37 Beverley Drive, Edgware, Middlesex.
G3ELR	J. C. Watkinson, 359 Leasowe Road, Moreton, Wirral, Cheshire.	G3GEL	L. S. Barton, 28 Marygate, York.
G3ENE	J. B. Wadham, 124 Parkway, Welwyn Garden City, Herts. (<i>Tel. : Welwyn Garden 245.</i>)	G3GEV	S. Hollingshurst, 30 Conway Road, Plumstead, London, S.E.18.
G3EOA	G. V. Heller, 234 Wilbraham Road, Manchester, 16, Lancs.	G3GFB	N. K. Sealey, 143 Birchfield Road, Redditch, Worcs.
G3EOC	D. J. Lloyd, 50 Greystock Avenue, Fulwood, Preston, Lancs.	G3GFG	D. R. Payne, 62 Padnell Road, Cowplain, near Portsmouth, Hants.
G3ERT	H. E. Chissell, 27 Northumberland Gardens, Lower Edmonton, London, N.9.	G3GFY	J. G. Peace, Prospect House, Park Walls, Wellington, Shropshire.
G3EXP	A. J. Bassett, 87 Craven Road, Newbury, Berks.	G3GGG	R. A. Bishop, The Garage, East Haggbourne, near Didcot, Berks. (<i>Tel. : Didcot 3271.</i>)
GM3FAL	R. A. Robertson, 6 Russel Street, Falkirk, Stirlingshire.	G3GGH	P. S. Horn, 17 East Grove, Beechwood Estate, Vigo Village, Mcopham, Kent.
G3FBQ	C. W. P. Birks, 76 Campbell Road, Stoke-on-Trent, Staffs.	GI3GGJ	A. H. G. Watson, 6 Park Parade, Belfast Road, Lisburn, Co. Antrim.
G3FDH	G. Hartley, 61 Middleton Street, Hull, Yorkshire.	G3GGK	P. J. Simpson, 62 Marfitt Street, Leicester.
G3FED	R. O. Watts, 71 Patrick Road, Yardley, Birmingham, 26.	G3GGL	A. W. G. Wormald, Little Gayles End, Otley Road, Bramhope, near Leeds, Yorkshire.
G3FKI	E. C. Lambert, 68 Lower Road, Rotherhithe, London, S.E.16.	G3GGN	F. T. Shute, 15 Sunny Close, Sea Place, Worthing, Sussex.
G3FKW	K. S. Ball, 63 Cedar Walk, Boxmoor, Herts.	G3GGO	C. N. Wriggway, Salewheel House, Ribchester, near Preston, Lancs.
G3FMM	C. H. Doley, 30 Mackenzie Road, Sparkhill, Birmingham, 11. (<i>Tel. : Sou 2514.</i>)	G3GHA	P. H. Pegrum, c/o 15 Montrose Avenue, Whitton, Twickenham, Middlesex.
GI3FOB	W. H. Kerr, 9 Glandore Gardens, Belfast, Ulster.	G3GHB	A. T. Eley, 31 Franklin Road, Bournville, Birmingham, 30.
GW3FPF	P. F. Jones, 20 Church Street, Rhyl, Flintshire.	GM3GHF	W. A. Gorman, 15 Northburn Street, Glasgow, C.4.
G3FPI	W. B. Hopkins, 121 Elmdale Crescent, Northfield, Birmingham.	G3GHI	A. D. Naylor, 3 Hillcroft Avenue, Purley, Surrey.
G3FRY	H. Brisbin, 52 Cleemount Road, Cheltenham, Glos. (<i>Tel. : 54425.</i>)	G3GHN	Clifton Amateur Radio Society, 225 New Cross Road, London, S.E.14.
G3FTI	P. G. Murphy, 74 Babacombe Road, Bromley, Kent.	G3GHO	B. McCall, 21 Exeter Road, Northampton, Northants.
		G3GHQ	D. Metcalf, 11 West Oakhill Park, Liverpool, 13. (<i>Tel. : Stoneycroft 5067.</i>)
		G3GHR	K. N. Cady, 14 St. Andrew's Road, Gillingham, Kent.

G3GHS	J. G. Holland, 42 Selwyn Road, New Malden, Surrey.	GM3BFJ	A. D. M. Frood, Station Garage, Biggar, Lanarkshire.
G3GHU	R. A. E. Goode, 4 Junction Road, Kingsley Park, Northampton, Northants.	G3DJG	C. Oakes-Jones, Flat No. 4, The Parade, New Donnington, Shropshire.
G3GIE	J. D. Munns, 39 Oliver Road, Leyton, London, E.10.	G3DUF	W. F. Poole, 23 Pickford Road, Bexley-heath, Kent.
G3GIM	F. Jackson, 71 Gollatly Road, New Cross, London, S.E.14.	G3FIO	L. Pennelegion, 44 Lawrie Park Gardens, Sydenham, London, S.E.26.
G3GIP	J. H. Balleff, Hamil Road, Burslem, Stoke-on-Trent, Staffs. (Tel.: 84475.)	G3FRN	G. N. Myatt, 270 Chester Road, Helsby, Cheshire.
GD3GMH	G. M. Holt, The Gay Heart, Queen's Promenade, Douglas, Isle of Man.	G3GKW	J. G. Kenyon, 8 Elliott Street, West Hartlepool, Co. Durham.
G3GRF	G. R. Foggin, 10 Macalagan Road, Bishopthorpe, Yorkshire.	G3IY	J. Pollard, 161 Woodgrove Road, Burnley, Lancs.
G3HAE	Maj. A. Eden, 31 Chatsworth Crescent, Hounslow, Middlesex.	G4CI	D. S. Babbage, 63 Inveresk Gardens, Worcester Park, Surrey.
GW3HCL	D. E. C. Lockyer (ex-ZC1CL/MD1D)	G4OK	H. Bailey, 5 Church Street, Wath-on-Dearne near Rotherham, Yorkshire.
G4MY	Didfa, Llangoed, Beaumaris, Anglesey.	G4SA	E. J. W. Ahier, 104 The Camp, Hanney Road, Stevenston, Berks.
G4XC	E. Hewitt, 6 Lincoln Avenue Bourne-mouth, Hants.	G5KC	G. W. Kelley, 79 Rawdon Avenue, York.
G5AO	J. Browne (ex-G2XB), 331 Hainton Avenue, Grimsby, Lincs. (Tel.: Grimsby 5165.)	G5RH	D. Q. Aldridge, c/o H. B. Thorpe, 55 Dalmerton Road, New Brighton, Wallasey, Cheshire.
	A. E. Lambourne, 23 Glynde Road, Brighton, 7, Sussex.	G6MI	R. Maynard, 81 Ansdell Road, Blackpool, Lancs.
	CHANGE OF ADDRESS	G6NW	F. James, 2 St. Nicholas Green, Wootton Road, Abingdon, Berks.
G2FKH	D. A. Smith, 18 Lucas Avenue, Harrow, Middlesex.	G8DN	G. E. Dakin, Russ Farm, Aller, Langport, Somerset.
G3AFL	W. B. Baker, 31 North Terrace, Berwick-on-Tweed.	G8GI	C. B. Raithby, School House, Martin, Lincoln.
GM3ANO	L. I. O. Shaw, 1 Mossbank, Cowdenbeath, Fifeshire.	G8IX	G. H. Tagg, 16 Nelson Road, Hanley Stoke-on-Trent, Staffs.
G3AWZ	G. P. Pearson, Lamorna, Jubilee Road, Street, Somerset.		CORRECTIONS
G3BD	M. T. Elvy, The New House, Colwich, Staffs.	G2BGG	J. Garner, Barbon, Aigburth Hall Road, Liverpool, 19.
G3BF	H. F. H. Palmer, Brackencot, Uplands Avenue, High Salvington, Worthing, Sussex.	G3SB	T. C. Bryant, 16 The Parks, Minehead, Somerset.
		GM8RV	W. L. Vinicombe, 6 O'Connell Street, Hawick, Roxburghshire.

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Several cards from the countries listed, plus many for European, W and G contacts, are in our QSL Bureau files awaiting collection.

If cards are being held for you it is because you have already had three batches for which the Bureau has borne all delivery expenses; you have been reminded on each occasion that a supply of stamped addressed envelopes would ensure a regular monthly clearance of any QSL's received for you, whether or not you are a user of the Bureau.

In most instances there are at least six cards held for the amateurs concerned. So please send S.A.E.'s to BCM/QSL, London, W.C.1. The cards will be despatched to you on the next G clearance, and any received in future will be cleared monthly—unless the instruction "await at least (so many) cards" is marked in the top left-hand corner of each envelope.

OTH, PSE !

Cards are held for the stations shown below; as we are without their addresses, the cards cannot be cleared. If your call is in this list, please send a large S.A.E., with name and callsign, to BCM/QSL, London, W.C.1; the cards will be forwarded on the next G clearance. And if you want your address to appear in "New QTH's" and subsequently in the *Radio Amateur Call Book*, please mention that at the same time.

G2AOF, 2CEZ, 2DSW, 2FGH, 2KB, 3AUS, 3AXG, 3BDZ, 3BEF, 3BYX, 3CZO, 3DAZ, 3DQM, 3DSU, 3DZW, 3EAJ, 3EDF, 3EFB, 3EQN, 3EWA, 3EYN, 3FDO, 3FHT, 3FQB, 3FRR, 3FST, 3FSY, 3FTH, 3FWD, 3FYJ, 3FYR, 3FZH, 3FZN, 3GBD, 3GBE, 3GCB, 3GCD, 3GDF, 3GFC, 3GFN, 3GFU, 3GGT, 3GLV, 3GRS, 3YA, 4SB, 5IB, 5JX, 6GU, 6YD, GI3FNA, GM3BJD, 3CSO, 3FAH, 4LE, 5YW, GW3ERW.

The Month with the Clubs

FROM REPORTS RECEIVED

In spite of the very early closing date this month reports have been received from 38 Clubs, which seems to indicate an active and flourishing state of affairs.

We should like to call Secretaries' attention to the remarks in the box appearing elsewhere in this feature, under the heading "Club Station QSO's." These notes come from G2AHB, the Hon. Sec. of Grafton, and we have to agree that while we see many references to "The Club Tx" we very seldom encounter the fruits of the same!

Next month's deadline for reports is March 14. They should be addressed to Club Secretary, *Short Wave Magazine*, 53 Victoria Street, London, S.W.1.

Clifton Amateur Radio Society.—The Club Tx, G3GHN, is now operating on the Top Band and has made some interesting contacts. It is the centre of interest on meeting nights. Several D-F days will be held during the spring and summer months in the neighbourhood of Farnborough, Kent. Other clubs able to travel to this area and wishing to participate are asked to contact the Hon. Sec. for full details. All members will be welcomed at the New Cross Clubroom on Friday evenings.

Bristol & District Short Wave Listeners' Club.—They have just obtained the Club licence and now hold the call G3GIS. The station will be on the air for the first time during February and reports should be sent to the Hon. Sec. (address in panel).

Brighton & District Radio Club.—This Club's Tx, G3EVE, is being hotted-up by the Tx Committee, and, it is hoped, will produce many QSO's on 3.5 mc. February meetings included a Quiz, a talk on AC Vectors, and a discussion on NFD. The Club Newsletter has taken on a new and improved shape under the

hand of G3DJD. Club nights are Tuesdays, 7.30 p.m. at the Eagle Inn, Gloucester Road, Brighton.

Reading Radio Society.—January meetings comprised a talk on Test Equipment (Audio Oscillators and TV Signal-Generators), and another on the industrial applications of the CRO. Plans for March include a talk on the DCR-19 Receiver (March 9), a meeting of the Instructional Section (March 11) and the A.G.M. (March 25). The Club subscribed for and presented a communications receiver to Mr. Lock, a blind member, as a Christmas gesture.

Kingston & District Amateur Radio Society.—Future meetings will be held fortnightly at Penrhyn House, the next meeting being on March 15. On this occasion there will be a lecture by Brookes Crystals, Ltd. It is hoped that the Club will shortly have its own Clubroom and a station working from this new QTH.

Warrington & District Radio Society.—A new Chairman and Secretary were elected at the AGM, warm thanks being offered to the retiring officials.

Meetings will now take place on the first and third evenings of the month, 7.30 p.m. at the Sea Cadet HQ, off Wilderspool Causeway.

Bradford Amateur Radio Society.—On March 14 G3ADQ will lecture on Marine Radio Communication. This lecture is of interest because the speaker served in the Merchant Service during the war and had the distinction of being the youngest Chief ever employed by his company.

Barnsley & District Amateur Radio Society.—Lectures have recently been given on TVI Suppression (G8WF) and Receivers (Audio Section)—G6LZ. The Annual Dinner was held in January with an attendance of approximately 100, including most of the amateurs within 15 miles' radius.

Wanstead & Woodford Radio Society.—This Club has had a few ladies present at recent meetings, and it is reported that they are becoming very keen. At all events their presence has somewhat improved the tone of the meetings! The January highlight was G2BCX's Model Aerial Demonstration, for which a "repeat order" has already been given. Meetings are held every Tuesday at Wanstead House, The Green, E.11.

West Cornwall Radio Club.—The various sections of this widely-dispersed Club continue to thrive, judging by the *Radio Link*—the Club journal which does a great deal to hold them together. The new President is G3AET, G2WW having relinquished the post after doing so much for the Club in the past.

Scarborough Amateur Radio Society.—The first weekly meeting of a new session was held recently at the Boy Cadets' XIX Club, St. Nicholas Street, Scarborough, and it is hoped that this new QTH will prove very satisfactory, one of the Club's chief difficulties having been the acquisition of suitable premises. Meetings are now held every Thursday at 7.30 p.m., and new members with an interest in any branch of



Top table at West Somerset Radio Society's dinner on January 19, with G3SB (Hon. Secretary) standing left. The ladies are the long-suffering XYL's of various enthusiastic members of the Club, which enjoys good support in a district not well populated in the radio sense

Amateur Radio will be heartily welcomed.

Leeds & District Amateur Radio Society.—This Club reports to us for the first time, and the Hon. Sec. states that support is at rather a low ebb, chiefly because of lack of publicity. Leeds amateurs, please note! The season's activity has been planned to include transmitting nights with the Club Tx, G3BEW, lectures covering most of the aspects, Morse classes and visits to places of interest. Meetings are on Friday evenings at Swarthmore Settlement, Woodhouse Square, Leeds.

Exeter & District Radio Society.—During February the Club had lectures on Operating Portable (G3EAZ), Test Techniques (Mr. D. W. Thomasson) and a visit from Mr. Alvey, of Dawe Instruments. Meetings are held on Thursdays, 7.30 p.m., at 9 Palace Gate, Exeter.

West Somerset Radio Society.—The AGM, held at the White Horse Inn, Stogumber, was followed by a dinner at which a number of members' wives were present. The Hon. Sec. was re-elected (see panel) and a working Committee for the ensuing year has been formed.

Future plans include more meetings in the Taunton area.

Torbay Amateur Radio Society.—At the January meeting there was a welcome visit from Mr. Sands, A.M.-Brit.I.R.E., who gave an interesting lecture on Wire Recording, followed by a demonstration of one of his own instruments. Members of the British Sound Recording Association were also welcomed. The recordings included some taken in the Two-Metre Band, and great interest was shown in this branch of radio.

Barnet Amateur Radio Society.—G2BCX's Aerial Demonstration was a popular event during February. New members will be particularly welcomed at this Club, which meets on the first Saturday after the 10th of the month at 7.30 p.m., Bunny's Restaurant, Station Road, New Barnet.

Midland Amateur Radio Society.—At a recent meeting the Club received an interesting summary of experiments concerned with wire recording from Mr. Wilson, who explained the simple approach to the subject. Meetings are held each month on the third Tuesday at the Imperial Hotel, Birmingham.

South Manchester Radio Club.

—The first meeting of the year was somewhat gloomy, the results of "MCC" being before the members! The Club soon recovered, however, and is resolved to top the list in the next event. Its station G3FVA is now on the air and it is hoped that many QSO's with other Clubs will be made. Two cups are to be presented annually—one for the best lecture by a member, and one for the best piece of equipment. Plans are also afoot for a News-Sheet—"The Intercom"

Willesden Radio Club.—This is the first report from this active group in North-West London. Meetings are held every Wednesday evening, 7.30, at 51 Dudden Hall Lane, London, N.W.10. The Club will soon be operating its own station G3BFZ on 14 and 3.5 mc. Secretary's QTH in panel.

Sutton & Cheam Radio Society.

—Recent events have included lectures on "VFO's," and "The Cossor Extension Viewing System." Competition Entries were judged in February. On March 7 there is an NFD Discussion, and on the 21st a lecture on "Repair and Maintenance of AVO Equipment," by a member of the well-known firm. The Club Shack is being improved, and it is hoped eventually to instal

rack-mounted gear covering all bands.

North Kent Radio Society.—At the AGM, in January, officials for the coming year were elected, and a programme outlined. An interesting feature is to be called "RAE Questions Answered"—for the benefit of intending candidates. Visitors and new members, whether transmitters or SWL's, will be welcomed; details from the Hon. Sec. (see panel).

Romford & District Amateur Radio Society.—The monthly news letter is having its effect and attendances at the meetings are improving. G3CRR recently gave an interesting talk on TV in the Birmingham area, and the Brentwood and South-West Essex societies were invited to a joint meeting last month. G3FNL demonstrated his electronic bug, and another member gave a talk on Electronics in Industry.

Brentwood & District Amateur Radio Society.—This Club continues to run smoothly, the only unusual item being a recent visit to the Romford Society (see previous paragraph). Most of the existing officials were re-elected at the AGM, and membership now stands at 30, 20 of whom attended the Annual Dinner in January. Meetings are held fortnightly, and the Club Tx, G3FSM, is on the Top Band at each meeting.

Southend & District Radio Society.—Plans for the coming season include the judging for, and awarding of, the "Pocock Cup," for the best piece of home-built gear. Date for

this is March 31. This cup has been awarded for the past fifteen years, and may be won outright this time, as the donor has generously provided another. Plans are also taking shape for the annual Hamfest (early in April). The first March meeting is on the 3rd, 7.45 p.m. in Room 1, Municipal College, Southend.

East Surrey Radio Club.—The 1950 officers were elected at the AGM, and the year's activities reviewed by the Chairman. It was decided to hold meetings twice a month in future, as an experiment. At the February meeting there was a sound film show, and on March 8 a 70-cm. transmitter will be demonstrated. On March 23 there will be a talk (to be announced in the Newsletter).

Montrose Radio Club.—This Club, though reporting for the first time, has been in existence for nearly two years, and meets every Monday at 8 p.m. in its own Clubroom at 39 Kincaid Street, Montrose. These meetings are preceded by an "open" Morse class starting at 7 p.m. Membership is at present 25, but others will be welcomed. The Club transmitter, GM3FVJ, is in course of construction. See panel for Hon. Sec.'s QTH.

Bournemouth Radio & Television Society.—A full programme for 1950 was arranged at the recent AGM, and the Club Tx, G3FVU, will shortly be on the air. A series of talks and classes will be held for members entering for the RAE. Meetings are on the first and third Thursdays,

7.30 p.m. at the Club HQ—Cricketers Arms, Windham Road, where new members or visiting amateurs will be heartily welcomed.

Yeovil Amateur Radio Club.—Regular weekly meetings have continued, and a welcome visitor has been MD2B, home on leave. The AGM was held in January, and a good year's work reviewed. The old Clubroom has had to be evacuated, and meetings are now held at 51 Larkhill Road, Yeovil, every Wednesday at 7.30 p.m. Several amateurs known to be active in the district have not shown up at meetings and the Club would be very pleased to welcome them.

Worthing & District Amateur Radio Club.—Meetings are held on the second Monday of the month, and the February talk was by Mr. Pratt, who enlightened members on the subject of AVO meters and equipment. The Morse class is held every Monday at 7 p.m.; regular meetings follow at 8 p.m.—Adult Education Centre, Union Place, Worthing.

West Bromwich & Handsworth Radio Society.—Activity continues successfully, with recent talks on Receivers (G2BJY) and Aerials and Feeders (G3WH). For this month it is hoped to arrange a talk on Television. Meetings are on the last Wednesday of each month.

Gravesend Amateur Radio Society.—At the AGM the Chairman and Secretary were re-elected, and G3EJK appointed President. January meetings covered VHF (by G3EJK), "My Station" (by G3FST) and a discussion on Aerials. Morse classes continue at the meetings, every Wednesday at the Clubroom, 30 Darnley Road, Gravesend.

Radio Society of Harrow.—Since moving to the new premises increased attendances have been recorded, and at the AGM it was decided to introduce a reduced subscription for junior members and a special scheme for Service members and shift workers. Recent lectures have been on

CLUB STATION QSO's

The Hon. Sec. of the Grafton Radio Society, G2AHB, writes as follows :
*"I constantly read from time to time about various Clubs taking out a Club call and stating that their station will be on the Top Band.
 "Grafton (G3AFT) are on the band (CW and Phone) every week—practically every Monday, Wednesday and Friday, from 2130 to 2315 hrs. Apart from MCC, we have not worked more than a couple of Club stations.
 "Where are these Top Band Club Stations? Why not publish every month a panel of 'Club Contacts'?"*

* * *

We are adopting this suggestion immediately, and we ask every Club with an active Top-Band transmitter to log all contacts with other Clubs and to send in to us the number of such contacts, beginning on March 1. We will devote a small box each month to a "ladder" crediting each Club station with the number of QSO's with other Clubs only.

Grafton (G3AFT) will set the ball rolling by calling CQ Clubs; others should do the same—not forgetting to listen for the other man's CQ as well!

Timepieces and Timekeeping (G5ZD) and on Naval Communications (Capt. Tuthill, U.S.N.). Forthcoming events are a demonstration (Taylor Electrical Instruments), a talk on a 2-metre outfit (K. W. Cranfield) and a one-valve receiver competition.

Lewes Amateur Radio Club.—This Club is now on a firm footing, although activity is more or less restricted to Junk Sales and Talks, but it is hoped to get a club workshop going and also to do some practical work on transmitters. A recent event was a visit to the BBC at Brighton. New members will be heartily welcomed.

Edinburgh (Lothians) Radio Society.—The fortnightly meetings continue at 25 Charlotte Square, March dates being the 16th and 30th. At the last meeting an exhibition of members' home-built gear

was held; a visit has also been paid to the local BBC studios. Local interest in the 2-metre band is increasing, possibly on account of two interesting talks at recent meetings.

North-West of Ireland Amateur Radio Society.—The AGM and Supper was held in February, and Mr. McCrary, the City Electrical Engineer, gave a talk on the early days of radio, with which he was connected in 1901! This talk was followed by one on Amateur Radio To-Day, by GI3BKG, the Club's new Chairman.

Wakefield & District Amateur Radio Club.—Now officially in existence, meetings take place at "The Swan with Two Necks," Westgate, Wakefield, every week. There is Morse class with about a dozen members, and a full programme of events will be available shortly. All trans-

mitters and SWL's will be cordially welcomed—Hon. Sec.'s QTH in panel.

Grafton Radio Society.—This Club was fortunate in receiving a gift of a large load of surplus gear. Members have had a busy time stripping it, and the results of this stripping will be put to valuable use for the new building programme scheduled by the committee. Meetings continue on every Monday, Wednesday and Friday at 7.30 p.m.

Eastbourne & District Radio Society.—This Club now has its own call, G3GJT, and operates QRP on 3.5 mc CW every Club night. This provides good practice for NFD, as the whole station has to be erected and dismantled each time. Meetings are on the first Friday, 7.30 p.m. at Friends Meeting House, Wish Road, Eastbourne.

NAMES AND ADDRESSES OF CLUB SECRETARIES :

- BARNET : M. R. Jenkins, G3EIM, 1193A High Road, Whetstone, N.20.
- BARNESLEY : J. A. Ward, G4JJ, 44 Northgate, Barnsley, Yorks.
- BOURNEMOUTH : F. G. Hamshire, 99 Elmes Road, Winton, Bournemouth.
- BRADFORD : V. W. Sowen, G2BYC, Rushwood, Grange Park Drive, Cottisley, Bingley, Yorks.
- BRENTWOOD : J. F. Moseley, G2CIW, 45 Geoffrey Avenue, Harold Park, Brentwood, Essex.
- BRIGHTON : L. Hobden, 17 Hartington Road, Brighton.
- BRISTOL : N. G. Ford, 71 Brynland Avenue, Bristol, 7.
- CLIFTON (S.E. LONDON) : W. A. Martin, G3FVG, 21 Brixton Hill, London, S.W.2.
- EASTBOURNE : R. Nugent, G2FTS, Field House, Windmill Hill, Hailsham, Sussex.
- EAST SURREY : L. Knight, G5LK, Radiohome, Madeira Walk, Reigate.
- EDINBURGH (LOTHIANS) : I. Mackenzie, GM3FGJ, 41 Easter Drylaw Drive, Edinburgh, 4.
- EXETER : D. W. Thomasson, Aytoun Cottage, Matford Avenue, Exeter.
- GRAFTON (N. LONDON) : W. H. C. Jennings, G2AHB, Grafton LCC School, Eburne Road, London, N.7.
- GRAVESEND : R. E. Appleton, 23 Laurel Avenue, Gravesend, Kent.
- HARROW : S. C. J. Phillips, 131 Belmont Road, Harrow Weald, Middx.
- KINGSTON : R. Babbs, 28 Grove Lane, Kingston, Surrey.
- LEWES : M. B. Beck, 5 Grange Road, Lewes, Sussex.
- LEEDS : L. H. King, G3CML, 14 Clarence Street, Bramley, Leeds.
- MIDLAND : A. W. Rhodes, 135 Woolmore Road, Birmingham, 23.
- MONTROSE : Miss J. M. Steers, 182 High Street, Montrose.
- NORTH KENT : L. E. J. Clinch, 8 Windsor Road, Bexleyheath, Kent.
- NORTH-WEST IRELAND : C. Castles, GI3FKL, 9 Academy Road, Londonderry.
- READING : F. Hill, G2FZI, 997 Oxford Road, Reading.
- ROMFORD : D. L. K. Coppendale, G3BN1, 9 Morden Road, Chadwell Heath, Essex.
- SCARBOROUGH : P. Briscoe, G8KU, 31 St. Johns Avenue, Scarborough.
- SOUTHEND : J. H. Barrance, M.B.E., G3BUJ, 49 Swanage Road, Southend.
- SOUTH MANCHESTER : M. I. Wilkes, G3FSW, 57 Longley Lane, Northenden, Manchester.
- SUTTON & CHEAM : L. Seaton, 8 Croft Road, Sutton, Surrey.
- TORBAY : K. Grimes, G3AVF, 3 Clarendon Park, Tor Vale, Torquay.
- WAKEFIELD : W. Farrat, G3ESP, Holmcroft, Durkar, Wakefield.
- WANSTEAD : R. J. C. Broadbent, G3AAJ, Wanstead House, The Green, London, E.11.
- WARRINGTON : J. Speakman, Davyhulme Cottage, Dark Lane, Whitley, Warrington.
- WEST BROMWICH : G. Johnson, G2BJY, 22 Lynton Avenue, West Bromwich.
- WEST CORNWALL : R. V. A. Allbright, G2JL, Greenacre, Lidden, Penzance.
- WEST SOMERSET : T. C. Bryant, G3SB, 16 The Parks, Minehead, Somerset.
- WILLESDEN : R. A. Axtell, 51 Dudden Hill Lane, London, N.W.10.
- WORTHING : R. Forge, G3FRG, 2 The Plantation, Worthing, Sussex.
- YEOVIL : D. L. McLean, 9 Cedar Grove, Yeovil, Somerset.

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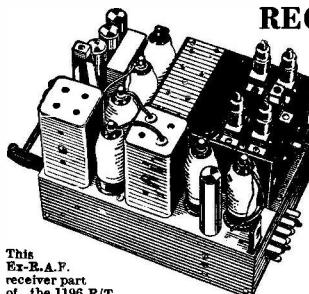
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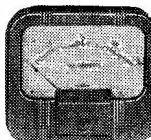
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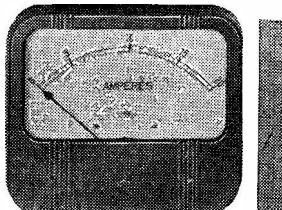
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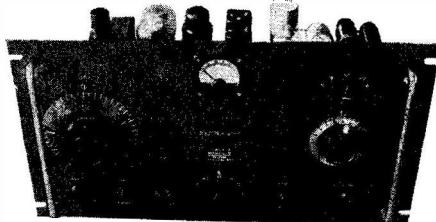
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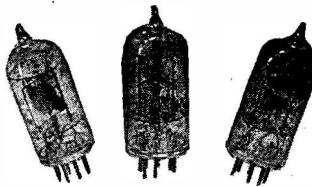
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H.S.3 Input 200/250v. Output 350/0/350v. 80 ma/a 17/6
H.S.2X Input 200/250v. Output 250/0/250v. 100 ma/a 19/6
H.S.30X Input 200/250v. Output 300/0/300v. 100 ma/a 19/6
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F.S.30 Input 200/250v. Output 300/0/300v. 80 ma/a 19/6
F.S.3 Input 200/250v. Output 350/0/350v. 80 ma/a 19/6
F.S.2X Input 200/250v. Output 250/0/250v. 100 ma/a 21/6
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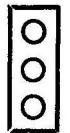
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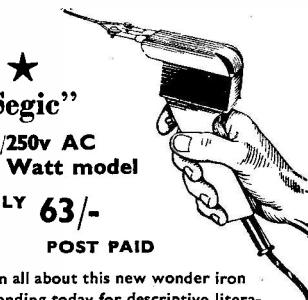
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NEW Goods, Boxed R.F. Meters, 350 milliamps. Moving Coil, 3/6, Midget Mu-metal L.F. screened chokes, 2,000 ohms. 8 mA, 1/- Variable 300-ohm, 30-watt resistors, with feet, 1/-. Midget relays DPST resistance 300 ohms, 1/-. "Dubilier" Mica condensers, .01 mfd, 400v, wire ends, 2/6 dozen. Silva mica .0003 at 3/- dozen. H6V valves, 1/- each.—Jack Porter, Ltd., "Radio," College Street, Worcester.

TRANSMITTER DRIVER UNITS TYPE 1. Standard rack units. Output frequency approximately 120 mc. Fully metered by cathode switching device. Coils easily modified for 145 mc or would make excellent 7. 14, 21 and 28 mc Driver Unit. Price 25/-, less valves. Callers only.

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WANTED.—AR88D's, SX28, cash or part exchange.
—P.C.A. Radio, Cambridge Grove, London N. W.6.
Tel. : RIV. 3279.

URGENTLY WANTED

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Receivers BC348, BC312 and BC221

Preferably not converted, accepted if in good condition. Also interested in other American receivers and instruments.—Box No. 688.

SMALL ADVERTISEMENTS

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3d. per word, min. charge 5/-, payable with order. Box numbers 1/6 extra.

HAM-built 100-watt CW/Phone Tx. Power supplies, crystals, VFO, accessories, spares. Ten-valve superhet. 465 crystal, S-meter, all on operating bench. £25.—Box No. 691.

BC312N S-meter, enclosed power supply, converter 21, 28, 56 mc. Valves and other components. Offers.—119 Tollers Lane, Old Coulsdon, Surrey. Phone: Downland 1490.

WANTED.—*Short Wave Magazine* Volumes I-VI complete; Volume VII numbers 1-7. *Short Wave Listener* Volumes I-III.—Box 690.

RMY TX. No. 12. 50 watt CW—30 watt Phone, A VFO/CO-BA-PA 160-80-40-20 metres, band-switched turrets, FB job, as new. 110-250V 50c AC. First offer over £20 secures. Add carriage.—Box No. 695.

BC221 frequency meter as new, £9, plus carriage.—Box No. 696.

POWER pack for SCR522 110-250V AC, £4, plus carriage. Laboratory power pack, 3 meters 6-12V AC, 400V DC. Stabilised 150V DC grid bias, Worth £60. Very fine job. Sacrificed for £15 plus carriage, for further details write to Box No. 697.

SALE 18 Rx/Tx, 40 metres, complete 'phones, key, microphone, aerials, spare valves, etc. Good condition. Offers to: Ellis, 262 Colinton Road, Edinburgh.

WANTED.—TCS6 or similar type transmitter with cabinet. Suitable for spare parts. Working order not essential. Reasonable price and details to Box No. 693.

BATTERY receiver 1224A, good condition in original transit case, 30-300 metres, £3.—Hegerty, 247 Kempton Lane, Basingstoke, Hants.

FOR Sale.—Hallicrafters S.40 with operating manual, perfect condition. Offers. Ken. 0264 or Box No. 694.

AR88D 550 kc to 32 mc, excellent condition, with matched speaker, £35 or near offer.—Shields, A.S.T. Club, Hamble, Southampton.

WANTED.—Instruction Manual with circuit diagram for AR77E. State price.—Wallace, Blantyre Terrace Ianstown, Buckie, Banffs.

BC348C and two 12v-40 APH accumulators. This equipment is new, £15/10/- Write: H. Smith, Gate House, Warnham Court, Horsham, Sussex.

IF/AF amplifier built by G2IQ as in August 1947 *Short Wave Magazine*, with 19-in. black crackle panel for rack mounting. Best reasonable offer.—K. Young, 76 Wendover Road, Eltham. S.E.9.

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New 69 Units (less 10 valves and motor) for stripping or conversion (circuit inside case), a real bargain at 25/- (about £5 in parts): R3132 for television, 25/-; R1116 all-wave battery double super-hets, 8 valves, tested, leaflet 3d.; R1355 television, good condition, with 10 valves only 50/-; Transformer recommended in Televisor Book for R1355—250-250V; 5v; 6.3-6 amps, 32/-; R.P.27's (few only), 32/6; S.130 voltage stabilisers, 11/- pair; (offers invited for 1,000); control boxes (new) with plugs for the recently released No. 19 sets, includes 2 fine Yaxley 3 bank switches, panel light, controls, etc., 6/- only; Jones plugs with covers for the R.F.26, etc., 1/9; plugs for 6 pin front R1355, etc., round amphenol, 2/-.

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TRANSFORMERS 230V AC Mains, shrouded, 150-0-150V at 100 Mills, size 3½" x 3½" x 4½". Fitted with ceramic terminals, 4/- plus 1/- post.

TRANSFORMERS 230V AC Mains, similar, 150-0-150V, 0, 10, 20, 30 and 40 Volts all at 70 Mills, size 2½" x 3½" x 3½", 4/- ea., plus 1/- post. No heaters.

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 Standard 6 Tier Steel Tx Racks, £2, post free

SMALL ADVERTISEMENTS

READERS'—continued.

145VFO with built-in buffer, £3/10/- W1191
 wavemeter converted Mains operation, £5/10/-
 —G3VW, 3 Albany Court, Montrose Avenue, Edgware.

WANTED.—AR88D in new condition and perfect
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 cash adjustment. Transaction preferred with someone
 in or near the London area. All letters answered.—
 Box No. 698.

WANTED.—Canadian C43 Tx technical manual or
 photostats.—A. Kent, c/o 30 Cecilia Road,
 Queens Road, Leicester.

NEW Valves. 829B (with new base), 35/-, 815, 25/-,
 6AK5, 8/-, 6AG7's, 83, EL33, 956 (with base),
 SU4G's, 8/-, CV66's, GS7, 6ACT's, EF36's, EF39,
 EK32, P61, 4/-, RGD. New 37 Osl/Tx, £6. 0-15 mA
 M/C meter, 10/-, 500-watt auto-trans. cased, fused
 (Ex-R.A.F.), 35/- Exchange/Wanted. B2 outfit.—
 56 Hampton Road, Forest Gate, E.7.

FOR sale, R1224A battery communications receiver,
 good condition, £5, or will exchange for MCRI
 receiver. Must be complete and in good condition—
 Box No. 699.

WANTED urgently, Perspex dial for AR88LF.
 Must be perfect condition.—Box No. 700.

SALE.—Hallicrafters SX18, tunes 550 kc to 38 mc.
 1,000-degree bandspread. Crystal filter. Nice job.
 First £15 secures.—G3BF, Brackencot, Uplands
 Avenue, Worthing. Phone : Swandeans 4044.

SALE.—B2 Tx, Rx and Power pack. All coils. Nice
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WANTED.—Manual for BC342N. Buy, borrow or
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BC342N¹¹⁰ AC auto-trans. Fine appearance
 and performance, £16, or first near
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GEENUINE bargains. BC348/power pack, S-meter,
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 pack 60 watt with complete coils, valves, xtals, meters,
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 All enquiries answered.—R. Mitchell, G5LH, Croft
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HRO nine coils, power pack, loudspeaker,
 splendid condition, also FARREX short-
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SKY Champion S20 540 kc-44 mc excellent condition,
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 1946 to February 1950, complete, 25/-, post free.
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 Surrey.

RSGB Bulletins, March 1939-March 1948,
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HRO-M receiver and power pack, spares,
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 Receiver complete with speaker, £25. Disc recording
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BC432N less xtal. In FB working condition
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AR88LF perfect alignment. Best offer over £35.—Box No. 701.

VHF valves, 6C4, 6AG5, 5/-, BC342N with 230/115v transformer, £15. B7G holders and screens, 1/6. Oilmite 60° volt condensers 0·1, 0·25, 1 μF, 6d., delivery return post.—Sevenoaks, Davenham, Cheshire.

WANTED—U.S. Army Signal Corps "Handie-Talkie." Please send details, price, condition, to D. Lloyd, 33 Crosbie Road, Birmingham, 17.

R107 one owner. S-meter, handbook, spare EF39, EBC33, 6X5G also RF26 modified, for 10 with p.p. Exchange lot for BC348 or HRO any condition. Offers.—Box No. 702.

R1155, spin illuminated dial : Internal, power pack (AC), output valve, S-meter ; Controls : AF, RF, tone, S/R, etc. New panel—whole re-enamelled, £10. RF24, RF25, 7/6. W1191 (modulated) chart, spare valves, £3. Inspect by appointment.—G2HCV, 90 Bentworth Road, London, W.12.

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BC348 brand new 200/250 Mains converted also BC348 brand new, unconverted, offers S.A.E. list other gear.—G3BNP, Rosedene, Portishead, Bristol.

WANTED—Super-Pro BC794B buy or exchange for AR88 (£40) or S27D and Panoramic adaptor (45) or Super-Pro BC779A (£25) or sell above. Offers to Fletcher, 6 Maple Avenue, Beeston, Notts.

HRO/MX with 9 coils, National power pack, loudspeaker, 2 spare valves perfect. £27/10/- cp. Williams, Ashfields, Cuddington, Malpas, Cheshire.

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RECEIVERS. New R1155's, £12/--. Car Radio's from, £8/-; ENAMELLED COPPER WIRE, 4lb reels, 16-20-22, 2/-; 24-26, 2/6; 28, 30, 32, 2/8; 34, 36, 3/-; 38 and 40 s.w.g., 3/6; METAL RECTIFIERS, 230v 60ma ideal for universal receivers, 3/6, 6-12v 6 amp, 4/6.

VOLTMETER MOVEMENTS, 500 micro amps, 2,000 Ω per volt. Calibrated 0-15, 0-600v, 4/6 each, 5 for 20/-, don't miss these!

BUILD YOUR H.T. BATTERY with inert cells! The cheapest way, you just have to fill them up with water, 60v 12/6, plus 2/6 carriage, 120v, 20/-, plus 5/- carriage. Sample 14v cell 7/-, 5 for 2/6.

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NEW Ex-USASC Master Oscillator Type M11946TA 2 807, grid meter, ready-made BFO, 1-5mc 2-10mc's, 78/-, 3 Valves FREE with this.

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High Voltage Condensers. 1 at 3kv, 3½" × 3" × 2½", 3/-; 1 at 2kv, 5" × 2" × ¾", 2/6; 25 at 2kv, 2½" × 2" × 1½", 3/-.

TX Condensers. 146μuf 4kv, will modify to split stator, 3/3.

Ceramic Switches. 3-bank 2-way, easily modified to 12-way, make fine 150V PA turret, 5/-; 3-pole 4-way 100W, 4/-.

Chokes. Midget 1½" × 1", 5H, 2/6; 5H 200ma, 5/6; swinging, 3/6-4/2H (50ma, 6/6; micro switches, 1/3.; 1225 chassis, 4/6; rev counters, 2/3; co-ax relays twin S.P., 70 ohms 12/24v, 6/6; B'ham. View Master instructions, 5/-.

Ribbon Feeder, 300 ohms HD, 70 ohms 50W 5d. per yd.

Please see January issue for dural tube and copper wire. We stock Eddystone, Denco, Raymart, View Master components.

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New Boxed Valves. 866A, 16/6; 804, 805, 832, TZ40, 23/6; 808, 811, 24G, 27/6; 803, 815, 36/-; 810, 813, 41/; PX4, 11/6; matched prs. PX25, 36/-; 387, 12/6; 807, 6N7M, 6F6M, 7/6; 6AG5, 6V6M, 6F6G, 6SQ7M, 6J7M, VR150/30, 3D6, 5U4G, 7/; 6F7, 6SSFM, 6/6; 6J5M, 6S7JM, 6/-.

New Unboxed. 604, 5Y3G, 6/6; 6J7G, 6/-; 8D3, 8/6.

Special Offer, 615G or GT, 3 for 8/- (ex-equip.).

Parmeko shrouded swinging chokes, 4-20H, 150 m/a, 6/9. Xfmrs. Pr. 110-250v 2 secs., ea. 500-0-500v 200 m/a (service rating), new crated, 46/- ea.

TX Chassis with 500 K/cs xtal, numerous components, 10/6 ea. Ceramic switches, 3B.2W, easily mod. 11-way, handle ¼ Kw. RF, 2 for 8/-.

All post paid.

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H.F. TEST SET

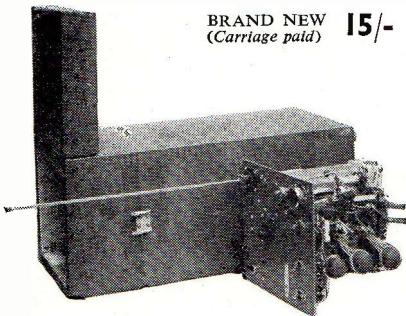
These four valve test sets, with their 18 in. pull-out, self-locking, vertical antennae, provide the basis of several modifications.

The panel is big enough to mount a calibrated dial and a small meter when modified for use as a Field Strength Meter Phone Monitor.

By using the valves themselves, which are battery types, HL23(3) and DI(1) a highly sensitive indicator can be constructed which can be used for the detection of harmonic radiation. The polar diagram of the antenna system may be plotted. Also using the valves in the unit, a small but highly useful signal generator can be constructed.

The transit case of this unit also forms the outer case of the test set. A recessed hinged lid covers the panel of the instrument. When batteries are required for operation, they may be stored in the bottom of the case.

BRAND NEW **15/-**
(Carriage paid)



R.1155A

This receiver is far too well known to require detailed description.

It is a first-class communications receiver, covering the ranges 75/200 Kc; 200/500 Kc; 600/1500 Kc; 3.75 Mc; 7.5/18 Mc.

By the use of a converter the 28 Mc. band may be covered. The valves contained in the DF section provide spares for the signal circuit tubes.

Little time is required to convert these receivers for immediate operation, the "conversion" being the addition of a power pack to supply 250v at 50 m/a, and 6v at 3 amps. They are in perfect condition; in fact, brand new, in transit cases. PRICE **£11.19.6**

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8/- each, or with grille **10/6** (Postage 9d, extra)

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New condition. 24v 5.9 amp. D.C. input 110v 1 amp **£4**
1 phase 400 c/s. Output 45 watts. (Carriage paid)

TRANSMITTING CONDENSER

A ceramic insulated condenser, having wide-spaced vanes, suitable for PA. operation. Satisfactory for use on voltages up to 750v. Capacity 130 pf.
(Postage and packing 6d.) **1/6**

SHORTHAND

ABBOT TR-4 TRANSMITTER RECEIVERS

We have available two of the above units, in perfect condition.

They are suitable for portable or fixed operation on two metres. The units are ideally suited for mobile link when undertaking investigations concerning antenna radiation characteristics, and the field strength of the fixed station.

Current consumption is extremely small, the combined total being approx. 60 milliamps at 250v. The heater current is of the order of 2 amps at 6v. Thus they can be operated successfully from a small motor generator when required for portable operation, or a compact power pack when used as a fixed station.

OFFERS ARE INVITED FOR THIS TRANSMITTER RECEIVER.

COLLARO RC.500 AUTO RECORD CHANGERS

Brand New. Guaranteed

Plays nine 10" or 12" records. AC mains 100-250v with high fidelity crystal pickup.

£4 down and six monthly payments of **22/6**

BRAND NEW MOTOR GENERATORS

Easily convertible to $\frac{1}{2}$ H.P. motors. Housed in steel cabinets, black enamel finished. Size $7\frac{1}{2}'' \times 8'' \times 16''$. Complete with all smoothing gear.

Type 35 : Input 18v 12 amps. Output 225v 110m/a and 6.3v 13 amps. (Carriage and packing 5/-) **20/-**

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Supplied complete with assembly instructions, tube of Bostik cement, and all fitting screws. For efficient water-tight co-axial cable connections and to improve signal strength.

See that you give your aerial a chance. Used on many famous maritime installations, we have exported these to all parts of the world.

Formerly 24/6 NOW **12/3** Post 9d.

RECEIVER FOR THE No. 18 TX/RX

As new and complete with 4 valves : VP23(3) and AR8(1). Requires power supply of 144v H.T. 12v GB, and 3v L.T. A 4-valve superhet covering 33-50 metres.

For only **17/6**

(Post and packing 1/6.)

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Phoenix feed-through insulators, less feed-through rod and bushes (4 BA screwed rod is satisfactory).

Four domes to make 2 complete insulators, at a bargain:

PRICE **1/3** (Post and packing 6d.)

SPECIAL!! TEST METER for D.C.

having the following ranges :—0/1.5v ; 0/3v ;
0/30v ; 0/300v ; 0/3 Kv ; 0/5000 Ohm ; 0/60 m/a.

BRAND NEW 18/6

At a price of only

This instrument measures $4\frac{1}{2}'' \times 4\frac{1}{4}'' \times 2\frac{1}{2}''$ and is complete with carrying strap.

The fundamental voltage ranges are 0/1.5 and 0/3v, but we supply the terminals and resistors for extending the ranges as above, thus greatly increasing its utility.

Fully detailed and illustrated leaflet on the conversion given, and this can be effected in a very short time.

HURRY! Get your portable tester while stocks last. A genuine snip far too good to miss.

*Instrument only 15/- Kit for extending ranges 3/11
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The famous wartime "Cat's-eye" tube used in "Tabby" for night sniping and observation. Provides a silver caesium oxide screen for the conversion of infra-red rays to visible rays, using an infra-red light source. Data provided.

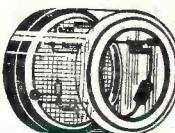
Dimensions overall : dia. 2" x 1". Screen dia. 1 1/2".

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Price only

Snooperscope

Screen
Post
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INFRA-RED IMAGE CONVERTER CELL



EX-ARMY. WS-18 Receiver Unit

A 4-valve superhet chassis, range 6-9 mcs. (50-33-3 metres), with ARPI2 (VP25) F.C. 2/ARPI2's I.F. and AR8 (HL23DD) audio loc. osc., 2nd det. and A.V.C., slug-tuned I.F. trans. 465 kcs. etc. The complete receiver, mounted on a chassis 8 1/2" x 5" x 1", all controls front panel 9 1/2" x 5 1/2". Unused, good condition. Power requirements approx. : 3v 0.2A. H.T., 120v 15ma. H.T., 1.5v bias.

Clydesdale's Price only

12/6

Carriage paid

Brand New in maker's original packing. Ex-U.S. Army WIRELESS SET NO. 48 MK. TRANSMITTER/RECEIVER

American version of the No. 18 set, modified to U.S. Army requirements.

Frequency coverage 6-9 Mc/s. 33-3-50 meters. Complete equipment for 'phone and C.W. comprising : TRANSMITTER, with 1,000 kc/s crystal, 4 valves, 1A5 master osc., 2/129's P.A., ILD5 mod., crystal osc., and diode R.F. rect., etc. RECEIVER, superhet circuit, employing 6 valves, ILN5 H.F. amp., ILA6 1st det., F.C. ILN5 L.F. amp., ILD5 2nd det. and B.F.O., ILD5 1st L.F. and A.V.C. 1A5 output, L.F. frequency 455 kc/s, etc.

HAND-DRIVEN GENERATOR, supplying H.T. and L.T. (plus 12v bias, when switched for WS18), with operator's seat.

AERIAL, 10 ft. rod type (11 section), range 5 miles R/T 10 miles, C.W. greater ranges can be obtained with a normal aerial.

PLUS, 25 ft. insulated aerial, 2 battery cases, 2 pairs M.C. headphones (ear insert type), T-17 MC mic., control morse key, spare kit of valves, conn. cables, satchels, canvas covers and instruction book. This equipment can also be used with dry batteries (not supplied) as a Portable Walkie-Talkie.

Power requirements H.T. 162v 60 ma. L.T. 3.1v 0.3A. Dimensions set and battery container : 11 1/2" x 10 1/2" x 17 1/2".

Clydesdale's
Price only

£14/10

Ex-Cdn. Forces. A few only V.R.L. RACK-MOUNTED COMMUNICATIONS RECEIVER

Made by Vancouver Radio Lab.

Frequencies 1.5-28 mcs. plus overlap (20-10.7 metres) for 110-115v A.C. mains operation, this 19-valve receiver is a double converter, with one R.F. stage, separate local oscillator, B.F.O. and noise limiter, with I.F. of 1.5 mcs/465 kcs.

Valves : 6K7, R.F. 6L7, 6K8, mixers, 6S17 L. osc., 2/6K7's, 6L7, 6H6, I.F.'s. 6K7, 2nd det., 6H6, A.V.C. 6L7 B.F.O. 6S5 1st audio, 6K6 audio output, 6G5 tuning ind., 80 rect., VR150/30 stabilizer, 6K6G, 6C8G, 6K7, frequency std.

All controls incl. B.F.O. sep. A.F. and R.F. gain, 2-speed tuning, wavechange, etc., mtd. front panel. Receiver mtd. lower part of rack, 6 speaker/power unit mtd. above, with 10-100-1,000 kcs. sub-standard.



number of telephones are used, the indicator lamp would indicate which one is being called.

Dimensions : 7 1/2" x 9" x 7 1/2" for wall mounting. Designed for ships' use, but can be used in the home, office or factory.

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Carriage
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Brand New in maker's original carton TRANSMITTER TUNING UNITS

Each having vernier tuning dial ; variable capacitors. Tank coil unit on ceramic former ; ceramic switch ; R.F. chokes, etc. In metal cabinet 17 1/2" x 7 1/2" x 8". Finish black.

TUBS. 1,500-3,000 kcs.

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TU6B. 3,000-4,500 kcs. TU7B. 4,500-6,200 kcs. TU8B. 6,200-7,700 kcs.

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TU26B. 200-500 kcs.

Clydesdale's
Price only

10/-

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Dimensions : Rcv. 17" x 15" x 11 1/2" with 19" rack panel.

Dimensions : P.U. 17" x 8 1/2" x 7 1/2" with 19" rack panel.

Plus angle iron rack, overall dim. : 19" x 24" x 12".

Finish grey crackle with black and chrome control finger plates.

Clydesdale's
Price only

£30

each Carriage
paid

16' SECTIONAL AERIAL WITH BASE

Comprising 4 lengths tapering from 2" to 1", each section sleeved into the other with insulated base.

Clydesdale's
Price only

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H151

Jumper lead ass. (for WS-19) 60 ft. of 5-core tinsel flex, fitted at ends with a 5-way rubber plug—ZA-2994, and 5-way rubber socket,

Clydesdale's
Price only

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Ex-Royal Navy SOUND POWERED TELEPHONE

Requires NO batteries, and will give long service without attention. Complete with warning indicator lamp and generator, giving a high-pitched note which can be heard through any noise; where a

number of telephones are used, the indicator lamp would indicate which one is being called.

Dimensions : 7 1/2" x 9" x 7 1/2" for wall mounting. Designed for ships' use, but can be used in the home, office or factory.

Clydesdale's
Price only

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each
Carriage
paid