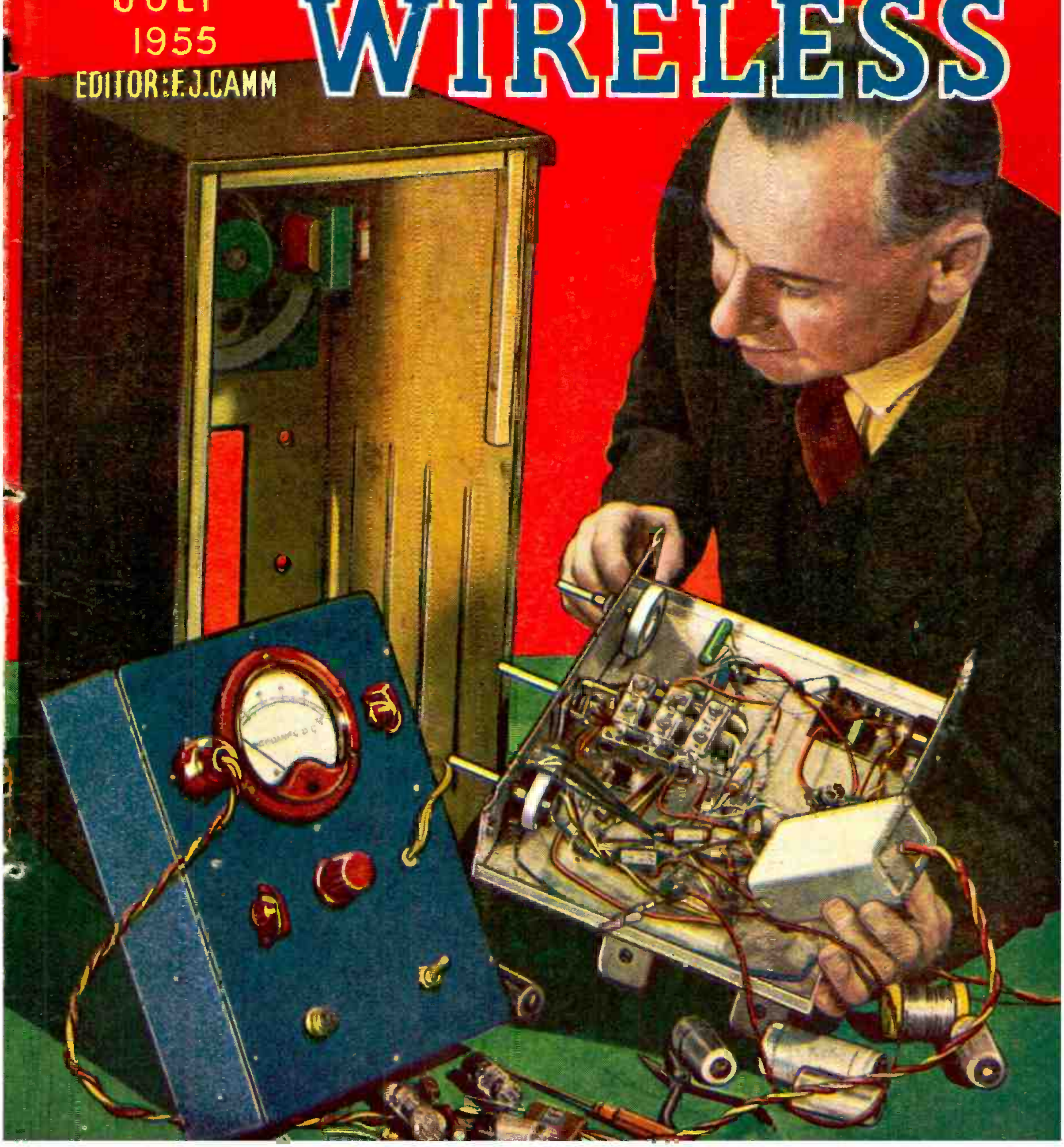
Making a Valve Voltmeter

PRACTICAL WIRELESS

1/-

JULY 1955

EDITOR: F.J.CAMM



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Send 2/- for layout, Wiring diagram and Components Price List.

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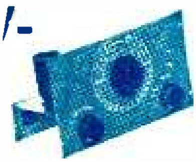

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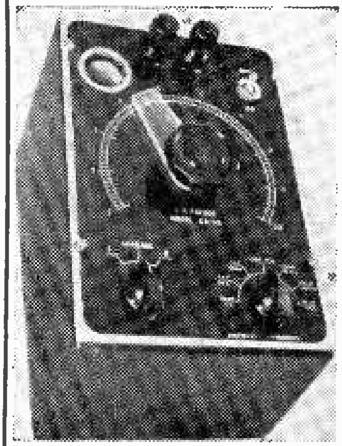

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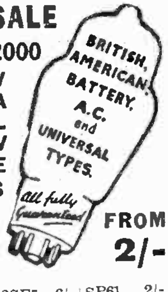

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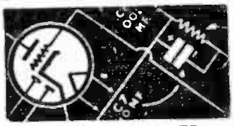

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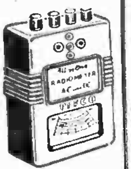

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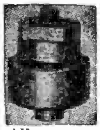

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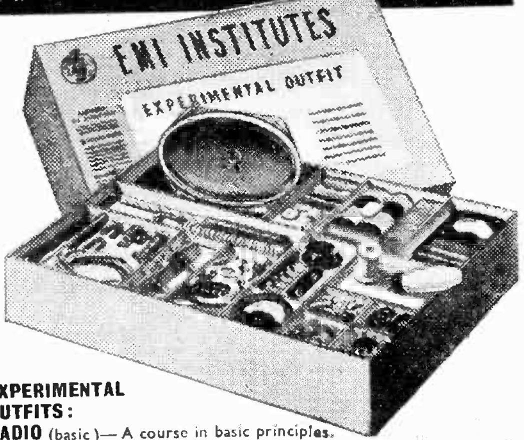

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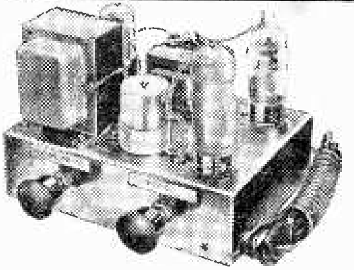

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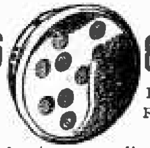

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6K8G, 6K7G, 6Q7G, 5Z4G, 6V6G ...37/6 "
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Model UA6 fitted H.P.G. 37 Cartridge.
3 SPEEDS :
33 r.p.m., 45 r.p.m., 78 r.p.m.
Complete with full instructions.
£9.19.6 Carriage 3/6.

HYDROMETER by Exide (Canada), complete in wood case ... ... 7/6 ea.

JUNCTION BOXES
Type 5X/2234 20-Way ... 1/6 ea.

BELL TRANSFORMER "CONCORDIA"
3v., 5v., 8v., 1 amp. fused. In bakelite case ... 8/6 ea.

EF50 PRE AMPLIFIERS, Less Valve
Coaxial input and output complete with plug for H.T. and L.T.... ... 6/- ea.

METERS
0-50 Ma. Milliameter by Ferranti—Panel Mounting ... ... 7/6 ea.

SURPLUS GEAR PARCELS
We have found from time to time stocks of components stripped from Ex-Government equipment, along with discontinued lines, etc. These are in small quantities and therefore unprofitable to advertise. To make room for new items we offer at less than cost parcels of these components at ... ... 10/- ea.

PUSH BACK WIRE
Size 7/012. Available in colours: Blue, Green, Red ... ... 2½d. yd.

Hand Microphone Bakelite switch in handle ... 7/6 ea.
High to low impedance headphone units (insert in lead) ... ... 3/6 ea.
Rubber grommets, assorted 6d. doz.
Bakelite Needle Cups ... 1d. ea.
Sleeving, various colours. 1 mm. ... ... 1d. lgth.
Mains Switch, 2-hole fixing S.P. ... ... 1/6 ea.
Yaxley Switch, 3 P., 3 B., 3 W. ... ... 1/6 ea.
Yaxley Switch, 1 Pole 9-Way ... ... 1/9 ea.
Waxed Carton, 8 Mfd., 450v. ... ... 1/9 ea.
Westectors, WX12, W4, WX6 ... ... 9d. ea.
Collaro, Hi-Fi Pick-up ... 32/6 ea.
Belling Lee, Type L709, Connector. Listed 8/9. Our Price 4/6.

TERMS: Cash with order or C.O.D. Postage and Packing charges extra as follows: Orders value 10/- add 9d.; 20/- add 1/-; 40/- add 1/6; £5 add 2/- unless otherwise stated. Minimum C.O.D. fee and postage, 2/3. MAIL ORDER ONLY.

WHEN ORDERING PLEASE QUOTE "DEPT. P.W."

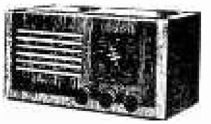
ALPHA RADIO SUPPLY CO.
5/6 VINCES CHAMBERS, VICTORIA SQUARE, LEEDS 1.

PREMIER RADIO COMPANY
B. H. MORRIS & CO., (RADIO) LTD.

OPEN TILL 6 P.M. SATURDAYS (Dept. P.W.) 207, EDGWARE ROAD, LONDON, W.2 Telephone: AMBASSADOR 4033 PADDINGTON 3271-2

BUILD THESE NEW PREMIER DESIGNS

3-BAND SUPERHET RECEIVER
MAY BE BUILT FOR **£7.19.6** Plus 2/6 Pk. & Carr.

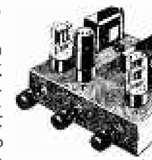


Latest type Superhet Circuit using 4 valves and metal rectifiers for operation on 200/250 volts A.C. mains. Waveband coverage — short 16-50 metres, medium 180-550 metres, and long 900-2,000 metres. Valve line-up 6K8 freq. changer, 6K7, IF, 6Q7 Detector AVC and first AF. 6V6 output. The attractive cabinet to house the Receiver size 12in. long, 6½in. high, 5½in. deep can be supplied in either WALNUT or IVORY BAKELITE or WOOD.

TRF RECEIVER
MAY BE BUILT FOR **£5.15.0** Plus 2/6 Pk. & Carr.

The circuit is the latest type TRF using 3 valves and Metal Rectifiers for operation on 200/250 A.C. mains. Wave band coverage is 180/550 metres on medium wave and 800/2,000 metres on long wave. The dial is illuminated and the Valve line-up is 6K7 H.F. Pentode 6J7 Detector and 6V6—Output.

4-WATT AMPLIFIER
MAY BE BUILT FOR **£4.10.0** Plus 2/6 Pk. & Carr.

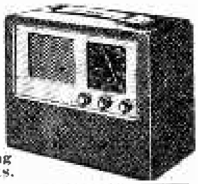


Valve line-up 6SL7, 6V6 and 6X5. FOR A.C. MAINS 200/250 VOLTS. Suitable for either 3-ohm or 15-ohm Speakers. Negative feed-back. Any type of pick-up may be used. Overall size 9 x 7 x 5in. Price of Amplifier complete, tested and ready for use, £5.5.0 plus 3/6 pkg. and carr.

INSTRUCTION BOOKS 1/- each, (post free) which includes Assembly and wiring diagrams, also a detailed Stock List of priced components.

CABINETS—PORTABLE
Model PC/1
Brown Rexine covered. 15/11.
Overall dimensions 15in. x 13½in. x 5in.
Clearance under lid when closed 2½in.
Model PC/2
Grey Lizard Rexine covered. 45/-.
Overall dimensions 15in. x 13in. x 6in.
Clearance under lid when closed 3in.
Model PC/3
Rexine type covering in various colours, 69/6.
Overall dimensions 16½in. x 14½in. x 10½in.
Clearance under lid when closed 6½in.
All the above Cabinets are supplied with Panel, Carrying Handle and Clips. Packing and Postage 2/6.
Send for details of the Premier Wide angle Televisor design which may be built for £30.

ALL-DRY BATTERY PORTABLE RADIO RECEIVER



4 miniature Valves in a Superhet Circuit covering medium and ong waves. Rexine covered Cabinets 11½in. x 10in. x 5½in. in two contrasting colours. Wine with Grey Panel, or Blue with Grey Panel, please state choice when ordering. The SET MAY BE USED EVERYWHERE—*home, office, car or holidays.* INSTRUCTION BOOK, 1/6 (Post free) which includes Assembly and wiring diagrams, also a detailed Stock List of priced components.

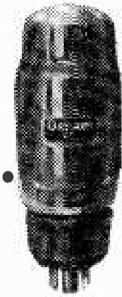
MAY BE BUILT FOR **£7.18.0** Plus 2/6 Pk. & Carr.

DECCA MODEL 37A DUAL SPEED RECORD PLAYER Includes turn over crystal pick-up with sapphire stylus and a light-weight, plastic, spring-balanced arm. Heavy gauge pressed steel case with brown enamel finish in good quality for operation on A.C. mains 200/250 v. 50 c.p.s. Supplied complete, £6.19.6. Plus pkg. and carr. 5/-.

★SEND 2½d. STAMP FOR OUR 1955 CATALOGUE.

www.americanradiohistory.com

THE NEW Osram KT55 output valve

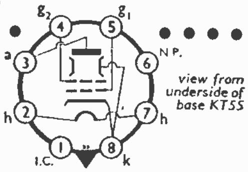


The new Osram KT55 beam tetrode has a heater rating of 0.3A, 52V. It is intended for use in a series heater chain for either DC or AC/DC mains amplifiers.

Outstanding characteristic is its high power output (25 watts per pair) with minimum distortion at comparatively low H.T. voltage (200V).

The Osram KT55 will form a popular companion-type to the well-known KT66. Two valves, type KT55, will supersede the need for four valves, type KT33C, in AC/DC amplifiers required to deliver up to 25 watts at 200 volts.

KT55. List price: 25/- plus P. Tax 8/2



HEATER

I_h	0.3	A
V_h	52	V

TYPICAL OPERATION

Tetrode connection. Push-pull.
Data per pair unless otherwise stated.

	Quiescent	Max signal	
$V_a(b)$	225	215	V
V_a	200	190	V
V_{g2}	200	190	V
V_{in} (gi—gi) (pk)		28.8	V
V_{g1} (approx.)	—20.5	—23.5	V
I_a	220	225	mA

	Quiescent	Max signal	
I_{g2}	15	45	mA
R_k (per valve)	175	175	Ω
RL (a—a)		2	kΩ
Pout		25	W
D		2	%
Zout		9	kΩ

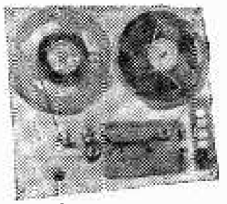
THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, W.C.2

!!HOME CONSTRUCTORS!!

You can assemble the Stern's "Fidelity" Tape Recorder for only £40

!!!IT ONLY NEEDS CONNECTING UP!!!

This 2-Speed Twin Track Recorder although supplied at a Genuinely Low Price, provides absolute Fidelity Recordings, and in addition to being completely dependable has a performance at least equal to Recorders marketed at a far higher price. The actual assembly of the Recorder is simple, and only involves a few connections. The Truvox Tape Deck and the Quality Amplifier are supplied tested and ready for use, and all that is required to complete the Recorder is to connect the two together (a connection chart is supplied for this purpose) and secure them by the screws provided into the Attache Case. The items illustrated and described below form the complete equipment.



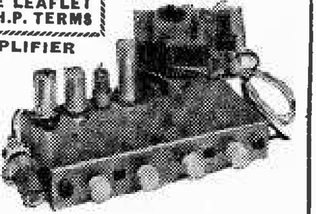
TRUVOX TAPE DECK MODEL Mk. III/TR7u

This is Truvox's new "small" design being only 14in. x 13in. The whole instrument is built to close engineering limits resulting in the minimum of "wow" and "flutter" values. It will play the NEW PRE-RECORDED TAPES and takes all standard tapes up to 1,200ft.

SEND S.A.E. FOR DESCRIPTIVE LEAFLET INCLUDING PRICE DETAILS & H.P. TERMS

MODEL TRIF QUALITY AMPLIFIER

Expressly designed to correctly operate with the above Truvox Deck for recording and playback. Supplied complete with Elliptical Speaker and has level response from 60-10,000 c.p.s. Hum level 50 db down at 4 watts. Incorporates efficient tone control arrangement and MAGIC EYE LEVEL INDICATOR. Valve line-up: EF86, ECC83, EL84, 5Y3, EM34 provides 4 watts undistorted.



SCOTSBOY MAGNETIC RECORDING TAPE

Supplied complete with a 1,200ft. reel of Scotsboy Tape. In addition, the Recorder will take all standard makes of tapes.

MODEL MIC33/1 ACOS CRYSTAL MICROPHONE

A highly sensitive Mike which accurately matches the input arrangement of the Amplifier.

It can be supplied complete and ready for use for £50 as illustrated above

PORTABLE ATTACHE CASE

This, as may be judged from the illustration above, is a neat, compact and attractively finished case, being covered with maroon rexine and having an ivory coloured speaker escutcheon. It contains concealed pockets to accommodate the Microphone, Mains Lead and a spare 1,200ft. reel of tape.

STERN RADIO LTD.
109 & 115, FLEET STREET, E.C.4
Tel.: CENTRAL 5812-3-4.

www.americanradiohistory.com

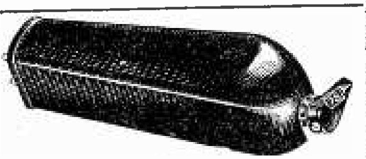
Bring your equipment up to date with ACOS REPLACEMENT PICK-UP HEADS

If you already own a fine radiogram or record-player you now have the opportunity of rejuvenating it — of bringing it right up to date for a quite modest sum. Acos Hi-g crystal pick-ups are now available in a range of specially designed "plug-in" models to suit most famous makes of record reproducing equipment.

These Acos "Hi-g" pick-ups, you will find, represent a truly phenomenal advance in pick-up design—with regard to both reproduction and tracking characteristics (so important with many of the new microgroove recordings). Ask your Dealer!

MODEL

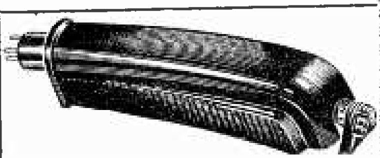
HGP 37-1 Collaro



A Hi-g pick-up head incorporating the HGP 37-1 turnover cartridge with cantilever sapphire styli. Designed for both standard and microgroove records. Will fit Collaro units RC 532: AC 534: AC3/534: 3RC 532 and the Studio pick-up. Available in cream or walnut.

Ask for Data Sheet No. 4800.

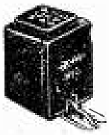
HGP 37-1 Garrard



A Hi-g pick-up head incorporating the HGP 37-1 turnover cartridge with cantilever sapphire styli. Designed for both standard and microgroove records. Will fit Garrard units RC 75M: RC 80M: RC 90: RC 111: Model TA.

Ask for Data Sheet No. 4800.

HGP 39-1



Hi-g pick-up heads incorporating cantilever sapphire styli. Separate heads for standard and microgrove records. Will fit the Acos GP 20 pick-up arm and the Garrard C type adaptor. Used on the following units: RC 72A; RC 75A; RC 80; and the Model M unit. Can be used on any units which at present use the GP 19 heads.

Ask for Data Sheet No. 4400.

HGP 35-1

Separate plug-in type Hi-g heads for standard and microgroove records; fitted with cantilever sapphire styli. The crystal unit is identical to that of the HGP 39-1 above. Can be used on Garrard units RC 75M; RC 80M; RC 90; RC 111; and the TA player.

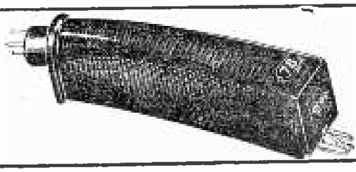
Ask for Data Sheet No. 4000

HGP 41-1

Separate Hi-g plug-in type heads for standard and microgroove records incorporating the crystal unit as used in the HGP 39 pick-up head. Will fit Collaro units RC 532; AC 534; AC3/534; 3RC 532. Available in cream or walnut.

Ask for Data Sheet No. 4500.

HGP 45



Separate Hi-g pick-up heads for either standard or microgroove records. The crystal unit is identical to that used in the HGP 39-1 head. Will fit Garrard units RC 80; RC 72A; RC 75A; and the Model M player. Can be used on any unit which at present uses the Garrard C adaptor with GP 19 heads.

Ask for Data Sheet No. 4600

ACOS *... always well ahead*

PRICE 32/6 (PLUS 10/5 P.T.)
for all types except HGP 39 models which are
32/- (PLUS 10/3 P.T.)

ACOS devices are protected by patents, patent applications and registered designs in Great Britain and abroad.

COSMOCORD LTD. ENFIELD MIDDLESEX. ● Tel:—Enfield 4022

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PRACTICAL WIRELESS

EVERY MONTH
VOL. XXXI, No. 585, JULY, 1955

EDITOR : F. J. CAMM

23rd YEAR OF ISSUE

COMMENTS OF THE MONTH

BY THE EDITOR

V.H.F. and F.M.

SINCE the opening of the new V.H.F. station at Wrotham, the first of ten to be completed by the end of next year, we have received a large number of letters on the subject. V.H.F. means very high frequency, or, in other words, very short wavelengths, and the new V.H.F. dials will have a band marked with figures of from 88 to 100. These figures represent frequencies, very high frequencies, in millions of cycles per second, and they are used on the dial because it would be cumbersome to use wavelengths. A frequency of 88 megacycles per second, for example, corresponds to a wavelength of 3.4090 metres, and it would be inconvenient to calibrate a dial in such short wavelengths. The ten V.H.F. stations will be Wrotham, Pontop Pike, Divis, Meldrum, and North Hessery Tor, Sutton Coldfield, Norwich, Blean Plwy, Holme Moss and Wenvoe and they are to operate between 88 and 100 megacycles per sec. There are hundreds of thousands of listeners in the United Kingdom who cannot rely upon interference-free reception of the BBC programmes and, they have to tolerate fading and the interference of unwanted foreign programmes. It is for this reason that V.H.F. stations are being erected. As V.H.F. transmissions cannot normally be received over long distances, it does not matter how many V.H.F. stations may spring up on the Continent because they are unlikely to cause serious interference here.

Frequency modulation reduces still further the likelihood of interference from unwanted programmes and also helps to reduce other forms of interference, caused by domestic electrical appliances, so that the programmes can be heard against a background of silence. It is not practicable to use F.M. on the long-wave or medium-wave bands, but it can be used in the V.H.F. band. When V.H.F. comes to your area you will need either a new set or an adaptor to receive it. We shall describe how to make V.H.F. tuner units and the industry itself is now producing sets which will tune to the new V.H.F. bands, as well as to the present medium and long wave. They are also producing adaptors. In certain circumstances a special aerial will be necessary; it will depend upon local conditions. A V.H.F. aerial will be somewhat similar to a television aerial, although smaller, and it is fixed horizontally. For best results the horizontal portion should be at right angles to the direction of the transmitting station. Freedom from interference and noise on a V.H.F. set depends partly on the strength of the signal it gets from the transmitting station, which in turn depends on the receiving aerial. It follows that the better the aerial the less will be the unwanted noises. Owing to the nature of the V.H.F. waves you may find that poor reception may be much improved if you move the aerial only a few feet. This can be done quite readily, as the V.H.F. aerial is very much shorter and easier to handle than the aerial required for medium and long wave reception. If you are satisfied with present reception on your receiver there is no need to change over to V.H.F., but it is important to remember that better quality reception, particularly of music, will be generally available from the V.H.F. transmitters. The normal medium-wave receiver needs to be designed to reject as far as possible interference from foreign stations using wavelengths close to those of BBC stations. In designing a receiver selective enough to do this quality suffers, and many of the overtones of music and speech are thus lost. A V.H.F./F.M. receiver gives reception much nearer to the original.

RADIO AND TV SALES

RADIO and radiogram sales have increased to 133,000 and 132,000 respectively, whilst television has been raised by 6,000 in January to 102,000 and 11,000 in February to 98,000. These figures, of course, relate to the month of March. The latest B.R.E.M.A. retail market survey shows that of receiver sales 41 per cent. were bought on hire purchase terms, as were 62 per cent. of the total sales of radiograms and 59 per cent. of the total sales of television receivers.

Sales remained remarkably stable during the first two months of the year; radiograms and television receiver sales for March fell by 13 per cent. and 23 per cent. compared with February—seasonal falls which could be expected—but radio receiver sales have resisted the normal trend by scarcely declining at all. Compared with the first quarter of 1954, sales of radio receivers and radiograms have risen from 254,500 to 384,000 and television from 168,500 to 286,000.—F. J. C.

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Round the World of WIRELESS

By "QUESTOR"

Broadcast Receiving Licences

THE following statement shows the approximate number of broadcast receiving licences in force at the end of March, 1955. The grand total of sound and television licences was 13,980,496.

Region	Number
London Postal	1,465,488
Home Counties	1,413,123
Midland	1,142,923
North Eastern	1,515,180
North Western	1,165,583
South Western	947,971
Wales and Border Counties ...	591,786
Total England and Wales ...	8,242,054
Scotland	1,015,709
Northern Ireland	218,967
Grand Total	9,476,730

Modifications to Studios

MODIFICATIONS are to be made to the BBC Studios One and Two at 201, Piccadilly, London, and building work is in progress.

Studio One, which is used mainly for dance-band shows, is having its stage enlarged and fixed audience seating installed instead of the loose chairs used previously by invited audiences. Studio Two will be employed more as a drama studio. It is being sound-proofed and this will necessitate the construction of an inner shell within the existing studio.

National V.H.F. Coverage

THE BBC announces that it has placed a contract with Messrs. Gee, Walker and Slater, Ltd., of 100, Park Lane, London, W.1, for the building of an extension to the Wenvoe television transmitting station to house the V.H.F. sound transmitters shortly to be installed there. Messrs. Gee, Walker and Slater, Ltd., built the original Wenvoe station.

Commonwealth Association in Air Radio

THE second meeting of the Commonwealth Association in Air Radio has been held in Sydney, Australia.

This association was inaugurated in 1954 to enable the companies concerned to make an approach in common to the problems encountered in radio.

Loudspeaker Installation

"STANTEL" column loudspeakers, produced by Standard Telephones and Cables, Ltd., have been installed in the Royal Festival Hall and the Egyptian Hall of the Mansion House.

New R.I.C. President

SIR EDWARD APPLETON, G.B.E., K.C.B., F.R.S., has accepted an invitation to become President of the Radio Industry Council in succession to Lord Burghley, who has held office since 1952. Sir Edward was awarded the Nobel Prize for Physics in 1947. He has been Principal and Vice-Chancellor of Edinburgh University since 1949, and for ten years before that appointment was Secretary of the Department of Scientific and Industrial Research.

Gibraltar-Tangier Link

A NEW direct multi-channel V.H.F. radio-telephone service between Gibraltar and Tangier was opened on May 6th. Previously communication could only be offered by a landline and cable route by way of Spain.

Cable and Wireless, Ltd., have installed new V.H.F. equipment to operate the Gibraltar end of the circuit as well as a 110ft. aerial tower.

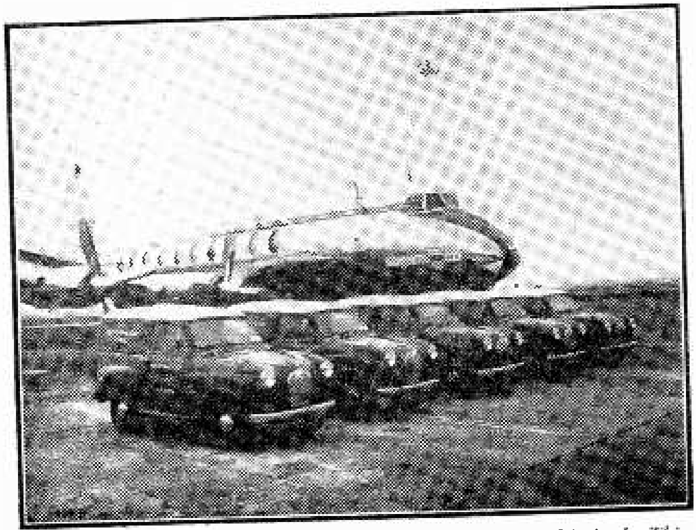
BBC Appointment

DAVID BRYSON, senior talks producer in the Midland Region, has been appointed the BBC's East Anglian representative. He will take up his duties in Norwich next October.

Aircraft Equipment Service

A FLEET of Austin vans has been put into operation by the Decca Navigator Co., Ltd., for servicing aircraft radio equipment.

The vans operate a service exchange system on the navigator units fitted in aircraft of B.E.A. and other operators.



The fleet of vans used by the Decca Navigator Company Limited. This photograph was taken at London Airport; one of the famous Vickers Viscount aircraft is seen in the background. (See "Aircraft Equipment Service.")

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Radio and Radar for Trawler

THE radio installation fitted on board the new steam trawler *Marbella* by members of the technical staff of the Hull depot of the Marconi International Marine Communication Co., Ltd., includes radar, echometer, direction-finders, telegraphic and telephonic communication and sound-reproducing equipment.

Tape Recorders for India

E.M.I. INTERNATIONAL, LTD., have received an order from the Indian Government on behalf of All India Radio, the official broadcasting organisation, for six Type BTR/2A tape recorders.

Record Radio Exports

THE Radio Industry Council has announced that exports of British radio equipment have reached new levels in 1955.

After record-breaking exports last year, valued at nearly £30 million, the provisional value of sales for the first quarter of 1955 is £7,625,000—an increase of more than £650,000.

Musical Anniversary

ALAN PAUL celebrated 21 years of writing music for the BBC on May 14th with a programme of his own compositions.

British Electrical Power Convention

THE Seventh British Electrical Power Convention and Exhibition is to be held at Brighton from June 27th to July 1st.

The president of the convention is Sir Harry Railing, D.Eng., Hon.M.I.E.E., chairman and managing director General Electric Co., Ltd., and the vice-president is Sir John Dalton, A.M.I.E.E., F.C.I.S., chairman W. T. Henley's Telegraph Works Co., Ltd.

Export Licensing Control Consolidation Order

THE Board of Trade announce the making of the Export of Goods Control Consolidation Order, 1955. This new Order incorporates for the convenience of exporters the 1954 Consolidation Order and subsequent amendments.

No change is made in the law but certain simplifications have been introduced in the new Order. In the First Schedule, goods subject to export licensing control to all destinations are marked with the letter A. Goods not so marked are free from export licensing control to the British Commonwealth, the Irish Republic and the United States of America.

The Second Schedule lists the destinations for which all goods are subject to export licensing control.

Philips' London and Home Counties Region

PHILIPS ELECTRICAL, LTD., announce the formation of a London and Home Counties Region which will be concerned with the marketing of all products of the company. It comprises the S.E. section of the country, bounded roughly in the north by the Wash, by the Oxfordshire/Worcestershire border in the N.W. and in the S.W. by Southampton. The area also includes the Isle of Wight and the Channel Islands.

Union Recognition

THE BBC announces that under a recently signed agreement the Corporation has recognised the Electrical Trades Union as a negotiating body in addition to the BBC Staff Association on staff matters in respect of all categories of electricians and their assistants employed by the BBC.

Marconi Installation for Canadian Ferry

THE new 7,000-ton twin-screw passenger, vehicular and train ferry *Princess of Vancouver* has been fitted with radio communication equipment and navigational aids by technicians of the Glasgow depot of The Marconi International Marine Communication Co., Ltd., on behalf of the Canadian Marconi Company. She has been built at the Linthouse yard of Alexander Stephen and Sons, Ltd.

The successful E.M.I. trainees. Left to right: T. M. Lawmon, J. Simms, K. A. Battle and W. Arnold. Extreme right are N. A. Robinson and W. W. Eggins, E.M.I. staff instructors. (*See "E.M.I. Trainees Win Prizes."*)

British Wireless Dinner Club

THE 32nd annual general meeting and dinner of the British Wireless Dinner Club at the United Service Club on Friday, April 29th, was attended by 126 members under the presidency of Major-General Vulliamy, C.B., D.S.O.

Lord Brabazon of Tara, guest of honour, recalled his early acquaintance with wireless in the first world war.

E.M.I. Trainees Win Prizes

OUTSTANDING successes have been scored by E.M.I. trainees in this year's Physical Society Craftsmanship and Draughtsmanship Competition. The official results were:

Class VI, Senior Grade:
1st Prize—John Simms.
2nd Prize—Trevor Murray Lawmon.
Equal 3rd Prize—William James Arnold: Keneth Andrew Battle.

Class VI, Junior Grade:
Honourable Mention—Douglas Edward Turner.

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Making a VALVE VOLTMETER

A SELF-CONTAINED INSTRUMENT WITH SCREENED VALVE PROBE. A DOUBLE DIODE AND A DOUBLE TRIODE ARE USED IN THE COMPLETE INSTRUMENT

By F. W. Austin

BEFORE proceeding it would be well to compare the performance of a valve voltmeter with a *good quality* multi-range testmeter. The difference is obvious: the *mode* of operation. The first depends upon the vg/ia curve (or portion of curve) of a valve which is subjected to voltage fluctuations via the mains. The second is limited (ohms per volt) only by the accuracy of the meter movement itself. Thus it would be idle to make claims of *high accuracy* for the instrument about to be described, although a good quality and useful one will be the result.

It is reasonable enough to assume that readers desiring to construct such apparatus are already in possession of a multi-range meter (having provision for ohms measurement), also that they are capable of interpreting a circuit diagram and have the usual "spares" box.

The circuit diagram is given in Fig. 1, and it will be noted that the meter movement is shown in dotted lines between points marked X(1) and X(2). These actual arrangements are discussed later, where it is proposed to give *practical directions* for utilising *any* meter movement having F.S.D. of between 100 and 500 microamps. This was undertaken in view of the expensive nature of this item and it is left to the individual to decide what he can afford. The range switch has been omitted from the circuit as this is a simple single-pole type in series with the meter movement (the number of contacts depending on the number of ranges required by the individual). Fig. 2 shows this switch together with the author's layout.

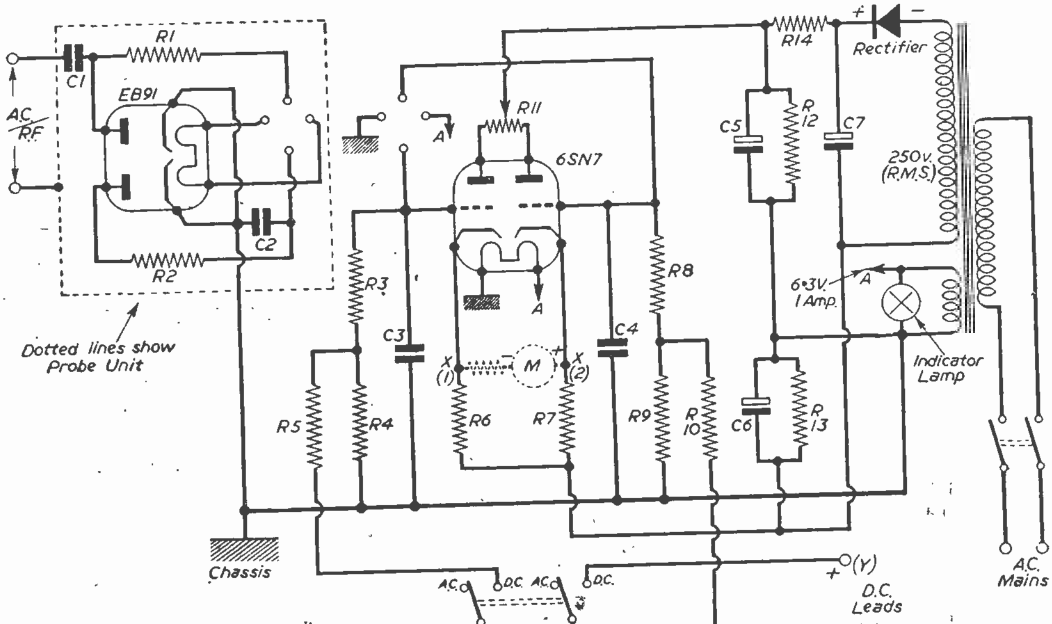

Fig. 1.—Complete circuit diagram. (For range of switching—see text.)

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General Construction

There is nothing critical about the layout and construction of the main section can go ahead, bearing in mind to leave sufficient space to accommodate probe socket, meter movement and range switch. Having built the main section up to the point of meter connection the various ranges are installed by making use of an *external* D.C. source.

The actual ranges of the instrument should be between 2.5 volts and 250 volts, but in many cases (for ease of reading) it would be well to take into account the *divisions* on the movement face. Thus a 250 microamp movement lends itself admirably to ranges of 2.5–25–250 volts, but intermediates of 5 and 50 volts can well be accommodated. An *extra* position of the range switch is useful for leaving the meter " open " before descending via the highest range to safeguard against component failure.

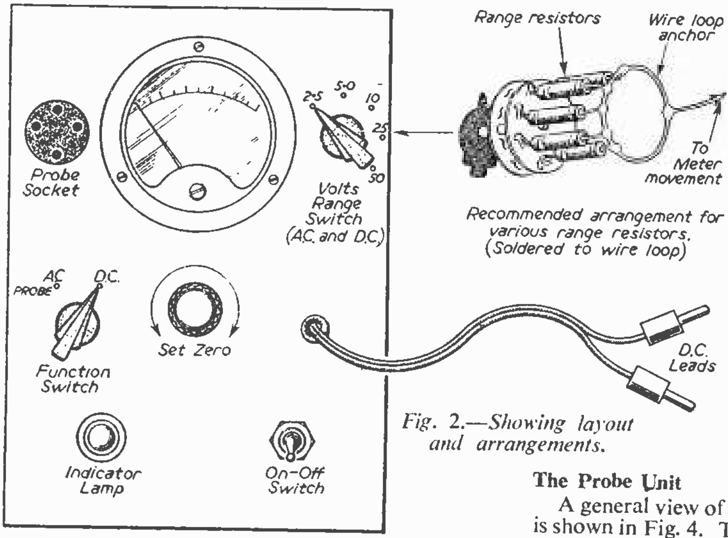


Fig. 2.—Showing layout and arrangements.

" Ranging " the Meter

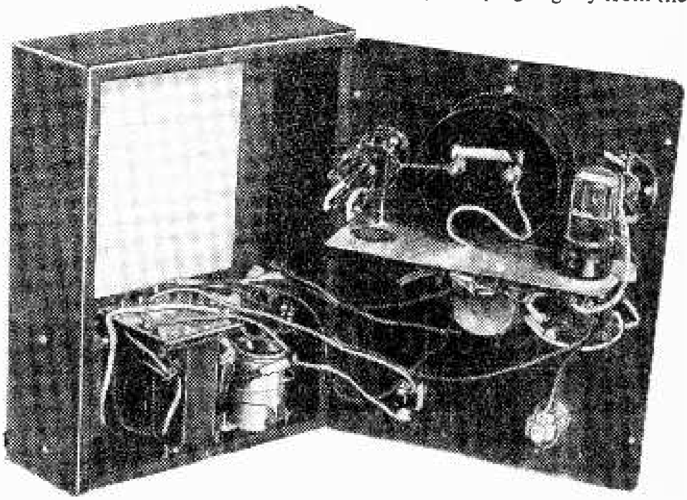
The arrangement of Fig. 3 is such as to "tie up" with the circuit diagram proper. The D.C. valve voltmeter leads have been marked (Y) and (Z) to give correct polarity when 6SN7 valveholder is wired strictly in accordance with valve base diagrams (*not* given).

This arrangement (Fig. 3) will be familiar to all those who have " compared " the calibration of one meter against another and the system is strictly analogous. The position shown in Fig. 2 for the range switch should temporarily be occupied by a 50K potentiometer (from " spares " box) for calculating the resistors necessary for lower ranges of volts. A flying lead with crocodile clip is taken from " arm " of potentiometer to negative terminal of meter movement; the clip facilitates removal for measuring resistance across potentiometer for the various ranges For the 25 volts range (using a 100 microamp movement) a 100K potentiometer will be necessary in this position, but as the author used such a movement correct figures can be given: these are 75K for 25 volts range and *pro rata* for all higher ranges.

Before connecting *external* voltage to voltmeter D.C. leads these should be " shorted " and the temporary potentiometer opened out to its highest resistance. Set the function switch to D.C. and allow voltmeter to warm up. Adjustment of the " zero-set " control should now be made, at the same time gradually decreasing the resistance of the temporary potentiometer. When the zero has settled the temporary potentiometer should be opened up again and external source applied corresponding to lowest required range (indicated on external voltmeter). The temporary potentiometer is reduced until F.S.D. has been attained on the voltmeter movement; the crocodile clip is removed and resistance across potentiometer is measured and noted. The same procedure holds for other ranges up to 25 volts (beyond which directions have already been given).

The Probe Unit

A general view of the probe unit built by the author is shown in Fig. 4. This was made to fit into an empty mustard tin. The bracket and rods were of " Juneero " material (such outfits are sold by most radio dealers) and the rods " take " solder extremely well. When the probe unit is plugged into the main body of the meter, the function switch (set to A.C.) isolates the D.C. leads. The probe leads should be shorted and zero set on lowest range; this should hold good for all other ranges. A useful check on calibration can be made by withdrawing the probe plug slightly from the



A view of the completed instrument. A list of parts is given on page 396.

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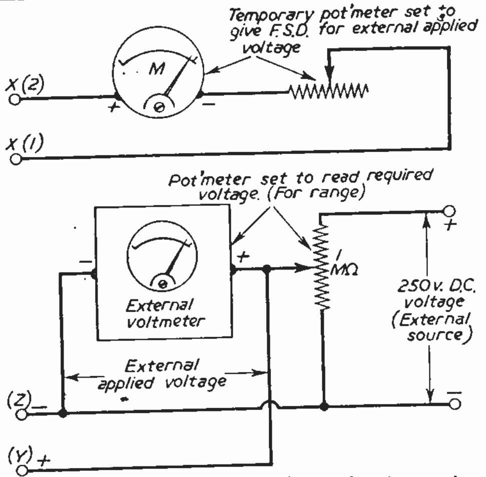


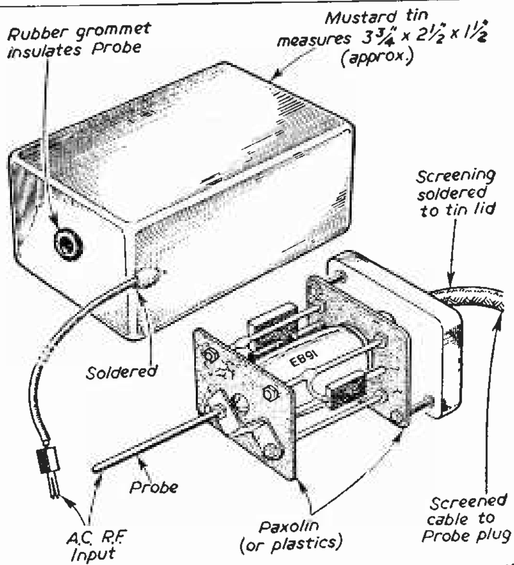


Fig. 3 (above).—Method used for calibrating various meters (100μA—500μA). Fig. 4 (right).—General view of probe (made from a mustard tin).

socket and touching probe on " live " filament pin whilst the meter is set to 10 volts range. The probe should, of course, always be removed for D.C. measurement.

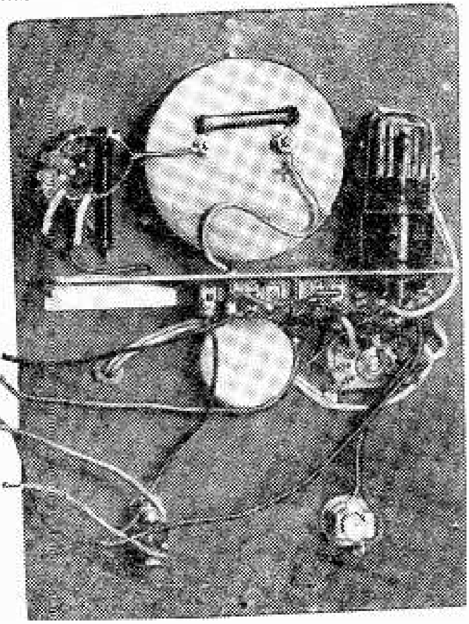
Notes

When testing out the probe unit as mentioned above the meter needle may " kick " in opposition to the scale. It is only necessary to reverse the two 6SN7 grid leads on probe socket to give correct " sense."

The case of the instrument should *not* be " earthed." When using the " temporary " potentiometer for the initial measurement of lower ranges it would be advantageous to leave the meter movement " open " by removing the crocodile clip until the instrument is warmed up. This will guard against the initial " kick " when one section of the 6SN7 heats up in advance of the other. (Many " sticky " movements are caused by the needle being driven " hard-over.")

Where it is found that A.C. readings are slightly on the " high " side a compromise can be made by shunting the meter movement with a suitable resistor. (D.C. will alter in similar degree.)

Advanced workers can achieve greater accuracy by calibrating against A.C. input (with probe) and experimenting with various values for R5 and R10 for D.C. input. Those given ensure a reasonably accurate D.C. valve voltmeter using the methods outlined.



A rear view of the panel.

COMPONENT LIST

MAIN CHASSIS

1 valve 6SN7 — 1 valveholder (octal)
1 selenium rectifier (250 v. 60 mA)
1 function switch (2-pole 2-way)
1 range switch 1 pole/multiple (to suit individual)
1 mains transformer : secondary—6.3 v. (1.0 amp.) —250 v. (RMS) 30 mA

RESISTORS

6 meg/¼ watt (R5, R10) — 5 meg/¼ watt (R3, R4, R8, R9)
47K/½ watt (R6, R7) — 33K/1 watt (R12, R13)
5K/½ watt (R14)
5K potentiometer (w/w) (R11)

CONDENSERS

.01 μF (350 v. w.) (C3, C4)
8 μF electrolytic (350 v. w.) (C5, C6, C7)

SUNDRIES

Indicator lamp 6.3 v. (.04 amps.) and holder
4-pin probe plug and socket, chassis, case, etc.

PROBE UNIT

1 valve EB91 (Mullard) — 1 valveholder (B7G)
Quantity of threaded brass rod 6BA (or " Juneero")
Resistors : 15 meg/¼ watt (R1, R2)
Condensers : .01 μF (350 v. w. small mica) (C1, C2)
Empty tin : screened lead, paxolin, etc.

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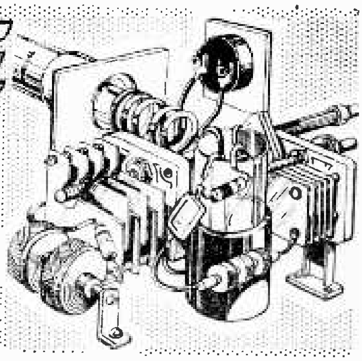
SHORT-WAVE SECTION



SHORT-WAVE NOTES—THE ROCKY POINT AND NEW BRUNSWICK TRANSMITTING STATIONS OF R.C.A. COMMUNICATIONS INC., NEW YORK

By A. W. Mann

ROCKY POINT is one of the radio telephone stations owned and operated by the Radio Corporation of America. This R.C.A. station played an important part in the early and subsequent development of the transatlantic telephone service.

Even in the early days of the service Rocky Point with its forest of aerials and associated buildings covered an extensive area. In addition a considerable amount of space being available to meet the demands of future expansion.

Rocky Point To-day

The land area available is 5,234 acres, of which 3,000 acres are in use.

Aerial Systems

On one site there are 60 aerials of various types available. They include 24 Rhombic, 52 directive and seven doublet aerials, together with 28 miscellaneous types and one long-wave aerial. The long-wave aerial is supported on two towers 410 ft. high, and spaced 1,250 ft. apart. These are used in conjunction with 34 short-wave transmitters in one section rating from 1 Kw to 75 Kw, three on phone and the rest on telegraphy. The long-wave transmitter which is A.T. and T.C. property is a 'phone transmitter.

Control

Station control is carried out from the master control room which houses the general control system and equipment, together with monitoring, automatic call signing and intercommunication equipment. This work is carried out on a four-watch system with two control technicians and two transmitter technicians.

Rocky point is the R.C.A. main transmitting station and is located on Long Island and is approximately 80 miles from the central radio office in Downtown Manhattan.

The land line or wire room is the terminal point of 11 lines from New York City, 8 lines from Riverhead and 67 audio control channels from New York City.

The foregoing data applies to the equipment associated with building No. 1. Before passing to building No. 2 a few details concerning the equipment in use at the terminal office, which was illustrated last month, and which is located at 66, Broad Street, New York City, may be of interest.

One piece of apparatus used is known as a package set. This apparatus keys the transmitters automatically by means of perforated tapes which pass through the transmitter distributors. The top section receives incoming messages while being monitored and recorded in a centre section.

There is also installed electro-mechanical equipment which permits several radio channels to be imposed on one frequency. This is known as multi-plex equipment. The main speaking room and other departments are also located at 66, Broad Street, N.Y., together with the programme and radiophoto control room.

Solar Observations

R.C.A. Communications Inc. have made extensive investigations relative to solar activity and magnetic storms which at certain periods disrupts radio communications. John H. Nelson, an R.C.A. radio engineer and astronomer, took solar readings daily over a period of five years, and in doing so discovered new evidence concerning the cause of magnetic storms which interfere with world-wide communications. This evidence has proved extremely valuable to R.C.A., and Mr. Nelson, by plotting the position of the planets and the sun, can predict many months in advance when and where magnetic storms will occur. Thus R.C.A. Communications Inc. are able to use these forecasts to select suitable radio channels with the assurance that they will be least affected by magnetic storms.

Building No. 2

Reverting to the Rocky Point transmitting station we pass to building No. 2. Here there are 20 short-wave transmitters. These range from 1.4 Kw to 75 Kw telegraphy types, while the 'phone transmitters are from 3 Kw to 15 Kw.

The programme service equipment located in this section consists of a five-channel audio control board, monitoring equipment limiting amplifiers and portable modulators, with two programme lines to New York. Two technicians are on duty per watch.

The total number of aerial systems associated with this section is 54. There are 38 directives, including 12 Rhombic, 26 miscellaneous types and 16 doublets.

Power Supplies

The public utility 23,000 volts 3 phase 60 cycles supply is fed to Rocky Point by two independent feeders at a distance of 10 miles from the generating station.

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This voltage is stepped down to 2,200 volts and is then regulated, after which it is further reduced to 230 volts 3 phase for distribution to the short-wave transmitters. The operating staff at the Rocky Point transmitting station total 80.

New Brunswick, New Jersey, Transmitters

R.C.A. also own and operate a telegraphy transmitting and receiving station at New Brunswick, New Jersey. This is located on an 858-acre site, of which 160 acres are in use.

The buildings are the power house and the main operating building in which are housed eight short-wave telegraphy transmitters. These are as follows:

Three 20/40 Kw two frequency sets, type F2F.
One 20/40 Kw type ED two frequency sets.
Two 15 Kw type X single frequency sets.
One 1 Kw type F two frequency sets.
One 1 Kw type X single frequency set.

Aerial Systems

Two V beams, three type R Rhombics, three harmonic wire, two extended dipole curtains and one doublet aerial.

Control

The master control room contains the communicating equipment and monitoring apparatus. Amongst this apparatus is tone signal converters, communicating and intercommunicating, and other apparatus including monitors, three short-wave receivers covering 550 kc/s to 30 Mc/s, one FSK monitor unit 2.4 to 26 Mc/s, one frequency expander 28 to 60 Mc/s, one printer monitor and one 80 to 170 Mc/s frequency measuring set.

Power Supply

Two public service 26 KVA 3 phase 60 cycle feeders which are automatically switched are utilised. Power is transformed to 2,200 volts, regulated and stepped down to 110 to 220 volts single and three phrase for transmitter power and station lighting.

Staff

One engineer in charge, five technicians, one per shift. In addition there is a small outside staff of three riggers, one groundsman, one outside maintenance man, one shop mechanic and a station caretaker.

Land Lines

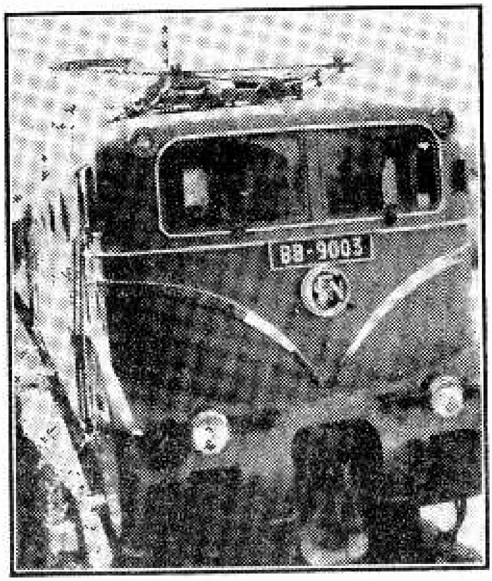
These are leased from the A. T. and T. Co., and are: One 5,000 cycle signal control line and one 2,300 cycle communication line.

RADIO-CONTROLLED TRAIN

SOME INTERESTING NOTES ON THE WORLD'S FIRST TRAIN TO BE OPERATED BY RADIO, WITHOUT A DRIVER

ON Monday, April 18th, 1955, a train composed of four carriages hauled by the French Railways BB 9003 electric locomotive and without driver or passengers reached a speed of 74.5 m.p.h. between Connerré-Beillé and La Ferté Bernard on the main line between Paris and Le Mans.

This locomotive is a sister engine of the BB 9004 which three weeks previously reached a new world record rail speed of 205.6 m.p.h. Running alongside on a parallel track was a diesel railcar carrying Monsieur Corniglion-Molinier, French Minister of Public Works and Transport, Monsieur Louis Armand, the Chairman of the French National Railway Company, and Monsieur Charles Boyaux, the General Manager of the French Railways, accompanied by forty technicians and representatives of the Press.



View of the train taken from the accompanying diesel railcar during the trial run on April 18th.

Orders to release the brakes, to control the supply of current to the traction motors of the locomotive, and to apply the brakes at the end of the run, were given verbally by radio telephone from the accompanying railcar to a radio control post set up on the sub-station at Sceaux-Boëssé about half-way between the starting and finishing points of the run. The radio-wave transmissions to carry out these orders were made from the control post to a receiving set which actuated a relay on the locomotive which in turn set the necessary mechanisms in motion.

At the end of the war, appreciating the growing value and importance of radio communications, the French Railways applied for and obtained from the French General Post Office an allocation of wavelengths for railway operation. These wavelengths were around 1 metre and eminently suitable from a technical point of view.

In 1945, the French Railways commenced equipping their big marshalling yards with a radio-telephone installation which within a radius of from 1¼ to 1¾ miles, in practice more than sufficient, enabled communications to be maintained between the hump

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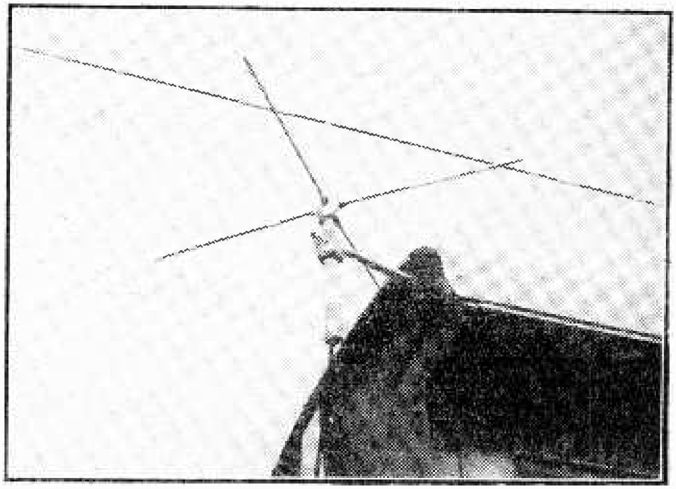
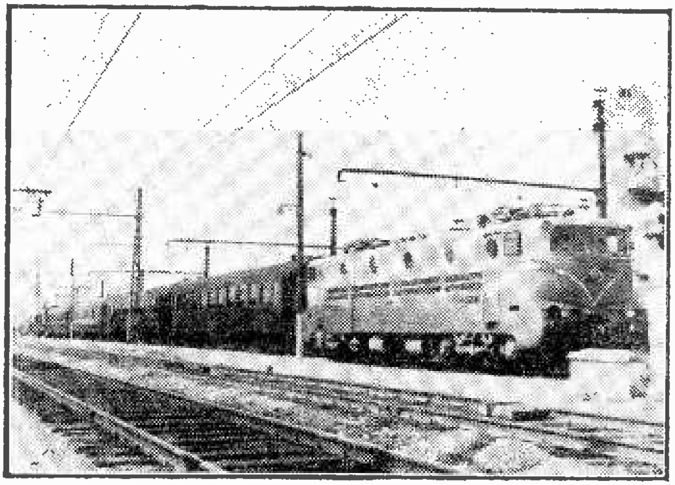
control tower and the shunting engines. The amount of work accomplished by these engines was thereby considerably increased and all the big marshalling yards are now equipped with similar apparatus at modulated frequency of French manufacture and bearing comparison with the best installations of the kind in use in other countries.

A new installation, unique of its kind throughout the world, has been tried out in a marshalling yard and is now being tested at Miramas, near Marseilles. It is a very light transmitting and receiving set carried on the back of the checker taking the numbers of goods waggons. Instead of inscribing them in the open on a sheet of paper, not always an easy task in bad weather or a high wind, he dictates them to the control tower, where they are either taken down on paper by a clerk or, more usually, on a magnetised wire recording machine. Having thus resolved the problem of short range communications, attention was then turned towards that of communications along the whole length of a railway line from the railway carriage to any telephone subscriber n France or abroad. French Railways have now perfected a system that makes possible a continuous telephone communication. It does so at a very low cost and reception is excellent even on an electrified line where screening effects and parasitic currents abound. Trials of this system have recently been carried out between Hirson and Charleville on the section of line electrified with monophase current at industrial frequency.



The receiving aerial on the train.



The world's first radio-controlled train hauled by the electric locomotive BB 9003.

The present trials of the radio control of a train without human intervention on the train itself represent a further step forward beyond what has already been achieved.

Two Types of Remote Control

As starting and acceleration up to maximum speed of the BB 9003, in common with some other types of French Railways electric locomotives, is automatic, only two types of remote control were necessary, one to operate the brakes and the other to regulate the supply of current to the traction motors. Two kinds of current were necessary for the transmission of orders to the robot train. One of the orders was given by the carrier frequency without modulation and the other by the carrier frequency with modulation at approximately 1,000 periods per second. The wavelength used was 1.9 metres. The relay on the locomotive which carried out the movement ordered and which received the order through an aerial of very limited length and a receiver very light in weight, can easily be placed in the waistcoat pocket.

For these trials which were prepared in a few days only, existing equipment had to be used, that is to say radio telephony adapted for radio control. This equipment gave excellent results during the preliminary trials. With special equipment designed for the purpose complete reliability is certain. The French General Post Office, which made the necessary frequencies available for these trials, gave every other assistance in its power to ensure their success. The French electrical manufacturers who have collaborated with the railways for the provision of radio communications are the Société Française Radio Electrique for the Hirson-Charleville line, and the Société N.O.R. for the Bordeaux-Dax speed trials and the present radio-control trials.

These trials were supervised by Moniseur Fernand Nouvion, an engineer of the Electric Traction Research Department of the French Railways.

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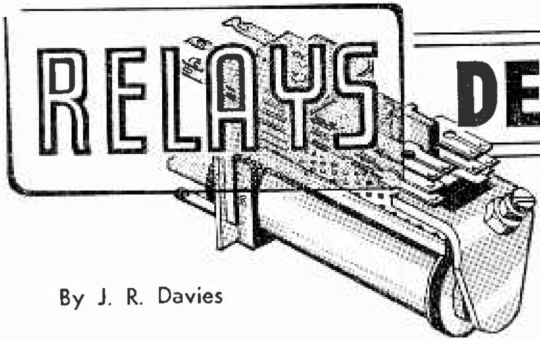

RELAYS DESIGN & USES

THE FIFTH ARTICLE IN A SERIES DEALING WITH A MOST USEFUL TYPE OF RADIO ACCESSORY

(Concluded from page 341, June issue)

By J. R. Davies

LAST month we described the design and use of the uniselector. We showed also that, due to the bulk and relatively heavy current consumption of the standard manufactured model, it cannot be used for the control by radio of small models. We discussed also the construction at home of a smaller and less complicated type of uniselector which would have a lower weight and current consumption.

Even this small uniselector had one or two disadvantages, however, and so in this month's article (the last in this series) we shall discuss several entirely different methods of remote control. Although we shall regard the subject primarily from the point of view of model control by radio we shall indicate also how the arrangements described may be used for the control of static equipment over interconnecting lines as well.

Carrier Control

The simplest type of remote control by radio would employ a receiver and a relay, the relay operating only on the presence or absence of a transmitted carrier. Thus when the transmitter was switched on the receiver would either energise or de-energise the relay. When the transmitter was switched off the relay would return to its original state.

A control of this sort would offer very little scope ; although it could, nevertheless, be used to give a fairly reliable control of a function such as steering. If, for instance, the controlled model were fitted with a rudder which was spring-loaded to turn to the left, the presence of a transmitter carrier could be used to operate a solenoid which would pull it over to the right. When it was desired to bring the rudder to the centre a series of " fifty-fifty " pulses could be sent, these supplying an average voltage to the rudder solenoid equal to half the full voltage. (The term " fifty-fifty " means that the length in time of each transmitted pulse would be equal to the period between pulses.) Should the rudder system have sufficient inertia (and the pulses be sent quickly enough) the rudder should answer to this average solenoid voltage and move to a mid-way position.

Apart from the use of a uniselector or something like the steering scheme just mentioned the single receiver relay operating from the carrier does not offer a great variety of control. When the transmitter is modulated, however, it is possible to increase the number of controllable circuits considerably.

Control by A.F. Tones

Control by audio tones of different frequencies is both practicable and relatively easy to incorporate into amateur-built equipment. The transmitter can be modulated by one or more tones, these being selected and separated in the receiver by A.F. filters. After selection each tone can be made to operate a relay (this being done usually by causing the anode current of a valve to alter), and thus actuate different mechanisms in the controlled equipment. By using combinations of tones it is possible to obtain a considerable number of different effects, as will be shown later.

Whilst these A.F. tones may be used to operate different circuits it is still at the same time possible to employ the carrier for control purposes as well. It can, for instance, be used to switch on the main driving motors of the controlled model. These will then run all the time the model is performing, and will stop only when the transmitter is switched off.

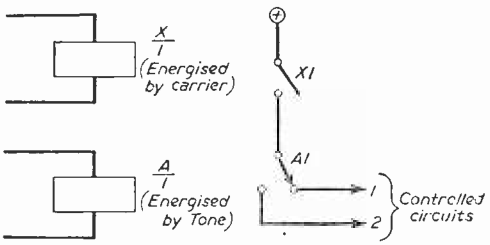

Fig. 25.—A simple receiver relay circuit operated by a carrier and single A.F. tone. The carrier by itself operates circuit 1, the carrier plus the tone operates circuit 2.

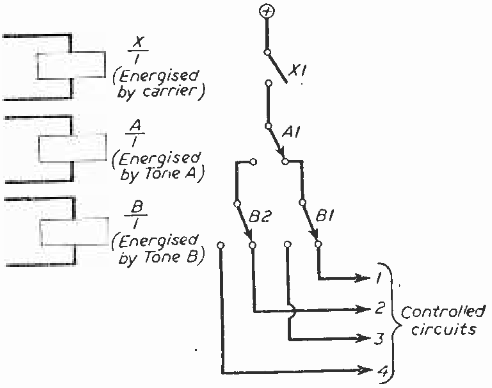

Fig. 26.—Illustrating how a carrier and two tones may be used to control four circuits.

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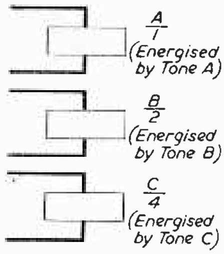
The additional filter circuits and valves needed at the receiver to select the A.F. tones will be too bulky for such things as model aircraft; but there seems little reason why, with careful design, they could not be used in model boats or land craft. The control of remote stationary objects by tones (which could be transmitted either over a single pair of lines or by the radio link) is quite feasible.



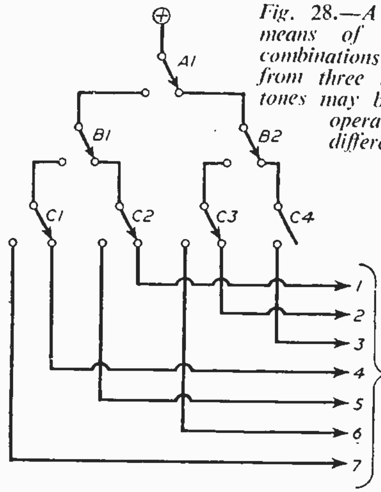


Fig. 28.—A circuit by means of which the combinations obtainable from three separate tones may be used to operate seven different circuits.

The most elementary form of control by A.F. tones would employ a single tone only. A suggested receiver relay circuit is shown in Fig. 25. This employs two relays, one operated by the carrier, the other by the tone. It is assumed that the relays shown in the diagram are energised on reception of the carrier or the tone. (If, due to the particular receiver circuit employed, it should happen that they de-energise, their contacts would, of course, have to be altered accordingly.)

Fig. 25 offers two alternative controls: these being given by the reception of the carrier by itself, and by the carrier with the tone. The diagram shows how these two alternatives are used to switch either one of two circuits in the model itself.

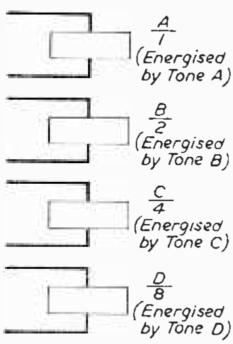
When two tones are used it is possible to obtain four controls. It will help here if we refer to the two tones as tone A and tone B. The combinations possible consist then of the following: carrier by itself, carrier plus tone A, carrier plus tone B, and carrier plus tone A plus tone B.

Fig. 26 shows how these various combinations may be "sorted out" by the receiver relay contacts. (It is again assumed that the reception of a carrier or tone causes the appropriate relay to energise.) The purpose of the relay contacts in the diagram is to pass the positive source of supply to whichever external controlled circuit has been selected. The numbered outlets (1 to 4) to these circuits correspond respectively to the combinations just mentioned.

As stated previously, the carrier need not be employed in the tone combinations, but can be used by itself in order to switch on the main motors of the model. If this procedure were adopted in this case our two tones would now give us three combinations only; these being tone A, tone B and tone A plus tone B. A circuit showing how these combinations could be selected by the receiver relay contacts is given in Fig. 27.

Three Tones

Let us now go a stage farther and see what can be obtained by using three tones: A, B and C. These tones would



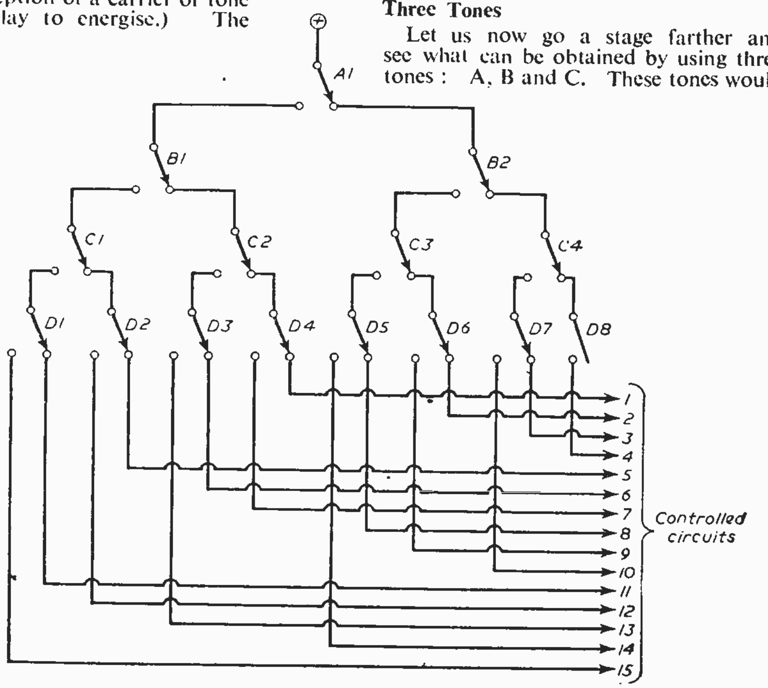


Fig. 29.—Showing how the combinations offered by four tones are capable of operating 15 different circuits.

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offer us seven combinations: A, B, C, A plus B, A plus C, B plus C, and A plus B plus C. This time it would not be worth while employing the carrier in combination with the tones as it would give only one extra combination (carrier by itself) and would necessitate an additional contact unit on each relay. There is nothing, however, to prevent the carrier from being used to operate the main driving motors, etc., in the manner mentioned previously.

A relay control circuit capable of selecting out the seven combinations from the three different tones is shown in Fig. 28. Once more the control output terminals (1 to 7) correspond to the tone combinations mentioned in the preceding paragraph. The reader will probably find it of interest to trace out the way in which the various contact units "sort out" each particular combination.

It will be seen in this diagram that relay $\frac{C}{4}$ has one make and three changeover contact units. Four contact units on one relay may present rather a heavy load if the relay is operated from a switching valve; particularly if low-voltage receiver batteries are used in the model. In such a case it may be necessary to use a light relay in the anode circuit of the valve, this operating another relay (bearing the four contact units) energised from the main driving battery.

Fig. 29 illustrates a circuit capable of selecting 15 different operations with the use of only four tones. The tone combinations are: A, B, C, D, A plus B, A plus C, A plus D, B plus C, B plus D, C plus D, A plus B plus C, A plus B plus D, A plus C plus D, B plus C plus D, and A plus B plus C plus D. It will be noticed that, once again, the carrier does not appear in the combinations. The extra control afforded by it is not worth the added relay contacts required.

It will also be observed that relay $\frac{D}{8}$ has eight contact units, one make and seven changeover. Although it is possible to obtain a single relay fitted with eight contact units, it would very probably be better to use two separate ones with four contact

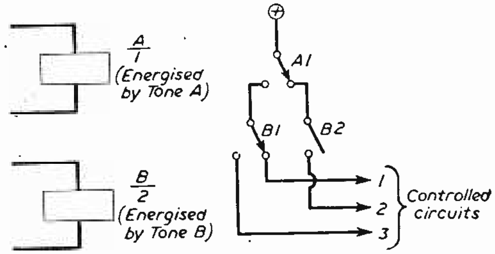

Fig. 27.—Two tones (without making use of the carrier) are capable of controlling three circuits, as shown here.

units each. If the receiver battery supplies are sufficient to allow the switching valves to operate four-contact-unit relays these two relays could then be operated by having their coils connected in series. Alternatively, it would be necessary to use light-action relays for both C and D switching valves, these relays operating the $\frac{C}{4}$ and $\frac{D}{8}$ relays proper from the main driving batteries.

Line Operation

It should be pointed out, before concluding, that the circuits of Figs. 27 to 29 are all capable of being operated by D.C. over interconnecting lines instead of by using the radio link.

Thus, Fig. 27 allows three operations to be obtained with the three lines (two and a common line). Fig. 28 allows seven controls to be obtained with four lines, and Fig. 29 allows fifteen controls to be obtained over five lines. In each case the common line could be eliminated, if desired, by using a reliable earth return instead.

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TWO new pre-selectors, the PV98 and PV98A, are announced by Plessey. They are designed for use in conjunction with a single channel fixed frequency H.F. receiver, such as the Plessey PR53A, PR53C or PR51C, to provide switched selection of any one of five pre-set crystal-controlled channels in the frequency range 2.7 to 27 Mc/s.

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Both pre-selectors comprise an R.F. stage, a crystal-controlled H.F. oscillator and a mixer, giving a low impedance co-axial output at a fixed frequency of 2.1 Mc/s. The R.F. stage is tuned by pre-set circuits and the oscillator stage crystal controlled, the appropriate circuits being selected by a single five-position rotary switch manually operated from the front panel. Alternatively, the selector switch may be motor-driven from the rear, thus permitting remote control.

Additional facilities are available on the PV98 for operation from external oscillators. The tuned circuits are mounted as plug-in units, six ranges being provided to cover the frequency band.

Two pre-selectors and two receivers may be connected to form a dual-diversity combination, the receiver outputs feeding a conventional path selector or diversity switch unit. Under these conditions, the channel frequency crystals need only be fitted in one of the pre-selectors, as the two may be operated with H.F. oscillator circuits cross-coupled, and similarly for diversity telegraphy, two B.F.O. outputs are provided for the operation of both receivers driven by a single crystal fitted in one only of the pre-selectors.

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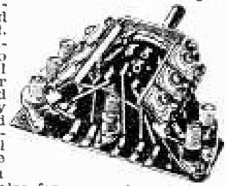

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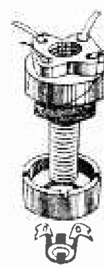

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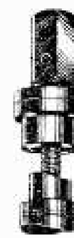

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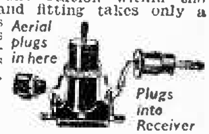

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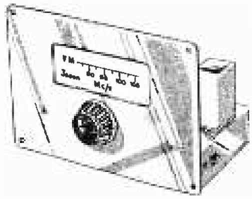

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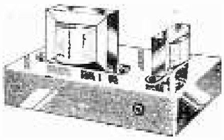

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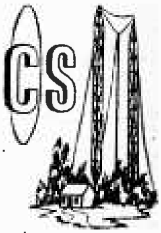

END AND TOP LOADED AERIALS FOR TOPBAND

By O. J. Russell, B.Sc.(Hons.), G3BHJ

PREVIOUSLY the base-loaded aerials have been considered, particularly from the point of view of the amateur faced with a restricted location for aerial erection. It may be tacitly understood that by implication the amateur with room for 100ft. or so of wire has no difficulties. However, the length of the wire is nothing like so important as its *height*.

To show the importance of height rather than length, consider a 100ft. length of wire. That is overall, from the far end right back to the base-loading coil at the TX. With this length of wire, consider three typical set-ups. The first amateur, relying on the value of length, erects his aerial only 20ft. high. Thus he has in effect an 80ft. top length and a 20ft. lead in vertical proportion. The second amateur decides on a little extra height, a mere extra 10ft., so he has a 70ft. top length and a 30ft. lead in. The third amateur (with the shortest garden) has only 50ft. of length, but due to two conveniently placed tall trees can raise the wire to 50ft. high, so his aerial is a 50ft. top with a 50ft. vertical lead in. These aerials are illustrated in Fig. 1.

Unfortunately for the amateur with the longest run of wire, the radiation resistance of his aerial is only about 2 ohms. Thus, with an earth resistance of 10 ohms, only 2/12 of his power is radiated, some 17 per cent. With possible loading-coil resistance added, only about 15 per cent. of power will be radiated on topband. The second amateur, with an additional 10ft. of height, has a radiation resistance of 6.5 ohms, so that he will radiate about 40 per cent. of his power, more than twice the efficiency of the first amateur's aerial. The third amateur with the tall trees, however, is luckier still, as his aerial has a radiation resistance of just over 12 ohms, so he radiates more than 55 per cent. of his available R.F. power. It is clear, however, that even the 10ft. increase in height of the second amateur has resulted in a worthwhile increase in radiation efficiency.

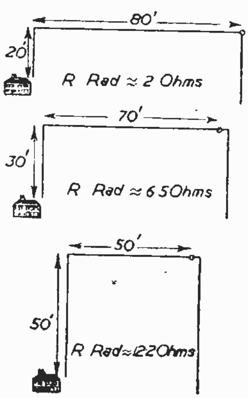

Fig. 1.—Three 100ft. aerials of very different topband efficiency.

Earth Resistance

The above figures would be more dramatic still if the earth resistance were higher, say, 20 ohms. As a single earth may have a resistance of around 30 ohms it is clear that even the possessor of a long wire on topband cannot be sure of effective and efficient radiation. The necessity in a Marconi system of a low resistance earth by paralleling multiple earth connections spaced widely apart is, therefore, emphasised. Where the soil is sandy or of high resistance, a counterpoise is often a much more efficient solution. In its simplest form, a counterpoise consists of a wire insulated from earth, but strung a few feet above earth, and running underneath the "top." This is shown in Fig. 2. For vertical aerials a radial array of wires radiating from the base of the aerial may be used. In some cases the ends of the counterpoise wires may be terminated in earth rods. Virtually this system is, of course, supplied by the suggested arrangement of multiple widely spaced earth points previously recommended.

The use of end-loading methods may now be considered in more detail than in previous descriptions. The end or centre loaded aerial is shown in Fig. 3. We can consider the purpose of the centre-loading coil is to tune the top part of the wire to resonance. Considering the curve of Fig. 4, which shows the approximate inductance required to tune the quoted length of wire to resonance, a coil may be designed to top or end load the aerial. In the case of short wires where the coil becomes a "centre" loading coil, the coil is, in fact, twice the inductance needed for base loading, as it is tuning the top half of the aerial, i.e., half the length of wire, which has half the capacity of the full length. However, this would appear to offer little advantage over base loading, as more wire (and hence more loss resistance) is needed in the coil. The "centre" loading, however, doubles the radiation resistance of the aerial. Thus, when earth losses are considered, a net gain occurs even if the coil resistance were doubled. In fact, however, the coil resistance need not double for doubled inductance, so that a further gain occurs.

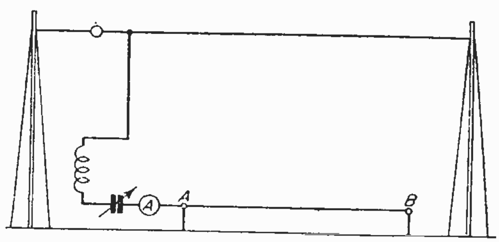

Fig. 2.—A counterpoise, AB, replaces the earth return. In some cases the end B may be earthed. Extra counterpoises may be added in a fan centred on A.

The curve of Fig. 5 shows the efficiency obtained with short, centre-loaded vertical aerials, with an assumed ground resistance of 10 ohms, and with centre-loading coils of various Q values. In practice these figures show an improvement over the values obtainable with base-loaded vertical aerials that is worthwhile, especially for the very short aerials. It should by now be crystal clear that mobile or similar topband operation with short whip aerials results in a very serious loss of radiation efficiency even with centre loading. In fact it is clear that, with the present 10-watt power limit, only fractional efficiencies can be expected with short aerials.

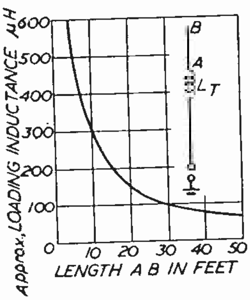

Fig. 3 (inset).—Centre-loaded aerial. Length AB and L_T should resonate to operating frequency. Fig. 4.—Centre-loading inductance values.

Mobile Operation

As mobile operation is now permitted, and particularly as RAEN exercises with mobile gear are now an important new amateur activity, it is clear that the topband does *not* provide a very suitable band for portable handset and car mobile operation, due to the low aerial efficiencies that are inevitable. Thus RAEN organisers must carefully consider the merits of other bands . . . such as 10 metres or even 2 metres, where small radiators are very much more efficient, and in fact virtually all power can be radiated. However, as local propagation conditions offer special problems on the higher frequencies, the choice of band for RAEN operation is not an easy one. In point of fact from some points of view the topband is ideal, particularly the freedom from QRM, so that attention to increasing radiation efficiency when using short aerials is very necessary. While a change to 80 metres would quadruple the efficiency of a very short-loaded aerial, the QRM problem makes 80 metre operation virtually useless for RAEN purposes. Further measures to increase radiation efficiency are therefore needed for topband aerials when only a short whip aerial is possible.

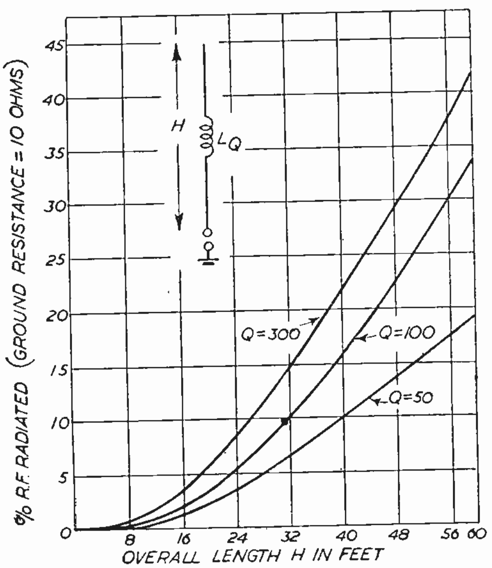

Fig. 5.—Topband efficiency of centre-loaded wires.

One method is the use of capacity loading to reduce the size of loading coil needed to resonate the aerial system. The extra capacity loading means a reduction in coil size, so that there is less actual loss resistance introduced for the same Q value. As, moreover, a coil of smaller inductance can be wound with larger wire, a gain in Q is possible, so that a further gain in efficiency results. It must be stressed, of course, that it is the preponderance of earth and coil losses that reduces the overall radiation efficiency of the whip aerial. The radiator itself radiates 100 per cent. of the power that reaches it, but unfortunately only a fraction reaches the aerial, as most of the R.F. power is dissipated in ground and loading-coil losses. Were it possible to reduce ground and coil losses to zero, the shortest aerial would radiate with 100 per cent. efficiency ! For topband operation with short aerials, the size of loading coil required is so large

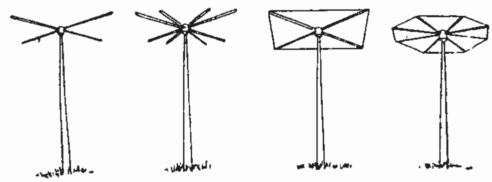

Fig. 6.—Various forms of top-loading skeleton capacities.

that the loss resistance of the coil completely swamps the radiation resistance of the short aerial. However, it should be noted that even a 50ft. vertical aerial is, technically speaking, "short" on topband, so much so that it is difficult to radiate much more than half the power supplied from the TX. This, however, is a vast improvement on the few per cent. of available R.F. radiated by shorter wires.

Top capacity loading offers yet another means of increasing the radiation efficiency of very short whip aerials. Spheres, cylinders and discs may be used to provide the capacity loading. However, the only really feasible system is a skeleton disc arrangement of wires fanned out radially, as shown in Fig. 6. In Fig. 7 the capacities, represented by circular discs of various sizes, are given. Even a disc of 1ft. diameter gives a worthwhile improvement. Also for mobile use with a car, a collapsible fan of wires forming a skeleton disc could be used, or jointed rods closing up to half diameter when not in use, or telescoped tubes offer other means of providing a top-loading capacity that is practicable for mobile or portable topband working. It is also entirely practicable to use top capacity loading at fixed stations, using larger aerials. One method of doing this, if four support poles or trees are available, is to suspend the vertical wire from the crosspoint of wires slung from pole to pole. The perimeter of the fanned wires may be connected by wires also. Where such a large fan is not practical, a number of parallel wires may

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be strung between spreaders to give an effective top-loading capacity.

While this arrangement (Fig. 9) may seem reminiscent of the early days of radio, it is necessary to point out that these means were adopted for the very specific aim of providing efficient operation, so that even a crystal set could perform feats of DX reception.

Capacity Loading

In the case of mobile operation, a skeleton capacity disc of a foot or so diameter is a worthwhile addition to a short whip. While the capacity loading disc should be as high up the whip as possible, preferably at the top, for mobile use it may be impracticable to mount it at the end of the whip for mechanical reasons. However, as centre loading is used, the disc may be mounted just above the loading coil, and thus provide a rigid structure.

In the case of the centre-loaded short aerial the loading coil should resonate the top of the aerial to resonance. Thus from the curve of wire length capacities, the capacity of the top whip is determined. The curve of Fig. 8 gives the inductance required to resonate various capacities to the topband. When a top-loading disc is used the capacity of the disc is determined from the curve of Fig. 6, and added to the capacity value of the top whip length above the loading coil. The loading-coil inductance to resonate this total capacity is obtained from Fig. 8.

Generally the inductance values are approximate, and will need adjustment. Also, as the system is a high Q resonant system, retuning is necessary when only a small shift in frequency is made. One way of loading and tuning is to use a variable inductance of the "roller coaster" type for the centre-loading inductance. A further method is to adjust the length or the spacing of the rods forming the capacity fan to obtain resonance. Where it is desired to have frequency control at the base, as for example, when operating on the move, one method is to use a smaller centre-loading coil than needed for resonance, and using the usual base tuning circuit. The presence of the centre-loading coil in this latter case makes the size of loading coil at the base very much smaller than with a plain whip aerial.

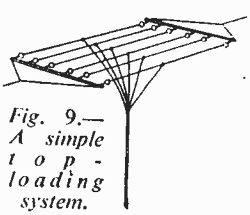

Fig. 9.—A simple top-loading system.

However the final loading and tuning are effected, some local tests with and without loading will give useful guides to aerial performance, and to the correctness of adjustments. In general, a base-loading coil may be used, as a tuned circuit link coupled to the coaxial line output of a transmitter. In other cases a matching inductance may be used, consisting of a small coil across which the coaxial line output of the TX is tapped. It is even possible to feed the base of the aerial directly with coaxial, matching and tuning being controlled at the TX output coupling end. However, many will find the convenience of some form of base-loading circuit employing a tuning condenser and coil the best solution. This does enable tuning adjustments to be made in comfort at the base of the aerial, whereas it is not always convenient to make tuning adjustments at the centre-loading position. In any case spectacular increases in aerial current must be regarded with suspicion, as this may often be due to a spurious local capacity to ground accidentally introduced near the base-loading circuit. This will not greatly affect efficiency, but may cause a large current to circulate in the aerial ammeter. Thus the efficiency changes are best monitored by means of signal reports from reasonably local amateurs. In many cases the same aerial may be used on 80 metres as well by adjusting the size of centre-loading coil. The top-capacity loading used need not be changed, of course. Generally, the top-loading coil should be one-quarter of the topband inductance for 80 metre operation. However, if only a small amount of centre loading has been introduced, thus leaving a sizeable base-loading coil, it may then be possible to load up on topband and eighty merely by adjustments of the base-loading inductance. Radiation efficiency on 80 metres will in any case be noticeably higher for short aerials than upon topband.

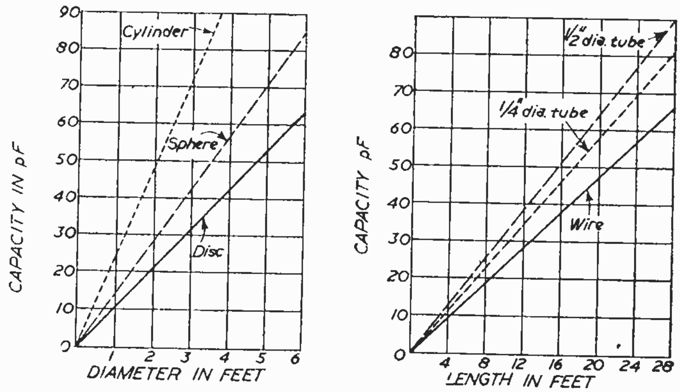

Fig. 7 (a) (left).—Capacities of spheres, discs and cylinders. (Cylinder has its length equal to its diameter.) Fig. 7 (b) (right).—Capacities of wires, rods and tubes.

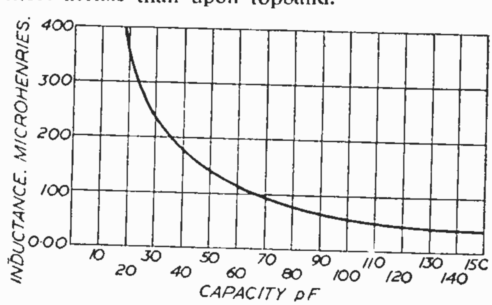

Fig. 8.—Inductance to resonate a given capacity to the middle of topband (1,900 Kc/s).

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Part 7 of a New Series of Articles Dealing with the Practical Application of Standard Test Equipment

(*Continued from page* 344 *June issue*)

FROM this reasoning it will be realised that by disconnecting the test leads and applying them across an unknown capacitance the meter will deflect to something less than full scale. The actual deflection will, of course, depend on the C to Cx ratio, which, by employing the following formula, can be used to determine the value of the unknown capacitor.

Capacitance (Cx) in μF=Ec×C/E minus Ec, where Ec=the voltage measured across C, C=the value of C in μF, and E=the applied A.C. voltage.

Since the resistance of the A.C. voltmeter is bound to have a shunting effect on the reactance of C and generally disturb the reactive balance of the circuit, a high-resistance A.C. voltmeter should be used for this test, particularly when relatively low capacitances are to be measured—a valve-type voltmeter is ideally suited for a test of this kind.

Because the reactance of a capacitor rises as the frequency is reduced, the lowest capacitance that can be successfully measured by the above methods is somewhat limited by reason of the relatively low frequency of the mains supply.

Estimating Inductance (21)

The measurement of inductance is a little more involved than the measurement of capacitance, and essentially a specialised bridge instrument is needed to provide an accurate indication.

Nevertheless, a rough indication, which is usually sufficient for the service engineer or constructor, is possible by measuring the A.C. voltage developed across an unknown inductance and comparing the reading obtained against the voltage developed across a resistor which is connected in the same circuit.

A circuit set-up for a test of this kind is shown in Fig. 26. From this it will be seen that a battery is also employed to drive a desired direct-current through the inductor under test. This is necessary because the value of inductance is somewhat affected by the presence of a direct-current, and when estimating the value of a smoothing choke, for example, it is usually of benefit to know its value under normal direct-current working conditions.

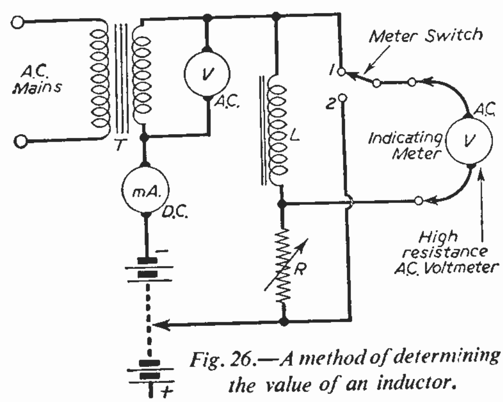

Fig. 26.—A method of determining the value of an inductor.

A transformer will be seen to supply A.C. to the circuit, the secondary of which is arranged to provide in the region of 30 to 50 volts, depending on the sensitivity of the indicating meter.

Initially, the battery tapping is adjusted to give the required direct-current indication on the D.C. milliammeter. Next, the meter switch is set on position 1 and a careful note taken of the voltage registered on the indicating meter. The meter switch is then set on position 2 and the variable resistor R adjusted until the indicating meter reading coincides with the reading taken on switch position 1. Finally, R is measured and the following formula used to find the inductance value: L=R/314, where L is the inductance in henrys, and R the value of the resistance in ohms. This test is made on the assumption that the impedance of the circuit is equal to the inductance, and that a 50 cps. A.C. supply is used.

The Valve Voltmeter (22)

The valve voltmeter, sometimes called the electronic testmeter or electronic multimeter, is progressively becoming more demanded for the testing and maintaining of sensitive electronic apparatus and television receivers. Generally speaking, the valve voltmeter in equivalent form to the multimeter is endowed with all the features of the latter, coupled with extremely high sensitivity approaching that of a delicate galvanometer.

With a valve voltmeter the voltage to be measured is applied to the grid circuit of a valve, and for this reason the resulting relatively high input resistance/impedance renders the instrument particularly suitable for use upon electronic circuits, and high-resistance networks, which are usually incapable of supplying sufficient energy to drive directly a normal moving-coil meter without causing a serious voltage drop and alteration in the power distribution of the circuit under test. As will be remembered, this aspect of the multimeter was fully dealt with in Part Two of this series, under Instrument Sensitivity (3).

Essentially most valve voltmeters are designed in a valve bridge circuit, a typical arrangement being that shown in Fig. 27. Here a double triode valve is used, with each section operating as a cathode follower. Its mode of working simply relies upon the measurement of the difference in potential obtained

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between the two cathodes as the result of comparing two voltages between the grids.

The voltage applied to the grid of section (b) is obtained from the potential divider network connected across the H.T. supply. This voltage can be controlled by the two variable potentiometers R1 (giving a coarse control) and R2 (giving a fine control). Initially both controls should be adjusted, with the instrument input terminals shorted, to provide a zero reading on the milliammeter connected between the cathodes.

It follows, therefore, that the application of a *negative* voltage to the grid of section (a) will reduce the voltage drop across the corresponding cathode resistor R3 ; this will disturb the balance between the two valves and thereby permit a flow of current through the milliammeter.

We can now well realise, then, how the relatively high input impedance of the triode successfully isolates the circuit under test from the low resistance of the moving-coil milliammeter.

It is as well to bear in mind at this point that the test voltage is not usually applied directly to the grid of the valve, but it is general practice to make use of a bank of switched series resistors for voltage selection, and a bank of switched parallel resistors for current selection, the same as the function of the multimeter. The actual value of the resistors employed will, of course, be considerably higher than those used in the same positions in an ordinary multimeter, because they will need to correspond to the higher input impedance of the valve voltmeter.

From the D.C. application aspect most of what has already been said in respect to the multimeter applies equally to the valve voltmeter. If a commercial model is being used the instruction manual should be carefully studied to avoid disappointing results, for each particular instrument, although from the same family tree, possesses individual characteristics.

Even though most valve voltmeters have the robustness of a multimeter, they should, nevertheless, always be handled with respect. It is desirable to look on such an instrument as a somewhat delicate multimeter of very high sensitivity ; the same applies, of course, when the instrument is being used for servicing and testing.

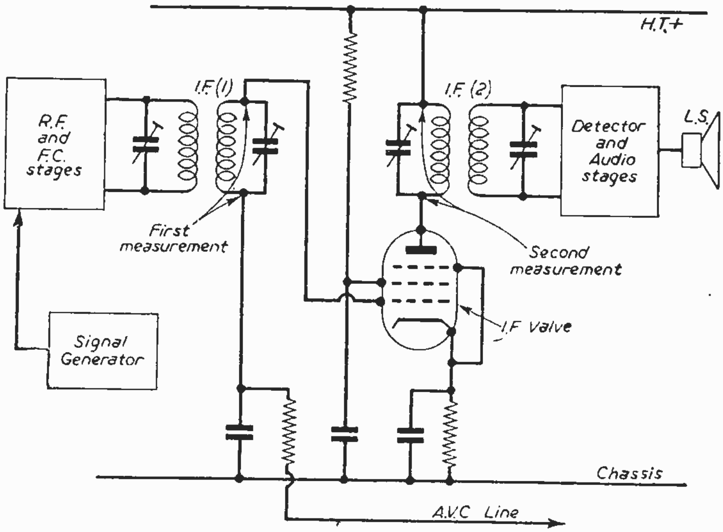

Fig. 28.—Showing the points in a typical I.F. amplifier stage at which comparative R.F. voltage measurements can be taken with a valve voltmeter.

Instead of using an internal metal rectifier for A.C. applications as with the multimeter the electronic testmeter or electronic multimeter invariably employs an external diode probe. As the result of the probe's low capacitance construction it is ideally suitable for measuring high-frequency voltages without loading the circuit under test to any serious degree.

Moreover, unlike the universal multimeter, most valve voltmeters respond to the *peak value* of the applied A.C. voltage, although it will, of course, be scaled to read in R.M.S. values, the same as a multimeter.

This is all very well provided the applied voltage is of sine waveform, but should it deviate from the ideal the possibility of an error in reading should always be recognised. Such an error would be of different calibre from that given on a universal multimeter subjected to the same conditions, since, as we have previously considered in some detail (see Parts Three and Four of this series), a rectifier moving-coil instrument is calibrated on A.C. proportional to the *mean* value of the waveform with which it is presented.

A valve voltmeter, being calibrated on A.C. proportional to the *peak* value of the applied waveform, will thus actually measure 1.4 volts due to an A.C. sine wave of one volt R.M.S. The main point to remember here is that even though the instrument will measure the amplitude of the positive peaks the

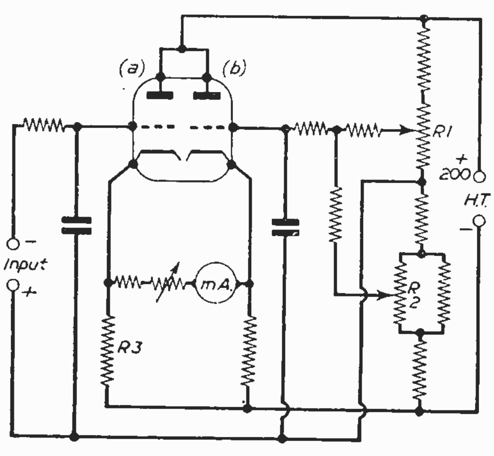

Fig. 27.—A typical valve voltmeter circuit.

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reading will be in R.M.S. values, that is because the scale is calibrated for peak *divided* by 1.414 (i.e., R.M.S. values).

Comparative R.F. Measurements (23)

As already intimated, the low capacitive construction of the external probe (generally in the region of a few picofarads only) readily permits the measurement of quite high-frequency voltages. In fact, a number of commercial valve voltmeters cater for the measurement of A.C. voltage up to and, in some cases, above 100 Mc/s.

Such a feature enables the signal voltage actually appearing across the various tuned circuits in a broadcast or television receiver to be measured either by injecting a signal from a signal generator into the receiver aerial sockets or into the grid circuit of the stage under examination, or by making use of the signal picked up by the aerial in the usual way.

Clearly, this not only represents a desirable method of tracing the actual R.F. signal through a receiver—perhaps as a quick way of pin-pointing a defective stage—but, since precise readings can be obtained, it also has the advantage of giving the operator some idea of the gain of the various stages and whether or not they are amplifying the signal to the best of their ability.

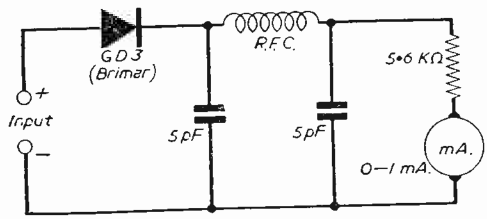

Fig. 29.—A circuit of a typical crystal voltmeter or crystal type R.F. probe.

Fig. 28 depicts a typical I.F. stage of a broadcast receiver. Now let us suppose that a valve voltmeter is connected across the secondary winding of the first I.F. transformer, the points corresponding to the "first measurement," and that the receiver is tuned to accept a signal given by the signal generator, which is either connected to the aerial terminals and adjusted to the signal frequency or connected to the signal grid of the frequency changer valve and adjusted to the intermediate frequency.

Let us further suppose that under these conditions a reading of, say, 0.5 volts is given by the valve voltmeter. Now, leaving the signal generator set at the original R.F. output, we remove the valve voltmeter from across the secondary winding of I.F. (1) and connect it across the primary winding of I.F. (2). We shall obviously hope to obtain a somewhat higher voltage reading as the result of the I.F. valve's amplification. Let us suppose that we measure, say, 25 volts, then, straightaway we know that the valve is giving a voltage amplification of 25/0.5 volts—something like 34 db.

Incidentally, these figures should not be taken as wholly representative of the possible amplification of a stage of this kind—a lot depends on the actual circuit and the quality of the valve voltmeter used. Nevertheless, it serves admirably to illustrate the ease by which relative measurements of this kind can be taken, and also provides a good idea of the scope of application of a valve voltmeter.

One or two precautions must, of course, be observed when using such an instrument for this purpose. In the first place, it is essential to employ the shortest possible length of wire to connect the probe to the test-points—it being sometimes desirable to connect the earth terminal of the probe to a true earth on the chassis under test.

Further, one must always recognise the possibility of the capacitances of the probe and associated wiring disturbing the balance of the tuned circuit across which it is connected. For this reason, especially if an accurate reading is demanded, the associated tuned circuits should be peaked up after the probe has been connected, making sure, of course, that the circuits are retrimmed back to normal after the test has been performed.

Do not forget that the valve voltmeter used may be insufficiently sensitive to measure small R.F. voltages, such as those present at the grid of an early stage. If the signal generator voltage is stepped up in an endeavour to procure a reading of reasonable magnitude under such a condition it might well be powerful enough to overload the associated valve, and thus give rise to a reading which is far from true.

R.F. and High Voltage Probes (24)

The probe itself is usually self contained and embodies an R.F. diode valve which picks up its heater voltage from the valve voltmeter's power-pack. Germanium crystal diodes are adequately suitable for detecting R.F. voltage, and these are sometimes used in place of a valve. Such diodes have the advantage, on the one hand, of not requiring a heater supply, but the disadvantage, on the other hand, of not being able to withstand the application of very high peak voltages. For this reason, therefore, a diode valve is nearly always employed in valve voltmeter probes where they may be subjected to a potential in excess of, say, 20 volts peak.

A typical crystal voltmeter is shown in Fig. 29. As will be seen, this is virtually a detector circuit, the load resistor of which has been broken and a milliameter inserted in series. Such an inclusion makes the device self contained, and obviates the necessity of connecting it to a valve voltmeter for voltage measurement within the sensitivity range of the milliameter. Quite a good indication can be obtained on a 0-1 milliammeter in conjunction with a 5.6 K ohm resistor for R.F. inputs of up to 10 volts.

A diode valve permits the application of higher peak voltages, but, even so, an ordinary R.F. diode has a limited rating—usually in the region of 250 volts peak—so one should never be tempted to procure an indication of the pulse voltage existing at, say, the anode of the line output valve or the anode of the E.H.T. rectifier valve in a television receiver by means of a conventional diode probe in conjunction with a valve voltmeter.

For tests of this nature a more substantial probe is essential, making sure that the associated diode valve is well able to withstand a large pulse voltage. It is often a good idea to make use of one of the E.H.T. rectifier valves in this position. The Brimar E.H.T. rectifier valve type R19, for example, represents a valve which is ideal for this purpose.

(To be continued)

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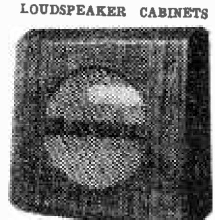

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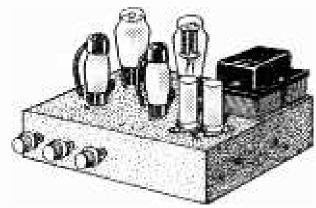

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On Your Wavelength

BY THERMION

Evangelism on the Air

I LISTENED to the perfervid rambling religious rantings of 15,000-dollar-a-year hot-gospelling William Graham who likes to be known as "Billy" (to be known by a pet contraction of a Christian name is, of course, to give an impression of popularity !). I have come to the conclusion that the BBC made a grave mistake in granting programme time to this American evangelist, with his minatory criticism of the whole of mankind as sinners, as if he were the only man in step. He keeps on and on about sin, without defining what it is, and prescribes cures for all our spiritual ills, rather like a doctor prescribing a cure for measles for a patient who is entirely healthy.

We have had these hot-gospellers before, from the time of Sankey and Moody. Not so many years ago, Mrs. Aimie McPhearson stumped the country on a similar mission, but evidently the effects of early evangelism were short-lived. I am tempted to ask who is Mr. William Graham that he should sit in judgment on the rest of the world and endeavour to reform them. He may be wrong ! In any case, I should have thought that the reformation of sinners in his home country of America would be a full-time, life-time job.

The hysterical crowds who attend his meetings and the larger audience who listen to him on the air and on television are not stray sheep who have wandered from the fold and are in need of spiritual uplift. They are mainly curious sightseers, attracted to the meetings by the banging of the big publicity drum, posters worthy of a circus and publicity bally-hoo more in keeping with the film industry than with religion.

In my view, it is particularly regrettable that the BBC has been guilty of this lack of judgment, which is a studied slight on English preachers. I understand that William Graham's entourage consists of producers, assistant producers, advance publicity managers, etc. As a religious scholar myself, I found his sermons circumlocutory and full of periphrase. Would the BBC have given the same programme time to such a mission organised, say, by the Archbishop of Canterbury ?

Graham is a self-appointed saviour of mankind anyhow !

One-Man Bands

I HAVE always criticised the policy of the BBC in presuming that one man only should conduct a feature programme—Philip Harben, for example, as the cookery expert. All of the housewives of this country will, if they take his advice, become Harbenised cooks. There are other experts in the culinary art who may differ from Mr. Harben and his methods of appealing to our gustatory organs. If it is necessary to teach women how to cook by means of lessons on the television screen, let us have a variety of chefs for variety is the spice of gastronomics.

Readers will remember my criticism of that most stupid programme, *The Brains Trust*, which was anything but brainy. The BBC presumed that a small panel with an occasional guest could answer any question sent in by listeners. The fact is that they never answered any questions but expressed opinions on topics where they could never be right or wrong. I, for one, am thankful that this particular programme finished when Joad was forced to vacate it for reasons which are well known. Let us have fewer one-man bands, BBC !

The Parlour Game Craze

THE BBC continues to develop the parlour game style of programme because it says its listener research bureau indicates that they have a very large audience. Are they not, however, becoming played out and boring ?

Misuse of Callsigns

I RECEIVED a letter from a member of the Nottingham University Students' Radio Society criticising my comments on I.S.W.L. It was signed " R Bastow (G3BAC) ". I accordingly wrote to Mr. Bastow, who also lives in Nottingham. He denies authorship of the letter. I then accordingly wrote to the address given on the original communication and received an anonymous reply from a member of the Society admitting that he had misused Mr. Bastow's callsign. I will report developments. Incidentally, the I.S.W.L., to whom I wrote, did not have the current address of Mr. Bastow ! I have since informed them of it.

I have also received a number of other inspired letters concerning the I.S.W.L., but they promptly went into the W.P.B.

My paragraphs have had the effect of gingering up the organisation of a large number of clubs who were unaware of their legal obligations, and I should be glad to receive details of any club which readers think is not run on constitutional and democratic lines.

Radio Research

THOSE interested in the progress of radio research should certainly read a booklet on that subject published at 2s. 6d. by the Department of Scientific and Industrial Research. It is a most interesting booklet and surveys the work the D.S.I.R. has conducted during the past year. The main emphasis of the research programme of the Radio Research Board for the year has been on the problems of wave propagation, especially at very high and ultra-high frequencies.

The Radio Show

WITHIN a few weeks we shall all be making our annual pilgrimage to Earls Court. Frequency-modulation and I.T.A. will be very much to the fore but, at the moment of going to press, I have not heard of any startling innovations. This journal will, of course, be represented there as hitherto, and our stand will be the meeting place for those thousands of amateurs who continue to build rather than buy.

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A Telephone Attachment for a Tape Recorder

A NOVEL DEVICE FOR RECORDING TELEPHONE CONVERSATIONS

By J. Brown

TELEPHONE attachments for tape recorders are rather expensive pieces of apparatus to purchase, so the writer decided to experiment in building one. After various attempts, there matured the unit explained below, and the results are certainly proving well worth while. Calls at 3-400 miles come in clearly and both sides of the conversation are recorded.

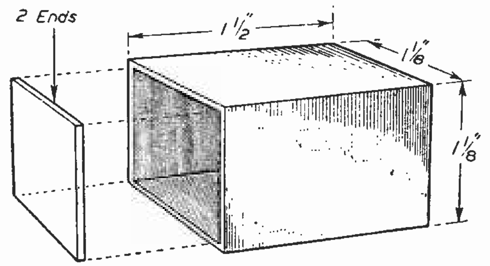

Fig. 1.—The base, made from aluminium tube.

The base was made from aluminium tube of square section $1\frac{1}{8}$in. and about $1\frac{1}{2}$in. long. This was originally from a cross-bar of a TV aerial. Two ends were made to be a tight press fit in the ends of the tube. Then a piece of silver steel was filed so as to make it a good tight fit inside the tube, $\frac{1}{4}$in. diameter and approximately 1in. long. This was fitted into 2 pieces of bakelite approximately $\frac{3}{4}$in. diameter and $\frac{1}{8}$in. thick to serve as cheeks for the solenoid or winding. In each of the 2 bakelite washers were drilled a 1/16in. hole, the purpose of which will be shown later. Next came the winding. This was approximately 450 turns of 30 s.w.g., One end of the winding came through one hole, and the end of the winding after 450 turns were wound on came through the other hole. These were used for the output leads connection.

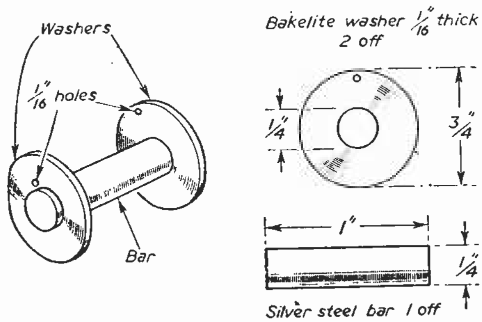

Fig. 2.—The solenoid or winding, fitted with bakelite cheeks.

The aluminium tube was next to be drilled, one hole for the leads to the recorder and one hole for the suction cup. The suction cup was originally for holding some tooth-brush holder or similar toilet device, and had a flange on it. This was 3/8in. in diameter, so a 3/8in. hole was drilled in the tube for the cup, and $\frac{1}{4}$in. hole for the lead. These holes were opposite each other.

Assembly

First, one end is pressed in the aluminium tube, and filed up to make it look clean, then the suction cup was fitted. The silver steel core and its associated coil is pressed into the tube, and the output leads connected up to the ends of the coil, the whole of the box is filled with wax or pitch. After cooling, press in the other end into the tube.

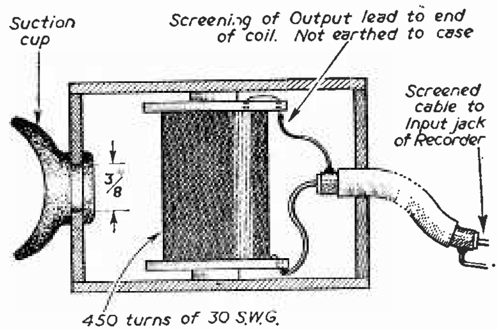

Fig. 3.—The completed attachment.

With the recorder switched on, and the lead from the completed unit plugged in to high gain input socket of recorder, and the unit held by suction cup to back of 'phone, the handset can be removed and the dialling tone recorded. The recording level indicator, whatever type, will fluctuate with the dialling tone. The position of unit on the 'phone was found to be best at the back, the opposite side to the dialling system, and this unit can be a great asset, both for business and entertainment.

MATERIALS NEEDED

1 piece square Aluminium Tube, $1\frac{1}{8}$in. section, $1\frac{1}{2}$in. long.
2 pieces $1\frac{1}{8}$in. square for ends
1 piece silver steel $\frac{1}{4}$in. diameter, approx. 1in. long.
Bakelite for washers.
Wire for Solenoid.
1 Suction Cup.
Screened Cable.
Wax for filling to keep damp-proof.

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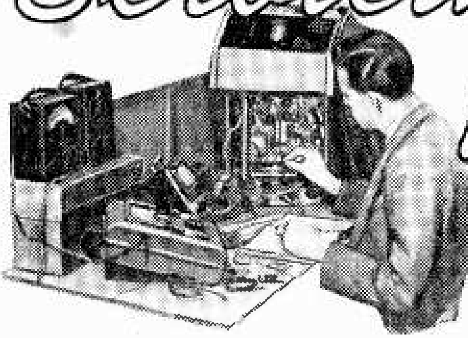
Servicing Radio Receivers



By Gordon J. King, A.M.I.P.R.E.

No. 2.—PYE MODEL P.43

THIS receiver is contained in a small moulded cabinet. It is designed for operation on A.C. mains supplies only, and its self-contained frame aerial brings it into the category of a mains transportable.

Circuit Description

As will be seen from the circuit diagram at Fig. 1, it uses three valves, plus a rectifier, in a superhet arrangement. Coil L1 is the medium-wave frame aerial, and coil L2 (frame aerial) is also brought into circuit when switched to long wave; a short-wave band is not incorporated. The circuit is shown switched in the long-wave position.

Waveband switching is performed by means of a wafer-type rotary switch, but for the sake of simplicity, each switch function is shown separately on the diagram. Switch S1 arranges correct resonance of the frame aerial circuit, as we have already seen, whilst switch S2 connects the long-wave trimmer T2 into the aerial circuit; switches S3, S4 and S5 function to select the corresponding oscillator coil.

T1 is the medium-wave aerial trimmer and T3 the medium-wave oscillator trimmer; variable capacitors C1 and C2 comprise the main tuning gang.

L3 and L4 constitute the medium-wave oscillator coils, feedback being maintained by the anode coil L4 and the coupling capacitor C5. On long wave a single coil only—L5—is used, feedback being maintained by coupling between the anode and the grid, via C5 again, of the triode section of the frequency changer valve V1 (ECH42).

Mixing occurs within this valve, and the intermediate frequency (470 kc/s) is developed across the first I.F. transformer (I.F.T.1). A voltage at I.F. is thus conveyed to the signal grid of V2, where it is amplified, and developed across the second I.F. transformer (I.F.T.2).

This amplified intermediate frequency signal is carried to the signal diode in V2 (EBF80), where it is demodulated and developed in A.F. form across the load resistor R2. It is coupled from here, through C6 and the volume control R1, to the signal grid of the output valve V3 (EL41). From here it is amplified and converted into power, in the normal manner, to drive the loudspeaker L.S.

A portion of the I.F. signal is taken by way of C7 to the A.V.C. diode of V2, where it is rectified and passed on as A.V.C. bias to valves V1 and V2.

The H.T. rectifier valve V4 (EZ41) is arranged in a full-wave circuit, smoothing being achieved by C3, C4 and R3. The H.T. tap on the primary winding of the output transformer T1 also aids in reducing mains hum disturbance.

A fixed degree of negative feedback is introduced to the output valve from the coupling between the output transformer and V3's control grid, through C8 and R1.

Servicing Remarks

Early receivers in this series exhibited rapid failure of the scale lamps. This can be overcome by removing the existing 3.5 volt 0.3 amp bulbs, rewiring the bulb holders in parallel across the heater winding on T2, and installing 6.5 volt 0.3 amp type bulbs.

A rather elusive kind of instability sometimes occurs on these receivers. It probably may not develop until after the receiver has been operating for a considerable time, and even then it may not reveal itself until the receiver is detuned slightly or tuned to another station—this having the effect of reducing the A.V.C bias and thus causing a rise in the gain of V1 and V2. The disturbance generally starts as a "bubbling" noise which develops into pure oscillation as the receiver is de-tuned slightly off the carrier.

In nearly all cases the trouble is due to a defect in V2, and this can be proved only by valve substitution as a normal valve test most often shows the valve as one hundred per cent. efficient—probably too efficient!

Another cause of instability which this time is unmistakable, is the result of C9 becoming either open-circuit or high in value.

Intermittent loss of volume on early receivers in this series can sometimes be attributed to faulty I.F.

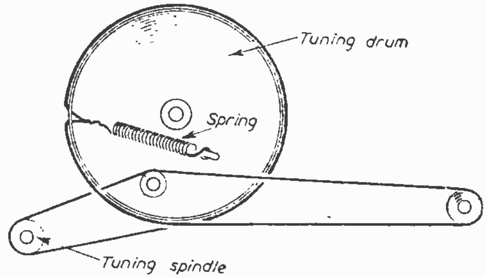


Fig. 4.—Drive cord details.

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transformers, or to a fault in one or more of the fixed 100 pF tuning capacitors ; a capacitor fault, though, more frequently results in a general fall-off of overall sensitivity. If the defect is definitely occasioned by

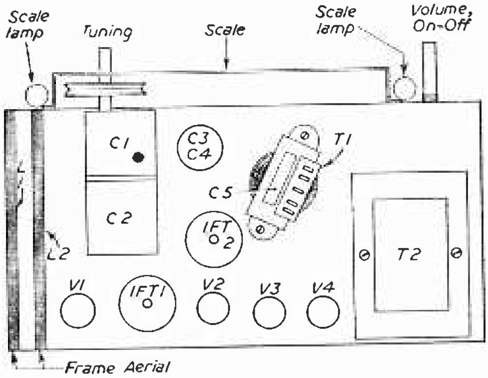


Fig. 2.—Top view of the chassis.

one of the transformers, we would mention that improved replacement types are now available through a Pye dealer.

No signals, but general liveliness throughout the set, should lead one to suspect trouble in the oscillator section. For instance, C5 may become open-circuit or high in value, or R4 may increase in value. If the effect occurs only on one band, then the appropriate oscillator coil and associated capacitors should be carefully examined. In this case, one should also always ascertain that the wavechange switch contacts are making properly. If the switch becomes noisy or intermittent in operation, a few carefully applied drops of "switch clean" works wonders.

A noisy volume control can also be treated in a similar manner, but in this case, to avoid ruining the carbon track, a few drops of "switch clean" should be instilled down the spindle bush, the control given one quick turn and then left for about ten minutes, after which time the control should be actuated vigorously for about one minute with the receiver disconnected from the mains.

If this procedure does not result in noise-free operation, then control replacement is long overdue.

If the receiver suddenly goes completely dead and the valves remain alight, C5 should be suspected for short-circuit and the primary of T1 for open-circuit. If the receiver goes dead apart from a hum from the loudspeaker, R3 should be suspected for open-circuit ; this fault will, of course, cut off the screen potential to V3, but even so, a hum is generally heard if the ear is placed close to the speaker.

Low volume may mean that C10 is open-circuit, whilst excessive distortion may mean that it is short-circuit. C8 becoming "leaky" also gives rise to excessive distortion.

Alignment Procedure

It should first be established that the tuning pointer coincides with the locating dot marked at the long-wave low-frequency end of the tuning scale when the tuning gang is fully closed. Next, the A.V.C. should be made inactive by shorting the A.V.C. decoupling capacitor C11 with a short length of wire. A correctly loaded output meter may be substituted for the loudspeaker, and throughout the alignment process the A.F. output should not be allowed to exceed 50 mW, it being necessary progressively to reduce the signal generator output as the various circuits are brought into tune.

I.F. Alignment

This is a straightforward process which simply

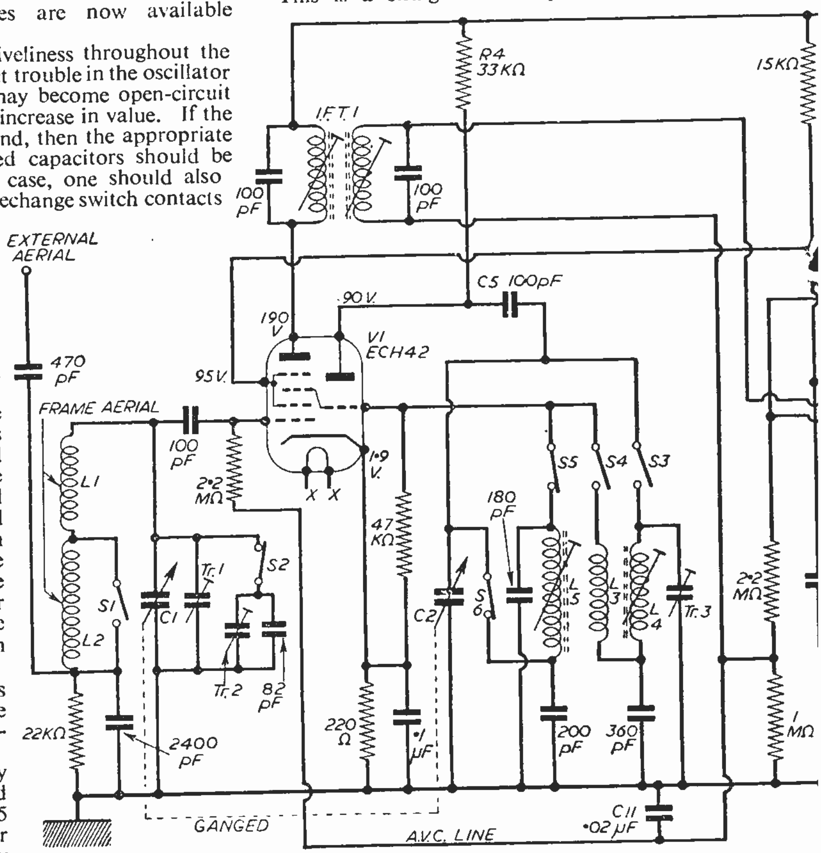


Fig. 1.—Circuit diagram

lemands the application of a modulated 470 kc/s ignal to the control grid of V1. It is desirable to nject the signal through an 0.1 μF isolating capacitor, hough the "earthy" side of the generator output nay be connected directly to chassis. As an aid in btaining an enhanced I.F. response the receiver hould be tuned to 560 metres, and in order to avoid ny spurious responses the oscillator should be muted y shorting C2.

After allowing sufficient time for the receiver to varm up properly and with the volume control at naximum the cores of I.F.T.2 and I.F.T.1 should be djusted for maximum output, repeating the operation ntil no further improvement can be obtained. The ores should then be sealed lightly with wax.

Oscillator and Signal Alignment

Remove the short from C2 and tune the receiver to 500 metres ; adjust the generator to the corresponding requency (600 kc/s) and adjust the core of L3, L4 Fig. 3) for maximum output. Re-tune the receiver and generator to 200 metres (1,500 kc/s) and adjust T3 (Fig. 3) for maximum output. Repeat these operations until maximum frequency accuracy is achieved at both ends of the medium-waveband. Seal trimmer T3 and the core of L3, L4 with wax.

Long-wave oscillator trimming is carried out at about 1,400 metres, with the signal generator tuned to 214 kc/s. At this frequency the core in L5 is adjusted for maximum output and finally sealed with wax.

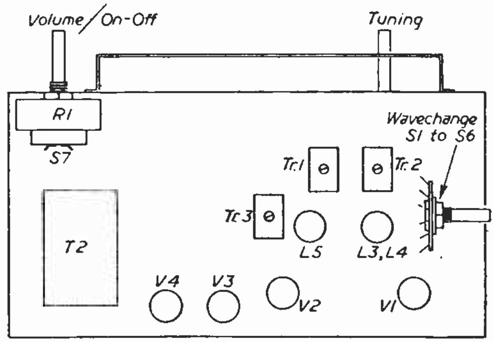


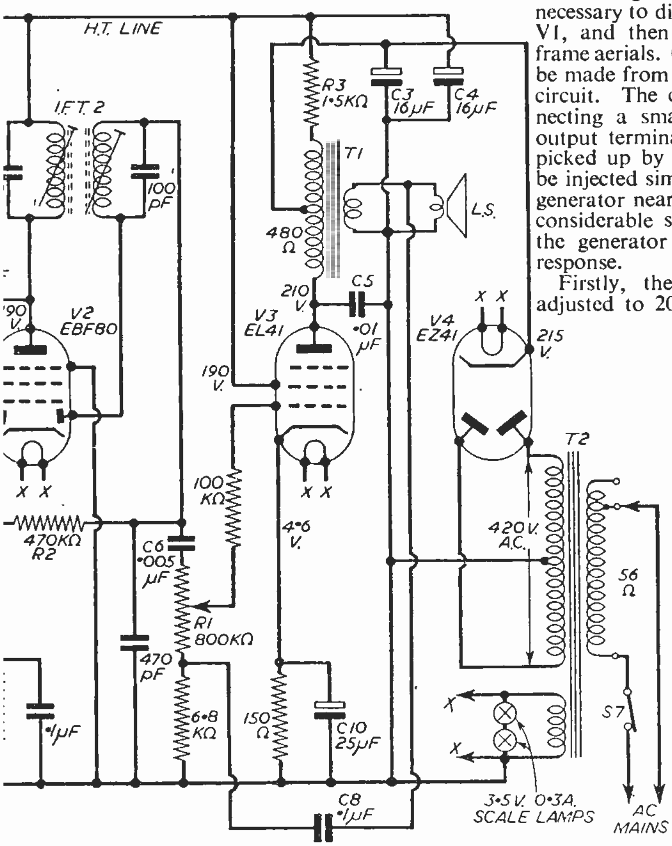
Fig. 3.—Underside view of the chassis.

To bring the aerial circuits into tune it is first necessary to disconnect the generator from the grid of V1, and then loosely couple the generator to the frame aerials. On no account must a direct connection be made from the generator to any part of the aerial circuit. The coupling may be made either by connecting a small frame aerial across the generator output terminals, so that the signal is radiated and picked up by the receiver's aerials, or a signal may be injected simply by placing the output leads of the generator near the frame aerials ; in the latter case considerable signal output may be demanded from the generator in order to obtain sufficient output response.

Firstly, the receiver and generator should be adjusted to 200 metres (1,500 kc/s) and trimmer T (Fig. 3) tuned for maximum output. Secondly, trimmer T2 (Fig. 3) should be tuned for maximum output with the receiver and signal generator adjusted to 1,400 metres (214 kc/s). To conclude the alignment, trimmers T1 and T2 should be carefully sealed, taking care to avoid the wax running between the plates ; the short should be removed from across C11 and the speaker substituted in place of the output meter.

General

The top and underside views of the chassis, showing positions of the valves, coils and trimmers, are illustrated in Figs. 2 and 3. Fig. 4 depicts the drive cord details which need little explaining, apart from mentioning that nylon type drive cord should be used for replacement, and that a total length of about 29in. is necessary.



Pye P.43.

MECHANICAL STATION SELECTION

VARIOUS METHODS OF TUNING A RECEIVER TO PRE-DETERMINED SETTINGS FOR QUICK PROGRAMME CHANGES

By F. G. Rayer

THOUGH many arrangements for the automatic, or "push-button," selection of stations employ switch-selected pre-set condensers, other methods, of a "mechanical" character, exist and are used by some manufacturers. In some cases these have advantages. For example, a very large number of pre-sets becomes necessary if a fair number of stations are to be provided for, and the chances of interaction are then increased. If a R.F./F.C. type of circuit were used, three pre-sets would be required for each station. This becomes troublesome if 10 or 12 auto-selected stations are desired, as no less than 30 and 36 pre-set condensers would then be required.

This disadvantage, applicable particularly to large receivers, may be overcome entirely by mechanical means of station selection. Such methods usually permit the gang tuning condenser to be set at once to any of a number of selected positions. The "push-button" tuning is thus accomplished by means of this component and no pre-set condensers whatever are required, as would be so with the switch-selected pre-set method of tuning. Possible losses and instability from switch and condenser wiring are also avoided.

Mechanical methods are thus worth considering with such receivers, and some may be built up without much difficulty.

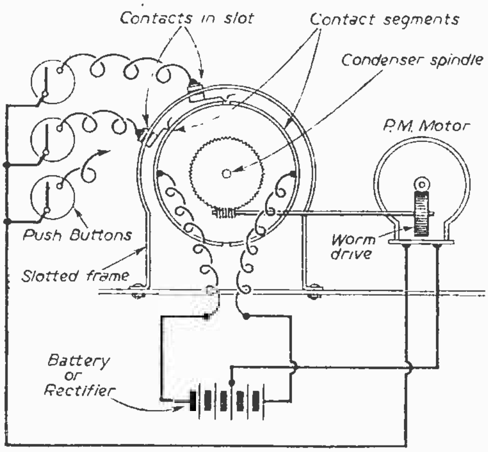


Fig. 1.—A motor-driven selector.

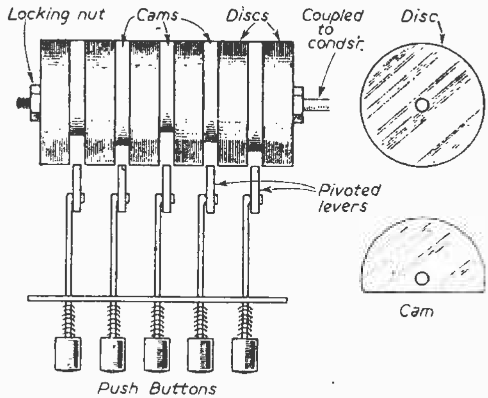


Fig. 3.—A disc and cam actuator.

Motor-operated Tuning

This method is in several ways an attractive one, and the usual type of tuning drive and dial can be retained, with manual tuning, if desired. For auto-selection, a push-button switch with the desired number of buttons is used. When a button is operated the pointer moves smoothly round on its own, halting at the required station.

A circuit for this type of selector is shown in Fig. 1. The motor is of small permanent magnet type, and turns the gang condenser through a worm or other reduction drive. If manual tuning is used the motor may drive the ordinary tuning knob spindle through a friction drive. (A solid drive is not possible if manual tuning is to be permitted.) An overall ratio of about 500 : 1 is suitable, and the motor must be of P.M. type so that it can be reversed by reversing the polarity.

Current is taken to the two contact segments by flexible pigtails or brushes. When a push-button is operated the motor commences to run, stopping only when the contact falls into the space between the contact segments. Since completion of the circuit with the other contact segment would reverse polarity, the condenser spindle will always be rotated in the correct direction to bring the space to the contact which has been switched in by the push-button. The latter unit is of the usual type, any button remaining down until a further button is operated. Connections to the switch may be of any length, and multi-core colour-coded flex can be used.

Dry battery operation is feasible because a small motor will have a moderate consumption and will only be drawing current for a short time. With mains sets a rectifier can be used to obtain current from a convenient transformer winding.

To set up, the desired station is tuned in and the related contact moved in the slotted member until it is positioned in the gap between the segments. The contact is then locked, and the condenser will then always return to this position when the button is operated. Should rotation always tend to be *away* from the gap, then the two leads to the motor are reversed.

Lever Selector

Some commercial systems are difficult to build, but Fig. 2 shows a simplified method quite easy to arrange. Here, each push-button presses a lever back

(*Continued on page 421.*)

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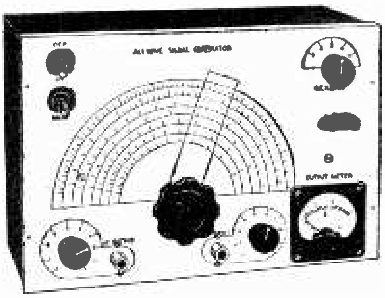

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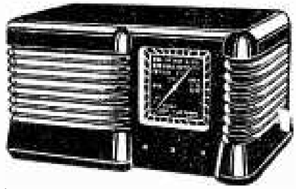

PLASTIC CABINET as illustrated, 11½ x 6½ x 5½in., in walnut or cream. ALSO IN POLISHED WALNUT, complete with T.R.F. chassis, 2 waveband scale, station names, new waveband, back-plate, drum, pointer, spring, drive spindle, 3 knobs and back, **22/6.** P. & P., 3/6.
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against projections on a crank. The crank is thus turned until *both* projections bear against the lever, when further movement is impossible.

A rigid construction is necessary. The cranks can be made from some type of shaft-coupler or by soldering metal strips to bushes with ¼ in. hole and set-screw. If manual tuning is used, it must present no appreciable resistance. A fairly large control knob, fitted directly to the spindle, can be used in most long and medium wave sets. Where a reduction drive is essential, means must be available for putting it out of action when the push-buttons are used. A clutch can be used for this, or a jockey pulley used to keep the driving cord tight, and moved to slacken the drive when required. A further button, for manual tuning, may be arranged to return tension upon the cord, when depressed.

To adjust, the desired station is tuned in and the related crank turned upon the spindle by depressing the button. The crank is then locked in place. Afterwards, the condenser will always return to this position when the button is depressed. All buttons spring out again after use.

If soundly made, this system is accurate and simple. It has the disadvantage that stations at the extreme ends of the wavebands cannot be selected, as the levers cannot then operate. This can be overcome, if necessary, by employing a spring-loaded 2 : 1 step-up gear between crank spindle and condenser. The rotation of the cranks will then be limited to 90 deg.

Fig. 3 illustrates a system which operates in exactly the same way, the levers riding in slots between discs. Each cam is turned until its flat face is presented to the lever, when the latter is pressed in. These rubbing surfaces should be smooth and true. All the discs and cams are loose upon the spindle and are locked up, with the flat surfaces of the cams in the required positions, by means of the locking nut. As with Fig. 2, it is only possible to obtain a limited amount of rotation. If full band coverage is essential a step-up gear is required on the gang condenser spindle.

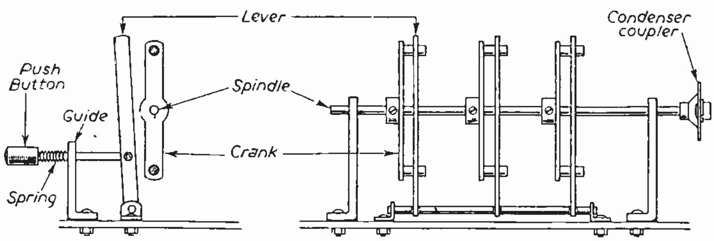

Fig. 2.—System operated by levers.

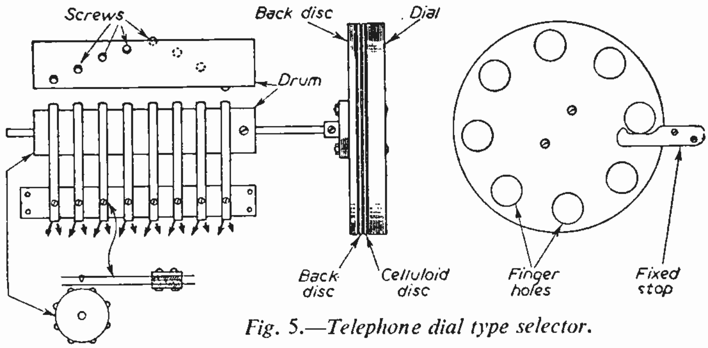

Fig. 5.—Telephone dial type selector.

A Simple Indicator

A method which has the advantage of great simplicity is shown in Fig. 4, and is usually provided for two or three stations only. Suitable windows, on the tuning dial or near it, have transparent coverings marked with the names of the most-used stations. For example, "Home," "Light" and "Third." Indicator lamps are fitted behind these windows, current being drawn from the transformer.

A small disc is provided on the condenser spindle for each lamp circuit, and is so positioned that the contacts are only closed by the small projection when the station is accurately tuned in. In use the ordinary tuning knob is rotated until the required window lights, which thus clearly shows the desired station to be tuned in.

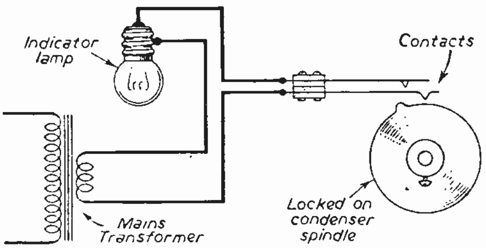

Fig. 4.—Tuning with a bulb indicator.

"Telephone Dial" Systems

These have the advantage of novelty and may be mechanical or electrical. One typical arrangement is shown in Fig. 5, making provision for up to eight stations. The station names are printed on the "station disc" which is protected by celluloid, the names showing through holes in the dialling disc. To choose a station the finger is inserted in the desired hole and the disc turned until the finger reaches the fixed stop.

A drum about 1in. in diameter, with eight round-headed screws, is fitted to the axle. Any set of eight pairs of contacts will thus be closed, according to the station dialled. Closure of the contacts may operate the tuning condenser through a selector of the kind shown in Fig. 1 or may switch in pre-set condensers which are adjusted for the desired stations. No return or spring mechanism is required, as the dial may be turned clockwise indefinitely. In effect the dial acts as an eight-way push-button or automatic switch.

An alternative is to provide holes round one-half of the dial only and to fix the latter to the condenser spindle. This has the disadvantage that the holes will require to be unevenly spaced. In addition, the condenser setting

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obtained by moving the finger round to the stop will only be sufficiently accurate for simple, local-distance sets of comparatively low selectivity. The only means to overcome this is to provide

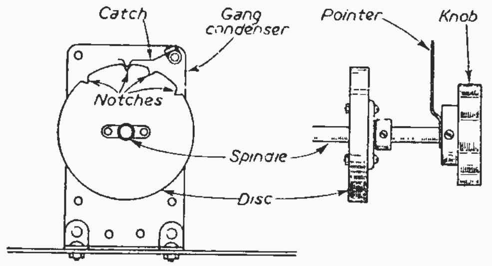

Fig. 6.—Catch selector for local station set.

a spring plunger in each hole. When dialling the plunger is pushed in with the finger and comes into contact with a fixed stop *behind* the dial. Accurate settings will thus be obtained. There is, however, the difficulty of returning the condenser to zero to permit further clockwise dialling, which requires a spring and friction device to hold the condenser at the dialled position until the dial is again operated.

Simple Catch Selector

This method is convenient for the simple type of T.R.F. or superhet where a definite tuning point is required for a number of stations at once. For such purposes it is extremely simple and handy.

As shown in Fig. 6, an ebonite or metal disc is fixed to the condenser spindle. No reduction drive is used, but a fairly large knob with pointer and scale. A strong spring catch, fixed to the gang condenser, bears on the disc.

The desired stations should be tuned in and the exact point where the catch bears is scribed on the disc. The station names are marked opposite the pointer. The disc then has small notches made in its circumference with a triangular file. The chosen stations are then found, easily and exactly, by turning the knob until the catch is felt to click into position. The notches should have sufficient depth to give a clear indication and any slight error can be corrected initially by filing a little one way or the other.

News from the Clubs

EAST GRINSTEAD AND DISTRICT AMATEUR RADIO CLUB

Hon. Sec.: R. A. Burnett, 19, Stockwell Rd., East Grinstead, Sussex.

THE Club held its annual meeting on March 24th.

The treasurer reported that the club, in spite of low membership (10 members) was in a very sound position financially.

At the time of writing the club had to share a hall with other clubs, and so restrict its activities, but in the near future it is hoped to have premises of its own.

The club transmitter is now under construction and should be on the air this year.

Although, as stated, the membership is low, the individual interests cover practically the whole range of electronics.

Morse classes are held once a week, and soon three more members hope to be licensed to share this branch of amateur radio with the present lone licensed operator, Mr. R. A. Lord (G3DSK), who is also the backbone of the club.

TORBAY AMATEUR RADIO SOCIETY

Hon. Sec.: L. H. Webber, G3GDW, 43, Lime Tree Walk, Newton Abbot.

THE Annual General Meeting of the Society was held at the Y.M.C.A., Torquay, at 7.30 p.m. on Saturday, April 16th, under the Chairmanship of G2GK. The President, G5SY, was also present. The present officers and committee of the Society were all re-elected, with the addition of Les Mays, G2CWR, as Hon. Auditor.

The President, G5SY, spoke of the sound position of the Society, which he referred to as a "happy family" of a Society, and although small in numbers was fairly representative of the membership in the area. He also said that he had just built a new transmitter, after the style of the "Elizabethan," which works on all bands from 3.5 mc/s to 28 mc/s.

A hearty welcome was extended to Ron Brown, G3GMQ, from York, who is blind, and who will be in the district for about three months. He is doing a course at a local Blind Home. The Society was therefore in the unusual position of having two blind members present—the other being Geo. Western, BRS. No. 20605. A programme of lectures for the coming year is being prepared by G2GK and the Hon. Secretary.

NEWARK AND DISTRICT AMATEUR RADIO SOCIETY

Hon. Sec.: J. R. Clayton, 160, Wolsey Road, Newark, Notts.

MUCH interest was shown in the lecture by C. L. Wright, B.Sc., on "Transistor Circuitry." It was attended by amateurs from several towns.

In March the Society heard a talk by A. Hall on "Valve-voltmeters" and one by G. Bark (G3ITG) on "N.F.D.—Reflections and Suggestions."

The annual general meeting and dinner on Sunday, April 3rd, was well attended. Meetings are at Northgate House at 7 p.m. on the first Sunday of each month.

SOUTHEND AND DISTRICT RADIO SOCIETY

Hon. Sec.: J. H. Barrance, M.B.E. (G3BUJ), 49, Swanage Road, Southend-on-Sea, Essex.

MR. P. BALDWIN gave a most interesting talk at a recent meeting in the Ekco Canteen on "Electronic Musical Instruments." He pointed out that there were at least 12 different types of electric organs. The general principle is a controlled revolving disc, which can be caused to rotate at certain speeds in magnetic field, thus creating the required frequency which produces the desired note. Speeds must be constant in order to avoid distortion. One method of obtaining the correct speed is by the use of a system of pulleys.

BARNSLEY AND DISTRICT AMATEUR RADIO CLUB

Hon. Sec.: Mr. P. Carbutt, G2AFV, 33, Woodstock Road, Barnsley.

THE programme for June is as follows:

June 10th. A quiz.

June 24th. A talk by P. Denison, G8OK, on "Fifty Years of Ham Radio."

The annual subscription for members is 7s. 6d. for adults and 2s. 6d. for juniors.

SHEFFORD AND DISTRICT AMATEUR RADIO SOCIETY

Hon. Sec.: G. R. Cobb, G3IXG, 7, Hitchin Road, Shefford, Beds.

THE Society, now in its seventh year, meets regularly on Friday evenings at 8 p.m. at Digswell House. New members and visitors are always welcome. The programme includes a general coverage of all radio and allied electronics. Film shows and junk sales are a regular feature and refreshments are available on the premises.

The Society receives the regular attention of G2DUS/T whose lectures are always well received. His latest demonstration was that of his TV monascope. Other recent talks included "Wire Recording" by G3GDH, and "The Manufacture and Use of Quartz Crystals" by Mr. J. Johnson.

ROMFORD AND DISTRICT AMATEUR RADIO SOCIETY

Hon. Sec.: N. Miller, 55, Kingston Road, Romford.

A WORKSHOP for the use of club members is now available, and after participation in N.F.D. it is hoped to take part in the Two-Metre Field Day. Meetings are held at R.A.F.A. House, Carlton Road, Romford, every Tuesday, at 8.15 p.m., and all visitors will be welcomed.

HAWICK RADIO SOCIETY

Hon. Sec.: G. Shankie, 17, Ettrick Terrace, Hawick.

RECENT activities of the above have been lectures on "1 Valve Receivers" and "Adding the 2nd Valve." These lectures, given by Mr. Walter (President) in an effort to cater for the members (young and old) who are not yet too familiar with the working of a receiver.

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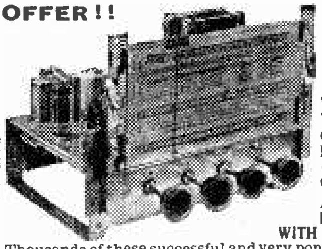

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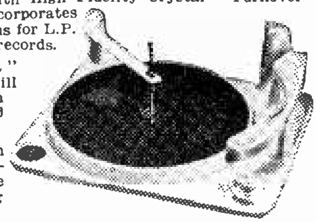

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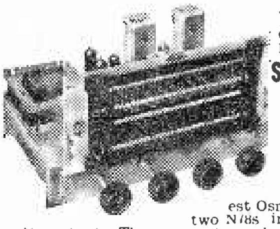

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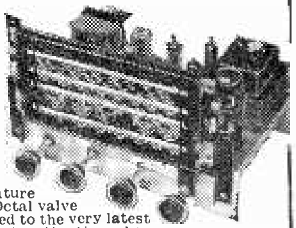

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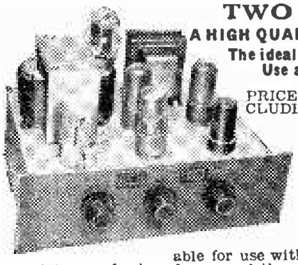

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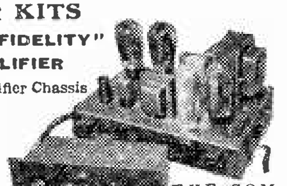

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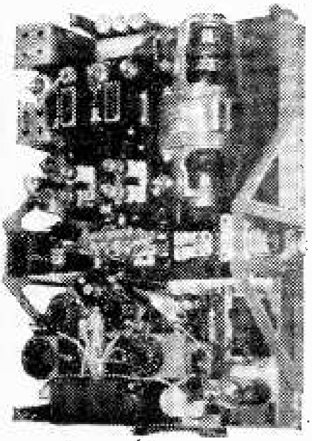

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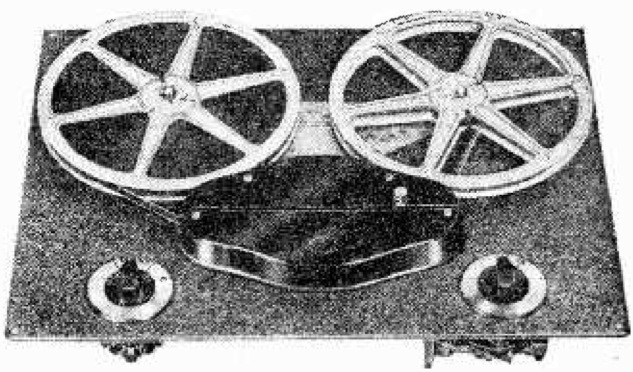

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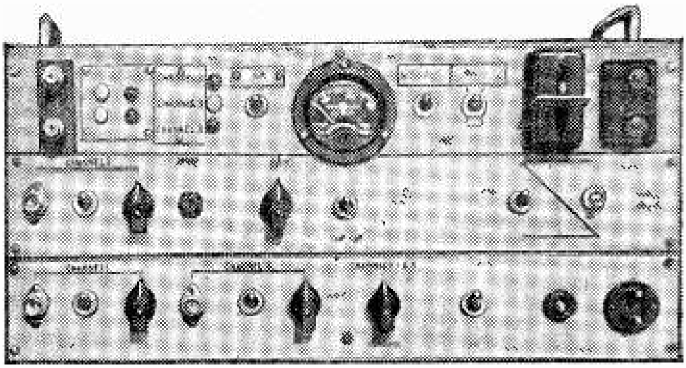
A Three-channel Mixer Fader Unit



This illustration shows the unit in use by the writer. The engraving is done on Perspex. Terminals at the top left-hand corner are for "prompt" purposes when the unit is used for stage work. Top right, are the speaker-terminals and H.T. fuses, below these output-matching switches. Bottom right, are the mains input and mains fuse.

A UNIT FOR THE AMATEUR WHO WISHES TO WORK WITH MORE THAN ONE INPUT AT A TIME

By H. W. Jeffries

THE unit described in this article was developed for use in the sound effects department of a local amateur dramatics society. Very few readers will be interested in this branch of reproduction, but as the unit is virtually a Three-channel Mixer Fader, some of the circuiting may prove useful to those wishing to work with more than one input at a time.

Facilities

A three-channel input was decided upon, as this met the writer's requirements, but, as will be seen, the circuit is readily adaptable to control two or four channels. Facilities include one high-gain channel (Channel I) and two medium-gain channels (Channels II and III), each with separate switching and input level controls. Control of levels of Channels II and III together, and all channels at once is included. Monitoring of all channels is provided for, using headphones.

A block schematic layout (Fig. 1) shows the various stages. It may appear that not all the stages are really needed, but in practice all channel input levels are independent ; insertion of monitor 'phones has no effect on output level, and inputs from crystal or carbon microphones, radio feeder or gramophone are catered for at the same time.

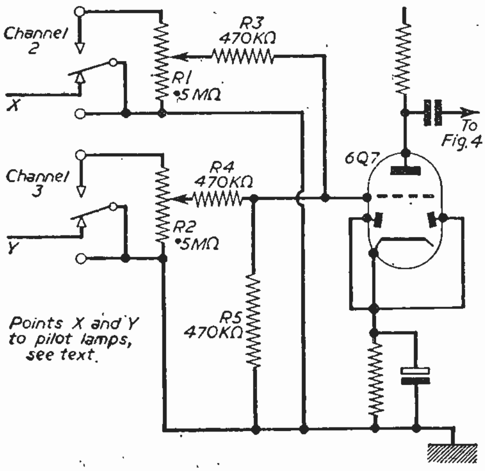


Fig. 2.—The inputs of Channels II and III.

Amplifier

The amplifier proper is quite conventional and has a push-pull output, using 6V6's working in class AB1, giving an output of some 12 watts audio. Pure quality enthusiasts may decry this form of output, but it is found that in a small cinema sufficient volume of quite good quality is delivered.

Circuitry

The inputs of Channels II and III (Fig. 2) are mixed by a potentiometer circuit. Leads were kept short, the casings of potentiometers R1 and R2 were joined to the chassis and resistors R3, R4 and R5 were mounted immediately under the valveholder.

Stability and smoothing of H.T. supply received attention (Fig. 3) in an effort to keep hum level at a

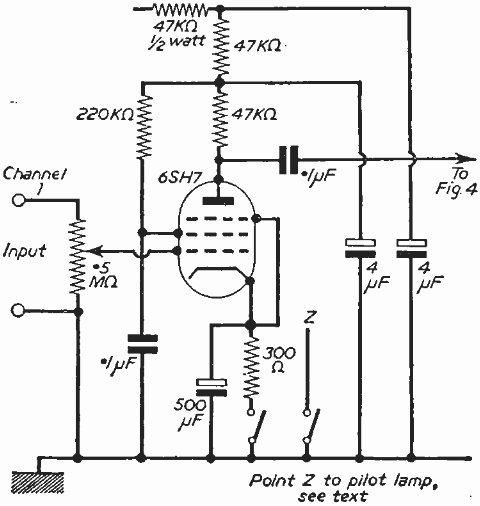


Fig. 3.—Channel I input.

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minimum: Channel I having higher gain than Channels II and III.

The three channels are ultimately brought together to give a single input to the amplifier proper (Fig. 4).

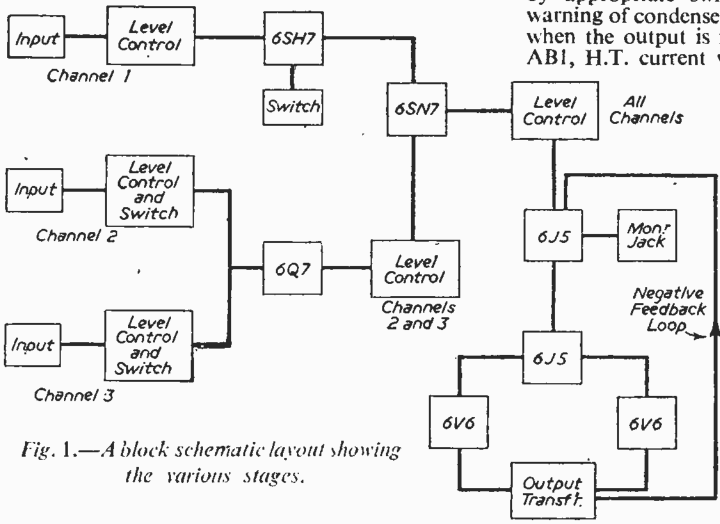


Fig. 1.—A block schematic layout showing the various stages.

The 6SN7 gives a slight stage gain, and the output from it, using a magnetic pick-up on Channels II and/or III, will fully load the amplifier.

For those who, like the writer, like a lot of gain in hand, a 6Q7 valve would do well in place of the 6J5 before the phase-splitter stage. (The writer's amplifier has now been modified to use a 6Q7 valve in place of the 6J5 to increase the stage gain.)

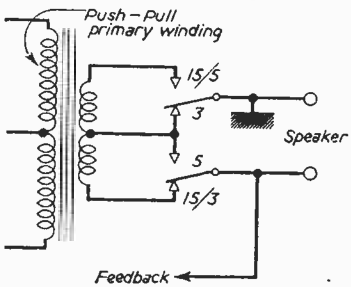
Refinements

Optional output impedance (Figs. 5a and 5b) for speaker networks of 3-5-15 ohms is available. The output transformer was made by a well-known firm of radio dealers, and is the ordinary push-pull 6V6 to 3 or 15 ohms type.

The extra matching to 5 ohms is achieved as shown. No mis-match is audibly noticeable when the 5 ohm output setting is used with two 3 ohm speakers joined in series. Care is taken to ensure that the speakers are phased properly.

A meter is incorporated in the writer's unit (Fig. 6) and both H.T. voltage and current can be measured by appropriate switching. Current reading gives warning of condenser failures, and is useful in showing when the output is fully loaded (i.e., push-pull class AB1, H.T. current varies).

The switches at the inputs of Channels II and III (Fig. 2) are of the single-pole change-over type; in the "On" position the chassis connection is transferred from short-circuiting the input to one side of the filament supply—the other side being connected to chassis. Channel I, however, used a double-pole single-throw switch (Fig. 3). One pole is used for the channel pilot lamp circuit and the other is in series with the cathode bias resistor. The cathode decoupling or by-pass condenser is of 500 μF and the effect when the channel is switched off is a slow automatic fade-out, a useful feature when one has perhaps to cope with three turntables and follow a script.



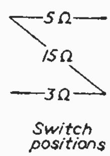
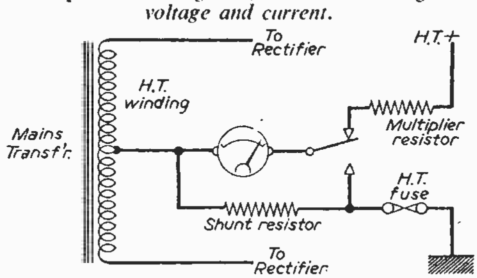


Fig. 5 (a) (above, left).—Output transformer switching, 3-5-15 ohms. Fig. 5 (b) (above, right).—Switch positions. Fig. 6 (below).—Metering H.T. voltage and current.



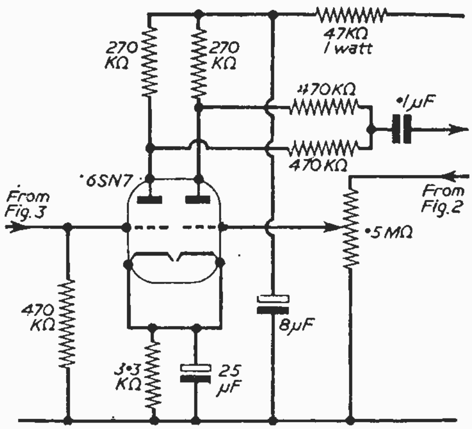


Fig. 4.—Mixer Channels I, II and III.

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10 watt } 25 ohms—10,000 ohms 1/6
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15,000 ohms—33,000, 5 w., 1/9; 10 w. 2/3

WIRE-WOUND POTS. 3W-LAB. COLVERN, Etc. Pre-set Min. T.V. Type. Knurled Slotted Knob. All values 25 ohms to 30 K., 3/- ea. 50 K., 4/-. Ditto Carbon Track 50 K., to 2 Meg., 3/-. Standard Size Pots, 2¼in. Spindle. High Grade. All Values. 100 ohms to 50 K., 5/6; 100 K., 6/6. **W/W EXT. SPEAKER CONTROL** 10 Ω, 3/-.

O/P TRANSFORMERS.—Standard Pentode, 4/6; ditto tapped prim., 4/9; small pentode, 3/9; Midget battery pentode (3V4, etc.), 4/6.

LF. CHOKES 10 h. 65 ma., 5/-. 20/25 h. 100/150 ma., 12/6. 10 h. 120 ma., 10/6. 15 h. 100 ma., 10/6. **LYNX.** 3h. 250 ma., 13/6. **SIMPLEX.** 10h. 150 ma., 10/6. **MAINS TRANS.**—Made in our own workshops to high grade specification. Fully inter-leaved and impregnated. Tapped prim. 200 v./250 v., Heater Trans., 6.3 v., 1½ amp., 7/6; ditto 6.3 v., 3 amp., 10/6; ditto, 12 v., .75 amp., 7/6; 350-0-350, 80 ma., 6.3 v., 4 a., 5 v., 2 a., ditto 300-0-300, ditto 250-0-250. 25/-. Viewmaster Auto Type, 35/-. Simplex 35/-. **P/W TAPE DECK,** 22/6. P/W Quality Radiogram (Morley), Mains Trans., 35/-. L.F. Choke, 13/6. Output Trans., 35/-. **AMPLIFIER TRANS.** 250 v. 50 ma. ½ wave, 6.3 v. 2 a. Fully shrouded, 17/6. Specials to requirements.

SOUNDMASTER SPECIALS.—Mains Trans., 35/-. L.F. Choke, 10/6. O/P Trans., 6/6. Envelope, 6/6. Specified Wafer Switches, 22/6 per set of 3.

SOLON SOLDERING IRONS (200-220v. or 230/250v.) 25 watt, instrument type, 19/6; 65 watt, Pencil Bit Type, 25/-; 65 watt, Oval Bit Type, 23/-. Comprehensive stock of spares available.

C.R.T. HEATER ISOLATION TRANSFORMER.—Low leakage winding with or without 25% sec. boost. Ratio 1:1 or 1:1.25, 2 v., 10/6; 4 v., 10/6; 6.3 v., 10/6; 12 v., 10/6. Ditto, with Mains Prim., 200/250 v., 12/6. Specials to order.

CRYSTAL DIODE.—Very sensitive. G.E.C., 2/-.

V'HOLDERS.—**Pax**: Int. Oct., **4d.**; EF50, EA50, **6d.**; B12A CRT, 1/3. **Moulded**: Int. Oct. **7d.**; B7G, **9d.**; with screening can, **1/6**; B8A, B8G, B9A, **1/-**; VCR97, **2/6**; **Ceramic**: EF50, B7G, 1/-. **ENG.** and **AMER.** 5-, 7- and 9-pin, etc., 1/-.

TAG STRIPS.—2- or 3-way, **3d.**; 4- or 5-way, **3d.**; 6-way, **4d.**; 9- or 10-way, **6d.**, etc.

TOGGLE SWITCHES EX-GOVT.—"On-off," **9d.** Ersin M'core solder 60/40. 16 g., **4d.** yd.; 18 g., **3d.** yd., **3/-** per ½ lb. T.C. wire, 18 to 22 s.w.g., **2d.** yd., PVC Connecting wire, 10 colours. Single or Stranded. **2d.** yd.

SLEEVING.—Various colours. 1 mm. and 2 mm., **2d.** yd. 3 mm. and 4 mm. **3d.** yd. 6 mm. **5d.** yd. **4 B.A.** or **6 B.A.** Nuts, Bolts and Washer Kits, ¼ in., ⅜in., or ½in., **1,-** per doz.

FUSES.—1¼in. all values 60 ma. to 10 a., **4d.**

ALADDIN FORMERS and cores, ⅜in., **8d.**; ⅜in., **10d.**

SLOW MOTION DRIVES.—Epicyclic ratio 6 : 1, **2/3.**

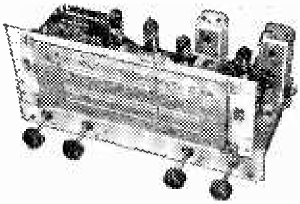
INT. OCTAL CABLE PLUG (8-pin), with cover, **1/3.**

200-250 Volt SELECTOR SOCKET (2in. x 1in.) with **Plug, 1/-. PILOT LAMPS.**—6.3 v. .3 a., **8d.**

SPEAKER FRET.—Expanded anodised metal. 8in. x 8in., **2/3**; 12in. x 8in., **3/-**; 12in. x 12in., **4/3**; 12in. x 16in., **6/-**; 24in. x 12in., **8/6.**

MAINS DROPPERS.—Silicone coated, with 2 slider clips. .15 amp. 1,500 ohms (2¼in. x ⅞in.). **4/3** ea.; .2 amp 1,000 ohms (2¼in. x 1¼in.), **4/3** ea.; .3 amp. 1,000 ohms (2¼in. x 1¼in.), **4/9** ea.; .3 amp. 750 ohms non-coated (3¼in. x 1¼in.), **4/6** ea.

LINE CORD. .3 amp. 60 ohms per foot, .2 amp. 100 ohms per foot, 2 way, **6d.** ft.; 3 way **7d.** ft.



ALL WAVE RADIOGRAM CHASSIS
THREE WAVEBANDS FIVE VALVES

S.W. 16 m. —50 m. LATEST MIDGET
M.W. 200 m.—550 m. B.V.A.
L.W. 800 m.—2,000 m. SERIES.

Brand New and Guaranteed. A.C. 200/250 v. Four position Wavechange Switch. Short-Medium-Long-Gram. Slow Motion Tuning. Speaker and Pick-up connections. High Q iron-dust cored coils, 465 kc/s I.F. Latest circuit technique, delayed A.V.C. and Negative feedback. Output approx. 4 watts. 3 ohms output transformer on chassis. Chassis size 13½ x 5½ x 2¼in. Glass Dial—10in. x 4½in. horizontal or vertical type available, lit by 2 Pilot Lamps. Colour Black Station names, L.W. Green, M.W. Red, S.W. White. Four Knobs supplied. Walnut or Ivory to choice, aligned and calibrated. Chassis isolated from mains. PRICE **£9.15.0** Carriage and Insurance, 4/6.
8in. or 10in. speakers to match available.

RADIO CHASSIS KIT

All components available for building up Chassis as per illustrated photo above. Drilled and punched chassis 13½in. x 5½in. complete with fixing brackets, backplate and dial 10in. x 4½in., Tuning Drum, Pulleys, Pointer Spring, Drive Cord, etc., **22/6.** P. & p. 2/6. Mains Trans., **22/6**; I.F. Trans., **10/6** pr.; Twin Gang, **8/6**; Coils, **2/6** ea., etc., etc.

BARGAIN VALUE IN RECORD CHANGERS

Recommended for above chassis

B.S.R. MONARCH. 3 sp. Auto Changer, Plays Mixed 7in., 10in. and 12in. records. Twin Sapphire Stylus. As used by leading Radiogram Manufacturers. Brand new, boxed and guaranteed. Listed, £16/10/-. Our Bargain Price 10 gns., carriage 4/6. **Plessey 3-speed Autochanger Mixer Unit for 7, 10 and 12in. Records. Twin Hi-Fi Xtal Head with Duopoint sapphire stylus. Plays 4,000 records. Sprung mounting. Superb Quality. Bargain Price 9½ gns.**

NEW BOXED VALVES ALL GUARANTEED

1R5	7/6	6Q7	8/6	EF41	10/6	MU14	8/6
1S5	7/6	6SN7	9/-	EF50		PCC84	12/6
1T4	7/6	6V6	7/6	Mullard	10/-	PCF80	12/6
1S4	7/6	6X4	8/6	EF50		PCF82	12/6
3S4	8/-	6X5	8/-	Equip.	5/6	PL81	12/6
3V4	8/-	12AH8	11/6	EF80	10/6	PL82	10/-
3D6	3/6	EA50	2/-	EF85	12/6	PL83	12/6
5Z4	8/6	EBC41	10/6	EF91	8/6	PY80	11/-
6AM6	8/6	EB91	7/6	EL41	11/6	PY81	12/6
6AT6	8/6	EBC33	8/6	EL84	12/6	PY82	10/-
6CH6	10/6	ECC83	12/6	EM80	12/6	SP41	5/6
6H6M	3/6	ECH42	10/6	EY51	12/6	SP61	6/6
6K7	6/6	ECL80	12/6	EZ40	10/-	U22	8/6
6K8	9/-	EF39	7/6			U25	12/6

Huge Stock B.V.A. Valves at 1951 low tax prices.

SPECIAL PRICE PER SET
1R5, 1T4, 1S5 and 3S4 or 3V4... ... ... 27/6
6K8, 6K7, 6Q7, 6V6, 5Z4 or 6X5 ... ... 35/-

3 VALVE AMPLIFIER

With variable Tone and Volume controls. 3 Midget B.V.A. valves. 4 watts output. Neg. feedback. Chassis isolated from Mains. A.C. 200/250 v. A quality amplifier at an economical price. PRICE **£3.19.6.** Carr. 2/6. Wired and tested, 7/6 extra. Circuit and instr. free.

WAVECHANGE SWITCHES.—Midget type, single wafer. 2 pole 2-way, 3 pole 2-way, **2/6** ea.; 1 pole 12-way, 2 pole 6-way, 3 pole 4-way, **3/6** ea.; 4 pole 2-way, 4 pole 3-way, **3/6** ea.

2 WAFER TYPE.—5 pole 4-way, **6/9.**

CONDENSERS.—Mica, S. Mica, Ceramics. All pref. values. 3 pf. to 680 pf., **6d.** ea., **5/-** doz. **Tubulars,** 450 v., Hunts and T.C.C. .0005, .001, .005, .01, .02 and .1 350 v., **9d.** .05, .1 500 v. Hunts Moldseal, **1/-**. .25 Hunts, **1/6.** .5 Hunts, **1/9.** .1 1,500 v. T.C.C. (Simplex), **3/6.** .001, 6kV., T.C.C., **5/6**, .001 12.5 kV. T.C.C., **9/6.**

SILVER MICA CONDENSERS.—10%.
5 pf. to 500 pf., **1/-**. 600 pf. to 3,000 pf., **1/3.**

DITTO 1% (ex stock).
1.5 pf. to 500 pf., **1/9.** 515 pf. to 5,000 pf., **2/-.**

ELECTROLYTICS ALL TYPES NEW STOCK

Tubular Wire ends
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50/50 v., 4/500 v. **2/-**
8/500 v., Dub. **2/6**
8 + 8 500 v. Dub., **4/6**
8 + 16 450 v. Hunts **5/-**
16/450 v. B.E.C. **3/6**
16 + 16/450 v. T.C.C. **5/6**
32/350 v. B.E.C. **4/-**
32/500 v. Dub. **5/-**
32 + 32/350 v. B.E.C. **5/6**
32 + 32/500 v. Dub. **7/6**
Can Types, Clips, 3d. ea.
8 + 8/450 v. T.C.C. **4/6**
8 + 16/450 v. Hunts **5/-**
8 + 16/500 v. Dub. **5/6**
16 + 16/450 v. B.E.C. **5/6**
16 + 16/500 v. Dub. **6/-**
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32 + 32/450 v. B.E.C. **6/6**
60/350 v. B.E.C. **6/6**
60 + 100/350 v. **11/6**
60 + 200/275 v. **12/6**
100 + 200/275 v. B.E.C. **12/6**
1500/6 v. B.E.C. **4/6**
1000 + 1000/6 v. B.E.C. **6/6**
500 mfd. 12 v. **3/-**

SENTERCEL RECTIFIERS. E.H.T. TYPE FLY-BACK VOLTAGES.—K3/25 2 kV., **4/3**; K3/40 3.2 kV., **6/-**; K3/45, 3.6 kV., **6/6**; K3/50 4 kV., **7/3**; K3/100 8 kV., **12/6**; K3/160 14 kV., **18/-**. **MAINS TYPE.**—RM1, 125 v., 60 ma., **4/-**; RM2, 100 ma., **4/9**; RM3, 120 ma., **5/9**; RM4, 250 v. 275 ma., **16/-.**

ENGRAVED CONTROL KNOBS for ¼in. Spindle. 1½in. diam. Walnut or Ivory, Gold Filled. "Focus," "Contrast," "Brightness," "Brilliance," "On-Off," "Brilliance—On-Off," "Record-Play," "Vol.—On-Off," "Volume," "Tuning," "Tone," "Wavechange," "Treble," "Bass," "S.M.L. Gram," "Radio-Gram," **1/6** ea. Plain knobs to match above, 1¼in., **10d.** ea., 1½in. dia., **8d.** ea. Superior Unmarked Knobs with Gold Ring. Walnut or Ivory, 1½in., **1/-** ea.; 1in., **9d.** ea. Pointer Knobs, Black, with White Line, **9d.**

WEARITE "P" TYPE COILS. All ranges. 1 to 7. **2/6** ea. Osmor Q Series Coils. Slug tuned. All ranges from **3/6.** Allen Coils L. M., S. Aerial and Osc. Dust core tuned. **2/6** ea.

REACTION COND.—.0001, .0003, .0005 mfd., **3/6 ea.**

I.F. TRANSFORMERS. 465 K/cs.

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ALUMINIUM CHASSIS.—18 s.w.g. Plain, undrilled, folded 4 sides and riveted corners lattice fixing holes. Strong and soundly constructed with 2½in. sides. 7in. x 4in., 4/6; 9in. x 6in., 5/9; 11in. x 7in., 6/9; 13in. x 9in., 8/6; 14in. x 11in., 10/6; and 18in. x 16in. x 3in., 16/6.

CHARGER TRANS.—Prim. 200/250 v., Sec. 0-9 v.-15 v. (for charging 6 v. and 12 v.) 1.5 a., **13/6**; 2a., **16/-**; 3 a., **18/6**; 4 a., **21/-**; 6 a., **26/-.**

FULL WAVE BRIDGE SELENIUM RECTIFIERS.—6 or 12 v. 1½ amp., **8/9**; 2 a., **11/3**; 2½ a., **12/-**; 4 a., **15/6**; 6 a., **23/6.** 12 v. ½ a. F.W. only, **4/6.**

CARBON MIKE INSERT.—Superior quality type 2¼in. x 1in. Brand new and boxed only **3/6** each.

BRIMISTORS.—CZ1 for .3a heater chains, **3/6.** CZ2 for .15 a., or .2 a., **2/6.** CZ3 (Pilot Lamp), **1/6.**

COPPER ENAMEL WIRE.—¼ lb. 14 to 20 s.w.g., **2/-**; 22 to 28 s.w.g., **2/6**; 30 to 40 s.w.g., **3/6.**

SWITCH CLEANER Fluid, squirt spout, **3/9** tin.

TWIN GANG TUNING CONDENSERS.—375 pf. Midget, **6/6**; ditto, with dust cover and trimmers, **8/6**; .0005 mfd. Standard size with feet, **8/6**; ditto, with trimmers, **9/3.**

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LOUDSPEAKERS P.M., 3 OHM.
Richard Allen, 5in., **16/6**; 6in. Goodmans, with trans., **21/6**; 6½in. Goodmans, **17/6.** 7in. Elliptical, **18/6**; 8in. Goodmans, **18/6**; 8in. Elac., **20/-**; 10in. Plessey, **25/-**; 12in. Plessey, **37/6.**

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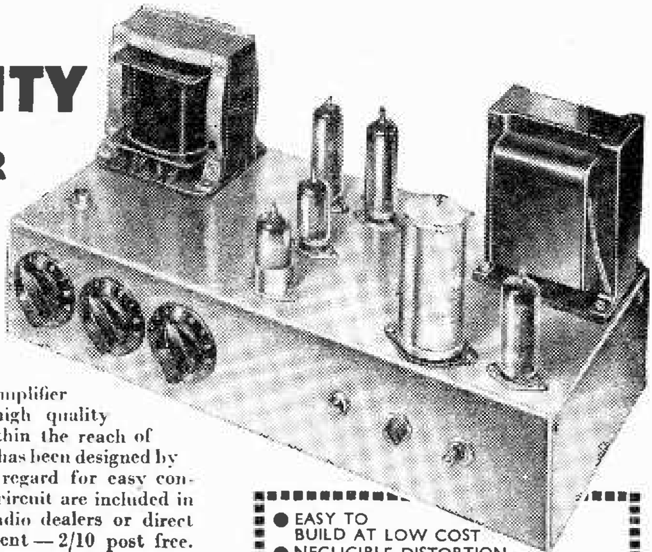

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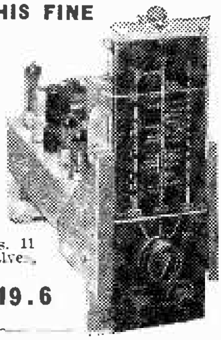
SAVE POUNDS ON THIS FINE 6-valve RADIOGRAM CHASSIS



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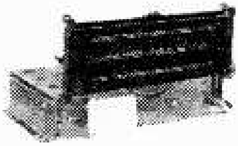
Carr. & Pkg. 7/6 extra.

SPECIAL OFFER • DRILLED CHASSIS & DIAL ASSEMBLY



Chassis, 13½ x 7 x 2½in., drilled for five latest type miniature valves, mains trans., I.F., etc. Dial, 13 x 4in., for horizontal or vertical mounting. Spin wheel tuning. All pulleys and spindle supplied.

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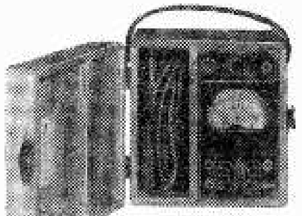

1,000 ohms per volt. Basic movement 400 micro-amp., 3in. AC/DC 0-5,000 v. 0-1 amp. 11 switched ranges; 100,000 ohms and 1 meg., also decibel range. In polished wood carrying case (6 x 6½ x 4in. closed), with leather handle and space for test leads.

LASKY'S PRICE **95/-** Post & Ins., 3/6.
BATTERY 6d. extra. TEST LEADS, 3/6 extra.

FOR PERSONAL PORTABLE CONSTRUCTORS

SETS OF 4 VALVES
Set 1. One R5, T4, S5 and 3S4. Price 27/6. Post 1/6.
Set 2. One DK96, DF96, DAF96, DL96 Price 39/6. Post 1/6.

CONDENSERS.—.1, .001, etc. ....Each, 7½d.
25 mfd., 25 volts 1/6
8 mfd., 150 volts 1/-
Post extra.

GANGED CONDENSERS.—(.0005 mfd.)
2-gang, with trimmers, 7/6
2-gang, less trimmers, 6/6
3-gang, less trimmers, 10/6
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3-in. P.M. SPEAKERS, 12/6.

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Med. wave, 5in. long, 8/9.
Dual wave, 8in. long, 12/6.
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OSC. COILS.—Iron dust cores. Medium wave, HO2, 3/-. Long wave, HO1, 3/-. Post extra.

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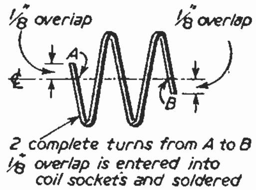
Modifying the R1132A

COIL DETAILS AND A POWER PACK



Coil Details.

FOLLOWING publication of details for this conversion in the March issue, we have received a number of queries concerning the new coil data. Above will be seen a sketch of the coils which are required, in which from A to B is two complete turns, with a ⅛in. addition at each end for insertion into the soil sockets, where they are soldered. This covers all the coils.

I have since modified the receiver to include a power pack, details of which are now given. As will be seen from Figs. 1 and 3, T1 is mounted on top of chassis, to the rear. V1 (5Z4) is mounted centrally between T1 and the voltage stabiliser. In Fig. 3 the choke CH can be seen mounted on the rear drop of chassis, directly under the mains transformer. Smoothing condensers C1 and C2 are mounted on the front drop of the chassis, directly under the 5Z4 and stabiliser. Also in Fig. 3 the mounting positions of F1, F2, SW1, SW2 can be seen, which are on the front panel proper. SW1, SW2 are the Bulgin types which are mounted sideways owing to lack of space. Fig. 2 shows the arrangement of F1, F2, SW1, SW2. Rubber grommets are used where leads pass through chassis. H.T.+ is connected to H.T.+ side of output transformer, and HT − connected to the nearest earthing tag. 6.3v. is connected to the nearest valveholder. This modification was carried out in four hours. All holes can be drilled without dismantling anything. A series of holes will need to be drilled in the case for ventilation. An aluminium screen is fitted between T1 and the rectifier, bolted to the chassis to help dissipate away the heat generated by the 5Z4, as this is considerable. The 6J5 output valve could be left in place by the reader who does not need the increased output, as this valve loads a 5in. speaker satisfactorily. An 11 K 10 watt resistor in the H.T. + would lower the H.T. volts to a suitable value. The bias resistor and condenser in this case should be left unmodified. The approximate frequency of this modified version is 85 mc/s to 123 mc/s. — L. H. Cox.

LIST OF COMPONENTS

T1—350-0-350, 150 mA, 5 v. 2 a., 6.3 v. 4 a.	SW1—D.P.S.T. } Bulgin
CH—150 mA, 500Ω.	SW2—S.P.S.T. } Type
C1 } 16+16μF, 500 v.	F1 } Panel Type Holders.
C2 } wkg.	F2 }
V1—5Z4G.	F1—1 amp.
	F2—250 mA.

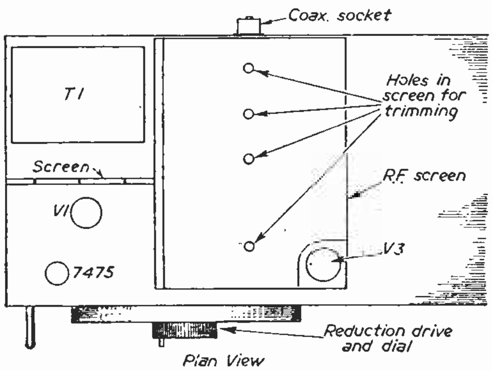


Fig. 1.—Top chassis lay-out.

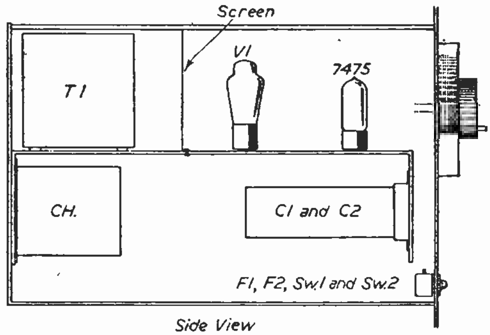


Fig. 3.—Side view of chassis.

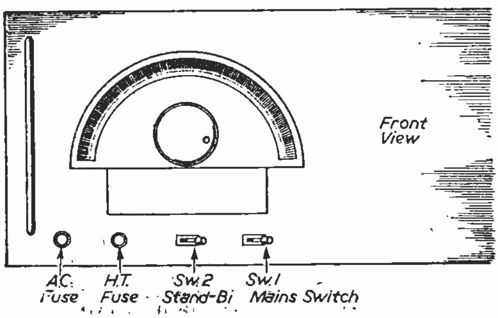


Fig. 2.—Front panel view.

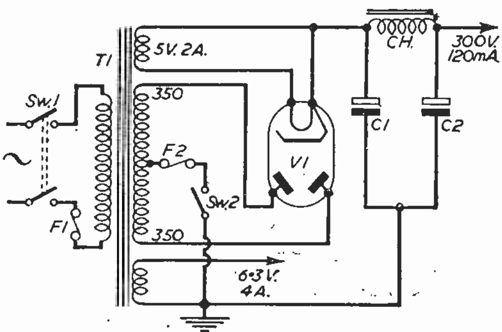


Fig. 4.—Theoretical circuit.

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A Case of Modulation Hum

By J. H. H.

READERS engaged in radio servicing may be interested in the following account of a case of modulation hum.

A customer living within 40 miles or so of the Daventry transmitter installed a good amplifier for record reproduction and to this he added a two-band tuner. After this addition he complained of a hum on the Home programme, moderate hum on the Third and reported no trouble on the long-wave Light. Everything pointed to modulation hum, for the tuner took its power from the main amplifier and this, by itself, was dead quiet.

Accordingly a deputy with suitable condensers was sent off with instructions to wire the condensers across the rectifier. He was gone for some considerable time and on his return reported that, though he had tried all the variants shown in Fig. 1, the result was merely to transfer the hum, now marked, to the long-wave band. As this could hardly be regarded as a piece of successful servicing, further condensers were provided, the instruction this time being to connect them in any of the ways shown in Fig. 2. The method shown at (b) was later reported as giving the best results, but the capacitance had to be over 1 μF for a worthwhile reduction of hum and the on/off switch then gave trouble through arcing.

The cure had by now become a matter of prestige and was accordingly placed in the hands of an experienced man. For a proper understanding of what he found Fig. 3 is needed. The shaded areas are internal brick walls, the thick line indicates 7/.029 T.R.S. cable run under the floor and not in conduit, while the dotted line shows the run of the aerial. R1 and R2 are 2 kWh heaters.

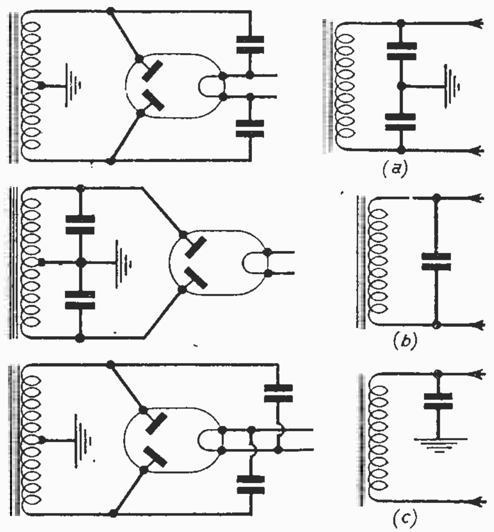
The expected hum was found on the long waveband when the set was switched on. An investigation of aerial and earth sockets showed them to be in order, so the lighting switches were operated in an effort to find the source of the induction. The only result was the usual slight click until R1 was switched on, when the hum vanished completely and reappeared again when R1 was switched off. The fittings, connections and insulation of the heater and the outlet were in order and the switch was properly wired in the live lead. The earth wire was also effective, but when the plug from R1 was removed operation of the switch had no effect on the hum.

The course of the supply cable was traced and this revealed the presence of the second heater R2 also in proper order and also effective in removing hum when switched on. Capacitors were therefore tried across various parts of the circuit with the final result that a value of 0.02 μF directly across the switch gave an adequate reduction of hum.

This seemed at variance with the fact that the earth pin of each plug was effective, until tests showed a difference of nearly nine volts between the local and the mains earth. This might indicate the presence of sufficient impedance at R.F., particularly as the cable length was very nearly that of the seventh harmonic of the transmitter. The condenser was accordingly moved to the junction box end of the cable and proved equally effective when wired to the phase lead and the local earth. This is a much better arrangement because there can be no possibility of even a slight shock when the switch is in the off position.

A final look round the system showed that the amplifier was earthed via the conduit to the mains earth so most of the hum must have been induced from the aerial. This seemed to indicate that most of the R.F. was being conveyed by the phase lead so that when this was effectively earthed by switching on R1 or R2 the induction ceased.

That completed the job. No hum remained on either band and there was a barely noticeable drop in signal strength that was more than compensated by the lack of hum. But why the hum was transferred from one band to the other in the first place we simply do not know!



Figs. 1 & 2.—By-pass connections for the transformer secondary. The connections tried on the primary.

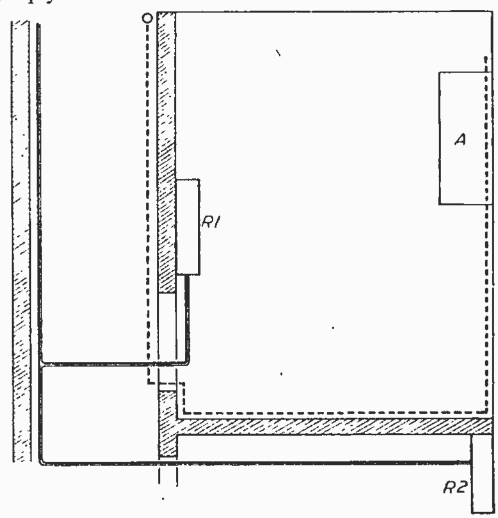


Fig. 3.—The layout of cables, heaters and amplifier and the run of the aerial.

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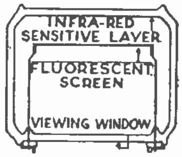

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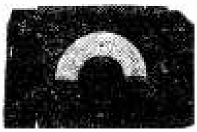

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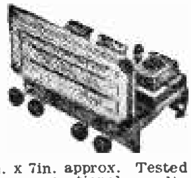

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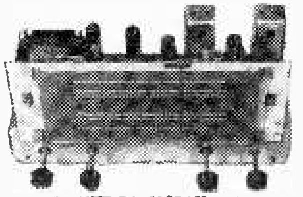

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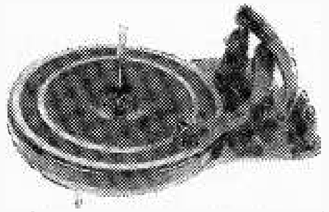

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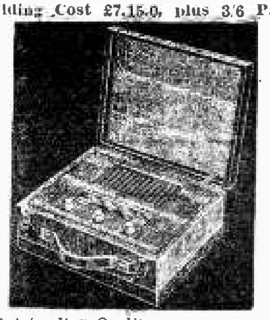

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A Dial Modification

A SIMPLE ADAPTATION TO ENABLE A DIAL SETTING TO BE ASCERTAINED BY TOUCH

By W. Nimmons

THIS dial modification was the result of expediency. It was found, when I was laid up by illness, that a certain amount of difficulty was experienced in selecting the Home, Light and Third Programmes by touch. That is, one never knew what part of the dial the pointer was at in the darkness of the bedroom. To add to my difficulties, the receiver was placed on a small table behind my head. I determined, therefore, as soon as I was up and about again I would see what could be done to circumvent the difficulty.

The result is eminently satisfactory, and should be of particular use to blind persons, since one can tell by feel what part of the dial the pointer is at.

I should mention that the scheme is applicable to those receivers which have a celluloid or glass front on the dial. It is nothing more or less than an extension of the pointer to the outside of the celluloid or glass, so that one can tell by the touch just where it is located. Stops or pointers can be placed at the main stations.

The first thing to do, if the dial has a celluloid front, is to cut a slit right along its length, or at least as far as the pointer travels. Examine the escutcheon to see if it can be taken off, exposing the loose celluloid. It may be necessary to remove the chassis. If the celluloid can be taken right out and laid on the workbench it is a simple matter to cut the slit ; otherwise it will have to be cut in situ. With a sharp pointed knife make two scores ¼in. apart in the direction of travel of the pointer, for the requisite distance. Continue scoring until the material is cut through.

When the front is of glass it will be necessary to divide the glass into two separate parts ; these can then be spaced ¼in. apart to give the slit. There is usually sufficient play in the holder for this to be done. If the glass is engraved with station names, etc., choose a part which gives the least dislocation when cutting the glass lengthways.

If it is found that the glass is no longer secure in its holder, strips of cardboard glued at the extreme ends (still preserving the slit) will make all secure. Tighten the screws holding it in place so that it will not rattle.

Pointer Extension

Next it will be necessary to fit the small extension to the pointer which will carry it out beyond the glass. Most pointers are of metal, painted black, so they should be easy to solder ; but if you should strike one made of a material other than metal it will have to be glued. The length of this extension cannot be given ; some pointers are just behind the glass while others are a quarter or even half an inch behind it. It may happen that an extension ¾in. long may be clear of the glass on the outside ; it should project at least ¼in.

The extension itself may be made of brass rod of about 2 B.A. thickness, with a slot cut in each end. The slot in one end is to fit over the pointer for soldering, while the slot in the other end is for an indicator on the outside of the glass, which will be mentioned later.

Scrape or sandpaper the paint off the pointer at a spot exactly opposite the slit in the glass and tin the metal, then solder the end of the extension to this point. This should, of course, be done with the chassis out of the cabinet. The slot at the pointer end of the extension, by the way, should be at right angles to the slot at the other end, for reasons which will be explained later. When the extension is soldered to the vertical pointer the chassis should be returned to the cabinet, making sure that the extension is projecting through the slit in the glass or celluloid.

Now that we have some indication which, by tactile methods tells us where the pointer is set, the rest belongs to the domain of refinements. We can attach an elongated indicator extending to top or bottom of the dial, and place stops or small excrescences out of the area of its travel, either fastened to the escutcheon or simply stuck on the glass. These will doubtless be determined by the nature of the material on hand, but a practical solution is depicted in Fig. 1. By this it can be seen that the indicator (not to be confused with the original pointer incorporated in the receiver) is in close proximity to one of the three cone-shaped stops which indicate the positions of the Home, Light and Third Programmes respectively. These can be fashioned from wood, bakelite or similar light material and simply stuck in place. The tuning knob, is of course operated to tune in the desired station in the usual way.

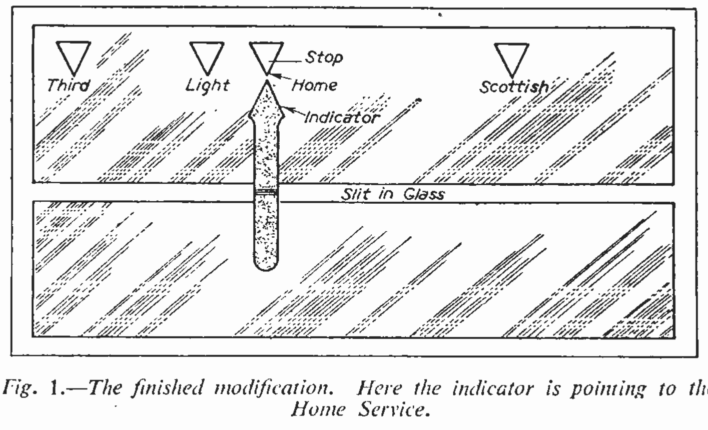

Fig. 1.—The finished modification. Here the indicator is pointing to the Home Service.

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The method of fastening the elongated indicator to the 2 B.A. rod previously mentioned should be one that puts no unwonted strain on the cord which carries the pointer of the receiver. This can be done easily enough by soldering it on, but a better way is illustrated by Fig. 2.

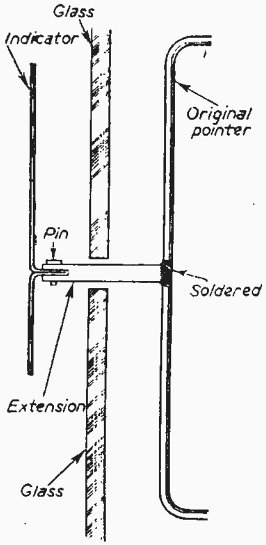

Fig. 2.—Extension Details.

Indicator

The indicator in this case consists of thin metal strip, suitably shaped, and pinched in the vice or pliers to form a projection at right angles which can be accommodated in the slot cut in one end of the 2 B.A. rod. In this case the rod should have a small hole drilled at this end before cutting the slot. The projection on the indicator should also have a hole of the same diameter drilled through its double thickness. When inserted in the slot the indicator will probably be somewhat loose, but a pin which can be freely inserted (and as freely withdrawn should the receiver need servicing !) can be inserted through the hole in the 2 B.A. rod. This pin can be made somewhat broader at the top end to prevent it falling out. The slot in which the indicator is accommodated is at right angles to the slot at the other end of the extension piece, for while the slot in the end which is soldered to the original pointer is vertical, the slot accommodating the indicator is horizontal.

Another way of attaching the indicator is by means of a metal collar and grub screw. But in view of the fact that the cord drives of the older receivers are notoriously very difficult to repair once they get out of order the above method, is preferred since the act of tightening the grub screw might upset things.

A further refinement would be the glueing of a small patch of felt or velvet to the underside of the indicator if it rubs against the glass in its travel ; this will prevent rattling at loud volume or on certain notes of the piano.

It is not pretended that this dial modification will enable the blind and the sick to tell by a touch to which station the receiver is tuned, apart from the " recognised " stops. Nevertheless it is of some small help in these cases and an improvement over existing receivers.

NOTE.—*If it should happen that the original pointer is connected to chassis, suitable precautions should be taken to guard against shock from A.C./D.C. receivers. In this case the extension should be of insulating material, or the indicator be made of bakelite or similar stuff.*

International Radio Controlled Models Society

THE International Radio Controlled Models Society has pleasure in announcing that its annual international contests for radio controlled models will be held this year in the north-east of England on Saturday, Sunday and Monday, July 30th, 31st and August 1st respectively.

Due to the large number of entries received last year, it has been decided to spread the contest for radio controlled boats over two days and these will be the 30th and 31st July. The contest will take place at Saltwell Park, Gateshead-on-Tyne, and will be split into three classes :

A. Model boats with any form of power.
B. Model yachts.
C. I.C. or steam driven model boats—points being awarded for steering only with a bonus for speed.

The radio controlled model aircraft competition will be held at Croft aerodrome, nr. Darlington, on Monday, 1st August in conjunction with the S.M.A.E. Northern Gala and will be split into classes for power driven aircraft and gliders. In the power driven class, a separate prize will be offered this year for aircraft controlled through a single channel, i.e., not tuned reeds, audio or similar systems. This is planned to encourage those competitors who have not progressed to the more complex systems.

Entrance forms, copies of the rules and further information will be available shortly.

For any further particulars readers should contact the Hon. Contest Publicity Secretary, D. W. Aldridge, 1, Fowberry Crescent, Fenham, Newcastle-on-Tyne, 4.

Technical Training Scheme

First Students Ready for Radio Industry

THE first of the students who entered three-year technical training courses started in 1952 are now about to enter the radio industry.

The courses were organised by the Ministry of Education, following consideration of training problems by the Radio Industry Council's Technical Training Committee and the Radar Sub-committee of Lord Hankey's Technical Personnel Committee, at five London and provincial centres. These are the Bolton Technical College, Manchester Road, Bolton ; the Coventry Technical College, The Butts, Coventry ; and. in London, Northern Polytechnic, Holloway Road, N.7 ; Norwood Technical College, King's Hill. West Norwood, S.E.27, and E.M.I. Institutes, Ltd., Pembridge Square, W.2.

The object of the courses is to provide students so well trained in the theory and practice of electronics that they will be able, on completion, to take their places at once as assistants to qualified research and development engineers.

Entry age is between 16 and 18 normally (although older candidates will be considered). While the appropriate examinations of the City and Guilds of London Institute, the Institution of Electrical Engineers and the British Institution of Radio Engineers can be taken in the courses, the syllabuses are wide in their general scope in addition to giving specialised training in radio engineering and electronics.

In most cases successful completion of the course carries a diploma.

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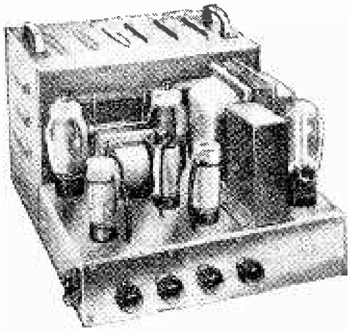
R.S.C. A4 HI-FIDELITY 25 WATT AMPLIFIER

A new design for 1955. "Push-Pull" output. "Built-in" Tone Control Pre-amp. stages. Increased sensitivity. Even further improved performance figures. Includes 7 valves, specially designed sectionally wound output transformer, block paper reservoir condenser and reliable small condensers of current manufacture. TWO SEPARATE INPUTS CONTROLLED BY SEPARATE VOLUME-CONTROLS allow simultaneous use of "Mike" and Gram., or Tape and Radio, etc., etc. INDIVIDUAL CONTROLS FOR BASS AND TREBLE "Lift" and "Cut." Frequency response ±3 db. 30-30,000 c/c. Six negative feedback loops. Hum level 66 db. down. ONLY 20 millivolts INPUT required for FULL OUTPUT. Certified harmonic distortion only 0.35% measured at 10 watts. Comparable with the very best designs.

ENTIRELY SUITABLE FOR SMALL HOMES OR LARGE HALLS, CLUBS, GARDEN PARTIES, DANCE HALLS, etc. etc. For ELECTRONIC ORGAN or GUITAR. For STANDARD or LONG-PLAYING RECORDS. FOR ANY "MIKE" or PICK-UP. **9 GNS.**

H.P. TERMS ON ASSEMBLED UNITS. DEPOSIT **26/-** and ten monthly payments **20/-**.



Size approx. 12-9-7in. For A.C. mains 200-230-250v. 50 c/cs. Outputs for 3- and 15-ohm speakers. Kit is complete to last nut. Chassis is fully punched. Full instructions and point-to-point wiring diagrams supplied. Unapproachable value at **9 Gns.** or ready for use, **50/-** extra. Carriage 10/-. If required, cover as illustrated can be supplied for **17/6**.

R.S.C. 10 WATT "PUSH-PULL" HIGH-FIDELITY AMPLIFIER A3

Ideal for the quality enthusiast in the home or small hall. Two different inputs can be simultaneously applied and controlled by separate volume controls. Any kind of Pick-up is suitable and most microphones. Tone controls give full Long Playing record equalisation for uncorrected Pick-ups. Sensitivity is very high. Only 130 millivolts required for full output. H.T. and L.T. available for Radio Feeder unit.

Complete with integral Pre-amp. Tone control stage (as A4 amplifier), using negative feedback, giving humproof individual bass and treble lift and cut tone control. **Six Negative Feedback Loops.** Completely negligible hum and distortion. Frequency response ± 3 db. 30-20,000 c.p.s. Six valves. A.C. mains 200-230-250 v. input only. Outputs for 3 and 15 ohm speakers. Kit of parts complete in every detail, plus 7/6 carriage. Or ready for use, **45/-** extra. **7 GNS.**

Illustrated leaflet **6d.** Cover as for A4 is suitable. H.P. TERMS ON ASSEMBLED UNITS. DEPOSIT **£1/13/4**, plus 7/6 carriage, and nine monthly payments **£1.**

A PUSH-PULL 3-4 watt HIGH-GAIN AMPLIFIER FOR £3/7/6. For mains input 200-250 v. 50 c/s. Complete kit of parts including circuit, point to point wiring diagram, and instructions. Amplifier can be used with any type of Feeder Unit or Pick-up. This is not A.C./D.C. with "live" chassis, but A.C. only with 400-0-400 v. trans. (Output is for 2-3 ohm speaker.) Supplied ready for use for **25/-** extra. Carr. 2/6. Descriptive leaflet, **7d.**

PLESSEY 3-SPEED MIXER AUTO CHANGER. Takes 7in., 10in. and 12in. records, standard or long playing. Crystal Pick-up with Duo-point sapphire stylus changed from standard to long playing position by simple switch movement. For A.C. mains 200-250 v. 50 c/cs. Limited number. Brand New, cartoned, at only **10 gns.**, carr. 5/-.

BATTERY SET CONVERTER KIT. All parts for converting any type of Battery receiver to All Mains. A.C. 200-250 v. 50 c/cs. Kit will supply fully smoothed H.T. or 120 v. 90v. or 60 v. at up to 40 mA. and fully smoothed L.T. or 2 v. at 0.4 to 1 a. Price, complete with circuit, wiring diagrams and instructions, only **48/9.** Or ready to use, **8/9** extra.

PERSONAL SET BATTERY SUPERSEDER KIT. A complete set of parts for construction of a Unit (housed in metal case) to replace Batteries where A.C. Mains supply is available. Input 200-250 v. 50 c/s. For 4 valve receivers requiring 90 v. 10/20 mA. and 1.4 v. 250 mA., fully smoothed. Price complete with circuit. Only **35/9.** Or ready for use, **42/6.** Size of unit, 5¼ x 4 x 1¾in.

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For mains 200-250 v. 50 c/s.
To charge 6 v. acc. at 2 a., **25/6.**
To charge 6 or 12 v. acc. at 2 a., **31/6.**
To charge 6 or 12 v. acc. at 4 a., **49/9.**
Above consist of transformer, full wave rectifier, fuses, fuseholders and steel case. Any type assembled and tested, **6/9** extra.

THE SKYFOUR T.R.F. RECEIVER. A design of a 3-valve 230-250 v. A.C. Mains receiver with selenium rectifier. It consists of a variable Mu high gain H.F. stage followed by a low distortion anode bend detector. Power pentode output is used. Valve line up being 6K7, SP61, 6F6G. Selectivity and quality are well up to standard, and simplicity of construction is a special feature. Point to point wiring diagrams, instructions, and parts list, **2/6.** This receiver can be built for a maximum of **£4/19/6** including attractive Brown or Cream Bakelite or Walnut veneered wood cabinet 12 x 6¼ x 5½in.

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6/12 v. 1 a.	4/9	250 v. 80 mA	7/9
6/12 v. 2 a.	8/9	RM4 250 v. 250 mA	11/9

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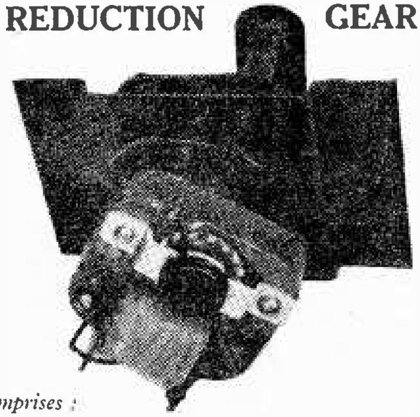

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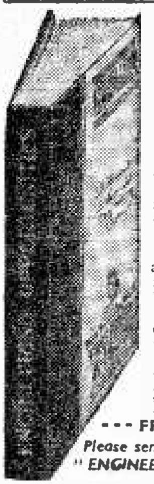

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V.H.F. 1125 SET, 7/9.—New and boxed. This little set is a V.H.F. receiver. Requires a little modification to put it into service. Complete with valves. Post 2/-.

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12in. TV TUBES, £5.—14in., **£8/10/-** ; 17in., **£12/10/-**. GUARANTEED SIX MONTHS. Ins. Carr., 15/6. C.W.O. 12in. Mullard, 6 mth. guarantee : other makes 3 mths. guar.

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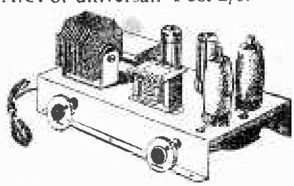
AMPLIFIERS, 57/6.—3 valve, 4 watt output, A.C. or universal. Post 2/6.



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2½d. stamp only for complete catalogue.

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News from the Trade

A New H.F. Point Contact Transistor

THE General Electric Company, Ltd., has developed a new high frequency germanium point contact transistor known as type EW51. Its main value is in pulse circuits (e.g., amplifying, forming and shaping of pulses) and it is therefore of considerable importance in the field of digital computers. Used as a pulse amplifier, its speed of response is such that, if the rise time of the input waveform is 0.05 microsecond, the rise time of the output waveform is less than 0.15 microsecond (usually less than 0.10 microsecond).

If the input waveform does not cause the transistor to "bottom" (a condition of high collector current, low collector voltage, in which further increase in the amplitude of the input signal does not increase the amplitude of the output signal) the fall time of the output waveform will be approximately equal to the rise time. If bottoming occurs, the fall time will be increased because of the "hole storage" effect; the actual increase will depend on the degree of bottoming and the duration of the pulse.—General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.

"Osmor" Coil Type QA81 (½ Cup)

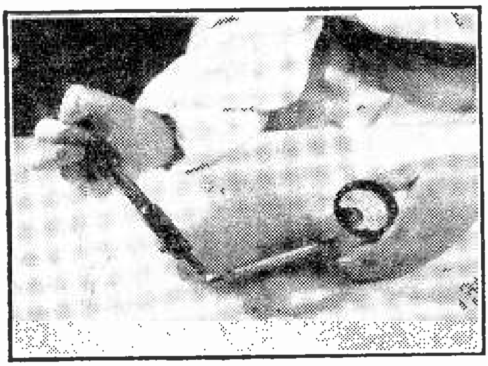
THIS is the aperiodic or mutual-inductance coupling type of medium wave superhet coil. The appropriate oscillator coil is QO8. Only the half-cup is employed with this type of coil to obtain optimum inductive coupling which is not possible with the full iron-dust cup, owing to the cup forming an inductive seal. The half-cup provides the required inductive coupling and may be so placed in a circuit for the half-cup to act as an electrostatic screen, and thus eliminate or minimise the amount of other screening required. The "Q" factor of these coils is considerably higher than normal and they are, therefore, particularly useful in the search for selectivity when losses for selectivity are usually inevitable.—Osmor Radio Products, Ltd., 418, Brighton Road, South Croydon, Surrey.

Multicore Introduce Solder Thermometer

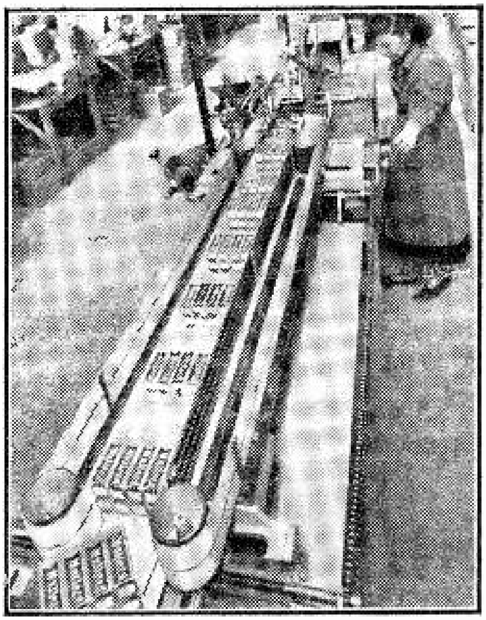
A RECENTLY introduced item by Multicore Solder is a solder thermometer.

The instrument is completely self-contained and comprises a meter movement which is connected to a thermo-couple mounted at the end of a tube attached to the meter. A scale is graduated in degrees Centigrade and Fahrenheit and the maximum temperature to which the instrument should be subjected is 400 deg. C. (752 deg. F.).

The solder thermometer will be supplied direct by Multicore to factories already using Multicore Solder at a net price of £6 12s. 6d. Delivery is stated to be approximately two months.—Multicore Solders, Ltd., Multicore Works, Maylands Avenue, Hemel Hempstead, Hertfordshire.



The new Multicore Solder Thermometer in use.



The Mullard machine which automatically wraps the valves in cellophane.

New Cellophane Wraps for Mullard Valves

AS from April 1st, a new valve carton wrapping system was brought into operation by Mullard, Ltd. Valves will be cellophane wrapped in batches of six or twelve, according to size of carton.

The new system is designed to overcome, as far as possible, inconvenience and time waste.

The advantage of the new cellophane wraps will primarily be felt by those who normally order valves in large quantities.

To obtain maximum benefit from the new system, they have only to order stock in multiples of six or twelve. A new type of availability sheet, issued at the end of March, indicates which valves are wrapped in batches of six and which in batches of twelve. There is, of course, no obligation to order in these quantities.

A special machine which automatically wraps the valves in cellophane packets has been installed at the Mullard Valve Service Department, Waddon, Surrey.

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Programme Pointers

Our Critic, Maurice Reeve, Reviews Some Recent Programmes

Music Notes

WEBER'S music has always had a fascination for me. Lacking the majesty of Beethoven and the peerless beauty of Mozart, it nevertheless has a charm all its own. It is redolent of its time and possibly that is why it is not great as the two aforementioned masters and Schubert are great. But it has sweetness, dignity and character, whilst the "Invitation to the Waltz" is unrivalled in its own sphere.

Five Saturday morning programmes have been given of his piano music which were wholly delightful. The pianists, Ronald Jones, Liza Fuchsova and Paul Hamburger (duettists), Natalia Karp, Natasha Litvin and Robin Wood, brought out the full flavour and sentiment of the music.

Music Magazine has fallen off a lot lately. Truth to tell, I suppose all the really original and thought-provoking subjects have been exhausted, leaving little left over. After all, the compilers went through music with a pretty fine toothcomb and the result has been some mighty fine programmes. Now, with a constant stream of "profiles" of current virtuosi, and such items as "The Things They Teach," etc., it looks as though the "What can we give them next week?" stage has been reached.

Egyptian Pyramids

"The Mountains of Pharaoh," the Arab name for the Egyptian pyramids, made an attractive programme about the greatest of the seven wonders of the ancient world. Many were the quotations from famous explorers and travellers. So many, in fact, that it was all the stranger that there was no mention of Lord Carnarvon's and Mr. Howard Carter's opening of Tutankhamen's tomb which made the headlines in 1922-23. Some of the voices reading the excerpts were, as they always are in these programmes, sanctimonious sounding and stuffed-shirtish, but it was a pleasing programme none the less. It was written and produced by Leonard Cottrill.

Is it necessary or desirable for the announcer to preface the Light Programme at 9 a.m. with the remark, "White rabbits, white rabbits, white rabbits. Ladies and gentlemen, here begins another day of broadcasting"? Surely, it couldn't raise a smile even among the youngest or silliest children?

The gentle art of being in two places at once is not given to many people. Its accomplishment, even on the BBC, must be very rare. But it is not surprising that that most versatile comedian Vic Oliver performed it recently, being on both the Home Service and the Light Programmes simultaneously. It was on a Saturday evening, in the weekly *Music Hall*, and as the "beat the expert" visitor in "What Do You Know?" at 8 till 9 p.m. and 8.30 till 9 p.m. respectively. Mr. Oliver, the comedian, was his usual gifted self. On Mr. Oliver, the "serious musician," being cross-questioned on Schubert's Unfinished Symphony we will draw a veil.

"The Key of the Garden," by Naomi Mitchison and Lewis Gielgud, is a pleasant play about the events which led up to the Crucifixion, culled from the Gospels. Merely a narrative, it would be unfair to accuse it of what it was never meant to be—a play of ideas. It contained some fine acting by a longish cast. The thunderstorm which in the story accompanied the End was frightfully artificial; each peal of thunder was an exact replica of the preceding one.

Calling Miss Courtneidge is a weekly series as good as most now running. Cicely herself is very versatile and on the last occasion I heard it did sketches with Graham Stark, Victoria Campbell and Donald Wolfit. This programme can be recommended.

During the football season *Sports Report* and *Sports Parade* are excellent programmes for the football fan every Saturday and I am full of admiration for Eamonn Andrews, who conducts them. But if only he would "cut his own cackle" by half, how much more could be covered and how much pleasanter it would be! He tells us regularly that there is hardly time to cover all that is due to be covered, yet he talks on and on and on, all of it irrelevant, irritating and time wasting. I am glad to see that the absurd weekly "competition" has apparently been dropped.

Plays

Marcel Pagnol's "Marius," a delightful French confection set in the great seaport of Marseilles, came over excellently in Barbara Bray's translation and radio adaptation in the *Monday Night Theatre* series. Telling of the love of a charming girl for a fellow whose love for the sea, she is convinced, is greater than his feelings are for her, and who renounces her happiness in consequence, it has most of the ingredients of a first-class radio play. "Fanny" and "Caesar"—the other chief characters—form a trilogy of plays which I hope we shall soon hear. Patric Boonan, Carol Marsh, James Hayter, Frank Atkinson and others gave it a salty and reasonably Frenchy atmosphere.

We can trust Emlyn Williams to maintain our interest and sustain the excitement throughout a play and his "Someone Waiting," in *Saturday Night Theatre*, was no exception. How the father of an innocent man, wrongly hanged, got his own back gripped me to the end. Richard Williams took the place of Laidman Browne and he and James Thomason, Catherine Salkeld, Martin Starkie, Miriam Karlin and Pamela Gordon, etc., thoroughly curdled our blood.

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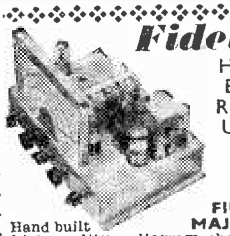

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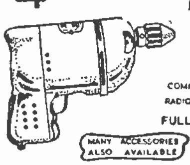

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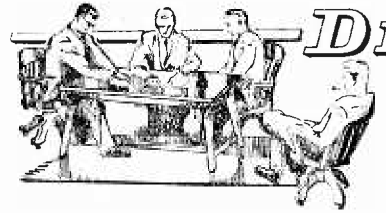

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Whilst we are always pleased to assist readers with their technical difficulties, we regret that we are unable to supply diagrams or provide instructions for modifying surplus equipment. We cannot supply alternative details for receivers described in these pages. WE CANNOT UNDERTAKE TO ANSWER QUERIES OVER THE TELEPHONE. If a postal reply is required a stamped and addressed envelope must be enclosed with the coupon from page iii of cover.

Cathode Follower

SIR,—With reference to the number of letters published in your magazine recently from O. G. Kirslake (Orpington), I would like to point out that the circuit which he loosely describes as "cathode follower output" is nothing like a cathode follower.

This kind of circuit (cathode follower), as most people know, has a low impedance output and a gain of less than unity, but he matches his speaker to the valve and uses the normal O/P. transformer; after that he says that the output is as great, if not greater, than with the normal arrangement.

The cathode follower is designed to have a low impedance output which he doesn't take advantage of, and if, as he says, he uses a cathode follower, then why doesn't he dispense with the output stage altogether? He should be better off.—E. W. BONES (L.A.C.) (St. Annes).

S.W. Bands

SIR,—The editorial of the March issue of PRACTICAL WIRELESS refers to the fact that "the so-called short-wave band has never proved popular on commercial receivers."

Can anyone explain just why this should be?

Surely no one can say that nothing of interest is to be found on these lower wavelengths (19 m.–49 m.). From such stations as Australia, Canada, France, U.S.S.R., Switzerland, Germany, Sweden, the Vatican and Holland just about every taste in politics, religion, music and mood, etc., can find satisfaction. Admittedly, though some of these stations daily pollute the band with political propaganda, the majority prove of great interest and education. Most of these stations publish schedules of their broadcasts monthly or quarterly or every six months, and some of these make very interesting reading.

However, the popular belief appears to be that from these "names on the dial" nothing is to be obtained but unintelligible jabber! Why is it that so many are ignorant of the fact that most of these stations operate a round-the-clock service in English with musical request programmes, competitions and information services?

Can it be that many still regard the controls of a radio set as being as sacred as the seal on the gas meter?—BRIAN E. BALDWIN (Bradford).

Time Checks

SIR,—I read with interest Mr. J. F. B. Elder's letter in PRACTICAL WIRELESS for May, concerning the lack of frequent time checks.

In a similar manner my job also entails the re-setting of radio beacon clocks on light vessel.

I would like to point out that these vessels, heard on trawler band, use M.F., so do not have receivers covering W.W.V. station, on approximately 2 Mc/s, nor GBIRS station, nor Rugby on 2.5, 5, 10, 15 Mc/s, so this method is not practical.

The procedure I use is to synchronise, first, a stop-watch with the BBC time signal 1300 or 1800 daily. On arrival on board the light vessel, the timing contacts of the special clock can be set to the stop-watch at any hour of the day or night.

On shore the radio beacon can be checked daily by listening on the appropriate wave band, again using the stop-watch.—E. A. VALENTINE (Dundee).

Tape Amplifiers

SIR,—Some time ago you were good enough to answer some queries regarding the tape amplifiers. I have only just found time to complete the modifications, and so have been somewhat tardy in writing to thank you and to say that these are very successful.

Altering the bias components produced a slightly larger output, but as I had previously used a lower value for R53 the audible results were not really noticeable.

I had provided switching for altering the equalisation in the recording amplifier, and the results are now quite good at 3¾ in. per sec. As a "purist" I doubt if I shall use this speed very much, but for some applications this is very useful.

I think you were right in saying I had become used to over-correction on L.P. It is surprising how quickly one gets used to a type of reproduction. I am now in the process of "re-educating" myself with the aid of a wide-range loudspeaker.

Following your March Editorial I have done a little computing to compare the cost of tape with gramophone. Aiming at similar standards there is not a great deal of difference in the cost of setting up. But in use, so far as popular "hit parade"

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numbers are concerned, the advantages are overwhelmingly in favour of tape. Sixty "popular" records, all bought in the last eighteen months, were examined and no less than 50 were bought for one side only. At 5s. 4½d. a time, this works out at approx. 4s. 6d. a number. I average 24 such numbers on a 1,200ft. reel (2 tracks, 7½in. per sec.). Even with Ferrotape at 45s. this works out at 1s. 10½d. per number, whilst with Easitape it is 1s. 6d. To this comparison must be added the facility of erasing and recording another item at no extra cost.

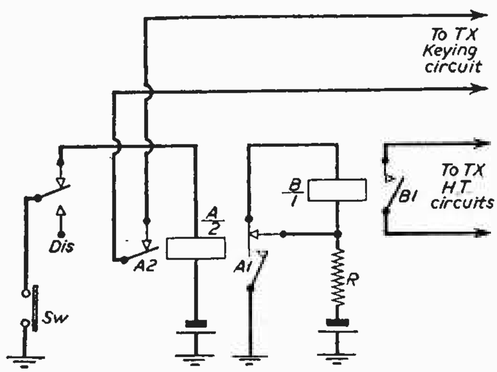
To the man with a taste for classical records, tape is not such a good proposition. The cost is roughly the same, with the added difficulty of having to wait for the right work to be broadcast, and the collector will not wish to erase.

Personally, I am completely sold on tape. I am still awaiting delivery of a second deck and will enjoy myself taking off what I want to keep.—A. A. WOMPRA (Conway).

Relays

SIR,—With reference to Fig. 14 of Mr. J. R. Davies's article on "Relays" in the May issue. Mr. Davies states further on in his article that two disadvantages exist on the use of this system for remote control of a transmitter : (1) An initial pulse is necessary to operate the B relay before keying ; (2) The transmitter is always on load when the H.T. is switched on.

In the hope that it may be of some use I submit



The diagram described by P. L. B.

the following suggested rearrangement, which, I think, will overcome these difficulties. Very briefly, the arrangement works as follows :

Use is made of a key with a contact made in the normal position. To switch on the H.T., switch is thrown to "on" which operates relay A. Contact A1 removes the short-circuit from B, and connects earth via a "make before break contact" which operates B. During keying relay A releases, and contact A2, releasing, completes the TX keying circuit, while A1 places a short-circuit across B, thus making it slow to release. Upon release of the key, A operates again, A2 disconnects the TX keying set, and A1 re-energises B again.

With this arrangement an ordinary relay can be used for B, and be made slow to release by placing a short-circuit across it. R prevents a short-circuit being put on the battery when A1 bunches.

Mr. Davies also states that "earth returns do not always give reliable results." I should like to point out that very extensive use is made in telecommunications of earth return for relay operation over considerable distances.—P. L. B. (Leominster).

The 6AG7

SIR,—I feel that the remark, "This circuit would no doubt be popular over here but for the fact that supplies of the 6AG7 are difficult, so that it is virtually unobtainable" (made by Mr. O. J. Russell in his article on "Overtone Crystal Circuits" in the May edition of PRACTICAL WIRELESS) should not be allowed to pass, since, if one refers to the advertisement columns of the same issue it will be found that this valve is advertised at a moderate price no less than three times.

It may also be of interest to readers to know that, whilst experimenting with this circuit (Fig. 2) in which the use of a 6AG7 is advised, I substituted an EF50, and using a "surplus" crystal rated at 2.115 Mc/s (without an aerial coupled to the oscillator) found that, by using the second harmonic of the oscillator frequency, a strong enough signal was radiated so as to produce a marked "fishtail effect" on a television receiver in the room above. Judging by this result, I think that it is a reasonable conclusion to draw that an EF50 would give a good output on most frequencies, working on either the fundamental or any harmonic up to the sixth. I hope this information will prove useful.—R. E. HALL (Moseley).

"Maximum Economy"?

SIR,—As a subscriber to your magazine for a number of years, I cannot help but notice the apparent policy of, as it were, "maximum economy."

I appreciate that in these days of high costs, etc., none of us are able to delve too expensively into our hobby. However, I feel that economy can be overdone.

The amplifier outlined in the June issue is a case in point. Can a *good* audio amplifier be built for £5, using valves designed for V.H.F. circuitry? Further, the eight-valve radio-gram chassis recently described uses air-cored tuning coils. Surely it is worth an extra pound or so to take advantage of all the improvements to be gained from dust-cores.

It is my experience that for a slight increase in outlay, a far greater degree of success is assured for most items of equipment for home construction. I feel I am echoing the sentiments of a large section of the amateur fraternity when I quote the old cliché—"Don't spoil the ship, etc."—J. R. MADLEY (Fife).

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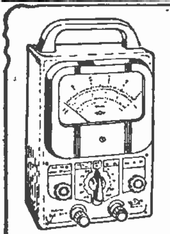

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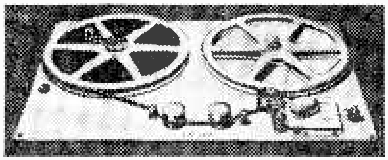

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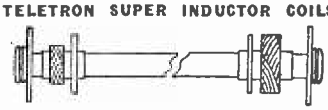

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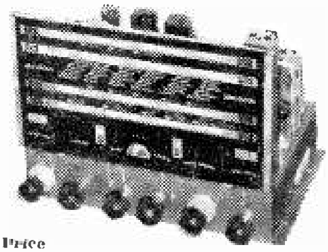

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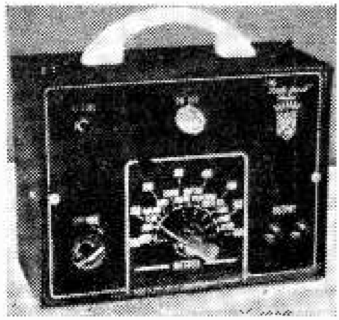

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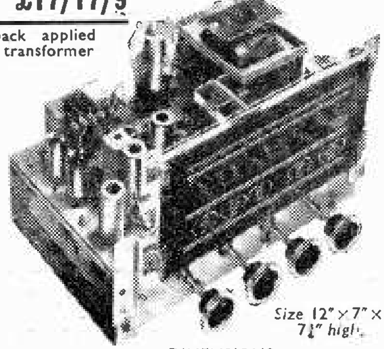

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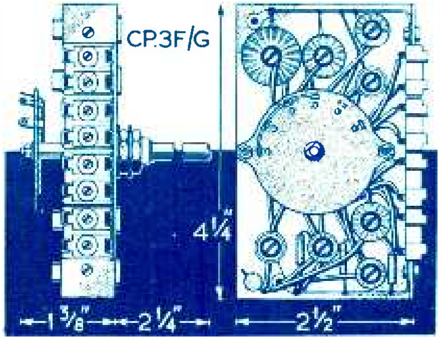

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