EXPERIMENTAL MICROPHONES

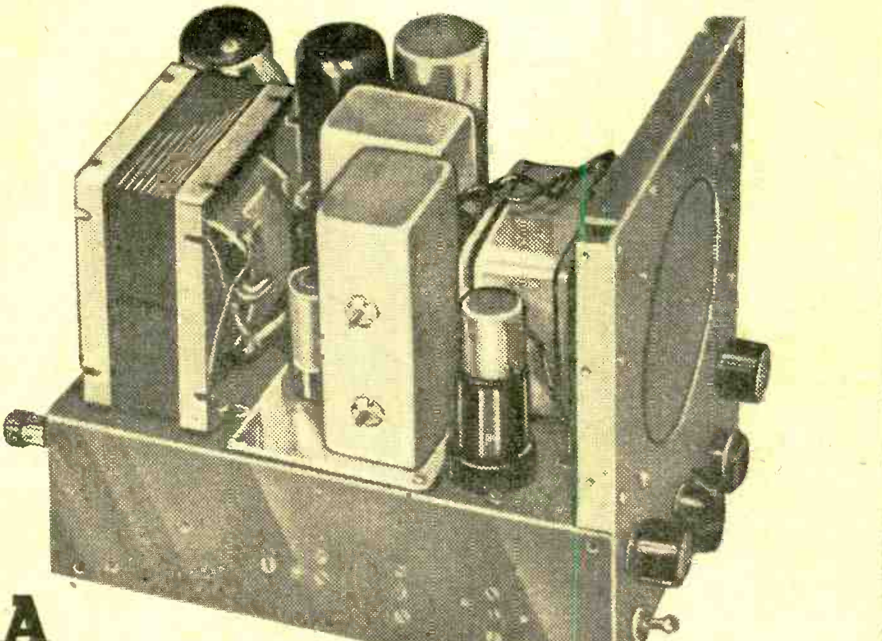
1/-

Vol. 30 No. 571

MAY, 1954

EDITOR: F. J. CAMM

PRACTICAL WIRELESS



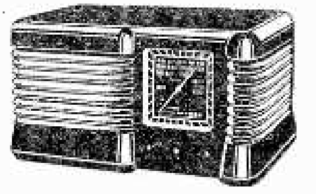
A PRE-SET A.C. Receiver

IN THIS ISSUE:

CABINET as illustrated, 11½ x 6½ x 5½in. in walnut or cream, complete with T.R.F. chassis, 2 waveband scale, station names, new waveband, backplate, drum, pointer, spring, drive spindle, 3 knobs and back. 22/6. P. & P. 3/6.

As above with Superhet Chassis 23/6. P. & P. 3/6.

As above complete with new speaker to fit and O.P. trans., 35/-. P. & P. 3/6, with Superhet Chassis, 36/-. P. & P. 3/6.



Used metal rectifier, 230 v. 50mA., 4/6; gang with trimmers, 6/6; M. & L. T.R.F. coils, 5/-; 3 Govt. valves, 3 v. hand circuit, 6/6; heater trans. 6/-; volume control with switch, 3/6; wave-change switch, 2/-; 32 x 32 mfd. 4/-; bias condenser, 1/-; resistor kit, 2/-; condenser kit, 4/-.

M & L Superhet Coils with circuit, 6/6; iron cored 465 IF's, 7/6; min. gang, 5/6; volume control with switch, 4/-; wave-change switch, 2/6; heater trans., 7/6; 4 v.h. 1/6; 4 Ex Govt. valves, metal rectifier and Xtal diode with circuit, 14/6; 25 x 25 mfd., 1/-; 16 x 16 mfd., 3/3; condenser kit (17), 7/6; resistor kit (14), 3/6.

Used 5 valve A.C. mains 200/250 3-waveband superhet. Complete in outstanding walnut cabinet, size 22 x 14 x 10½in. Valve line up, 6K8, 6K7, 6B8G, 6F6 and U50 rec., 8in. P.M. speaker. In first-class working order. £7/19/6. P. & P. 12/6. We have a few of these in A.C./D.C., price as above.

All dry A.C. mains battery unit, 200/250 v. Metal case size 8 x 5 x 3in., by famous manufacturer incorporating Westinghouse metal rectifiers, 3/500 mfd. 16/24 mfd. mains trans., 3 smoothing chokes, output 90 v. 10 mA., 1.4 v., .25 amp. P. & P. 2/6. 39/6.

COMPLETELY BUILT SIGNAL GENERATOR

Coverage 120 Kc/s-320 Kc/s., 300 Kc/s-930 Kc/s., 900 Kc/s-2.75 Mc/s., 2.75 Mc/s-8.5 Mc/s., 8.5 Mc/s-25 Mc/s., 17 Mc/s-50 Mc/s., 25.5 Mc/s-75 Mc/s. Metal case 10 x 6½ x 4½in., size of scale 6½ x 3½in., 2 valves and rectifier. A.C. mains 230/250 v. Internal modulation 400 c.p.s. to a depth of 30%. Modulated or unmodulated R.F. output continuously variable 100 millivolts. C.W. and mod. switch, variable A.F. output and moving coil output meter. Black crackle finished case and white panel. £4/19/6. P. & P., 4/-.

Used resistance and capacity bridge in leatherette covered case, with carrying handle, size 12½ x 8½ x 6½in. 10 pf. to 100 mfd. in 3 ranges. 1 to 10 meg., 3 ranges, power factor check 200, 300, 400 and 500 volts flash test. Magic eye, rectifier and triode. These require re-checking. £3/19/6. P. and P. 4/-.

High impedance plastic recording tape by famous manufacturer, 1,200 feet complete on spool, 17/6. P. & P. 1/6. 600 feet 8/-. P. & P. 1/-.

Amplifier Case, black rexine covered, leather carrying handle, chrome plated corners, rubber feet, felt lined, detachable lid. External dimensions 13½ x 13½ x 9½in. £1. P. & P. 2/6.

Pr. 200/250 v., secondary 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20, 24 and 30 volt at 2 amps., 13/-.

Drop thro' 280-0-280, 200 mA. 6 v. 5 amps., 5 v. 3 amps. 27/6.

Heater Transformer. Pri. 230-250 v. 6 v. 1½ amp., 6/-; 2 v. 2½ amp., 5/-; 2, 4 or 6 v. at 2 amps., 7/6; 2 v. 2½ amp 5/-. P. & P. each 1/-.

R.I. MAINS TRANSFORMERS, chassis mounting, feet and voltage panel. Primaries 200/250.

300-0-300 80 mA. 6.3 v. 1 a., tapped at 4 v. 6.3 v. 2 a. tap 4 v. 13/6.

350-0-350 75 mA. 6.3 v. 3 a. tap 4 v. 6.3 v. 1 a. 13/6.

350-0-350 70 mA. 4 v. 5 a. 4 v. 2.5 a., C.T., 18/6. P. & P. on the above transformers 2/-.

500-0-500 125 mA. 6.3 v. C.T. 4 a. 6.3 v. C.T. 2 a. 5 v. C.T. 2 a., 27/6.

500-0-500 120 mA. 4 v. C.T. 4 a. 4 v. C.T. 1 a. 4 v. C.T. 2.5 a., 27/6.

500-0-500 250 mA. 4 v. C.T. 5 a. 4 v. C.T. 5 a. 4 v. C.T. 4 a., 39/6.

P. & P. on the above transformers 3/-.

32 mfd., 350 wkg.	2/-
16 x 24 350 wkg.	4/-
4 mfd., 200 wkg.	1/3
10 mfd., 450 wkg.	3/6
16 x 8 mfd., 500 wkg.	4/6
16 x 16 mfd., 500 wkg.	5/9
8 x 16 mfd., 450 wkg.	3/9
32 x 32 mfd., 350 wkg.	4/-
32 x 32 mfd., 350 wkg. and 25 mfd., 25 wkg.	6/6
25 mfd., 25 wkg.	11d.
250 mfd., 12 v. wkg.	1/-
16 mfd., 500 wkg., wire ends	3/3
8 mfd., 500 v. wkg., wire ends	2/6
8 mfd., 350 v. wkg., tag ends	1/6
50 mfd., 25 v., wkg., wire ends	1/9
100 mfd. 350 wkg.	4/-
100+200 mfd., 350 wkg.	9/6
16+16 mfd., 350 wkg.	3/3
Ex Govt. 8 mfd. 500 v. wkg., size 3½ x 1½, 2 for	2/6
60+100 mfd., 280 v. wkg.	7/-
16+32 mfd., 350 wkg.	6/-
50 mfd., 180 wkg.	1/9
65 mfd., 220 wkg.	1/6
8 mfd., 150 wkg.	1/6
60/100 mfd., 280 wkg.	8/6
50 mfd., 12 wkg.	11d.
32+32 mfd., min., 275 wkg.	4/-
50 mfd., 50 wkg. 8 mfd., wkg., wire ends	1/9
Miniature wire ends moulded 100 pf., 500 pf., and .001 ea.	7d.

Fully shrouded mains transformer, input 200/250 secondary 350-0-350 175 mA. 6.3 v. 7 amp., 5 v. 3 amp., p.p. 3/-, 35/-.

Fully shrouded pushpull transformer, PRI 6,000 ohms, SEC 15 ohms, p.p. 2/-, 20/-.

Fully shrouded choke, 15 Hen. 180 mA., p.p. 2/-, 15/-.

Fully shrouded choke, 5 Hen. 120 mA., p.p. 2/-, 8/6.

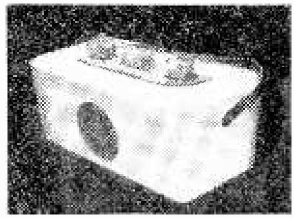
CONSTRUCTOR'S PARCEL, comprising chassis 12½ x 8 x 2in., cad. plated 18 gauge, v.h., IF and trans. cut-outs, backplate, 2 supporting brackets, 3 waveband scale, new wavelength station names. Size of scale 11½ x 4½in., drive spindle, drum, 2 pulleys, pointer, 2 bulb holders, 5 paxolin international octal valve holders, 4 knobs, and pair of 465 IF's, 16/6. P. & P. 1/9.

AS ABOVE, but complete with 16+16 mfd. 350 wkg. and semi-shrouded drop thro' 250-0-250 60 m.a., 6 v. 3 amp. Pri. 200-250, and twin-gang 31/6. P. & P. 3/-.

5in. M.E. field coil 750 ohms with O.P. trans. 17/6. P. & P. 1/-.

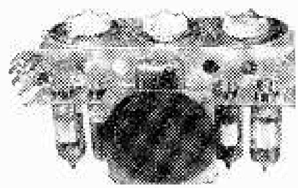
Germanium crystal diode, 2/3, post paid.

BATTERY CHARGER KIT, comprising metal case 5 x 4½ x 4½ trans. 230/250 v. and metal rec. Will charge 6 or 12 v. battery at 1½ amp., 19/6. P. & P. 2/6.



PERSONAL PORTABLE CABINET in cream-coloured plastic, size 7 x 4½ x 3in. Complete 4-valve chassis. Scale and 3 knobs. Takes miniature 90 v. and 7½ v. batteries. 10/-. P. & P. 2/-.

3in. P.M. SPEAKER to fit above, 10/-. Miniature output transformer, 5/-. Miniature wave-change switch, 2/-. Miniature 1-pole 4-way used as Volume and Off, 2/-. 4 B7G valveholders, 2/4. Midget twin gang ⅞in. dia., ⅝in. long and pair medium and long-wave T.R.F. coils ⅜in. long x ⅜in. wide; complete with 4-valve all-dry mains and battery circuit, 9/6. Condenser Kit, comprising 11 miniature condensers, 3/6. Resistor Kit, comprising 15 miniature resistors, 4/6. 25 x 25 mfd., 1/6. P. & P. 2/6. Valves to suit above 10/- ea. Point to Point Wiring Diagram 1/-.



View of chassis as it would look when assembled with valves inserted.

Extension speaker cabinet, in contrasting walnut veneers size 15 x 10½in. Will take 6½ or 8in. speaker, 17/6. P. & P. 2/-.

Volume Controls. Long spindle less switch, 50 K, 500 K, 1 meg., 2/6 each. P. & P. 3d. each.

Volume Controls. Long spindle and switch, ¼, ½, 1 and 2 meg., 4/- each; 100 K. and 50 K., 3/6 each. ½ and 1 meg., long spindle, double pole switch, miniature, 5/-. P. & P. 3d. each.

Standard Wave-change Switches, 4-pole 3-way, 1/9; 5-pole 3-way, 1/9. Miniature 3-pole 4-way, 4-pole 3-way, 2/6.

Valveholders. Paxoline octal, 4d. Moulded octal, 7d. EF50, 7d. Moulded B7G 7d. Loctal amphenol, 7d. Loctal pax., 4d. Mazda Amph., 7d. Mazda pax., 4d. B8A, B9A amphenol, 7d. B7G with screening can, 1/6. Duodecal paxolin, 9d.

Trimmers, 5-40 pf., 5d.; 10-100, 10-250, 10-450 pf., 10d.

Twin-gang .0005 Tuning Condensers, 5/-. With trimmers, 7/6.

Midget .00037 dust cover and trimmers, 8/6.

P.M. SPEAKERS	with trans.	less trans.
3½in.		13/6
5in.	16/6	12/6
6½in.	16/6	12/6
8in.	18/6	15/-
10in.		19/6

Post and packing on each of the above, 1/6 extra.

Truvox BX11 12 in. P.M. 3 ohm speech coil, 45/-. P. & P. 3/6.

Crystal pick-up with Sapphire Trailer Needle, with volume control, 23/-. P. and P. 1/-.

Terms of business: Cash with order. Dispatch of goods within three days from receipt of order. Where post and packing charge is not stated, please add 1/- up to 10/-, 1/6 up to £1, and 2/- up to £2. All enquiries and list, stamped addressed envelope.

D. COHEN,

RADIO AND TELEVISION COMPONENTS

23, HIGH STREET, ACTON, W.3. (Opposite Granada Cinema)

Hours of Business: Saturdays 9-6 p.m. Wednesdays 9-1 p.m. Other days 9-4.30 p.m.

Apology

TO

Partridge Transformers

LIMITED

It is deeply regretted by Messrs. D. Cohen that their advertisement in PRACTICAL WIRELESS, issues February and March, referred to transformers and chokes as being of "Partridge" manufacture. Messrs. D. Cohen wish to emphasise that this statement was incorrect and the transformers and chokes mentioned were *not* of Partridge manufacture.

Messrs. D. Cohen now learn that it is the policy of Partridge Transformers Ltd. that components of their manufacture are sold only by recognised dealers at the published list prices.

Messrs. D. Cohen wish to apologise to Partridge Transformers Ltd. for any inconvenience caused by this misrepresentation and, as stated above, hereby revoke any reference made to "PARTRIDGE" in the aforementioned advertisements.

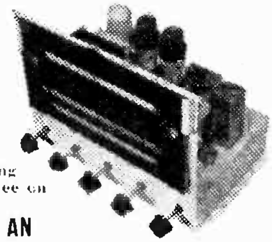
for 20 years

and more, there has been and still is

only one

Armstrong

THE F.C. 38
RADIOGRAM CHASSIS



An 8-valve superheterodyne chassis, giving 8 watts push-pull output with negative feedback and independent BASS and TREBLE LIFT and CUT CONTROLS. Wave range: 16-50 metres, 190-550 metres and 1,000-2,000 metres.

Price only £23.13.0 including tax. (Money back guarantee on every chassis supplied.)

MAKE SURE YOU HAVE AN 'ARMSTRONG' THERE IS NO SUBSTITUTE

Manufacturers of
the HIGHEST QUALITY radio chassis, amplifiers and radiograms.

ARMSTRONG** WIRELESS & TELEVISION **CO. LTD.
WARLTERS ROAD, HOLLOWAY, LONDON, N.7.
Telephone: NORth 3213/4

BARGAINS IN RADIO VALVES

EF50 4/- SP61 2/6 SP41 2/6
EA50 2/-

D1	2/-	EB34	2/-	VU111	3/-	VU133	3/-
EBC33	7/6	EF39	7/-	EF36	4/6	EF8	7/-
EF54	5/-	EF91	8/6	EL32	7/-	EK32	7/6
CV6	2/6	VR125	2/6	7193	3/-	CV63	5/-
FW4/500	8/6	5Z4	8/6	5Z3	8/6	5U4G	8/6
VU39	8/6	2X2	7/-	U22	7/-	6V6	8/6
6Q7	8/6	6K7	6/-	6J5(M)	6/-	6J5G	5/-
6K8	10/-	6SH7	6/-	6J7	7/6	6SN7	10/-
CV66	4/6	EC52	5/-	ECC32	7/6	ECC31	7/6
EB91	7/6	6BW6	8/-	6BW7	8/-	6AT6	8/-
IR5	7/-	IT4	7/-	IS4	7/-	IS5	7/-
3S4	7/6	Pen220	3/-	6AC7	7/6	954	3/-
955	5/-	TT11	6/-	HL2K	2/6	CV188	5/-

CONDENSERS.—Elect. B.E.C., W.E. 450 v. wkg. 8 mfd., **2/6**; 20 mfd., **3/6**; 8+8 mfd., **3/9**; 16/16 mfd., **4/6**.

DUBILIER.—500 v. 16 mfd., **3/9**; 32 mfd., **5/-**; 32 mfd.+32 mfd., **6/6**; 25 mfd. 25 v., **2/-**; 50 mfd. 50 v., **2/-**. T.C.C. .0001 pF., .001 pF., .15 pF., 25 pF., **6/-** dozen.

KNOBS.—6d. and 1/- each. Pye plug and socket, 1/- pair.

POTENTIOMETERS.—All values to 2 Meg., **2/6** each; ½ Meg. 100 K., 2 Meg. W Switch, **4/6** each.

CO-AXIAL CABLE.—80 Ω ¼in. dia., 8d. per yd.

VINER'S (Middlesbrough)

Radio ***Electrical***

26, EAST STREET, MIDDLESBROUGH
Telephone: MID 3418

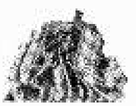
The solder for all HOME TELEVISION CONSTRUCTOR SETS

Designers of television constructor sets know that the efficiency of their equipment depends on the solder used by the constructor—that's why they recommend Ersin Multicore for trouble-free, waste-free soldering. Ersin Multicore, the only solder containing three cores of extra-active, non-corrosive Ersin Flux, is obtainable from all leading radio shops. Ask for Cat. Ref. C.16018, 18 S.W.G. 60/40 High Tin Television and Radio Alloy. The size 1 Carton contains 55 feet of solder, costs 5/-.

Ersin Multicore Solder

In case of difficulty in obtaining supplies, please write to:
MULTICORE SOLDERS LTD. MULTICORE WORKS, MAYLANDS AVE., HEMEL HEMPSTEAD, HERTS. • Boxmoor 3636 (3 lines).

... more than you BARGAIN FOR!



You get more out than you put in when you fit one of these really powerful units in compact form. OSMOR "Q" Range Coilpacks provide quality and performance right out of proportion to their midget size and modest cost. They have everything that only the highest degree of long practised technical skill *can* ensure—*extra selectivity, super sensitivity, adaptability.* Size only 1¾" x 3½" x 2¼", with variable iron-dust cores and polystyrene formers. Built-in trimmers. Tropicalised. *Prealigned,* receiver-tested and guaranteed. Only 5 connections to make. All types for Mains and Battery superhets, and T.R.F. receivers. Ideal for the reliable construction of new sets, also for conversion of the 21 Receiver. TR1196, Type 18. War-time Utility and others. Send to-day for particulars!

SEPARATE COILS

A full range is available for all popular wavebands and purposes. Fully descriptive leaflet and connection data available. Just note these 5 star features.

** Only 1in. high. * Packed in damp-proof containers. * Variable iron-dust cores. * Fitted tags for easy connection. * Low loss Polystyrene formers.*

4/- EACH

We keep stocks of many radio components for use in published circuits, including:

"PRACTICAL WIRELESS"
Coronet "FOUR." Beginners' Superhet. Modern High Power Amplifier 2: Attache Case Portable: R1155 Converter: A.C. Band-pass 3: Modern 1-Valver: 3-Speed Autogram, etc., etc.

"WIRELESS WORLD"
No Compromise T.R.F. Tuner. Midget Mains Receiver. Sensitive 2-Valve Receiver: Television Converter, etc.

MATCHED COMPONENTS
Various types of OSMOR Dials, Chassis, I.F.s, Speakers, Transformers, etc., to match our coils and coilpacks are all listed.

Dear Reader, *We can't mention all our products here, but shall be glad to receive your enquiries **for Chassis, Tuning Condensers, Switches, Volume Controls, and all other Radio Components.** If it's top quality components and a speedy, courteous service you are looking for—try Osmor. We really shall do our best for you.*

Trade Enquiries Invited

FREE! *Send 5d. (stamps) for fully descriptive literature including the really efficient 5-valve Superhet Circuit and practical Drawings. 6 valve ditto. 3 valve (plus rectifier) T.R.F. circuit. Battery portable superhet circuit. Coils and Coilpack leaflets. Chassis Cutter leaflet, and full radio and component lists, etc., etc*

OSMOR radio products ltd.
(Dept. P47) 418, Brighton Rd., South Croydon, Surrey. 'phone CRO 5148/9

Clydesdale Prices slashed

RECEIVER 6A.
Channel checking Unit working on 49-100 metres. Contains 5 VR91 (EF50), 1 6K8, 1 VR55 (EBC33), 1 VR53 (EF39) Valves. Thermal switch breaking at 85 degrees F., etc., etc., in metal case 8¼in. x 7in. x 10in.
Ask for P/H477A. **29/6** Carriage 2/6 extra

POWER UNIT TYPE 266. in Transit Case.
Input 80 v. 1.5K c.p.s., A.C. Outputs H.T. 120 v. D.C. bias 3 and 9 v., L.T. 2 v. Smoothed and stabilized. Complete with 5U4G valve VS110 stabilizer. 12 v. 1a metal rectifier, etc., etc., in attractive metal case with handles. Dim.: 11in. x 9¼in. x 7½in.
Ask for P/E570 **22/6** Each Carriage Paid

GLASS DOME INSULATOR
With Threaded Terminal Top and Metal Lead-through Rod. Dome dim: 2½in. x 1½in. high, lead-through projects 6½in. Overall length 9¼in.
Ask for P/H54 **2/-** Each Post 3d. extra

CERAMIC AERIAL SPREADER
Individually boxed. Length overall 11in., between centres 9¼in.
Ask for P/H718 **1/-** Per pair Post 3d. extra

Ex-R.A.F. V.H.F. CONTROL PANEL TYPE 3A.
Input 24 volts. D.C. Intercom. Control, contains 3 induction coils type 21A, 3 Retardation coils type 39A, 6 relays, type 26A tuning hand generator, type 25 twin bell set, plus plugger key switches, key switches, panel indicator lamps, etc., etc., Panel finished grey with handles. Unit dim.: 19in. x 11in. x 9in.
Ask for P/E947 **21/-** Each Carriage Paid

BLACK PLASTIC CHAIN AERIAL INSULATORS.
comprising 3 links, 3¼in. long, 1¼in. wide, each link. Total length 7¼in. A.M. ref. 10A 1275.
Ask for P/H525 **9d.** Per pair Post 2d. extra

AERIAL SYSTEM TYPE 62.
U.H.F. Antenna on streamlined moulding with VR92 (EA50) untuned detector stage. Overall dim.: 13in. x 4¼in. x 2¼in. Antenna 22.5 cm.
Ask for P/H496 **3/6** Each Post 9d. extra
Circuit 1/3 each.

WIRELESS REMOTE CONTROL UNIT D
No. 2, Mk. 2, ZA.20491. Wooden box 7¼in. x 6¼in. x 5¼in. with hinged lid, containing 3 relays, 1 make, 500 ohms, 1 make, 20 ohms and H.D. double-coil type 1,750 ohms coil makes, 200 ohms coil breaks, plus QMB switch and 8 brass terminals.
Ask for P/H803 **7/11** Each Post Paid

SUPPRESSOR UNIT 5C/870.
Contains 4 H.F. chokes and 4 Tubular Condensers, 0.1 mfd., 250 v., D.C., carrying 5 amps. (2 sets on each lead), each choke and condenser separately screened in compartments of Aluminium Alloy Box 4¼in. x 4in. x 2in., 4 hole fixing.
Ask for P/H907 **2/6** Each Post 1/- extra

STILL AVAILABLE
AS PREVIOUSLY ADVERTISED

R1155 RECEIVER UNIT
Reconditioned and tested, used, good condition. In transit case.
Ask for P/H916 **£8.19.6** Each Carriage Paid
Also R1155 as above, but Loose stored.
Ask for P/H898 **£5.19.6** Each Carriage 7/6 extra
Circuit and data 2/3.

T1154B TRANSMITTER UNIT in Transit Case.
Ask for P/E5A **39/6** Each Carriage 7/6 extra
Circuit 2/3.

RECEIVER UNIT TYPE 25
Ref. 10P 1L.
Part of TR1196. Range 4.3-6.7 mc/s.
Ask for P/H299 **35/-** Each Post Paid

WS-18 RECEIVER CHASSIS.
with valves.
Ask for P/H22 **25/-** Each Post Paid
Circuit and Data 2/3.

WS-18 XMTR RECEIVER CHASSIS
partly stripped by the M.O.S.
Ask for P/H349 **33/6** Each Carriage Paid
Circuit 4/6.

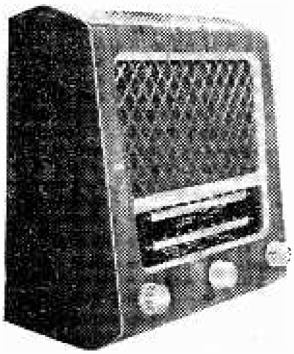
RECEIVER CHASSIS
Range 150-200 mc/s. Less valves.
Ask for P/H940 **21/-** Each Post Paid

26 WATT OUTPUT TRANSFORMER
Parmeko type AF5094 IA. Mfg. surplus.
Ask for P/H565 **19/6** Each Post Paid

PLEASE NOTE Carriage and Postal charges refer to the U.K. only. Overseas freight, etc., extra.

Order direct from:—
CLYDESDALE SUPPLY CO. LTD. 2, BRIDGE STREET GLASGOW - C.5
Phone: South 2706/9 Branches in Scotland, England and Northern Ireland

S.R.S.



BUILD A "SUPERIOR" T.R.F. RECEIVER

A POWERFUL 4 VALVE MIDGET

- ★ **Attractive New Cabinet.**
- ★ **Figured Walnut Veneered.**
- ★ **Size Approx. 10½" High, 10" Wide, 5" Deep.**
- ★ **Approx. Building Cost £7.10.0.**

This is a Long-Medium Wave Receiver suitable for A.C. Mains 200 250 volts. Valve line up: 2. 6SG7, 6V6GT, 6X5GT. The Cabinet is of very attractive design and finished in light Walnut, with the sides and Dial surrounds in Peach. Only brand new components are used throughout the construction of this receiver, thus assuring a high degree of performance and reliability All components required are available from stock.

Send for **S.R. CONSTRUCTION BOOKLET** giving easy to follow instructions, prices and component parts required to construct this superb receiver. Price 2 -, post free.

THE SUPERIOR CABINET ASSEMBLY. This contains Cabinet and Back, all Chassis Metal Work, Dial parts, Knobs, Switches, etc., and is available separately for the Constructor who wishes to design his own circuit. Price, 45 -, plus 2 6 post and packing.

BATTERY CHARGER COMPONENTS.

RK. L.T. RECTIFIERS.

A newly manufactured range, fully guaranteed for 12 months.

6 or 12 v. 1 amp. F.W. bridge type, at 7 6
6 or 12 v. 2 amp. F.W. bridge type, at 11/3
6 or 12 v. 3 amp. F.W. bridge type, at 12 6
6 or 12 v. 4 amp. F.W. bridge type, at 15 0
6 or 12 v. 6 amp. F.W. bridge type, at 23 6
6 or 12 v. 10 amp. F.W. bridge type, at 37 6

CHARGER TRANSFORMERS

High-grade. Wax-dipped. 220/240 v. input, 6 12 v. at 2 amp. output. Price 11/9 each. Also 6 12 v. at 4 amp. Price 17/6 each.

CHARGER CASE

Size: 6" High, 5" Wide and 4" Deep, made from 20 Swg. Metal and spray finished in Black or Grey. Sides and Top louvred for ventilation. Front undrilled except for two outlet holes for L.T. Leads. Ideal for use with the above rectifiers and transformers. Price 9 - each.

Please add postage under £1. C.O.D. or Cash with order. C.O.D. charge extra.

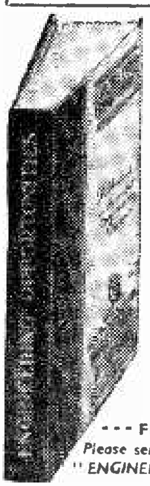
3-4 WATT AMPLIFIER

Suitable for A.C. Mains 210 230/250 v. Valve line up: EF91, 6K6GT, 5Z4. Chassis size: 9" Long x 5" Deep. Overall height 6". Two controls, Volume On/Off, and Tone. High quality fully shrouded mains transformer fitted. Also screened P.U. Lead and O P Transformer. All components used are Brand-New, and are covered by the normal guarantee. This unit is ideal for use in constructing a low priced Record-Player. Price £7 10/-, plus 2 6 post and packing.

SUPERIOR RADIO SUPPLIES, 37, HILLSIDE, STONEBRIDGE, N.W.10
Phone : Elgar 3644.

FREE TO AMBITIOUS ENGINEERS!

This 144-page Book



Have you sent for your copy ?

'ENGINEERING OPPORTUNITIES'

is a highly informative guide to the best-paid Engineering posts. It tells you how you can quickly prepare at home on "NO PASS—NO FEE" terms for a recognised engineering qualification, outlines the widest range of modern Home-Study Courses in all branches of Engineering and explains the benefits of our Employment Dept. If you're earning less than £15 a week you cannot afford to miss reading this unique book. Send for your copy to-day—FREE.

WHICH IS YOUR PET SUBJECT?

Mechanical Eng.
Electrical Eng.
Civil Engineering
Radio Engineering
Automobile Eng.
Aeronautical Eng.
Production Eng.
Building, Plastics,
Draughtsmanship
Television, etc.

GET SOME LETTERS AFTER YOUR NAME!

A.M.I.Mech.E.
A.M.I.C.E.
A.M.I.P.E.
A.M.I.M.I.
L.I.O.B.
A.F.R.Ae.S.
B.Sc.
A.M.Brit.I.R.E.
CITY & GUILDS
GEN. CERT.
OF EDUCATION
etc., etc.

FREE COUPON

Please send me your FREE 144-page "ENGINEERING OPPORTUNITIES"

NAME ....

ADDRESS ....

....

Subject or Exam. that interests me ....

British Institute of Engineering Technology
409B, College House, 29-31, Wright's Lane, Kensington, W.8.

BIET

G2AK *This Month's Bargains* G2AK

TEST PRODS with red and black leads. **2/-** pair, P. & P. 6d.

TEST METER. 7 ranges as follows : 1.5 v. 3 v. 150 v. 6 ma., 60 ma., 5,000 ohms, 25,000 ohms. 2½in. Dia. scale M.C. meter. Rotary selector switch, Black bakelite case, **6 x 4½ x 4½**, fitted with removable lid, also provision for internal batts, ranges can be easily extended. Bargain Price, **30/-** plus **1/6** post.

MULTI-METER BASIC UNIT.—400 Microamp. F.S.D., scaled 8 ranges A.C./D.C. volts, HI and LO ohms, complete with rectifier made by Triplett, U.S.A. Only **32/6** post free.

SHADED POLE MOTORS for tape recorders or gram. units. With voltage tapping plate 200/250 volts, 3-hole fixing. Our price **12/6** ea. or **21/-** pair. Post and pkg. on either, **1/6.**

SPECIAL TRANSFORMER OFFER.—Pri. 115, 210, 240 v. Secs. 260/260 v. **100** ma., 6.3 v. 3 A. and 6.3 v. 1 A, for 6 x 5 rectifier. Universal mounting. Few only. **17/6** ea., post free.

CRYSTAL HAND MICROPHONES. High quality, very sensitive. Chrome finish, complete with screened lead and standard jack plug. Our price only **25/-** ea. Few only.

Special Valve Offer. Kit of 4 midget valves 1.4 v., 1 each 1S5, 1R5, 1T4 and 1S4, **30/-**, or **8/6** ea. separately. **807's, 10/-.** ea. or 2 for **17/6.** Most of the 1.4 v. B7G range available at **8/6** ea.

HEADPHONES. Low resistance type CLR No. 3, **9/6,** DLR No. 2 **13/6,** High resistance CHR Mark 2, **17/6,** and the most sensitive of all DHR No. 5B **18/6** per pair. P. & P. 1/- pair.

METERS. 0-5 ma. 2in. square, **10/-.** 0.-50 ma., **7/6.** **0-10 A.** D.C., **7/6.** 0-1 ma., **20/-.** 0-350 ma. thermo, **7/6.** 0-4A, 5/-.

Germanium Diodes, B.T.H., **2/-** ; G.E.C., **2/6** ea. **Deaf-Aid Crystal** mike units, **12/6** ea.

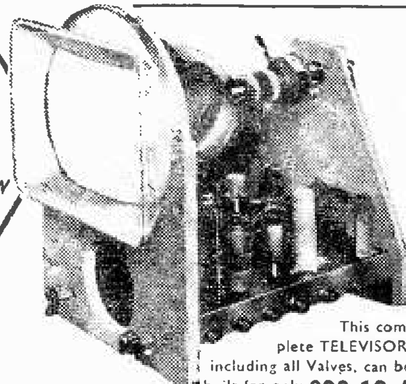
V.H.F. FANS. Air space Co-axial Cable, 150 ohm, good to **600** Mc/s ; normal price, **3/11** per foot. **Our Price,** 20 yard coil, **£1.** Very limited quantity available.

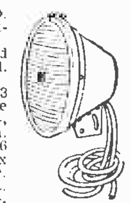
Postage free on all orders over £1 except where specifically stated. **PLEASE PRINT YOUR NAME AND ADDRESS.**

C. H. YOUNG, G2AK

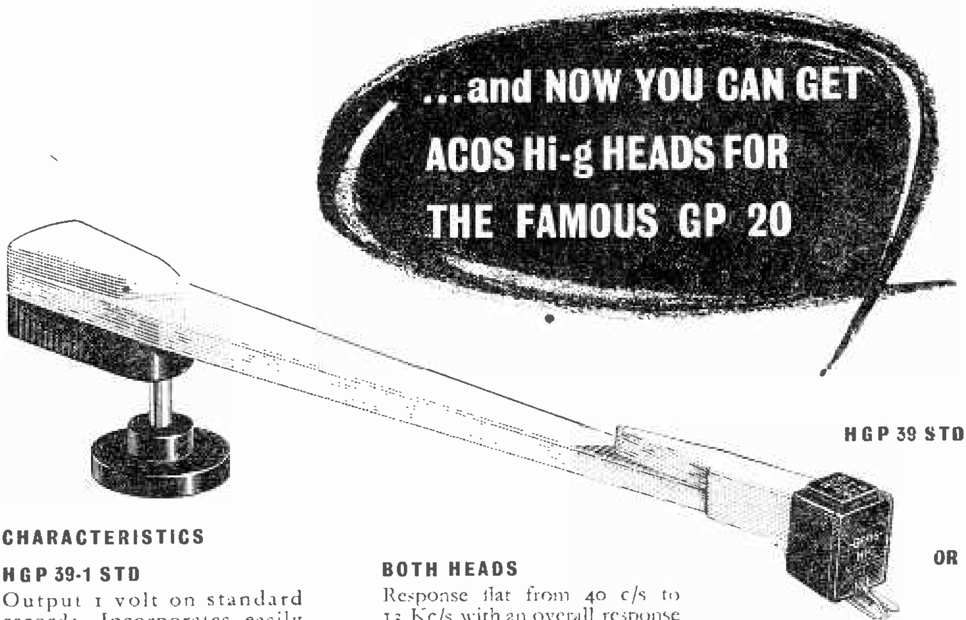
All callers : **110 Dale End, Birmingham 4** (CEN 1635)

Mail Orders : **102, Holloway Head, Birmingham 1** (MID 3254)





"Pick-ups and cartridges incorporating the ACOS Hi-g development will track with ease all present day records — and those of the foreseeable future too"



CHARACTERISTICS

HGP 39-1 STD
Output 1 volt on standard records. Incorporates easily changeable 0.0025" sapphire stylus.

HGP 39-1 LP
Output $\frac{1}{3}$ volt on microgroove records. Incorporates easily changeable 0.001" sapphire stylus.

BOTH HEADS
Response flat from 40 c/s to 13 Kc/s with an overall response from 20 c/s to 17 Kc/s. Tracking weight 8 grammes.

PRICE
STANDARD OR LP HEAD ONLY
£1 · 12 · 0 (Plus 10/3 P.T.)

G.P. 20 Hi-g COMPLETE PICK-UP WITH EITHER HEAD £2 · 12 · 0 (Plus 16/8 P.T.)

always well ahead

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

COSMOCORD LIMITED · ENFIELD · MIDDLESEX

Practical Wireless

EVERY MONTH
VOL. XXX, No. 571, MAY, 1954

Editor: F. J. CAMM

22nd YEAR OF ISSUE

COMMENTS OF THE MONTH

By THE EDITOR

Purchase Tax

THE Treasury has benefited by £28,000,000 extracted in purchase tax on radio receivers, radio gramophones and television receivers during the year which ended on March 31st. Purchase tax paid in the two previous years was £24,000,000 (1952/3) and £21,000,000 (1951/2). These figures reflect the rise in the sale of radio and TV sets. The former rose by 20 per cent. during the year to reach the grand total of 951,000 and TV by 44 per cent. to reach the record figure of 1,129,000. Export sales, however, fell by 26 per cent. and 16 per cent. respectively, although radio exports as a whole rose about 5 per cent. Thus radio and television sales show no real diminution, apart from seasonal variations. They are still the cheapest form of entertainment and, although it may be felt by some that purchase tax is another form of entertainment tax, it must be remembered that it is a non-recurring charge and, spread over say 5 years, it is still much less per pound than the tax which would be paid on cinema and theatre tickets.

Although the TV licence is being raised to £3 it will still be the cheapest form of visual entertainment in this country, and, with the exception of countries where there are only sponsored services, British television is probably the cheapest entertainment in the world.

The chief object of raising the licence is to improve the service and, therefore, it will tend to increase rather than decrease the sale of receivers. The commercial TV Bill makes it clear that the independent TV authority must radiate programmes predominantly British in tone and style, of high quality and well-balanced in subject matter.

THE RADIO SHOW

THE main feature at this year's Radio Show, which takes place from Aug. 25th to Sept. 4th, will again be electronics, with the purpose of demonstrating some of its many applications outside the field of domestic radio and television. They will be grouped under such descriptions as "Electronics in industry," "Electronics in medicine," etc. The exhibits will be of special displays made up for the occasion to demonstrate a principle and not any particular piece of production equipment ; equipment of unusual interest taken from the production line, from service or from development, and ready-made displays which have already been exhibited elsewhere. This journal will, of course, be represented there as in former years.

THE CABINET MAKER

ONE of the smallest trade associations is the British Radio Cabinet Manufacturers' Association. The cabinet which houses the set proper is seldom given a thought, but a great deal of design work is involved in its production. The external appearance of the cabinet has a great deal to do with sales. No matter how efficient the receiver itself may be it is often the external appearance of the magic box which influences its sale. The manufacturer must produce a variety of styles to match in with furnishing schemes, and he must co-operate with the set designer on matters of the position of the speaker grille, height of auto-record changer, location of knobs and dissipation of heat. The association has been in existence for 33 years, and in that time it has brought about radical changes in cabinet design. One has only to compare present cabinet styles and finishes with those of, say, 20 years ago to mark the change.

"THE PRACTICAL MOTORIST AND MOTOR CYCLIST"

AS announced last month, our new monthly *The Practical Motorist and Motor Cyclist* is now on sale. Published at 1s. on the 8th of each month, its contents are entirely devoted to the upkeep, overhaul, maintenance and repair of all types of motor vehicles—motor cars, motor cycles, and motorised bicycles, irrespective of the year of manufacture. Its policy in a word is Service ! Service to its readers and the vehicles they run. As with all our companion practical journals there is a free reader service. Readers of the first two issues have the opportunity of entering competitions, each of which carries £250 as first prize. There is no entrance fee. The newcomer to our practical group covers entirely new ground in automobile journalism, and fills a need in these days when the high cost of repairs makes it more than ever necessary for the owner-driver to carry out his own repairs. Indeed, it is a fascinating hobby.—F. J. C.

ROUND the WORLD of WIRELESS

Broadcast Receiving Licences

THE following statement shows the approximate number of sound receiving licences issued during the year ended January, 1954. The grand total of sound and television licences was 13,315,969.

Region	*Number*
London Postal ...	1,637,592
Home Counties ...	1,440,448
Midland	1,256,676
North Eastern ...	1,636,248
North Western ...	1,276,775
South Western ...	1,008,953
Wales and Border ...	634,840
Total England and Wales	8,891,532
Scotland	1,101,926
Northern Ireland ...	216,867
Grand Total	10,210,325

New V.H.F. Transmitters

IN connection with their plans for the introduction of V.H.F. sound broadcasting in this country the BBC have placed an important order with Standard Telephones and Cables Limited for their latest type of frequency modulated V.H.F. broadcasting transmitters. The order calls for 12 10 kW transmitters, type C.F.4, and 12 1 kW transmitters, type C.F.2.

The transmitters embody all the latest principles and practices of modern design. An important feature is an entirely new approach to the system of transmitter control ensuring the high standard of reliability essential to unattended remote-controlled operation. At each station twin transmitters will be used for each programme so that either transmitter can be switched off without interrupting the service.

Booking by Radio

PYE LIMITED of Cambridge are to supply radio for the first radio-equipped mobile ticket office in the world. This new idea will enable people going to football matches, race meetings or garden parties to book their theatre seats on the spot without going to the trouble of visiting agencies or theatres. Not only will the mobile van provide working people on their way to factories within the Greater London area with a prompt service, but it will also make it possible for early morning workers in Covent Garden, Smithfield and Billingsgate to obtain tickets while they are actually at work in the markets.

The van, belonging to Keith Prowse, is to be in constant communication with a Poland Street control room which acts as a central clearing office for the whole of their network of ticket agencies.

Shoppers queue to take advantage of the new Keith Prowse mobile booking office.

Third Exhibition for Radio Amateurs

HUNGARY'S amateur radio fans will hold their third annual exhibition in May. Special interest is attached to this year's exhibition as the first experimental television broadcasts have already been started in Hungary.

Exhibitors, either individuals or amateur radio clubs, can send in their own products under five categories — receivers, aerials, measuring instruments, microphones and transmitters—and raw materials should preferably be of Hungarian origin to facilitate construction.

Commercial Telephone Service

THE only municipal telephone service in this country is to be found in Hull, where callers may ask to be connected with the city's amusement telephone service.

For only twopence they can hear Eddie Calvert's recording of "Oh Mein Papa," advertising a local music store, or listen to part of the sound track of the film showing at their favourite cinema. Normal calls also cost no more than twopence.

B.I.R.E.

THE following meetings will be held during April, 1954 :—

London Section.—Wednesday, April 21st, 6.30 p.m., at the London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, W.C.1.—" Crystal Valves in Radio and Electronics." B. R. A. Bettridge (G.E.C. Ltd.).

South Wales Section.—Wednesday, April 7th, 6.30 p.m., at Glamorgan Technical College, Treforest.—" The Manufacture of Radio Receiving Valves." G. P. Thwaites, B.Sc. (S. T. & C. Brimar).

North-Eastern Section.—Wednesday, April 14th, 6 p.m., at Neville Hall, Westgate Road, Newcastle-upon-Tyne.—" Electroencephalography." Prof. Alexander Kennedy, F.R.C.P., and J. W. Osselton, B.Sc. (Durham University—King's College, Newcastle-upon-Tyne).

West Midlands Section.—Tuesday, April 27th, 7.15 p.m., at Wolverhampton and Staffordshire Technical College, Wulfruna Street, Wolverhampton.—" Radio Telephone Equipment." T. C. Howell.

SOS and Police Messages

LAST year the BBC broadcast 426 SOS messages. Of those broadcast from London, 188 were successful, 82 unsuccessful and the result of 48 was not known. Of those from the Regions, 46 succeeded, 33 failed and the result of 29 was not known.

Of 334 police messages for witnesses of accidents, etc., 96 broadcast from London were successful and 111 unsuccessful; 44 from the Regions succeeded and 83 failed.

General Sales Manager

MR. C. L. G. FAIRFIELD, M.A., M.I.E.E., A.M.I.Mech.E., Barrister-at-Law, who joined the Telegraph Construction and Maintenance Co. Ltd., in April last as manager of their Overseas Division, has now been appointed general sales manager covering cables, plastics and engineering products.

Mr. E. H. Gosling, A.S.M.A., previously home sales manager of Telcon's Cables Division, has been appointed home sales manager for these products.

Mr. A. W. Montgomery

MR. A. W. MONTGOMERY, joint general manager of Standard Telephones and Cables Ltd., has been elected a Fellow of the (U.S.) Institute of Radio Engineers for his leadership in radio and telecommunication research in England and his services in the international liaison in these fields.

International Training Centre

UNDER the American Mutual Defence Assistance Programme of foreign military aid, students from the Armed forces of America's allies in Europe, Asia and South America are able to attend service schools primarily intended for American servicemen only. One such training base is Keesler Air Force Station, Mississippi, where officers and enlisted men of fifteen friendly nations throughout the world study as electronics technicians.

At all times the foreign students are given every consideration and encouragement. If they encounter difficulties, not compensated for by the regular language classes, they are given additional assistance by qualified interpreters who can help with both language and technical problems.

A group of five students, from three different countries, are engrossed in the operation of a cathode-ray oscillograph during a class in electronics training at Keesler Air Force Base, Mississippi.

Use of Electronic Valves

PARTS 1 and 2 of the British Standard Code of Practice on the use of electronic valves has now been published.

Part 1 gives general information and recommendations for all types of electronic valves, whilst Part 2 sets out additional recommendations on the use of domestic receiving valves, cathode-ray tubes and rectifiers.

The Code was prepared by a committee set up jointly by the Institution of Electrical Engineers, and the British Standards Institution. Copies of the Code CP. 1005 (Price 6/-) may be obtained from the British Standards Institution, 2, Park Street, London, W.1.

Improvement in Home Service Coverage

AS a further step in the plan to make local improvements in the coverage of the Home Service, the BBC has installed a new low-power transmitter at its station at Whitehaven, Cumberland.

The new transmitter took over the service from the present temporary transmitter on Sunday, March 14. It has a power of 2 kW., four times that of the existing temporary transmitter, and it is expected that this will extend the area of improved reception as far as Maryport and Cockermouth in the north and beyond Egremont in the south. Like the present temporary transmitter the new transmitter will radiate the North of England Home Service on 434 metres (692 kc/s).

200th " Ray's a Laugh "

ON March 25th, just under five years after it first went on the air, " Ray's A Laugh " reached its 200th programme. The original broadcast was on April 4th, 1949. There have been changes in form during that time but four of the cast who were in that first edition have been heard in every programme since. They are Ted Ray himself, Kitty Bluett, Patricia Hayes and Peter Sellers. George Inns, who devised the show, has been in charge throughout.

Morphy-Richards Ltd.

MORPHY-RICHARDS, LTD., announce that as from March 25th, their new London office address is 6, Conduit Street, London, W.1, to which all home and export sales and advertising enquiries should be addressed.

AMPLIFIER DESIGN

2.—BASIC CONSIDERATIONS—CONTINUED

By R. Hindle

(*Continued from page 234, April issue*)

A short series of articles dealing with the theoretical considerations of amplifier design, and containing at a later stage constructional features of various types of amplifier.

IN order to make the input signal operate over the selected parts of the characteristic it is necessary to apply a grid bias and this is now determined by reading the voltage on the characteristic corresponding with the mid-point of the chosen section of the characteristic.

All operating details can now be filled in. The valve will operate with the H.T. supply voltage for which the curve has been prepared and with the anode resistor specified by the maker on the curve being used. The grid bias has been determined as above and the amplitude of signal was specified in the original design stipulation. The makers' characteristic graph will also give a curve of amplification factor for the same constants and from this μ is read for the set of working voltages chosen. This figure is now used in the formula for actual gain previously obtained, giving the voltage output signal that will be available. Before giving a practical example, however, there are some other considerations to refer to.

In actual practice, of course, these valve characteristics are never absolutely straight and, therefore, perfectly distortionless distortion can never be achieved. The deviation from true amplification is specified by quoting the percentage distortion, or more correctly the percentage that the amplitudes of the harmonics introduced as a result of the distortion bear to the amplitude of the total output signal. Valve makers commonly quote working constants for a distortion of 5 per cent. Often, of course, a much lower degree of distortion is required and in such a case the valve is worked well short of the specified signal amplitudes permissible for the 5 per cent. distortion condition. If a reduction in signal amplitude is not permissible the decrease in distortion can be obtained by increasing the H.T. voltage. Thus, the Brimar 6BS7 (triode connected) with an H.T. supply of 100 volts and an anode load of 200 KΩ gives a maximum peak output voltage of 26 with a stage gain of 13; this is for 5 per cent. distortion and if 26 volts output is essential the distortion will have to be tolerated. However, if the H.T. supply is increased to 300 the valve will give a maximum peak output of 96 with the same anode load and about the same gain (actually quoted as 14). Now, the valve will accept about 3½ times as much input with only the same distortion factor, but if the input is restricted to that required for only 26 volts output the percentage distortion will be much less than with the lower H.T. There are other methods of reducing distortion that will be introduced later on in this series of articles.

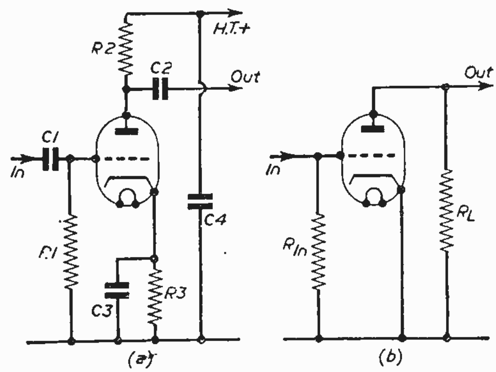


Fig. 8.—Basic Triode Amplifier.

The basic amplifying circuit is given in Fig. 8(a). A fluctuating voltage applied to the grid of the valve causes current through the valve to vary in sympathy. Note that the valve is not an amplifier in the basic sense of the word; it is actually a convertor, accepting D.C. from the H.T. supply and converting it into an A.C. varying in sympathy with the varying voltage applied to the grid. The anode current has to flow through R2 and, by Ohm's Law, it will produce across R2 a voltage which will be in proportion to the current flowing through it, and as this current is varying in sympathy with the grid signal so must the voltage across R2 vary in a manner similar to the input voltage. The extent to

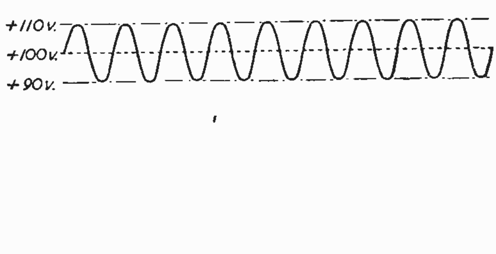


Fig. 6.—This illustration should have been given last month in place of Fig. 9 on the right.

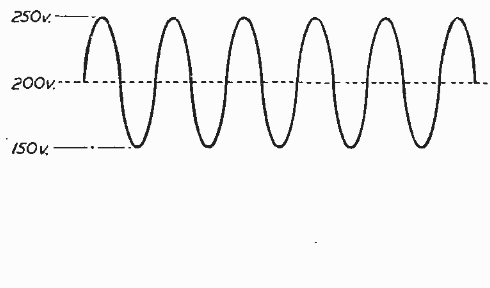


Fig. 9.—A.C. 100 v. Peak-to-Peak, with D.C. 200 v.

which the voltage across R2 varies depends upon the amplitude of the current fluctuations and upon the value of R2 ; in practice, the anode voltage fluctuations can be made considerably larger than the input fluctuations and so amplification results.

Consider the moment when the grid input moves more negative. Then the flow of electrons through the

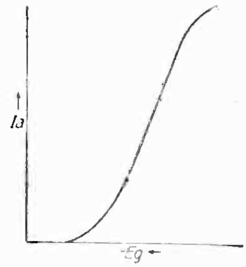


Fig. 10.—Triode anode current/grid voltage curve.

valve is reduced and this lower voltage causes fewer volts to be dropped across R2, causing the anode voltage to move towards the H.T. voltage : in other words the anode goes positive when the grid goes negative, giving effectively a phase reversal across the valve. Besides the fluctuating voltage, however, there is still the steady voltage from the H.T. supply also present at the anode. In case any reader is wondering how two different voltages can be at one point at the same time it will be as well to explain that an alternating voltage is considered to move equally on each side of zero volts, i.e., positive and negative. If the mean voltage is not zero, however, but has some value positive or negative, the waveform is looked upon as an alternating voltage and a steady voltage combined. Thus, in Fig. 9, the anode voltage is shown to vary between the limits of 250 volts and 150 volts in sine waveform and, of course, the anode has only one voltage at any given instance. The steady H.T. applied to the valve is 200 volts and the waveform is clearly the combination of this steady voltage shown dotted in Fig. 9, and an alternating voltage of peak-to-peak amplitude 100 volts fluctuating about zero. As only the fluctuating voltage and not the steady component is normally required by the following valve or circuit (there are some complications in pulse and television technique that can conveniently be avoided for the present) C2 in Fig. 8, is introduced, which in the first instance can be considered as being so large in capacitance as to be negligible in impedance so far as audio signals are concerned. C1 serves a similar purpose in isolating the grid of the valve from any steady voltage in the preceding circuit and is similarly assumed to be so large that it can be neglected to a first approximation. R3 is introduced to bias the valve, the steady current through the valve in the absence of signal potentials having to pass via this resistance, consequently developing a voltage across it. The fluctuating signal currents would also need to pass through this resistance except that C3 across it is assumed to be so large that it has negligible reactance to audio frequencies and so shorts out R3 so far as signals are concerned, and these two components R3, C3 can be ignored from an audio point of view for the time being. C4 is the smoothing capacitor in the power equipment and this also is so large as to be a short-circuit to audio signals and so the upper end of R2 can be considered to be connected to earth so far as the audio signals are concerned. The circuit thus simplifies to Fig. 8(b), and so long as the input resistance Rin and the load RL are, in fact, pure resistances the only component that can now cause distortion is the valve itself ; the valve can cause distortion only if the relationship between grid voltage and anode current is non-linear, or in other words if a small change in grid voltage does not always cause the same amount of change in anode current. Here attention has to be turned to the valve characteristic curves, and in particular to the grid voltage (Eg)/anode current (Ia) curve, which has the shape shown in Fig. 10. Linear (and therefore, distortionless) operation requires a characteristic that is itself a straight line ; then at all parts of the characteristic it will be seen that a given small change in Eg will cause the same change in Ia. But according to Fig. 10, there is a curve in the characteristic, so it is essential to work the valve in such a manner as to avoid bringing the curved part into play. Hence the need for negative bias on the grid to bring it on to the straight part of the characteristic. The signal applied in the case of sound amplification swings equally on each side of the bias point and care must be taken to see that this does not swing on to the curve. Bias is not very critical if only a small signal is to be fed into the valve, but if the maximum possible signal has to be handled without overloading, it is necessary to read off carefully the range of Eg over which the "curve" is substantially straight. In practice it is

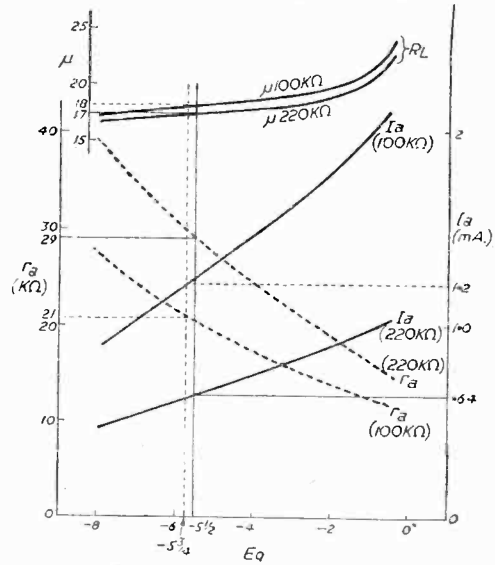


Fig. 11.—Dynamic characteristic of the 6BR7, triode connected. H.T. is 250 v.

never absolutely linear and so there must always be some slight distortion. The applied grid bias must then be exactly mid-way between the two extremes to allow the grid to swing linearly on either side of the bias point.

These curves are usually printed in "families," each curve in the family being for a different anode voltage. The higher the anode voltage the longer the straight part of the characteristic becomes though as the anode voltage increases the maximum permissible current through the valve decreases, being limited by the maximum anode dissipation determined by the valve makers, so beyond a certain critical anode voltage the *usable* part of the straight section of the characteristic becomes shorter.

Dynamic Characteristic

This is all very well so far as it goes but the curve that has been used above is a static one and assumes that all except the two factors plotted, Eg and Ia, remain constant. This would be so if there was no anode load, but then there would be no output voltage produced by the fluctuating current and so the circuit would not be much use as an amplifier. In practice, however, the load resistance causes the anode voltage to fluctuate with the signal and this has its effect on the current flowing quite apart from and in addition to the grid voltage fluctuations already referred to. What is wanted for design work is a dynamic characteristic that takes into account the load resistor. Fortunately, the valve manufacturers provide this. As an example the Brimar 6BR7 would be a good choice as an audio amplifier and the following data are derived from the maker's leaflet to illustrate the method. This valve is a pentode designed for audio work, being made very rigid to avoid microphony (i.e., mechanical ringing when subjected to shock or vibration as, for instance, from a speaker), and the construction is such as to reduce hum to a minimum and to reduce valve hiss to a minimum. It can be worked as a triode by connecting the screen grid to the anode and the suppressor grid to the cathode.

Fig. 11 reproduces the dynamic characteristic of the 6BR7 triode connected and assuming the anode load to be either 220KΩ or 100KΩ, and in each case 250 volts H.T. It will be noted that the inclusion of a load resistance lessens the slope of the characteristic. If a straight-edge is put along the Ia characteristic for 220KΩ load, it will be seen to be substantially straight from -3 to -8 volts grid bias. Thus the valve will accept an input grid swing up to five volts peak to peak without distortion, though the valve must have a fixed bias midway between these extremes (i.e., $-5\frac{1}{2}$ volts) so that the signal will swing between the quoted limits. If the maximum input signal is less than five volts the fixed grid bias can deviate from the optimum value quoted. For instance, if the maximum signal to be handled is one volt peak to peak, it will be safe to bias to half volt below the maximum quoted above, i.e., to $-7\frac{1}{2}$ volts. At the same time it is good practice to design for optimum and so a bias of $-5\frac{1}{2}$ volts is decided upon. The anode current at this working point is read from the graph and is found to be .64 mA. The bias resistor is then indicated by Ohm's Law, i.e.,

$$R=\frac{1000.E}{I} \text{ (I being in mA ; hence the factor 1000)}$$

$$=\frac{1000\times 5.5}{.64}$$

$$=8500 \text{ ohms.}$$

The striking thing about this valve worked in this way is the size of the cathode resistor required; one has been accustomed to think of bias resistors in hundreds rather than in thousands of ohms. This is due to the low anode current resulting from the use of a high value of anode load.

The curves show that with the working characteristic chosen the amplification factor (μ) of the valve is 17 and the anode impedance (ra) is about 29,000 ohms. This compares with the static figures for the same valve (as quoted in less comprehensive data lists) of 20 for μ and 11,600 for ra.

The gain of an amplifying stage is:

$$\text{Gain}=\frac{\mu.RL}{RL+ra}$$

where RL is the load resistance (220 KΩ as above) and μ and ra are as given above.

$$\text{i.e., Gain}=\frac{17\times 220000}{220000+29000}$$

$$=15.$$

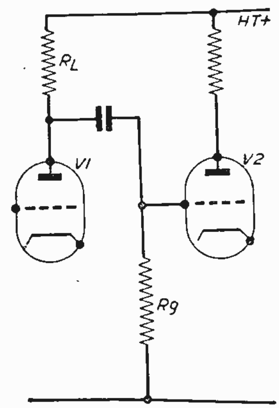


Fig. 12.—This is the circuit diagram of a standard intervalve coupling of the resistance-capacity type.

Following Circuit

This ignores the circuit to which the amplifier is connected and being a voltage amplifier it will probably be connected to a second such amplifier or to the output stage. In either case there will be a resistance in the input circuit of the following valve as in Fig. 12. It has been shown that RL can be considered as being connected between the anode of V1 and earth so, as the coupling capacitor is large enough to be ignored from an audio point of view, Rg can be considered as being effectively in parallel with RL. The resultant of these two in parallel is thus actually the load across which V1 produces its audio output, but the coupling capacitance is an effective stopper to D.C. and consequently D.C. conditions are determined by RL alone. The procedure is to determine the value of the grid resistor of the following stage, which will normally be as large as the valve at V2 will permit. Now the figure of gain produced as above has to be reduced to allow for the effective reduction of load by virtue of the following grid leak. The usual formula for resistances in parallel applies. Designate the effective load (i.e., RL and Rg in parallel) Req. Then

$$\frac{1}{Req}=\frac{1}{RL}+\frac{1}{Rg}$$

$$Req=\frac{RL.Rg}{RL+Rg}$$

The actual gain is now $\frac{Req}{RL}$ times the gain calculated for RL alone (i.e., 15), so

$$\text{Gain}=\frac{15.RL.Rg}{RL\ (RL+Rg)}$$

$$=\frac{15.Rg}{RL+Rg}$$

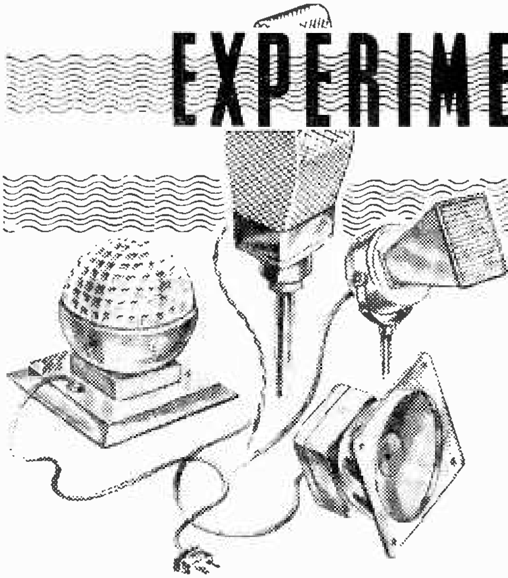
But RL is taken as 220 KΩ. Assume an Rg of 1 MΩ. Then the amplification will be:

$$\frac{15\times 1}{1\times .22} \text{ (all resistance in M}\Omega\text{)}$$

$$=12 \text{ times.}$$

(To be continued)

EXPERIMENTAL MICROPHONES



DETAILS OF SOME EASILY-CONSTRUCTED COMPONENTS WHICH WILL FORM A BASIS FOR EXPERIMENT BY THE BEGINNER

By W. S. Fowler, M.A.

THE radio amateur from time to time requires microphones for various purposes without having to go to the expense of purchasing a really good quality instrument. The microphones here described can be constructed from the odds and ends in the experimenter's box and have been found to give satisfactory results, especially when the main requirement is for intercommunication and speech work.

Electro-magnetic Types

A simple but highly efficient microphone can be constructed from a headphone earpiece. Simply connect the two leads from the headphone to the amplifier input socket and you have a microphone capable of delivering fair quality and volume.

The headphone must be of the high-resistance type—about 2,000 ohms is the usual value. Low-resistance headphones can be used as microphones but the leads from the headphones must be taken through a step-up transformer (a pentode output transformer used in reverse will do) before being connected to the amplifier input (Fig. 1).

An improvement in quality with this type of microphone can be effected by "damping" the earphone diaphragm. To do this, remove the earpiece, take off the diaphragm and place a piece of paper between it and the poles of the earphone magnet. Then replace the diaphragm and earpiece in the usual way.

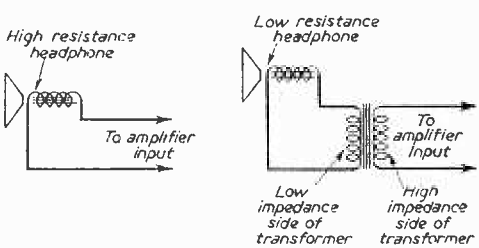


Fig. 1.—Using headphones as microphones.

An intercommunication outfit can easily be made with two pairs of headphones. Simply connect the two pairs together by means of a piece of flex and one earphone in each set can be used as a headphone and one as a microphone. The output, without amplification, is only small, but with high-resistance phones the signal can be heard quite clearly over a good length of connecting wire (Fig. 2). To economise, using only one pair of headphones, split the two phones and use each alternately as a headphone and a microphone (Fig. 3).

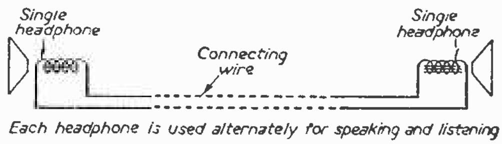


Fig. 3.—Simple experiment to show use of headphone units.

Moving-coil Types

A very efficient, good quality microphone can be constructed from any small moving-coil loudspeaker. Simply connect the speaker leads via a step-up transformer (preferably a microphone transformer, but an output transformer can be used) to the amplifier input and speak into the loudspeaker. The 2½in. and 3in. core speakers make the best microphones, and with these really good results can

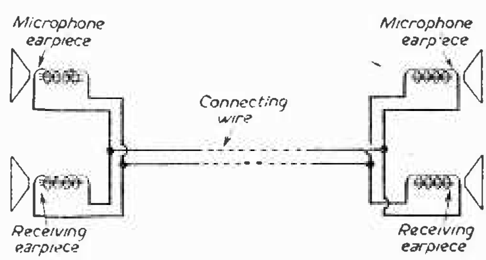


Fig. 2.—A relay system without amplification.

be obtained (Fig. 4). It is important to screen the transformer and also the leads from the transformer to the amplifier. The transformer ratio should be approximately 100 : 1 step-up. If an output transformer is being employed use the highest ratio possible, usually about 60 : 1.

Ribbon Types

An interesting experimental ribbon mike can be constructed from an old magnet and a piece of aluminium foil. The best type of magnet to use is one taken from an old meter movement or a magnetic pick-up. Take a 1in. strip of aluminium, or other non-magnetic metal foil, about a ¼in. wide and press it between two pieces of corrugated cardboard to give it resilience. Take the "corrugated" foil and arrange it across the air-space of the magnet by means of copper wire clamps or bolts (Fig. 5). Take a lead from each end of the foil and connect to the low-impedance side of a step-up transformer (100 : 1). The high-impedance side of the transformer is then connected to the amplifier input. The whole microphone can be placed inside a wire mesh frame for protection and will be found to give quite good results.

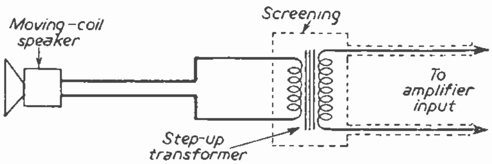


Fig. 4.—Using a small loudspeaker as a microphone.

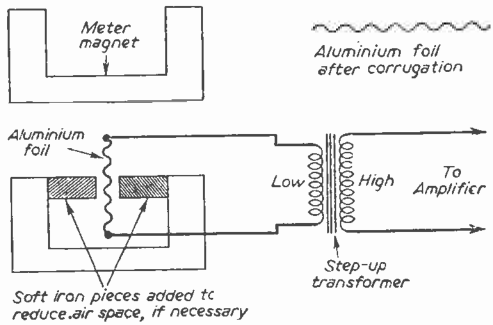
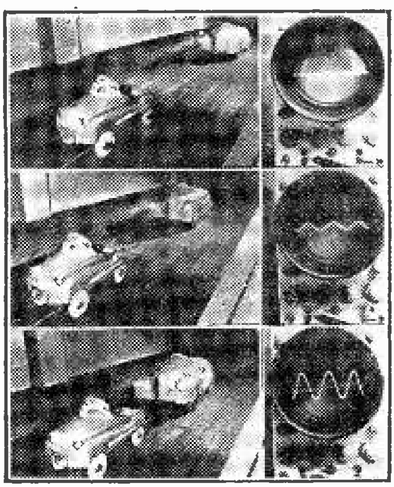
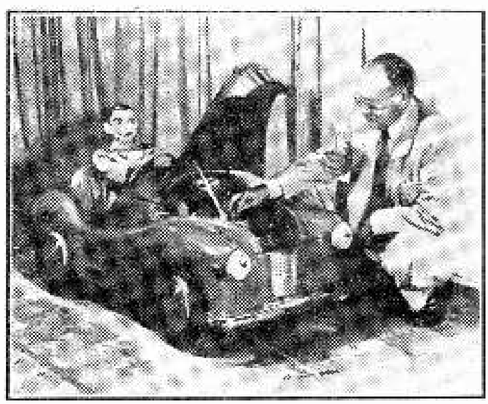


Fig. 5.—Details of construction of a ribbon mike.

Radio Safety Aid

AN exploration of how electronics can be put to work to reduce highway accidents and to relieve drivers of tiresome tasks on modern superhighways, has been initiated by Dr. V. K. Zworykin, pioneer television and electronic scientist of the Radio Corporation of America. To study the basic problems of automatic driving Dr. Zworykin and assistants at the David Sarnoff Research Centre of R.C.A., in Princeton, N.J., U.S.A., have equipped a model five-foot car with electronic equipment. This laboratory car, which is powered by a storage battery, can: (1) Steer itself along a prescribed route. (2) Stop itself when approaching a metal obstruction. (3) Turn out of its original lane into a second lane as if to pass another car moving at a slower speed. In the laboratory set-up, the model car is guided by a wire which represents a cable that would be laid in the roadbed of a superhighway. The wire sets up a magnetic field at a certain frequency, and this is picked up by two coils, one on each side of the car. If one coil receives more of the signal than the other it means the car is no longer centred over the wire, and electronic equipment controlling the steering wheel immediately brings the car back "on course." To prevent a collision with an obstruction simple transistor circuits associated with the guidance wire send out warning signals (at another frequency) whenever an obstruction passes or is stalled over them. These warning circuits, in effect, produce a "radio tail" at the rear of any metal obstruction on the route. When equipment in the model car receives the warning signal the brakes are automatically applied and the car comes to a halt.


The car and oscilloscope patterns of the "radio tail."


Dr. V. K. Zworykin and the radio-equipped car.

1912 The FIRST TWELVE YEARS 1925

AN EARLY AMATEUR CONTINUES HIS REMINISCENCES OF THE PERIOD BETWEEN 1912 AND 1925

By C. H. Gardner

(*Continued from page 242, April issue*)

THE events described in my last article brought us nearly to the outbreak of the first World War, an event which was to stop completely the amateur movement for a period of some four years. For some little time before the outbreak of war quite an amount of wireless gear had been made available to the amateur by some of the big stores and also by certain dealers who had specialised in providing electrical equipment suitable for the enthusiastic schoolboy.

Some of the catalogues describing such equipment, both wireless and electrical, were masterpieces, and it is a matter of great regret that one has not kept one of these historical documents. These various suppliers also appeared to employ correspondence clerks who were geniuses in schoolboy psychology, as considerable technical correspondence had to be entered into by them in regard to the merits of a 10s. dynamo or a half-crown accumulator. Credit is due to these concerns for having encouraged youthful interest in this way, and thus provided a considerable nucleus for manning what was to develop into a major industry.

In fact, so varied was the equipment made available that it was possible to buy, ready made, the pieces of apparatus necessary to install quite an effective spark transmitter and an efficient receiving set. Little technical knowledge was needed to connect these various pieces of apparatus together but, so far as the receiving equipment was concerned, we early home constructors never felt that it rose to the same efficiency as the equipment that we had designed and made ourselves.

It was early in 1914 that an amateur friend asked if he might bring along a gentleman who had become very enthusiastic in transmission and reception. He had, my friend explained, purchased a lot of extremely expensive apparatus which he would like to bring to my den in order that he could be shown how to connect and operate it. In due course the gentleman arrived with the apparatus in the back of his car and it must be confessed that this equipment, obviously purchased regardless of expense, was a matter for considerable envy.

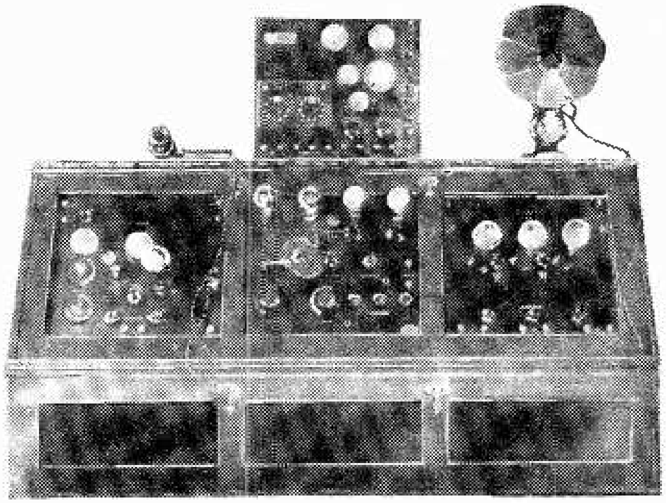
Shortly afterwards an invitation was received to view this equipment, which had been installed in elaborate glass-faced cupboards, in his private house although, as he explained, it had not as yet been put into operation.

The few weeks immediately preceding the outbreak of war were times of great excitement to the amateur wireless enthusiast, and a few days before war was declared it was possible to log the recall by Germany of a considerable number of their merchant ships sailing on the high seas. Shortly afterwards we received notification from the Post Office that our licences would be withdrawn and that a representative would be calling to collect our equipment, seal it, and take it to the Post Office, where it would be held for us until the termination of hostilities.

When the representative duly called, he asked for information concerning any amateurs in addition to those he had on his list, and two things became apparent at the same moment: one was that my friend with all the elaborate equipment had apparently never taken out a licence, and also that he had an extremely Germanic name. It was felt to be a duty to give his name and address to the Post Office representative and explain the extent of his installation. The result was interesting. Our acquaintance did indeed prove to be Germanic. He had more than a little working knowledge of wireless, and on investigation it was found that he had erected a concealed aerial running up inside one of his chimneys. Needless to say, he spent the remainder of the war in internment.

The First World War

Personal war experiences need not be dwelt upon



An early 2H.F.-Det.-LF., receiver.

as only in the very earliest few weeks had they any remote connection with radio. Having enlisted as an "instrument mender" and spent three weeks without seeing an instrument other than a pitch-fork, which was provided to clean out some stables, it was decided that some more rapid method of using one's hobby in wartime was desirable, and as luckily the Signals Section had taken on over strength, a transfer was not difficult to obtain.

One dark and dire deed whilst home on leave must be confessed to. The désire to hear some wireless signals (even if they could not be understood) was too great, and a friend and myself one dark evening wound an inductance, took a crystal and headphones, and journeyed to a certain factory to which he had access and which had conveniently a factory chimney up which ran a lightning conductor. Details need not be entered into here, but for ten minutes we forgot the woes of war and once again heard some of our old commercial station friends bleating out their Morse signals. I have often wondered since how my friend managed to explain away and get repaired the curious break which occurred in the bottom two feet of the lightning conductor.

It may be difficult for the present-day amateur to appreciate the intense enthusiasm which resulted in one committing such a heinous offence, but the amateur of those days just lived for his hobby, a fact which no doubt was accentuated by its rapid development which gave so much scope for experimental work, even by those with next to no technical knowledge.

Demobilisation led me into a line of business not immediately connected with radio, but allowed of the opportunity of gathering up the lost threads and getting together some equipment. In the intervening period the valve had, of course, made its appearance, and the first item on the agenda was somehow or other to obtain one of these desirable articles. So early in 1919 I became the proud possessor of one triode valve, and the first purpose to which it was put was as an amplifier to boost up the rectified signals from the crystal detector. This coincided with the time of the General Strike, and seeing somewhere that radio amateurs were required to establish lines of communication, contact was made with Headquarters, Western Command, who suggested a discussion on the matter. A 200-mile trip on a motor-cycle resulted in a gift of no less than three triode valves and a roughly drawn circuit showing how to make one of these oscillate and produce signals.

Instructions were received to get this "transmitter" into operation as quickly as possible and call Headquarters on a given frequency.

This probably all sounds extremely simple to the present-day amateur, but in view of the fact that the only available H.T. supply was from a number of dry cells in series, that one could only roughly guess at the frequency at which one was transmitting, and the distance to be covered was the best part of 100 miles with intervening hills, it is not to be wondered at that communication had not been established during the few days before the strike terminated.

Following this period there was a short period during which personal conditions prevented any time being spent on radio matters, and when the time came to start rigging things up again there had become available the extreme excitement of the possibility of receiving telephony transmissions as well as the Morse signals which had hitherto provided the basis of experimental work. It is very difficult to describe one's feelings at the time of first hearing speech come over radio. One's immediate inclination was to rush out to the street and call in every casual passer-by to hear the new miracle which was occurring. What amateur of those days will ever forget the transmissions from Two Emma Toc, Wrrrrittle calling, with Captain Peter Eckersley counting up to ten and repeating the days of the week, and certainly none will forget the occasion upon which Dame Melba gave us what was almost our first song to be heard transmitted over wireless.

Curiously enough, most of us were still using crystal or crystal plus a valve amplifier, and circuitry for us had changed very little.

Telephony

The advent of telephony, however, very naturally made us more than a little anxious to start experimenting on transmssions of this type, and it was not long before we had developed simple circuitry for such transmissions which were carried out on 440 metres.

It would take up too much space to detail the step-by-step technical advances that were made, or to recall incidents concerning early official broadcasts, but in these early stages many of us were still using dry cells or inert cells for the H.T. supply for the transmitter and a grid modulation circuit which put the microphone at high potential to earth. This latter detail of circuitry occasionally had some amusing results. On one occasion my station quite suddenly went off the air following a request from the friend to whom transmission was being made to speak a little more closely into the microphone. As the microphone had been fitted with a small tin trumpet, the result of this request can easily be imagined, and it took some little time to disintegrate the operator from numerous pieces of transmitter and several hundred dry cells which he had pulled on top of himself as a result of falling flat on the floor following an applied potential of some 400 volts to the tip of his nose!

Racing Car Aid

In the spring of 1922 a friend called at my office and told me that the well-known racing motorist, the late Mr. S. F. Edge, was proposing to try to beat the world's double twelve hour record and was due to start on this endeavour at the Brooklands Track the following morning.

As a result of a conversation over lunch, it had been agreed that I would provide some radio equipment whereby Mr. Edge would be able to communicate between his car and the pits during the course of this run.

Even to-day, with only a few hours' notice, it would not be easy to carry out such a project. Thirty years ago it appeared completely impossible, but in those days the enthusiastic amateur was inclined to supreme optimism in the possibility of attaining the apparently impossible.

Transmission of speech was, in the light of available knowledge and in view of the time available, out of the question. Morse communication seemed a faint possibility if some way could be found of installing a spark transmitter in a racing car in a matter of a few minutes. *(To be continued.)*

THE BATTERY CORONET FOUR

IN the theoretical diagram and wiring diagram of this receiver, published in the last issue, the polarity of the 25 μF condenser across the bias resistor in the output stage was reversed. The positive side of the condenser should, of course, be connected to earth.

Model-control Receivers

DETAILS OF A DIRECT-COUPLED AMPLIFIER

By F. G. Rayer

MODEL-control receivers using a single valve have one or two disadvantages which can become very grave in certain circumstances. If carrier-wave control is used with a single-valve receiver and the latter employs a "hard" or vacuum valve, the range at which control can be obtained is rather limited. To overcome this, a gas-filled valve is usually employed. This is very satisfactory in small models, and equipment used for comparatively short periods, and the range is very much increased. However, this type of valve has a rather limited operating life (usually in the neighbourhood of about twenty hours). This fact makes it unsuitable for equipment which is to have long periods of use.

These disadvantages may be overcome by using a directly-coupled amplifier or control valve. The size of the equipment is increased, and additional batteries are required. In some instances, however, these considerations are not very important, and the life of the valves is very long—similar, indeed, to that obtained from such valves when used in ordinary broadcast band or other receivers. This consideration alone can make such circuits well worth using.

The Quenching Detector

Single valve model control receivers usually employ one valve in a conventional U.S.W. self-quenching detector circuit. Such a detector operates in a state of continuously-interrupted oscillation (usually termed "super-regeneration") which greatly increases sensitivity. Oscillation at radio-frequency (usually about 27 Mc/s) is obtained by a suitable anode/grid coil, while quenching (normally at about 10 Kc/s) may be obtained by a suitable choice of grid condenser and leak values.

When the receiver is operating, the bias produced by oscillation settles to a steady value, and the valve anode current depends upon this value. When the transmitter carrier is radiated, the strength of oscillation is modified, resulting in a change of bias and anode current. With a gas-filled valve, the anode current may change from 1½mA. with transmitter off, to ½mA or less, with transmitter on, even at fair range. This is ample to operate a sensitive relay. With a vacuum valve, however, the change in anode current is very much smaller—possibly only 0.1mA or so—even at reduced range. Direct operation of a relay then becomes impossible, or unreliable, unless "amplification" of this change in anode current is obtained.

The D.C. Amplifier

Conventional forms of amplifier circuits cannot be used because they operate with A.C. signals only, and not with a change in D.C. potential. The desired result can, however, be obtained, and the circuit in Fig. 1 shows how this arises.

Here, R1 is the anode load of the quenching detector, and may be from 25,000 to 100,000 ohms, according to type of valve and H.T. voltage available. Assuming that the transmitter is switched off, and that the anode current and load are of such values that a voltage drop of 20V arises in R1, then it will be seen that the control grid of the second valve is 40V positive relative to the filament of V1. A suitable tapping on the H.T. battery enables the filament of V2 to be 45V positive. The grid of V2 is then 5V negative, relative to filament, and V2 passes an anode current according to this value of bias.

When the anode current of V1 falls, the voltage drop in R1 also falls, thereby tending to bring the grid of V2 more positive. This results in an increase in anode current in V2, and this increase is very much greater than was the decrease in anode current in V1. A relay may therefore be operated.

With this circuit, separate filament batteries are essential. It must also be noted that the operation of the relay is reversed—relay coil current *increases* when the transmitter is switched on, instead of falling, as with the usual 1-valver. The relay contacts must accordingly be wired in such a way that the exterior circuit is closed by the armature being energised, instead of when it is released. This is a simple matter when alternative, or change-over armature contacts are provided. If they are not, then a small secondary relay may be introduced to produce the required effect.

2-Valve D.C. Receiver

A complete circuit employing this method of operation is shown in Fig. 2. The detector may be a 2V small-power triode type, if 2V accumulators are to be used for the filament supply, or an output type valve, either octal based or of B7G type, may be used for dry-battery operation. For the control valve, a pentode of the output type is used, since this gives increased changes in anode current for given changes in grid voltage, compared with the triode in Fig. 1.

The tuning coil will require approximately 11 to 13 turns of wire, if self-supporting and about 1in. in diameter, wound with 18 to 20 s.w.g. wire. (The exact number of turns will depend upon the stray

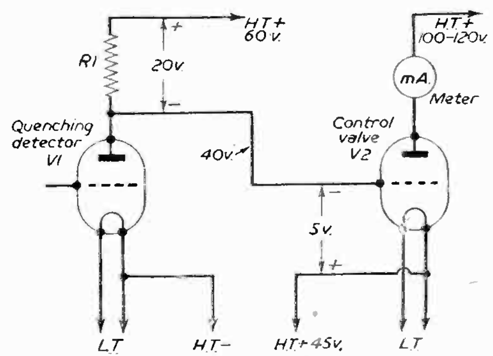


Fig. 1.—Action of a D.C. amplifier.

capacitances of wiring, holder and valve.) The detector stage should be adjusted, with a meter included in series with H.T.1, to obtain the maximum possible change in anode current when the transmitter is switched on. To accomplish this, the tuning condenser should first be rotated until a dip arises in anode current, when tuning to the transmitter carrier. If no dip is obtained, the valve is either failing to oscillate, or the receiver is not tuning to the correct frequency. If shorting the tuning condenser does not cause an increase in anode current, the valve is not oscillating. This may be caused by tight aerial coupling, low filament voltage, a poor valve, or insufficient H.T. voltage.

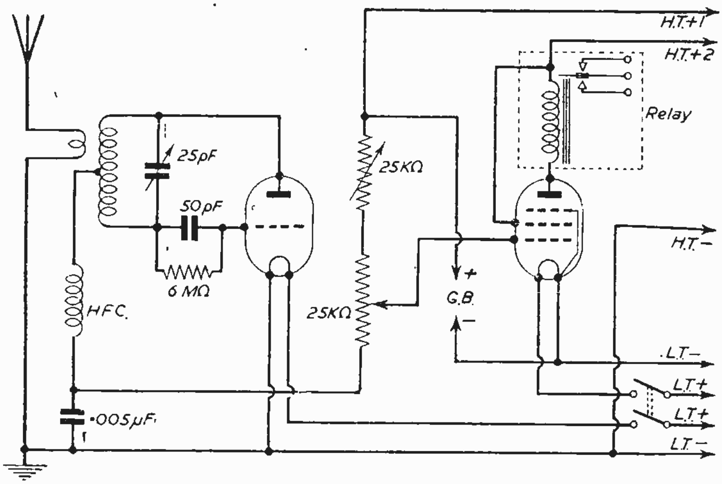


Fig. 2.—Practical circuit for a two-valve receiver.

When oscillation and correct tuning have been obtained, the 25 KΩ regeneration control should be adjusted to bring the valve into its most sensitive condition. Local oscillation should not be too fierce, or control by the transmitter will be lost, especially as range is increased. A little experiment will, however, enable the most sensitive point to be found, and a change in anode current of about 0.5 mA should be obtainable at short range from a transmitter with an output of 1 watt or so.

When the detector is operating correctly, the grid bias value should be adjusted so that adjustment of the 25 KΩ potentiometer enables the grid of the controlled valve to pass through a suitable voltage range for operation of the relay. Final adjustments may be made with a meter in the anode circuit of the second valve, the aim being maximum increase in anode current when the transmitter is switched on. A current change of several milliamps should be obtained at short range, but this will, of course, gradually fall as the range is increased.

The relay should be adjusted so that the armature is *just* released when the transmitter is not radiating. Maximum range will be then secured. Incorrect relay adjustment may very considerably reduce range, so that the relay only operates when transmitter and receiver are close together and the change in anode current is relatively great.

F.M. Transmitters for BBC

THE BBC has placed an order with Marconi's Wireless Telegraph Co., Ltd., for the construction of twenty-six V.H.F. Frequency-Modulated (F.M.) transmitters for sound broadcasting. Delivery will commence within fourteen months.

These transmitters, of Marconi design, comprising twenty-four of 4½ kilowatts power and two of 10 kilowatts, will form part of the BBC's plan to provide a powerful reinforcement to the coverage of its present medium- and long-wave stations, by the use of V.H.F. F.M. stations.

As envisaged, the 4½ kilowatt transmitters will operate in parallel pairs, each pair handling one programme. Thus, six of these transmitters will be used on each three-programme station. The two 10 kilowatt transmitters will be used in parallel at the BBC's existing V.H.F. station at Wrotham, where there are already two 25 kilowatt Marconi transmitters.

Nine Marconi station monitors have also been ordered by the BBC for use on this project.

Technical Details

The range of transmitters has been designed to cover output power-requirements of 1 kW, 4½ kW, 10 kW, and 25 kW. Many new features are incorporated, and the performance of each is outstanding in its own particular output-category.

These transmitters, comprising units of basically similar design, but suitably arranged to provide the various output ratings, operate on the frequency-band 87.5-108 Mc/s. Air-cooled valves are used throughout, leading to a simplification of equipment, with reduced installation and maintenance costs.

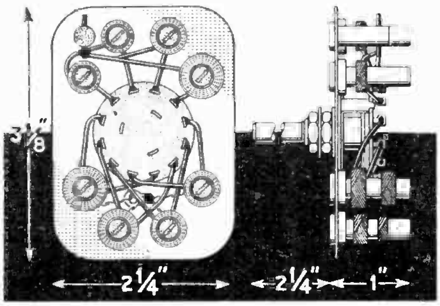
The F.M.Q. drive unit used on these transmitters, employs a frequency-modulated quartz crystal, and supplies an output at the carrier-frequency. This signal is then amplified to raise it to the required output level, the number of amplification stages used depending on the rated power-output.

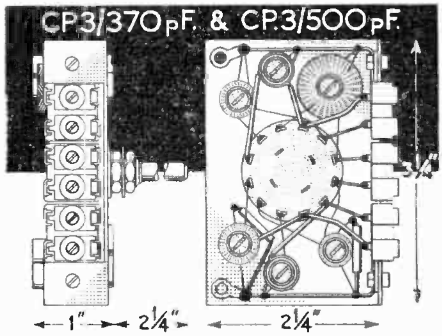
The initial R.F. amplification stages consist of a double-tetrode stage, capacity coupled to a pair of tetrode valves, the anode circuits of which take the form of quarter-wave balanced lines magnetically coupled to a 50 ohms line, from which the output is taken at 250 W.

A third amplifier stage is added (in this case a triode), for the 1 kW equipment. The input is fed via the 50 ohms line to the cathode, the two cathode leads being at the same R.F. potential and forming the inner member of a tuned unbalanced line. The grid is grounded, and the anode circuit takes the form of a concentric line whose electrical length is variable by moving an R.F. short-circuit along the line.

We GUARANTEE these four Coil Packs to be the finest of their class in the Country. Mechanical precision, design and technical performance unsurpassed

CP.4/L & CP.4/M





These compact 4-station Coil Packs are available for either—1 Long wave and 3 Medium wave stations (CP.4/L), or 4 Medium wave stations (CP.4/M). They are fully wired and require only four connections for use with any standard frequency changer valve.

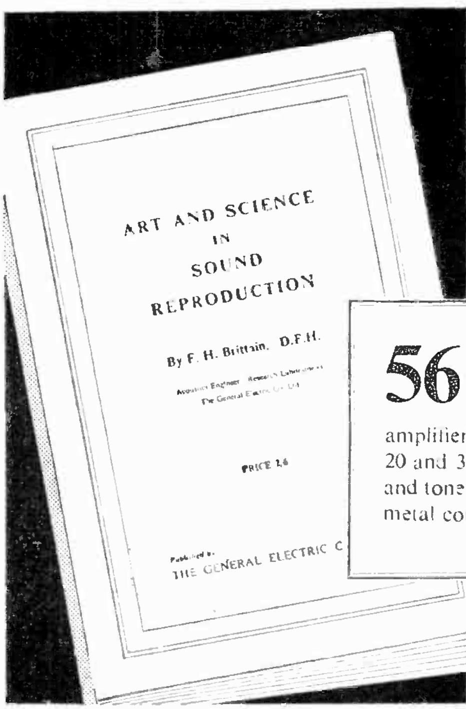
Retail Price of each unit:
25/-, plus 8/4 P.T.—Total 33/4

These 3 waveband Coil Packs are available for use with either 370 pF or 500 pF tuning condensers. The coverages are: Long wave 800-2,000 metres, Med. wave 200-550 metres, Short wave 16-50 metres. Designed for use with Jackson Bros. Full Vision Drive or SL.8 Spin Wheel Drive.

Retail Price of each unit:
32/-, plus 10/8 P.T.—Total 42/8.

Send 9d. for General Catalogue.

DENCO (CLACTON) LTD. **357/9 OLD ROAD, CLACTON-ON-SEA, ESSEX.**



A new essential publication for your technical library!

Published by The General Electric Co. Ltd.

56 PAGES The Art of listening · The loudspeaker · Amplifiers for the high quality reproduction of sound · Design factors in high fidelity amplifiers · Circuits and constructional details on 6, 12, 14, 20 and 30 watt amplifiers · The design of the pre-amplifier and tone control · Notes on feeder units · Using the G.E.C. metal cone Loudspeaker.

2/6 *Post and packing 3d. extra.*

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

SPOT FREQUENCY

SIGNAL GENERATOR

35/-

P. & P. 1/6

Supplied in kit form
No calibrating. No metal work.
Just assemble and use.

Fully Screened in Robust Steel Case 4in. x 4in. x 3in. Operates on Standard 1½-volt Torch Cell.
Six Switched Spot Frequencies, three on Medium and three on Long Wave Bands.
Specially designed to simplify alignment and general receiver servicing.
Can be used anywhere, and is practically indestructible

Our Famous Range of Test Gear Kits also include— **Res/Cap. Bridge, 31/6. Twin Multi-ohmer, 25/-. Inductance Bridge, 42/6. I.F. Aligner, 17/6. Audio Frequency Bridge, 38/6. P. & P., 1/6 each.**

Cash with order or C.O.D. Stamp for illustrated leaflets.

RADIO MAIL DEPT. F, 4 & 6, RALEIGH STREET, NOTTINGHAM.

SOUTHERN RADIO'S WIRELESS BARGAINS

TELESONIC 4-Valve Battery Portable. Complete with Hivac Valves. In Metal Carrying Case. Simply converted to Personal Portable. £2, including conversion Sheet.
TRANSMITTER RECEIVERS. Type "38" Mark II. BRAND NEW. Complete with 5 Valves. Headphones. Aerial and Throat Microphones. £4/15/- per Set. Less Batteries. **TYPE "18" Mark III** Complete with all valves but less Batteries and attachments. READY FOR USE. £7/17/6 Carriage Paid.
ONE HUNDRED ONLY Type "38" Mark II TRANS-RECEIVERS. Used but Complete with all Valves and contained in usual Carrying case. Ready for Use. LESS ATTACHMENTS. 30/- per Set.
RECEIVERS R109. 8-VALVES. Vibrator Pack for 6-volts. In Metal Case with built-in Speaker. 1.8 to 8.5 Mcs. NEW, £7, Carriage Paid.
CRYSTAL MONITORS, TYPE 2. NEW in TRANSIT CASE. Less Crystals, 8/-.
BOMBSIGHT COMPUTERS. Ex-R.A.F. NEW. Contains GYRO, MOTORS, REV. COUNTERS, GEAR WHEELS, ETC., ETC. Ideal for MODEL MAKERS, EXPERIMENTERS, Etc. £3/5/- each.
LUFBRA HOLE CUTTERS. Adjustable ¾ to 3½in. Improved High Speed Type. 6/6. For Metal, Plastic, Wood, etc., use.
RESISTANCES. 100 Assorted Useful Values. Wire-ended. 12/6 per 100.
CONDENSERS. 100 Assorted Values Mica and Tubular, etc. 15/- per 100.
PLASTIC CASES. 14in. by 10¾in. Transparent. Ideal for Maps, Photos, Display, etc., 5/6.
STAR IDENTIFIERS. Type I A-N. Covers both Hemispheres. In case, 5/6.
WESTECTORS. Wx6 and W112, 1/- each.
CONTACTOR TIME SWITCHES. Complete in sound-proof case. 2-impulses per sec. Thermostatic control, 11/6.
REMOTE CONTACTORS for use with above, 7/6.
MORSE TAPPERS. Ex-Government 3/6. Heavy Duty Types, 8/6. Complete Morse Practice Sets with Buzzers, 6/9.

ALL LINES PREVIOUSLY ADVERTISED STILL AVAILABLE.

Full List of RADIO BOOKS, 2½d.

SOUTHERN RADIO SUPPLY LTD.,
11, LITTLE NEWPORT STREET, LONDON, W.C.2
GERrard 6653.

- **T/V TECHNOLOGY**
- **RADIO ENGINEERING**
- **ELECTRONICS**
- **RADIO SERVICING**

There's a big future in T/V and Radio. Act now! Increase your knowledge. Back up experience with a sound theoretical background. I.C.S. offer courses of instruction in—

T/V TECHNOLOGY
ADVANCED SHORT-WAVE RADIO
RADIO ENGINEERING
RADIO SERVICE ENGINEERING
RADAR
ELEMENTARY ELECTRONICS

I.C.S. will also coach you for the following examinations :—
B.I.R.E. ; P.M.G. Certificate for Wireless Operators ; Radio Servicing Certificate (R.T.E.B.) ; C. & G. Telecommunications, etc., etc.

DON'T DELAY—WRITE TO-DAY for free descriptive booklet, stating which subject or examination interests you. Fees include all books needed. Examination students coached until successful. **Reduced terms for H.M. Forces.**

Dept. 170D, I.C.S., 71, Kingsway, W.C.2.

INTERNATIONAL CORRESPONDENCE SCHOOLS, (Dept. 170D), International Buildings, Kingsway, London, W.C.2.

Please send booklet on..

Name.. Age...........
(Block letters, please)

Address..
....

ICS

BUILD THIS AMAZING RADIO

POWERFUL! PERSONAL! PORTABLE!

FOR **30/-** POST FREE

- Selective tuning.
- Acorn low drain valve.
- Loud clear tone.
- Long range.
- No earth.
- Short aerial, 2ft.
- Welded steel case.
- Easy to assemble.
- All parts for this set are sold separately.

MAIL ORDER ONLY

This little set was designed to give you a real personal portable radio that you can enjoy anywhere without disturbing others. Use it on camping trips, in bed, in your office, or just anywhere. Send 2/- for layout, Wiring diagram and Component Price List.

Details of our 30/- Short Wave Receiver are now ready. Send 2/- for Layout, Circuits and Component Price List.

R. C. S. PRODUCTS (RADIO) LTD.,
11, OLIVER ROAD, LONDON, E.17

On Your Wavelength

BY THERMION

Not Sacked !

AS a result of many pleas from readers the Editor has decided not to sack me—yet ! Readers have pleaded with him to give me another chance ! Naturally I am touched by this reader concern that I should not join the dole queue and live like so many others on the welfare state. One reader, Mr. F. J. Jane, of Lostwithiel, one of my fans, says, however, that I have disappointed him recently in that I have "let up" in my attack on those who are paid money for crooning instead of being shut up in a sound-proof chamber with every other crooner and jazz band at full moan, groan and blast. I thought I had written the last word on this topic. Every reader knows my views about *ridm*, and I can assure him I have not changed my views. This reader says that if I *am* sacked "Mr. F. J. C. can expect a row." He wishes more power to my pen.

Jet-propelled Steam Radio

MR. P. H. SPAGNOLETTI, B.A., Chairman of the B.R.E.M.A., recently referred to V.H.F. as jet-propelled steam radio and stated that it would prevent any further deterioration in the sound programme. V.H.F., of course, has been tried in America, but because it did not live up to expectations in that country it is thought by some that it would be an equal failure over here. This is false reasoning for the conditions which apply in America with its hundreds of broadcasting stations which have comparatively small coverage are by no means the same as over here. In this country we rely upon a few high-powered stations whereas in America large numbers of stations are of comparatively low power. Interference over here has been largely due to the increase in the power of stations and it is my view that V.H.F. will eliminate many of the problems of interference.

Parlour Games

NO change in system, however, can eliminate problems not concerned with technique but with programme selection. The tendency to-day is to convert radio programmes into a series of parlour games, or to drag someone to the microphone or the TV screen to deal with such childish and elementary subjects as putting a washer on a tap. Some items give me the impression of having been dragged in by the skin of their teeth. These "panels" with giggling pulchritudes answering stupid questions irritate me. They always remind me of that obnoxious person to be found in most house parties who wants to organise party games. Some of the bearded youths in corduroy trousers, baggy at the knees, suède shoes, green ties and yellow shirts, should be purged from the Augean stable, and the whole subject of programme selection placed in the hands of skilled impresarios or entrepreneurs.

In any case when technical programmes are put out, an expert should be commissioned for the job and not some amateur who knows little of the subject. It would do the BBC good to listen to some of the comment of skilled craftsmen when listeners or viewers are told how to paper a room or repair a crack in the wall. One such aspirant to radio fame recently advised a friend to repair a leaking cistern by putting a film of concrete over the bottom of it !

Reception by Land Line

THIS country has pioneered a system of relayed broadcast reception free from distortion and atmospherics or electrical interference. This is enjoyed in many towns and cities in this country through the operation of British Relay Wireless and Television, Ltd., an organisation that brings direct land line reception from the BBC studios to the terminal unit in the subscriber's premises.

A typical installation is in Leeds, in the industrial north, where B.R.W., as they are generally known, operate their service to a variety of places, including private homes, factories, canteens, hotels, blocks of flats, offices, institutions, hospitals and schools. Subscribers have the choice of four programmes by the simple operation of a selector switch and volume control. No other controls are necessary.

The three BBC programmes are relayed from the studios by direct land line, leased from the General Post Office, to a B.R.W. Central Control Room in each of their main operating areas, where the programmes are monitored and amplified.

In addition to the three BBC programmes B.R.W. also relay their own fourth programme—a composite one composed of selected items from foreign broadcasts. To receive the many stations that help to make up a day's programme a main radio receiving station at Saxmundham, Suffolk, one of the most modern in Europe, is equipped with a large number of specialised aerial arrays. Every known and many unique techniques are employed in the aerial systems to ensure as perfect reception as possible, irrespective of the many variable factors in reception conditions.

Two 100-mile (161-km.) Post Office music circuits connect the receiving station with B.R.W.'s Main Control Centre in London. Other Post Office circuits carry the programme to the company's other operating areas in the Midlands and the West and North of England. In each of these areas Post Office circuits carry the four programmes to amplifying stations which distribute them direct to subscribers by unobtrusive overhead lines.

Many types of receiving units are offered to subscribers and specialised equipment is available to hospitals and schools.

To cover the considerable area in which B.R.W. operate—they have over 160,000 subscribers—many hundreds of miles of cable are required, and for this purpose they make extensive use of our polythene insulated and sheathed cables.

R.E.C.M.F. EXHIBITION, 1954

THE ELEVENTH RADIO COMPONENT SHOW TO BE HELD AT GROSVENOR HOUSE, APRIL 6th-8th, 1954

LIST OF EXHIBITORS

Firm	*Stand No.*
A.B. Metal Products, Limited	33
Advance Components, Limited	11
Aerialite, Limited	118
Antiference, Limited	52
Associated Electronic Engineers, Limited	1
Associated Iliffe Press, Limited	104
Associated Technical Manufacturers, Limited	29
Automatic Coil Winder and Electrical Equipment Co., Limited	111
Allan Richard Radio, Limited	114
Bakelite, Limited	122
Belling and Lee, Limited	55
Bird, Sydney S., and Sons, Limited	53
Bray, Geo., and Co., Limited	93
British Electric Resistance Co., Limited	28
British Insulated Callenders Cables, Limited	68
British Mechanical Productions, Limited	62
British Moulded Plastics, Limited	113
Bulgin, A. F., and Co., Limited	46
Bullers, Limited	4
Carr Fastener Co., Limited	21
Clarke, H., and Co. (Manchester), Limited	92
Collaro, Limited	82
Colvern, Limited	38
Connollys (Blackley), Limited	60
Cosmocord, Limited	76
Creators, Limited	100
Daly (Condensers), Limited	105
Dawe Instruments, Limited	73
De La Rue, Thomas, and Co., Limited (Plastics Division)	80
Diamond H. Switches, Limited	3
Dubilier Condenser Co. (1925), Limited	69
Duratube and Wire, Limited	24
Edison Swan Electric Co., Limited	63
Egen Electric, Limited	20
Electro Acoustic Industries, Limited	40
Electronic Components	98
Electrothermal Engineering, Limited	88
English Electric Co., Limited	101
Enthoven Solders, Limited	43
Erg Industrial Corporation, Limited	119
Eric Resistor, Limited	15
Ever Ready Co. (Great Britain), Limited	124
Ferranti, Limited	16
Fine Wires, Limited	91
Garrard Engineering and Manufacturing Co., Limited	37
General Electric Co., Limited	129
Goldring Manufacturing Co. (Great Britain), Limited	74
Goodmans Industries, Limited	12
Gresham Transformers, Limited	30
Guest, Keen and Nettlefolds, Limited	107
Hallam, Sleigh and Cheston, Limited	90
Hassett and Harper, Limited	117
Hellermann, Limited	81
Henley's, W. T., Telegraph Works Co., Limited	2
Hunt, A. H. (Capacitors), Limited	44
Igranic Electric Co., Limited	7
Imhof, Alfred, Limited	57
Jackson Bros. (London), Limited	51
Langley, London, Limited	126
London Electrical Manufacturing Co., Limited	42
London Electric Wire Co. and Smiths, Limited	14
Long and Hambly, Limited	31
Magnetic and Electrical Alloys, Limited	39
Marconi Instruments, Limited	103
Marrison and Catherall, Limited	110
McMurdo Instrument Co., Limited	64
Micanite and Insulators Co., Limited	59
Morgan Brothers (Publishers), Limited	128
Morganite Resistors, Limited	23
Mullard, Limited	65
Mullard Overseas, Limited	109
Mullard (Valves), Limited	108
Multicore Solders, Limited	66
Murex, Limited	5
Mycalex Co., Limited	86
Neill, James, and Co. (Sheffield), Limited	123
N.S.F., Limited	61
Painton and Co., Limited	27
Parmeko, Limited	48
Partridge Transformers, Limited	22
Plessey Company, Limited	67
Plessey International, Limited	49
Pye, Limited	130
Radio Instruments, Limited	106
Reliance Electrical Wire Co., Limited	47
Reproducers and Amplifiers, Limited	75
Reslosound, Limited	45
Rola Celestion, Limited	35
Ross Courtney and Co., Limited	102
Salford Electrical Instruments, Limited	36
Scott, Geo. L., and Co., Limited	89
Simmonds Aerocessories, Limited	116
Simon Equipment, Limited	83
Spear Engineering, Limited	127
Stability Radio Components, Limited	72
Standard Telephones and Cables, Limited	32
Standard Telephones and Cables, Limited (Valves Division)	79
Static Condenser Co., Limited	94
Steatite and Porcelain Products, Limited	54
Stocko (Metal Works), Limited	99

Firm	Stand No.
Stratton and Co., Limited	10
Suflex, Limited	77
Supply, Ministry of	112
Swift, Levick and Sons, Limited	125
Symons, H. D., and Co., Limited	97
Taylor Electrical Instruments Limited	18
Telcon-Magnetic Cores, Limited	95
Telegraph Condenser Co., Limited	17
Telegraph Construction and Maintenance Co., Limited	78
Telephone Manufacturing Co., Limited	26
Thermo-Plastics, Limited	9
Transradio, Limited	120
Truvox, Limited	71
Tucker, Geo., Eyelet Co., Limited	6
Tufnol, Limited	87
United Insulator Co., Limited	8
Vactite Wire Co., Limited	13
Vitavox, Limited	41
Walter Instruments, Limited	85
Wego Condenser Co., Limited	25
Welwyn Electrical Laboratories, Limited	58
Westinghouse Brake and Signal Co., Limited	34
Weymouth Radio Manufacturing Co., Limited	115
Whiteley Electrical Radio Co., Limited	19
Wimbledon Engineering Co., Limited	84
Wingrove and Rogers, Limited	56
Wireless Telephone Co., Limited	70
Woden Transformer Co., Limited	50
Wolsey Television, Limited	96
Wright and Weaire, Limited	121

A Brief Review of Some of the Exhibits

THERE will be 130 exhibitors in the Eleventh British Radio Component Show, to be held at Grosvenor House, London, from April 6th to 8th, 1954. This is more than at any previous show, and includes six firms who have not previously taken part in this exhibition. This annual private exhibition is organised as usual by the Radio and Electronic Component Manufacturers' Federation (22, Surrey Street, Strand, London, W.C.2), from whom invitations may be obtained. It crowds into the space of a few thousand feet, in a comfortable hotel, a representative display of an industry which employs 40,000 people and turns out nearly 1,000,000,000 components, valves and accessories a year.

The exhibits comprise British-made components for the radio, electronic and telecommunication industries, as well as gramophone components, valves and test gear.

While several manufacturers will not announce their new products until the opening day, it is possible to give some idea of the scope of the exhibits and trend of development and to give some examples. As might be expected, there will be a good many exhibits catering for the development of television all over the world and for its expansion in England to the higher frequencies. Several manufacturers will show multi-channel tuners for TV receivers, there will be valves for the new British TV frequencies and picture tubes with improved focusing units. Some new instruments for television servicing will be shown and there will also be camera cables and television aerials for continental as well as home use.

Resistors, capacitors and other components will be shown in new ranges, meeting still more stringent tests of efficiency under the most severe conditions of temperature and humidity and there will be new applications of some of the latest plastics and other materials. Several firms will show tape recorders this year. Gramophone components, including a new ceramic pick-up, will be well featured and there will also be new microphones and loudspeakers. Printed circuits will also be seen.

The following are extracts from early information received about exhibits in the Radio Component Show.

Aerials

Aerials for sound radio, including FM, and for TV suitable for export to particular markets. One firm has a range of 300 different aerials, specially designed for the American and Canadian standards, including 10-element arrays and stacked all-band aerials. Elimination of metal-to-metal contacts which are prone to corrosion has been accomplished, and universal mounting of telescopic car-radio aerials is also mentioned.

Cables and Couplers

A coupler specially designed for use with centimetre link equipment, but expected to receive other applications.

Demonstration of reduction of residual cable noise by a factor greater than 50 : 1, following special treatment of inner and outer surface of the core insulant.

Wire-end terminals in 150 different sizes.

New 50-ohm helical membrane coaxials and a new 75-ohm cable of 1¼in. diameter.

Air-spaced articulated cable, claimed to be closely approaching the ideal 100 per cent. air-insulated concentric line.

Capacitors and Resistors

A new stable high permittivity ceramic for by-pass capacitor manufacture.

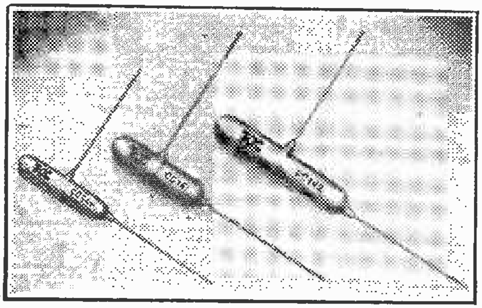
Improved characteristics in reduced size in electrolytics for radio and TV, specialised electronics and A.C. motor starting. Average reduction in size over past year for given capacitance and voltage is esti-

The New Collaro Model 2010 3-speed Transcription Gramophone Unit.

mated at 10 per cent. Standard commercial range operates from minus 20 deg. C. to plus 80 deg. C., and works inspection standards for leakage current has improved by 33⅓ per cent.

Miniature metallised paper capacitors for use up to 85 deg. C.; thermetic metal-cased midgets for operation from minus 100 deg. C. to plus 120 deg. C.

Variable condensers in range of 16 standard patterns covering the whole electronic field from



In the T.C.C. range these ceramic pulse-feed condensers have many advantages.

miniature receivers to transmitting types up to 5,000 v. test.

Extension of capacities and voltages to the range of subminiature electrolytics for transistor circuits and hearing aids.

Controls and Switches

A hermetically-sealed 5-watt rheostat potentiometer, stated to be the only potentiometer of its type fully approved to "H.1," the highest Service specification for resistance to temperature (minus 60 deg. C. to plus 100 deg. C.) and humidity.

Sine/cosine potentiometer 20 K to 30 K to an accuracy of plus/minus one per cent.

A new rotary main switch combining a number of microsensitive switches which can be ganged together in any number up to 12 units. It is compact and small and switches up to 750 watts per section.

Four-channel composite control unit for 3-D sound.

Germanium Exhibits

Apparatus illustrating applications of transistors.

Germanium junction power rectifier a quarter of the size of the present metal rectifier with electrical efficiency of 99 per cent.

Plastics

Silicone mouldings for heat stability, polyester resins for potting miniaturised circuits.

Nylon mouldings, large injection mouldings such as radio cabinets made from medium impact polystyrene as opposed to articles formed from glass fibre impregnated mat.

Extruded insulation in two and three colours, spirally applied—giving colour in depth, not by surface printing.

Terylene as insulation for copper conductors and resistance wires for operation up to 130 deg. C.

Sound Reproduction and Recording

A new transcription motor and ceramic pick-up, to be in production soon, suitable for tropical use.

Tape recordings at a variety of tape speeds—11/16in., 1⅞in., 3¾in. and 15in. per second.

Tape monitor for long duration air/ground communications.

New microphones in both general purpose and deaf aid ranges.

High-fidelity power speakers for large gatherings.

Miscellaneous

New rubber-to-metal bonding technique.

Complete soldering and fluxing process for printed circuits and an automatic soldering head for repetition soldering processes. This automatically feeds the solder forward and brings the iron down to the component to be jointed, making up to 3,000 joints an hour.

Photo-electric cell measuring ¼in. by ⅜in., so sensitive to light that it will operate a relay direct without any form of amplification.

"C" cores with improved bonding technique giving complete stability in operation in temperatures up to 200 deg. C.

A range of small diameter ceramic tubes, the smallest being 0.018in. (0.45 mm.) diameter with a bore of 0.004in. (0.1 mm.), suitable for temperatures up to 1,600 deg. C.

Electronic gauge used in guided missile and supersonic flight research, capable of rapid measuring and calibrating machine parts to a few millionths of an inch.

New nickelising technique for bushes and seals.

Fifteen volt battery for hearing aids of the following dimensions: 19/32in. x 35/64in. x 1⅜in. (15 mm. x 14 mm. x 35 mm.).

TV Valves and Components

New valves for the new British television frequencies (Band III) and V.H.F. F.N. reception.

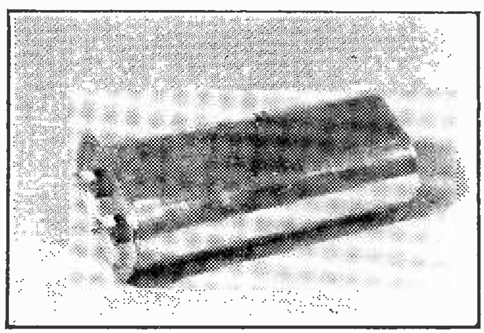
Claimed to be the first wide-angle electrostatically focused tube to be manufactured in Britain, featuring semi-automatic focus, eliminating the need for an external focus coil or magnet.

A new 21in. TV tube giving nearly twice the area of the 17in. tube.

Dual magnet focus unit made more compact than hitherto and incorporating a less expensive method of picture positioning for use in low cost TV receivers.

New focusing unit departing from the use of ring magnets.

Multi-channel turret TV tuners.



A Dubilier "Duconol" capacitor in special aluminium container.

TRANSMITTING TOPICS

DX AND THE GROUND-PLANE AERIAL

By O. J. Russell, B.Sc., A.Inst.P. (G3BHJ)

ONE simple and highly effective aerial system is the ground-plane aerial. However, there are certain aspects of this aerial which are not sufficiently stressed in the few articles describing it. It is too often assumed, for example, that it is a "one-band" system, and thus of little interest to those wishing to work upon all of the DX bands. Moreover, the particular properties of the ground-plane aerial, making it of special value for extreme DX working, may in fact make a casual experimenter think that it is a poor arrangement. This is due to its suppression of "semi-local" signal of the short-skip type of up to, say, 1,000 miles radius. Actually, this feature enables weak DX of long range to be received at up to some 20 Db better discrimination as against a conventional horizontal aerial.

It is clear, therefore, that the ground-plane aerial must be treated with respect. Furthermore, some appreciation of the actual operating principles of a ground-plane aerial are in order, as this will enable effective use to be made of a ground-plane for DX working. In fact, of course, a ground-plane aerial is no more than a scaled-down version of a quarter-wave Marconi aerial, plus a full quarter-wave radial counterpoise system. In practice, of course, few amateurs could possibly erect such a system on top band or even 80 metres for operation on the L.F. bands. However, upon the H.F. DX bands, such a scaled-down system becomes the ground-plane. In operating principle there is very little difference between them. However, there *are* a few points to watch. First of all with an H.F. ground-plane aerial, the *whole* aerial—ground-plane radials as well—can be comfortably erected at a reasonable height above the ground. On V.H.F. systems it may, in fact, be erected at a very considerable height above ground. The London Taxi service aerial near the Crystal Palace is, no doubt, familiar to many readers. However, for the DX bands it is still possible to erect the ground-plane radials well above earth. This is well worth while if it can be arranged, as the ground-plane radiates a very low-angle pattern. The effects of nearby obstructions may, in fact, interfere badly if the aerial system is erected at ground level. Accordingly, the absorption of nearby buildings can conveniently be overcome by raising the ground-plane aerial system well above earth. The diagram of Fig. 1 shows the *theoretical* radiation pattern obtained over a perfectly conducting earth, *plus* the effects of the lower conductivity of a normal location.

Radials

While the basis of the ground-plane aerial is a quarter-wave vertical with quarter-wave radials, optimum performance is obtained by having the radials slightly longer than the vertical "whip" section. As a basis for constructing a practical ground-plane aerial, the following design notes may help. The

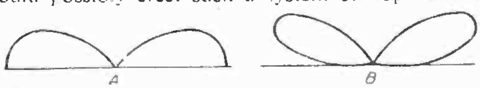


Fig. 1 (above). A, Vertical radiation pattern of a ground-plane over a perfectly conducting earth. Maximum radiation at zero angle. B, Vertical pattern of ground-plane over average location. Radiation pattern is still good at low angles, but zero angle radiation is attenuated.

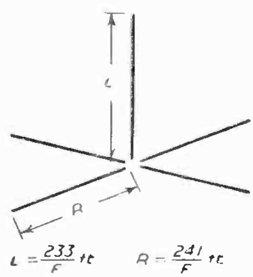
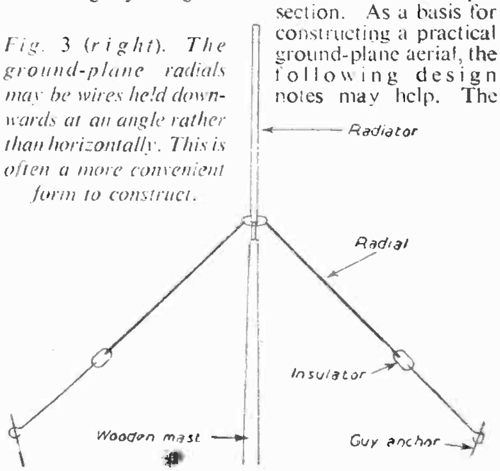


Fig. 2.—Dimensions of whip and radials for a frequency "F." Four radials are conventionally used.

Fig. 3 (right). The ground-plane radials may be wires held downwards at an angle rather than horizontally. This is often a more convenient form to construct.



vertical "whip" should be cut for a frequency of F megacycles to $\frac{233 \text{ ft.}}{F}$, and the radial wires should each be $\frac{241 \text{ ft.}}{F}$ long. However, if ground effects or nearby buildings interfere, these lengths may need very slight readjustment.

One aspect of the ground-plane is that the vertical "whip" is quite short on the DX bands. This has an important bearing upon construction. Thus for 20 metres, the vertical will be, say, 16ft. 8in. for C.W. edge operation. This can, therefore, be made of the well-known interlocking steel tube units available as "surplus" items. Some supporting guy wires may be necessary for 20 metres, but certainly not for a 10-metre band ground-plane. On 40 metres more rigid tube is needed, but a "gas-pipe" whip is a possibility. Furthermore, where it is not feasible to have the ground radials at right-angles to the "whip," they may be sloped downwards. This actually raises the centre impedance of the ground-plane from its 36-ohm figure for right-angled radials, and the limit is reached then the whips hang down so that the aerial becomes a centre-fed vertical of 72 ohms centre-feed impedance. However, with the radials at an intermediate angle, they still function as a ground-plane, but need no longer be self-supporting, as they can be wires maintained in tension by guys taken to anchors (Fig. 3).

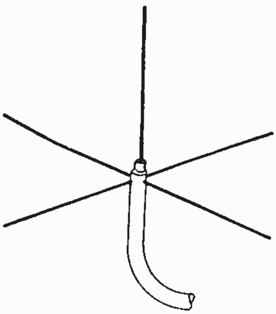


Fig. 4.—Method of attaching aerial components to a coaxial feed line. Radials are soldered to the outer sheath. The centre "whip" goes to the centre wire of the coaxial cable.

Feeding

Methods of feeding such ground-plane aerials are, of course, of importance. The conventional method is to use coaxial feed, with the centre conductor of the coax taken to the whip, and the radials grounded to the outer sheath of the coaxial cable (Fig. 4). This is an elegant method, much in vogue for V.H.F. radiators. However, despite the agonies of self-appointed "experts," there is no real need to use coaxial cable. In fact, a tuned resonant parallel wire feed may be used. This is of real utility, as it makes multiband operation of a ground-plane feasible. Spaced wire feeders, or 300 ohm line, preferably the round-section type for all weather use, are satisfactory in this application. Despite the presence of standing waves, efficiency will be high. It might well be higher than if cheap coaxial cable were used. Moreover, if multiband operation is desired, the parallel tuned line is more convenient. Thus a 20 metre ground-plane will also operate on 10 metres with reasonable efficiency. A 20 metre ground-plane will operate on 40 metres, although not with the highest efficiency. Thus three-band operation is feasible. A 20 metre ground-plane would thus be useful for 40 metres and 10 metres as well. However, while a 40 metre ground-plane would be effective upon 20 metres, it *would not* give correct low-angle radiation on 10 metres. It would still be useful for shortskip 10 metre Q.S.Os however, while retaining the full DX capabilities for 20 and 40 operation.

The transmitting end coupling circuits also need some discussion. Coaxial feed for one-band operation requires a low-impedance feed. Three suitable circuits are shown in Fig. 5. A Pi output TX for example, designed to operate into a low-impedance line (the usual arrangement), Fig. 5A, is thus a popular choice. Also for low-impedance feeds, the series-tuned circuit link coupled to the TX (Fig. 5B) is also very useful. Under some conditions the use of taps across a link-coupled parallel-tuned circuit (Fig. 5C) may be more effective. For parallel-feed systems, using tuned lines, the conventional series-tuned or parallel-tuned link-coupled tuning systems (Fig. 6) will be used. For lines approximately an odd number of quarter waves long (for fundamental ground-plane frequency working) the parallel-tuned system will be used. For lines multiples of half-waves (i.e., an even number of quarter waves), the tuning system will be the series circuit. However, for operation on other than the fundamental frequency, it may be necessary to change from series tuning to parallel tuning or *vice versa*, depending on circumstances.

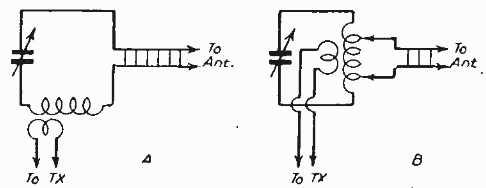


Fig. 6.—Parallel resonant wire feed lines are easily handled by the appropriate series circuit A, or the parallel circuit B, according to line length and band of operation.

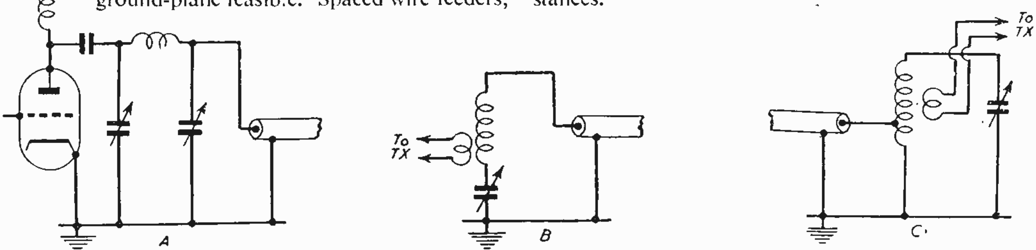
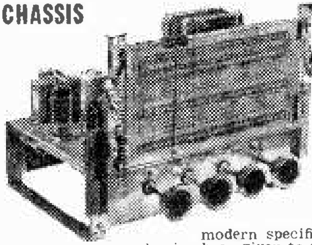


Fig. 5.—Arrangements A and B are most useful for feeding coaxially fed ground-plane aerials. However, arrangement C may be of value in case of difficulty with A or B methods.

A COMPLETELY ASSEMBLED "ALL-WAVE" SUPERHET CHASSIS



MODERNISE YOUR OLD RADIOGRAM FOR £23

We offer this Autochanger complete with Model B.3 3-waveband as advertised together with 10in. p.m. Speaker for £23 plus 10/- carr. and ins., or with B3PP Model for £26, plus 10/- carr. and ins.

MODEL B.3—A 5-valve 3 waveband Superhet Receiver for operation on A.C. mains 100-120 volts and 200-250 volts employing the very latest miniature valves. It is designed to the most modern specification, great attention having been given to the quality of reproduction which gives excellent clarity of speech and music on both Gram and Radio, making it the ideal replacement Chassis for that "old Radiogram," etc.

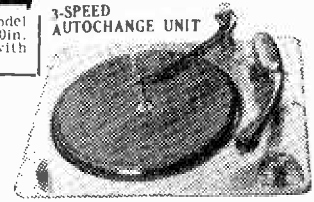
Brief specifications:—Model B.3—Valve line up, 6BE6, 6BA6, 6AT6, 6BW6, 6X4. Waveband Coverage: Short 16-50; Medium 187-550; Long 900-2,000 metres. Controls (1) Volume with on/off; (2) Tuning (flywheel type); (3) Wave change and Gram; (4) Tone (3 position switch operative on Gram and Radio).

Negative Feedback is employed over the entire audio stages. Chassis size, 11in. x 7¾in. x 8½in. high. Dial size, 9¼in. x 4¾in. Price, complete and READY FOR USE excluding speaker, £12/12/-. (Carr. and Pkg. 7/6 extra.)

MODEL B.3. P.P.—This model is the B.3. Receiver but incorporates two 6BW6 VALVES in PUSH-PULL, resulting in really excellent quality reproduction up to approximately 6 watts. Price £15/15/-. (Plus 7/6 carr. and ins.)

A GENUINE SPECIAL OFFER!

The COLLARO 3RC/521 3-SPEED AUTOCHANGE UNIT



£9/19/6

(plus 7/6 carr. and ins.)
Normal price £18 10/-.

- These units will auto-change on all three speeds, 7in., 10in., and 12in.
- Incorporating Hi-fi Crystal "Turnover" Head.
- They have separate sapphires for L.P. and 78 r.p.m. which are moved into position by a simple switch.
- Minimum base-board size required 13¾in. x 12¼in. with height above 5¼in. and height below baseboard 2¼in. A bulk purchase enables us to offer these BRAND-NEW UNITS, including mounting instructions, at this exceptional price.

A DUAL CHANNEL PRE-AMPLIFIER and TONE CONTROL UNIT

This comprehensive PRE-AMPLIFIER and TONE CONTROL UNIT provides full control of Bass, and Treble in conjunction with a main Volume/Mixer Control. Can be used with any Amplifier and any Pick-up, the range of frequency control provided by the unit affording ample compensation for all types of Pick-up and all natures of recordings, i.e., English, American and Long-Playing, without recourse to Pick-up correction. The extreme flexibility of the Bass and Treble Controls is such that the level of Bass and Treble can be set to suit any conditions irrespective of the volume output of the Amplifier.

The Unit measures only 7in. x 4in. x 2in. including self-contained Power Supply, and can be accommodated either on or away from the main Amplifier, i.e., in the front panel of a Cabinet or any other position. Price, including drilled chassis, valves (6SN7 and 6J5), £3 16/9. Complete assembly data are available separately for 1/3. Completely assembled and ready for use, £5/5/-.

ANNOUNCING A NEW DESIGN

The STERN'S "SUPER-SIX"

A COMPACT AND HIGHLY EFFICIENT RADIO-RADIOGRAM RECEIVER CHASSIS.

BRIEF DETAILS

- Covers 3 Wavebands, 18-50 metres, 190-550, 800-2,000 metres.
- DELAYED A.V.C. on ALL WAVEBANDS.
- 4 POSITION TONE CONTROL.
- Provides INDEPENDENT MAINS SUPPLY FOR RECORD PLAYER (if required).
- Employs 6 VALVES having PUSH-PULL for 5-6 WATTS OUTPUT.
- PRE-SELECTIVE FEED-BACK.
- REAL QUALITY both RADIO and GRAM.
- FOR AC MAINS SUPPLY 200-250 Volts 50 cycles.

THE COMPLETE ASSEMBLY MANUAL IS AVAILABLE FOR 2/-. This gives very detailed practical drawings and layouts and includes a complete price list.

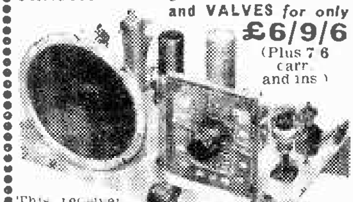
- THE COMPLETE RECEIVER CAN BE BUILT FOR £10/7/6, including the OCTAL VALVE LINE-UP or for £12/7/6 with the MINIATURE VALVES.

A 4-VALVE QUALITY "PUSH-PULL" 6-8 watt AMPLIFIER for A.C. mains

Incorporating Negative Feedback, Filter Input, Circuit and employing 6V6s in Push-Pull. A simple arrangement is provided to enable either a magnetic crystal or lightweight pick-up to be used, and is suitable for use with Standard or Long-Playing records. A tone control is incorporated, and the 10-watt output transformer is designed to match 2 to 15 ohm speakers. The overall size of the assembled chassis is 10in. x 8in. x 7½in. high, and full practical diagrams are supplied. Price, including drilled chassis and valves, of complete kit, £6 17/6. Price of assembled chassis, supplied ready for use, £8 12/6. Full descriptive leaflets are available separately for 1/-.

A COMPLETE 4 VALVE T.R.F. CHASSIS including a 5" P.M. SPEAKER and VALVES for only £6/9/6

(Plus 7/6 carr. and ins.)



This receiver is the very latest design covering both L. and M.W.-bands, and includes modern BVA miniature valves, line up being 12BA6—12AT6—12A6—35W4. It incorporates Permeability Tuned Coils, ensuring excellent selectivity and sensitivity. Overall size of complete chassis including Speaker 10½in. x 4½in. x 6½in., attractive Bakelite Ivory finished Cabinet size 11½in. x 5½in. x 6½in. available for 16/6. (Plus 2/6 carr. and ins.)

COMPLETE KIT for 12 WATT HIGH FIDELITY "Push-Pull" AMPLIFIER

Designed for A.C. mains 200 to 250 volts, employs 6 valves plus rectifier, with negative feed-back, and comprises a main amplifier chassis and a remote controlled Pre-amplifier and Tone Control Unit, incorporating four controls—bass, treble, main volume or mixing control, and a radio, gram, microphone selector switch. This control unit measures only 7 x 4 x 2in. The measured frequency range of the amplifier with this unit shows an excellent response from 14,000 cycles down to 20 cycles, the bass and treble controls allowing independent control of gain at both ends of the frequency range from zero to a gain of 50. It can be seen, therefore, that ample correction is provided to suit any type of pick-up with any type of recording. Input voltage for maximum output is 70 mV. 6.3 volts at 2 amps. and 30 mA. H.T. is provided for tuning unit etc. Price of complete kit, Amplifier and Control Unit, including drilled chassis and valves, £14. Complete specification and layout, 2/-. We can also supply completely assembled and ready for use at £17. Please add 7/6 carr. and insurance.

THIS AMPLIFIER COMPARES WELL WITH THE WILLIAMSON AND SIMILAR DESIGNS AT A FRACTION OF THE COST.

"Personal Set" Battery Eliminator

A complete kit of parts to build a Midget "All-dry" Battery Eliminator, giving approx. 69 volts and 1.4 volts. This Eliminator is for use on A.C. mains and is suitable for any 4 valve Superhet receiver requiring H.T. and L.T. voltage as above or approx. to 69 volts. The kit is quite easily and quickly assembled and is housed in a light aluminium case, size 4¼in. x 1¾in. x 3¼in. Price of complete kit with easy-to-follow assembly instructions, 42/6. In addition we can offer a similar COMPLETE KIT to provide approx. 90 volts and 1.4 volts. Size of assembled Unit 7in. x 2¼in. x 1¼in. Price 47/6. (Plus 1/- carr. and ins.)

STERN RADIO Ltd.

109 & 115, FLEET STREET, E.C.4.
TELEPHONE: CENtral 5812/3/4

HANNEY of BATH offers:—

EDDYSTONE 740 RECEIVER, ex-stock at **£42/15/-**. Send for illustrated brochure. NEW Eddystone catalogue **1/2** post free.
MIKES.—Acos Mic. 22-2. **84/-**; Mic. 30, **50/-**; Mic. 33-1, **50/-**; Mic. 35-1, **25/-**; Rothermel 2AD56. **63/-**.
LOUDSPEAKERS.—Goodmans Audiom 60, **£8/12/6**; Axiom, 150 Mk. II, **£10/5/6**. W B, HIGH FIDELITY, 3 Ω coil. HF.610, 6in. **50/6**; H.F.810 8in., **60/6**; H.F.912, 9in., **67/-**; H.F.1012, 10in., **73/6**; (15Ω available at **73/6**).
COILS. (State range required.)—Osmor Q. **4/-**; Weymouth H. **3/9**; Wearite P, **3/-**; Denco C TRF. **8/-** pr.; Denco Maxi-Q std. or miniature, **3/11**, with reaction, **4/9**; R.E.P. dual range high gain. **4/-**. OSMOR Q Coilpacks. Type HO, **48/-**; LM, **40/-**; Batt., **50/-**; TRF, **40/-**; ETA 4 Station Tuning pack. **43/8**.
I.F. TRANS. (465 Kc/s.) Denco IFT. 11, **12/-** pr.; IFT. 6, **18/4** pr.; Wearite M.800, **21/-** pr.; Weymouth P.4, **15/-** pr.; P.5, **8/6** each; P.5A, **10/-** each.
OUTPUT TRANSFORMERS.—50 watt POTTED de Luxe type to suit single or push-pull PX4, 6V6, 6L6 and KT66 valves. Optimum leads 4,000Ω to 10,000Ω. Eleven ratios 15½ : 1 to 78 : 1. **47/3**. Elstone MR/T 4 w. multi-ratio, **8/9**; Elstone MR/7, 7-10 w. multi-ratio, **18/9**; MR.15, 15 w. multi, **41/6**; MR.30, 30 w. multi, **49/6**. Woden Williamson, Potted, WOT25, 1.7Ω secs., **£6 10/-**. WOT.2.6, 3.6 Ω secs., **£6/18/6**.
P.W. CORONETS.—JB. SL8 Drive. **27/6**; E.2 V-Condenser. **14/-**; W.B. 8in. H.F.810 L.S. (less trans.), **60/6**; All resistors and condensers as per our General List.
TELEKING.—Constructors' Envelope, **6/-**; Coilsets, **44/6**; Chassis kit, **50/-**; T.C.C. kit. **£7/4/3**; RM4 rectifier, **21/-**; Allen Components, LO308, **40/-**; FO305, **21/-**; DC300, **39/6**; FC302, **31/-**; GL16 and GL18, **7/6** each; BT314, **15/-**; SC312, **21/-**; AT310, **30/-**; OP117, **9/-**; Dubilier Resistor pot. kit, **81/6**.
P.T. SUPER VISOR
T.C.C. Condenser kit, **£8/6/4**; Erie resistor kit, **54/4**; 4 w/w pots, **26/-**; 7 Erie carbon pots, **35/-**; Allen coilsets, **44/6**; Allen CD/300C, **39/6**; GL.16 and GL.18, **7/6** each; SC.312, **21/-**; FC.302, **31/-**; OP.117 output trans., **9/-**; Denco WA/FMA1, **21/-**; WA/LOT1, **42/-**; Denco chassis kit, **51/6**; Westinghouse WX.6, **3/10**; WG4A, **7/6**; LW.7, **26/8**; English Electric polystyrene mask, **45/8**; perspex filter, **32/8**; anti-corona ring, **6/8**; Tube sheath, **6/2**; T.901 tube, inc. carriage and insurance, **£22/14/10**; Elac IT8 ion trap, **5/-**.
WIDE ANGLE VIEWMASTER.—Instruction Envelope, **3/6**. Priced parts list available on request.
CATHODE RAY TUBES.—Mazda, CRM.121B, **£16/13/8**; CRM.123, **£17/14/6**. Mullard MW31-74, **£16/13/8**; MW36-22 & 24, **£19/9/3**; MW43-74, **£23/12/8**. Ion traps for all tubes, **5/-** each. Please add 10/- carriage and insurance on all tubes, any excess being refunded.
Send 6d. in stamps for our GENERAL LIST, which contains details of components for Viewmaster, Teleking, Magnaview, Super Visor, 'Universal' large Screen Televisor, by Mullards, Coronet Four, Williamson Amplifier, Soundmaster, etc., etc. Please add postage to orders under £2.

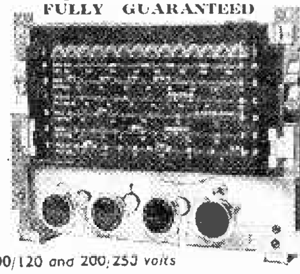
L. F. HANNEY 77, LOWER BRISTOL ROAD, BATH Tel.: 3811

DIRECT FROM THE MANUFACTURER

DULCI RADIO/RADIOGRAM CHASSIS

Built to Highest Technical Standards
FULLY GUARANTEED

All chassis 11¼in. x 7in. x 8½in. high. Latest type valves 6BE6, 6BA6, 6AT6, 6BW6, 6X4. Flywheel tuning. Negative feedback over entire audio section. Engraved knobs. 3 tone positions for radio and gram.



For A.C. Mains 100/120 and 200/250 volts

Model B3.—Long, Medium, Short 5 Valves. Output 3½ watt	**£12/12/0**
Model B3.—Plus Push Pull Stage 6 Valves. Output 6 watt	**£15/15/0**
Model B3.—Double Feature with P/Pull & R.F. Stage. 7 Valves Output 6 watt	**£18/18/0**
Model B6.—Six Wavebands. Med.Long, 4 Short. (3 Bandspread.) 5 valves. Output 3½ w.	**£15/15/0**
Model B6.—Plus Push Pull Stage 6 Valves. Output 6 watt	**£18/18/0**
Model B6.—Double Feature with P/Pull & R.F. Stage. 7 Valves. Output 6 watt	**£23/2/0**

ALL PRICES TAX PAID

Escutcheon for 9in. x 5in. dial, 4/9 extra. Matching speakers P.M. type 3 ohms. 8in. or 10in. available. **Chassis sent under money back guarantee conditions against remittance.** Free particulars from the manufacturers.

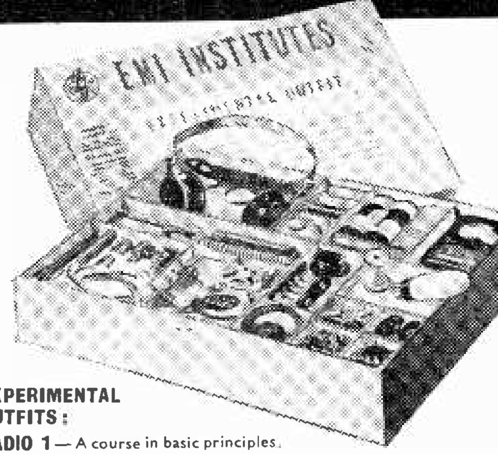
THE DULCI CO. LTD.,
99 VILLIERS RD., LONDON N.W.2. *Telephone: Willesden 7778*

NEW! EXPERIMENTAL OUTFITS

LEARN THE PRACTICAL WAY

Specially prepared sets of radio parts (which you receive upon enrolment) with which we teach you, in your own home, the working of fundamental electronic circuits and bring you easily to the point when you can construct and service radio sets. Whether you are a student for an examination; starting a new hobby; intent upon a career in industry; or running your own business — these Practical Courses are intended for YOU — and may be yours at very moderate cost.

EASY TERMS FROM £1 A MONTH



POST THIS COUPON TODAY

Please send me your FREE book on Practical Courses:

I am interested in ....

To: E.M.I. INSTITUTES, Dept. 32X, 43 Grove Park Road, Chiswick, London, W.4.

NAME..

ADDRESS ....

....

EXPERIMENTAL OUTFITS:

RADIO 1 — A course in basic principles.

RADIO 2 — Instruction and equipment from which you build a Radio Receiver.

TELEVISION — Instruction and equipment for building a Television Receiver.

Also for Mechanics, Electricity, Chemistry, Photography, Carpentry, Draughtsmanship, Commercial Art, Amateur S.W.Radio, Languages.

E.M.I. INSTITUTES The only Postal College which is part of a world-wide Industrial Organisation.

IC23

The Beginner's Guide to RADIO

The Thirteenth Article of a Series Explaining the Fundamentals of Radio Transmission and Reception. This Month the Transmission of the Signal is Being Discussed

By F. J. CAMM

WE carry the pendulum analogy a little farther. Suspend a weight from a piece of string and swing the weight. If, whilst it is swinging, you hold the centre of the string you will notice that the rate of swing increases. If you suddenly increase the length of the string while the pendulum is in motion its speed will be reduced. In this example the pendulum may be considered as the aerial circuit of a receiver. If the pendulum is of the right length, so to speak, it will swing in harmony with the waves, but if it is not it will get out of step. In other words, if the aerial circuit of the receiver is accurately tuned it will resonate in sympathy with the incoming wireless waves, but not otherwise.

Station Selection

It is because a set must be tuned to a particular frequency in order to receive a particular programme that it is possible for a number of transmitting stations to broadcast at the same time and to receive only one of them. Each broadcasting station radiates on a different wavelength (length of pendulum analogy). Refer back to Figs. 55, 56 and 57 on page 210 of the April issue. The pendulum is shown swinging in unison with the waves on the water. The crest of each approaching wave strikes it at the right point in its course to keep it swinging continuously. Now suppose that the waves become more crowded (of shorter wavelength) so that before the pendulum has time to swing back from the first stroke it receives an impact from another wave.

Obviously, the swing of the pendulum will be upset and it would not respond to the action of the waves. In the same way, if the waves are more widely spaced (longer wavelength) there will still be no response from the pendulum. These three conditions correspond to the conditions prevailing when a set is tuned to a particular station while two other stations are also transmitting, one on a shorter and the other on a longer wavelength. Only one station would be received, not three. To pick up either of the other two stations the aerial circuit must be retuned in the same way as the length of the pendulum would have to be altered if it were to keep in synchronism with shorter or longer waves.

The Aerial Tuning Coil

Aerial tuning coils take many forms. We have seen earlier that it may consist of a simple hank of wire, a number of turns wound round a cardboard former or it can take the more complicated form seen in receivers to-day. The wire for the coils is copper and it is covered with either cotton or silk so that the turns are insulated from one another. This is necessary in order to compel the small electric current picked up by the aerial to travel from one end of the wire to the other and not to jump across from one turn to the next.

The simplest way of connecting the aerial coil is to join one end of the wire to the aerial and the other to the earth. This latter may be a metal rod or plate bedded in the earth, a water pipe or some piece of metal in connection with the earth. The tuning of the aerial circuit is dependent on the size of the aerial coil (number of turns) and the capacity of the tuning condenser.

The Tuning Condenser

The use of the tuning condenser is to vary the capacity of the aerial circuit. It is a sort of vernier device. The aerial coil is wound with sufficient turns to receive all stations on the particular wavebands to be covered—medium and long, and sometimes short, medium and long (as in the case of all-wave receivers). The condenser is used to vary the range of the coil. The tuning knob varies the interleaving of the fixed and moving plates and by rotating the knob you can

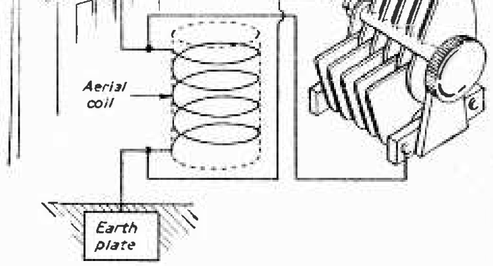


Fig. 58.—The elements of the aerial tuning circuit shown diagrammatically.

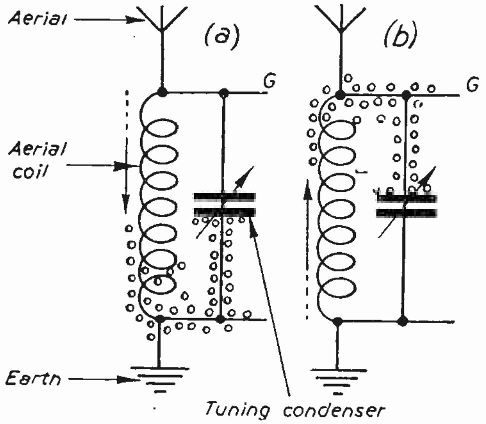


Fig. 59 (a) and (b).—Diagram illustrating the flow of electric currents in the aerial circuit of a receiver. The electrons first flow to one end of the tuning circuit as at (a), and then to the other end, as at (b).

tune the receiver to various wavelengths. This is similar to being able to adjust the rate of the pendulum in the examples previously given. If you wish to receive a station on the lower wavelengths the plates are moved outside the fixed plates and the reverse for the higher wavelengths.

The Carrier Wave (see Fig. 58)

As soon as the broadcasting station is switched on, and before anyone speaks into the microphone, wireless waves are being radiated. These I liken to waves on the surface of water, and, as previously explained, they are all of the same height and follow one another at the same interval of time. What happens when anyone speaks into the microphone is that the waves no longer remain the same height, but fluctuate in accordance with every variation in the tone of the speaker's voice. Of course, they do not vary in length (distance between each crest), but only in height. Naturally, the length of the waves must not vary, otherwise we should not be able to tune them in. This means that the waves will still cause electric currents to surge up and down your aerial, but they will vary in strength according as the waves vary in height, these variations in turn having been caused by the fluctuating sounds of the speaker's voice. Thus, the height of the waves varies while the length is constant.

The Speed of Waves

It is perhaps as well at this stage to make some mention of the velocity of wireless waves. Actually they travel incredibly fast, something like 300,000,000 metres per second. This means, for instance, that waves 200 metres in length sent out by a broadcasting station would strike your aerial at the rate of 1,500,000 per second. These in turn set up electric currents in your aerial circuit which surge up and down it at the same speed. Owing to their very rapid oscillations these currents are known as high-frequency currents. It is with these that the first valve in our receiver has to deal. In order to explain the action of this valve we shall have to make one or two elementary studies of electricity.

What is Electric Current ?

The accepted theory of electricity is that all matter of whatever nature, whether it be solid, liquid or gaseous, whether it be metal, wood, stone, water, air or anything else, is composed of minute particles called atoms. But these atoms are not simply tiny pieces of one sort of stuff. They in themselves are composed of a centre core or nucleus of positive electricity. This nucleus is surrounded by a number of negative particles of electricity. These latter are the electrons—and in size we know them to be infinitesimally small—which are responsible for electric currents. These, unlike the positive nuclei, need not remain stationary on a substance, but can move about. If a number of them are made to travel to one end of a wire it is said that an electric current flows along the wire.

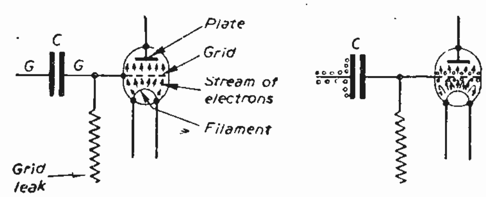
In the ordinary way there are just sufficient electrons in each atom electrically to balance the positive nucleus ; but if some of the electrons leave the atoms at one end of the wire and go to the other end, then the end to which they have gone will have a larger proportion of negative particles than normally, and is, therefore, said to be negative ; in the same way, the other end of the wire having a deficiency of negative particles will be positive.

Electric Currents in a Radio Receiver

First the electrons mentioned above travel to one end of the circuit and then to the other. This is going on all the time your set is tuned to a station, the only difference being that sometimes a larger and sometimes a smaller flow takes place, according as the wireless waves vary in magnitude with the speech or music being transmitted. By connecting a wire to the first valve, the electrons are made to do some useful work.

The reason that we cannot connect up the loudspeaker right away and hear the music is that the currents in the aerial circuit move too fast. We have already seen how quickly they oscillate backwards and forwards, the result being that the loudspeaker would be unable to follow them, for as soon as it commences to respond to the flow in one direction, the current would have already changed and be flowing in the opposite direction, the average effect being nil.

(To be continued.)



Figs. 60 and 61.—(Left) The normal electron flow inside the valve. (Right) the signal electrons on the grid and grid condenser.

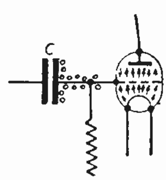
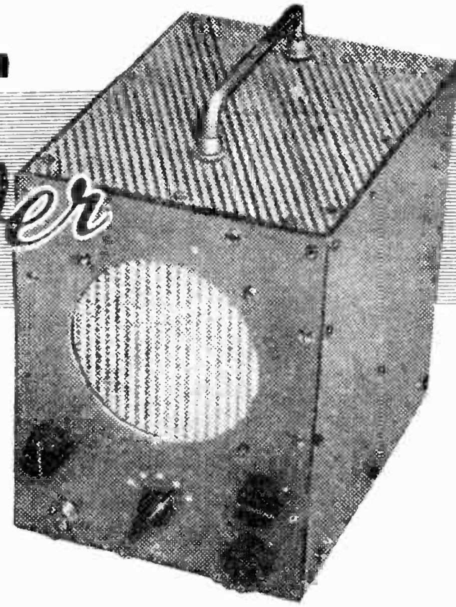


Fig. 62.—The accumulation on the grid side of the condenser.

a PRE-SET A.C. Receiver



A SIMPLE AND COMPACT 5-VALVE SUPERHET

By D. A. Smith

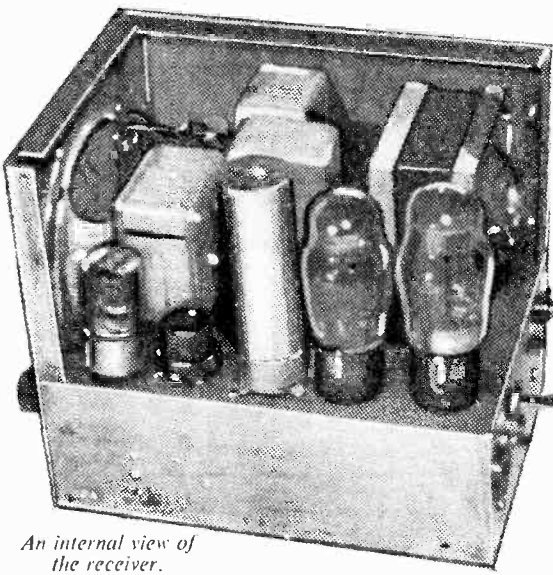
THIS receiver was constructed for portability and was required to provide for the reception of either the long-wave Light Programme on 200 kc/s or the medium-wave Home Service on 908 kc/s by the operation of a single switch. It is robust, and small enough to be carried from room to room, making a useful secondary receiver. A switch is incorporated to enable it to take its power supplies from an external source via an octal socket in the rear, so that with the installation of a vibrator pack in the car it can be used on picnics, etc.

The circuit diagram shows that it is quite straightforward. Some non-essential components have been left out in order to make it easier to wire up, and to keep the size down without resorting to the use of miniature components.

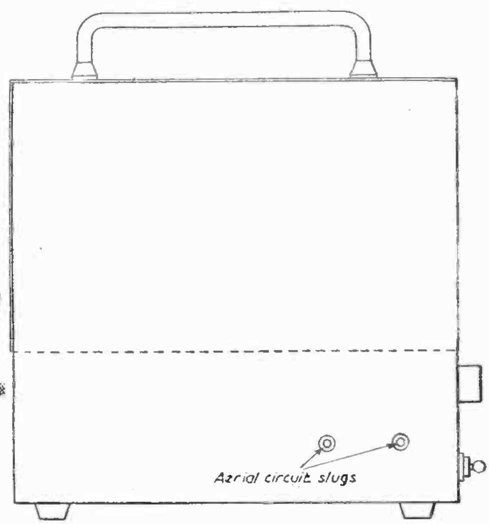
To use up some I.F. transformers already to hand, an intermediate frequency of 175 kc/s was selected, but there is, of course, no reason why the conventional 465 kc/s should not be used if the local oscillator is adjusted accordingly.

A triode hexode, such as the 6K8, is the obvious valve to use as the frequency changer, but a 6L7 pentagrid was available in the spares box so this was used. This particular pentagrid is designed for use as a mixer only, with a separate oscillator. It was found to function satisfactorily in this application, however, as a combined oscillator and mixer, the cathode and first two grids forming the oscillator section and the signal being applied to grid No. 3.

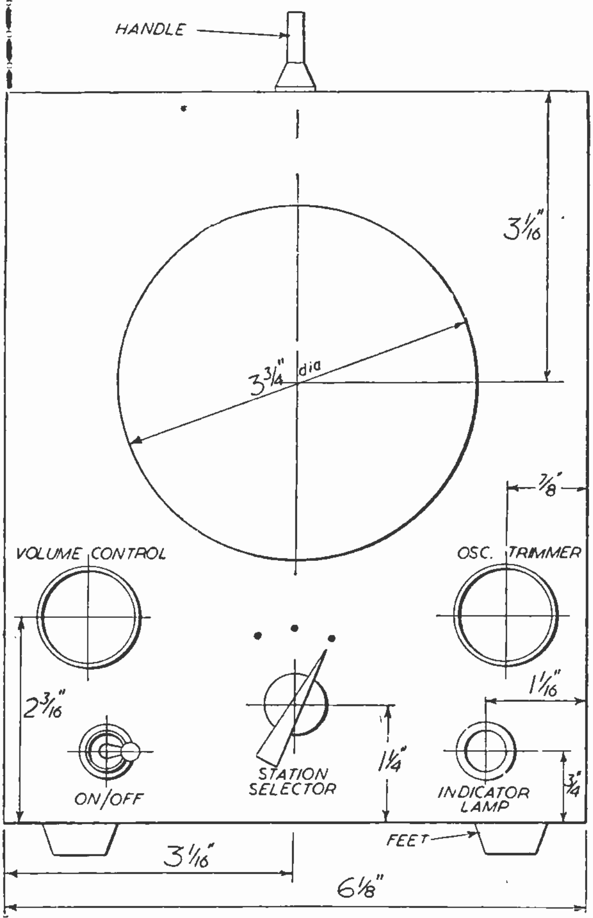
A four-pole three-position switch is used as station selector, the third position being a silent one—a useful facility. This switch selects tuned circuits for the frequency changer input and oscillator circuits. The coils used in this case were surplus from a BC433 radio compass receiver, but proprietary ones



An internal view of the receiver.



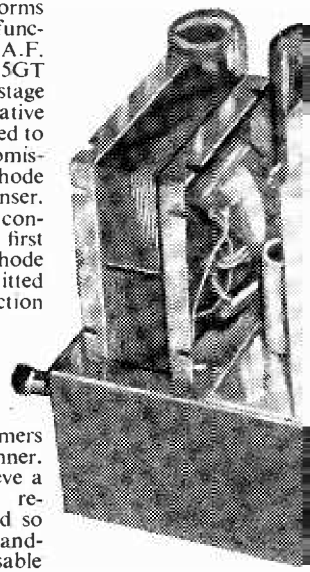
Side view, showing position of trimmers.



Details of the front or panel.

would be more suitable, providing they have adjustable slugs for tuning.

The I.F. amplifier is a 6BA6 vari-μpentode—here, of course, there is a wide choice of suitable R.F. pentodes. There are no frills to the second detec and A.V.C. circuits, and the number of compone used has been restricted to the bare minimum. single diode performs both the above functions. The first A.F. stage uses a 6J5GT and the output stage is a 6V6G. Negative feedback is applied to this stage by the omission of a cathode decoupling condenser. The decoupling condenser on the first A.F. stage cathode can also be omitted with a small reduction in gain.



Another view of the receiver.

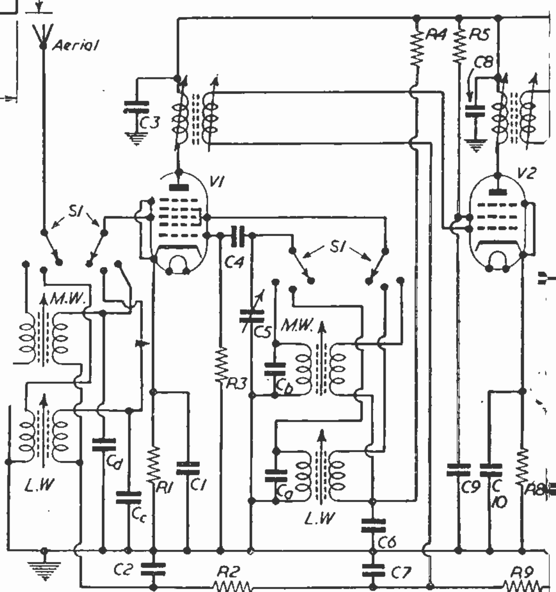
Adjustment

Lining up commences with the I.F. transformers in the usual manner. In order to achieve a double - humped response curve, and so improve the bandwidth, it is advisable to connect a temporary shunt consisting of a 30 KΩ resistor in series with a 0.1 μF condenser across ea winding of the transformers in turn while tun the other winding.

Having lined up the I.F. transformers the L.

LIST OF COMPONENTS

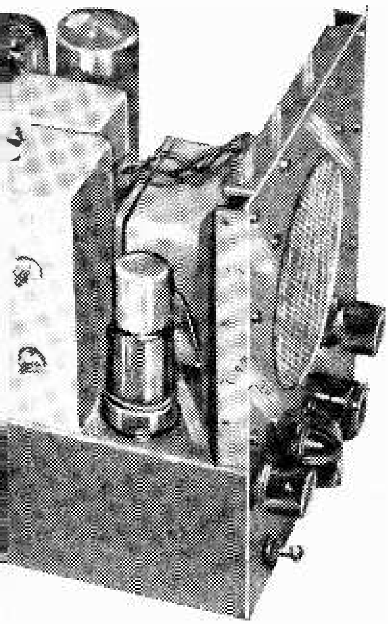
C1, C3, C6, C8, C9, C10	0.1 μF	R1,	1.000 ohms
C2, C7,	0.05 μF	R2, R9, R11,	2.2 Megohms
C4m,	100 μF	R3, R6, R7,	100.000 ohms
C5,	25 μF, variable	R4,	15.000 ohms
C11, C12,	200 μF	R5,	33.000 ohms
C13,	0.01 μF	R8,	100 ohms
C14,	25 μF, 12 v. wkg.	R10,	1 Megohm
C15,	0.0065 μF	R12,	2,700 ohms
C16, C17,	32-32 μF, 350 v.w.	R13,	500.000 ohms, Pot.
Ca, Cb, Cc, Cd	See text	R14,	220 ohms
		Ch1,	10 Henry, 100 mA
V1,	6L7	T1,	Output transformer, 40 : 1 ratio
V2,	6BA6	T2,	Power transformer. Secondaries : 4 v. at 2 a. ; 6.3 v. at 2 a. ; 250-0-250 v. at 80 mA.
V3,	6H6		
V4,	6J5GT		
V5,	6V6G		
V6,	DW2		



Theoretical

tor
nts
A

coils are selected by means of the switch, and a 200 kc/s modulated signal at a level of about 1 volt is injected at the third grid of the frequency changer.



The value of the fixed condenser, Ca, required across the oscillator grid can then be determined by connecting across this coil temporarily a 500 pF variable condenser. This is adjusted until the signal is heard in the output, the coil slugs having previously been set to approximately the mid-position of their travel. The value of the variable condenser at this setting is then measured on a bridge and the appropriate value of fixed condenser, or combination of condensers, fitted.

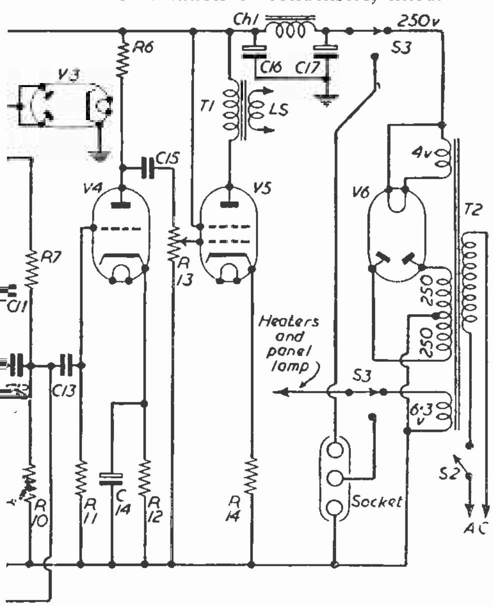
.ch
ng
W.

The signal generator is then transferred to the aerial terminal and its output reduced to a reasonably low level. The same technique can now be used to find the value of Cc across the input circuit coil.

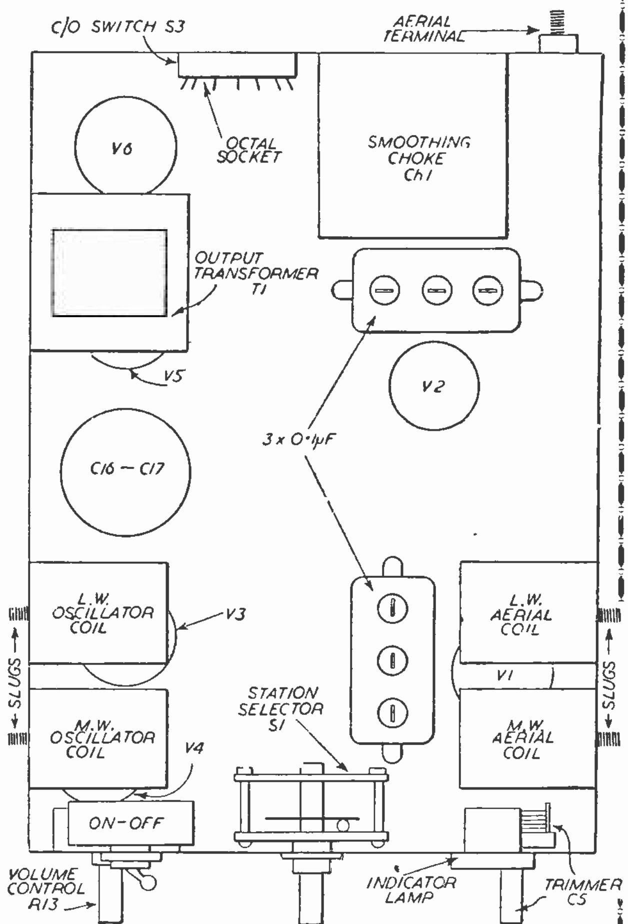
This procedure is then repeated to line up the medium-wave channel on 908 kc/s for the Home Service, unless some other station is required. The final adjustment is made on the coil slugs when receiving the programme, and using about 3ft. of wire as an aerial. This should produce ample output.

Panel Control

A small variable condenser of about 25 pF maximum is connected across the oscillator grid circuit on both ranges, and is available as a control on the front panel to allow for oscillator drift. This has not proved to be essential in practice, however, and any long term drift can be corrected by means of the coil slugs which are accessible from the outside of the cabinet.



:ircuit.

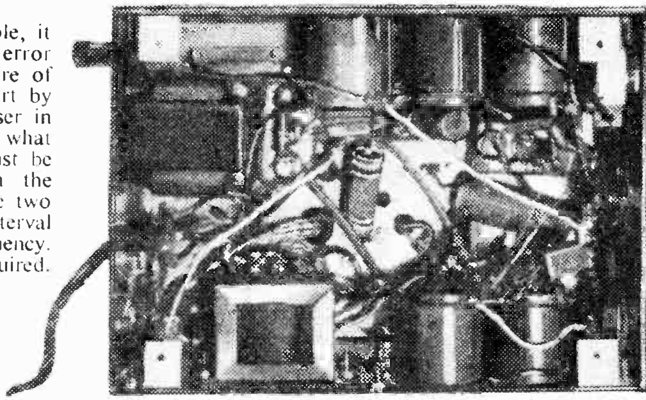


Details of underchassis component layout.

Lining-up

If a capacity bridge is not available, it is necessary to resort to trial and error methods for the lining up procedure of the frequency changer stage. Start by connecting, say, a 100 pF condenser in circuit for Ca and find out to what frequency the signal generator must be tuned to produce an output in the receiver. There will, of course, be two such frequencies, separated by an interval equal to twice the intermediate frequency. The lower of the two is the one required. The oscillator frequency can then be calculated by adding the intermediate frequency to the signal generator frequency found above. You are then in a position to alter the value of Ca to bring the oscillator frequency towards the required figure (665 kc/s for L/W Light Programme when using 465 kc/s I.F.).

Another method of finding the oscillator frequency would be to listen for it on an accurately calibrated receiver. A similar trial and error process must then be applied to the frequency changer input circuit to find the values of Cc and Cd.

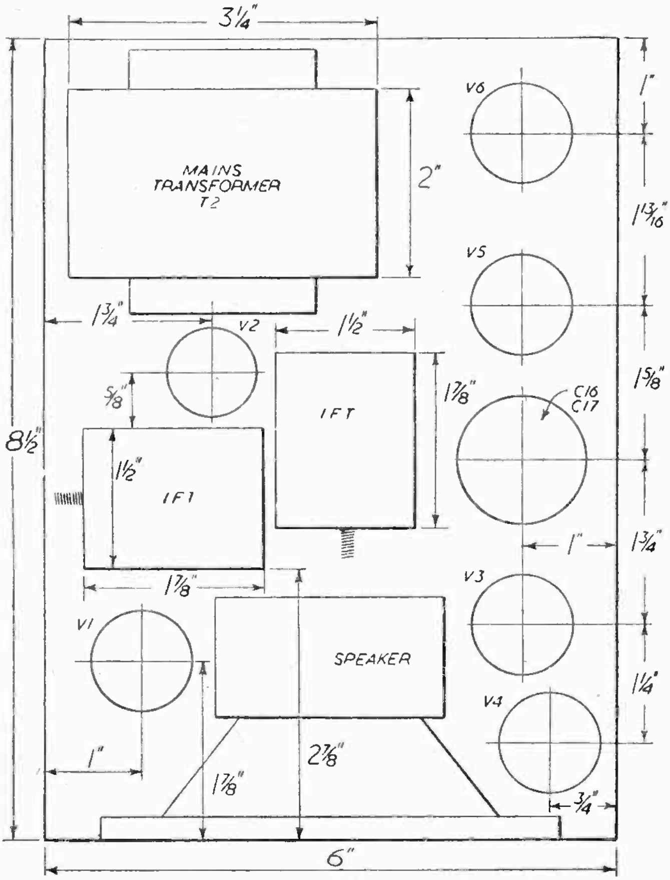


View of underside of chassis. The principal components are identified in the illustration on page 289.

Layout

The receiver layout is shown in the accompanying illustration. It is built on a chassis 6in. x 9in. x 3in. deep, the bottom of which is covered in with a piece of expanded metal fixed by four 4 B.A. screws to four pieces of angle brass. These are secured to the chassis sides and drilled and tapped to take the fixing screws, which also hold four feet in position. There is a cut-out in the front of the chassis to accommodate the bottom of the 5in. speaker, which is bolted to the front panel.

The front and side panels are of 16 gauge duralumin sheet. They are bolted to the chassis sides, and above chassis level are held together at the corners with ½in. angle brass drilled and tapped 4 B.A. Angle brass also runs round the inside edges of these panels at the top and down the back inside edges of the side panels. To this is secured the top and back cover of expanded metal, which is easily bent to make the required L shape. 4 B.A. screws are used for fixing. A carrying handle bolted to this cover completes the job.



Another dimensioned layout.

Speaker Fret

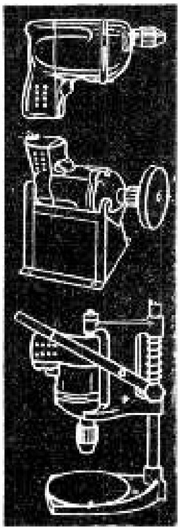
Expanded metal can also be used for the speaker fret. An alternative to the labour involved in making the large circular hole for the speaker aperture is to make a pattern of four or five holes with an octal chassis punch.

The positions of the station selector switch can easily be marked on the front panel by making shallow holes in its surface with a small drill (No. 25 say) and filling them with white paint with the aid of a sharpened matchstick, keeping the panel horizontal until dry. This should be done after the panels have been painted.

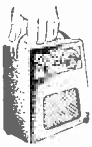
ELECTRONIC PRECISION EQUIPMENT LTD.

POWER TO SPARE

BLACK & DECKER ELECTRIC TOOLS



Drills, sands, polishes, grinds, sharpens. Also with attachments drives: lathe, saw bench, rise and fall, bench grinder, buffer, etc. This robust Black & Decker electric drill with trigger switch and self-centring chuck is yours for £2 and nine monthly payments of 10/6 or **£5 . 19 . 6** cash. All attachments available. Horizontal Stand 17/6. Vertical Stand £3.7.6. Three items together **£10.4.6 or £3.8.2** deposit. Send for our free booklet **HANDY HINTS.** All Black and Decker electric tools available on H.P. terms if required send 1/3rd deposit.



HANDY BATTERY THREE

Constructional data showing how to make useful portable loudspeaker set (total cost 70/-, including cabinet) is available **1/6.**

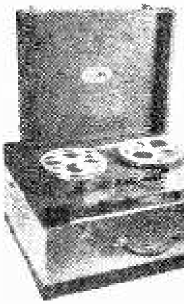
MULTI-METER KIT

The Multimeter illustrated measures D.C. volts, D.C. m/amps and ohms. It has a sensitivity of 200 ohms per volt and is equally suitable for the keen experimenter, service engineer or student. All the essential parts including 2in. moving coil meter, selected resistors, wire for shunts, 8-point range selector, calibrated scale, stick on range indicator and full instructions for making are available as a kit, price **15/-**, plus 9d. post and packing.

THE STANDARD

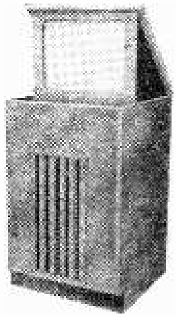
A well-proved design, solidly constructed and pleasantly finished in medium-toned veneer, highly polished, uncut, motor and control board. Size 30in. wide, 30in. high, 15in. deep. Price **£11/10/-** or **£3/16/8** deposit.

THE PORTA-PLAYER



This a robust, handsome carrying case finished in two-tone leather cloth with fold-away carrying handle and clasps. Approximate dimensions 19in. x 14½in. x 10in., ample for 8in. speaker, mains or battery driven amplifier, and tape deck or other record-playing mechanism. Price **£3 19 6**, carr. and ins. 10/-.

THE PROJECTOR



An impressive cabinet, originally designed for T.V. but slight modification makes it into an unusual, but most dignified, radiogram or amplifier. Size 23in. wide, 22in. deep, 37½in. high. Price **£8 15/-**, or **£2 18 4** deposit. Carriage and ins. £1.

THE REGINA

Highly polished, nicely figured, two-tone walnut finish, developed for the home constructor and supplied with component parts for a shelf that can be fitted in any at desired height. Suitable for most constructor sets, "Viewmaster," "Supervisor," "Magnevisor," "Tele-king," etc., etc. Size 18½in wide, 18½in. deep 34in. high. Cut for 12in. tube, but not drilled. Price **£7 17 6**, or **£3 12 6** deposit.

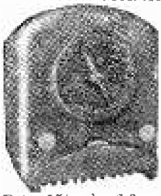
THE TABLE-TELE

Another cabinet which through the misfortunes of a manufacturer we are able to offer at below cost. Designed to take a 12in. tube, we supply this complete with armoured plate glass at **£3 17 6**, plus 7/6 post. Metal work, punched chassis, outrigger, etc., available as a parcel. Price **17/6**, plus 2/6 post.

THE NON-REPEATABLE

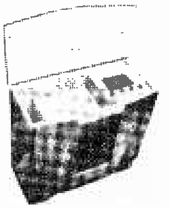
Through a manufacturer ceasing production we are able to offer this really handsome cabinet at well below cost. It was originally made for a very expensive televisor so its quality is beyond question. Size, 1ft. 10in. wide, 1ft. 4in. deep and 3ft. 5in. high. Complete with plywood back, fitted "Bowler Hat." Price **£7 5/-**, or **£3 8/4** deposit. **Note:** The cutout is for 12in. tube but holes for the controls are not drilled.

THE MIDGETRONIC



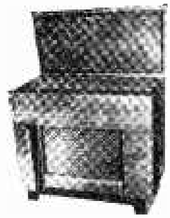
Yet another bankrupt bargain. This pleasing little cabinet (size approx. 8in. x 7in. x 3½in.), moulded in bakelite is supplied complete with dial ring and special pointer as illustrated. Price **15/-**, plus 2/6 post. Or complete with all the valves and parts to make an excellent T.R.F. set, price **£3 15/-** plus 2/6 post. **Note:** A few suitable transfers make this an ideal nursery cabinet.

THE EMPRESS



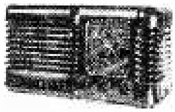
A cabinet to delight the eye of any discerning connoisseur, beautifully styled and elegantly veneered medium full-grained walnut. High polish finish. The amply sized control board is raised to a convenient level, but is not cut or drilled. Motor board, again uncut, measures 16in. x 14in. deep and has a clearance of 5in. To the extreme left is a space for recordings storage. Size 3ft. wide, 2ft. 8in. high. 1ft. 4½in. deep. Price **£15 15/-** or **£5 5/-** deposit.

THE CONSORT



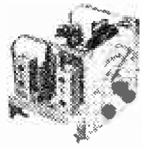
In two-tone, highly polished walnut veneer, with contrasting inlaid bands. Lift-up lid and storage compartments. Uncut motor board. Size 2ft. 6in. wide, 2ft. 5½in. high, 1ft. 2in. deep. Clearance to motor board is 6in. Price **£12/10/-** or **£4/3.4** deposit.

MAKE A RADIO



Using our parts in one evening you can make an all mains 4 valve radio with bakelite case, then you will be giving a **£12** present which costs you only **£6.1.6 or £3.2.0** deposit and 12 monthly payments of **11/6.** (Carr. and insurance 5/-).

BEETHOVEN 5-VALVE SUPERHET



Complete with valves and Rola loudspeaker, ready to work off A.C. mains—three waves (L., M. and S.)—large dial, slow motion drive, dust cored, coils, etc., **£8.17.6** or £3 deposit (balance over 12 months), carr. 7/6.

Cabinets available this month send for illustration.

ELECTRONIC PRECISION EQUIPMENT, LTD.

Post Orders should be addressed to:

ELPREQ HOUSE (Ref. 7), HIGH STREET, WEALDSTONE, MIDDX.

Personal shoppers, however, should call at:

42-46, **Windmill Hill, Ruislip, Middx.** Phone: RUISLIP 5780 Half day, Wednesday.	152-3 **Fleet Street, E.C.4,** Phone: CENtral 2833 Half day, Saturday.	29, **Stroud Green Road, Finsbury Park.** Half day, Thursday.

KLYSTRONS SIMPLIFIED

AN ELEMENTARY EXPLANATION OF THE V.H.F. VALVES AND THEIR USE

By D. Currie and D. R. Sharp (Technical Officers, Admiralty)

Introduction

A GREAT number of modern electronic devices depend for their operation upon the use of very high frequencies, which are known as centimetric wavelengths. These are of the order of 10^4 and 3×10^3 megacycles, which is 3 cm. and 10 cm. wavelengths respectively. The object of this article is to explain one method by which these V.H.F.s are generated, amplified and propagated.

Basic Electronic Phenomena at V.H.F.

At these frequencies the use of a normal thermionic valve as used in commercial radio receivers would be unsuitable. This is because the inter-electrode capacity (mostly that existing between anode and grid) together with stray capacities in the necessary external circuitry form feedback loops which introduce heavy losses, thereby preventing oscillation at the desired frequency.

Another undesirable feature of this type of valve is that the density modulation of the electron beam produces a certain amount of velocity modulation. This is partly responsible for the non-linear characteristics.

In all Klystrons both forms of modulation are used. In fact, the electron beam is first velocity modulated in order to produce density modulation.

The Two-cavity Klystron

Of the various types of Klystrons we will discuss first the two-cavity Klystron (Fig. 1). This consists of the usual heater-cathode assembly electron gun, an accelerator grid, the Rhumbatron or " Buncher," the " Catcher " and an electron " trap."

Electrons leaving the cathode reach a velocity which is determined by the potential of the accelerator grid. We will assume that a V.H.F. is present at the " Buncher " which, in itself, is an oscillatory circuit consisting of the capacity between its two grids (G_1 and G_2) and the inductive loop joining them. The two grids are in very close proximity and the transit time of an electron passing through the gap will be a very small fraction of a cycle. As each electron passes through the gap it will be either further accelerated or retarded or remain at its original velocity, according to the phase and magnitude of the V.H.F. present in the gap at that instant.

The electrons will next traverse the " Drift-space," which is a " null " region between " Buncher " and " Catcher," where density modulation is formed due to the variations in kinetic energy of the electrons in the beam. In other words, bunches will be formed as faster-moving electrons draw nearer to those moving at a slower rate, and in this way velocity modulation produces density modulation.

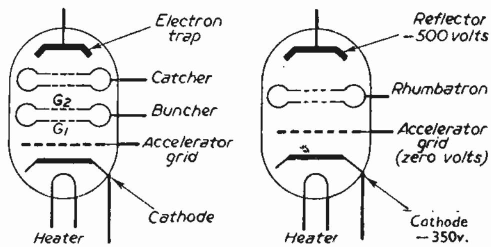
These electron bunches now pass through the gap of the " Catcher " which again is a resonant cavity (oscillatory circuit), and the V.H.F. component of the beam current produces excitation.

It will be seen that this device constitutes an amplifier, the power being derived in the normal way from the D.C. component of the electron beam. It will amplify at one particular frequency only (i.e., that at which both " Buncher " and " Catcher " are resonant).

The phase relationship between input and output is dependent upon the transit time of the electrons in the drift space, which is a function of the physical dimensions of the drift space and the velocity of the electron beam.

Effect of Transit Time on Coupling

If transit time in the drift space is too short then the electrons will not have time to form " bunches " correctly, and if the time is too long then " de-bunching " will take place as faster electrons overtake the slower-moving ones, and the distance between them increases. Therefore to obtain a maximum efficiency of the system it is essential that the transit time be of a critical period.



Figs. 1 and 2.—Diagrams of two common forms of Klystron.

Transit Angle

It is customary to express transit time effects in terms of the transit angle:

$$\theta = 2\pi fT \text{ radians.}$$

where f = frequency of oscillation in cycles/sec.,
and T = transit time in seconds.

Thus, at a frequency of 1,000 Mc/s (10^9 c/s) and a transit time of 1,000th of a microsecond (10^{-9} seconds), the transit angle would be 2π radians or 360 deg.

The Two-cavity Klystron as an Oscillator

Any oscillator is fundamentally dependent upon its regenerative properties. Considering the two-cavity Klystron: if the transit angle is such that the " Catcher " is oscillating in-phase with the " Buncher," then a portion of the output may be fed back to the input (as with normal oscillating circuits) by means of an external feedback loop, and the system becomes regenerative. Thus, the Klystron can become a self-oscillatory device, any small change in beam current being sufficient to drive it into oscillation. This feed-back loop usually takes the form of a concentric line. Care must be taken to ensure that this inductive loop produces the requisite coupling co-efficient. The main disadvantage of the two-cavity Klystron oscillator lies in its rather limited frequency coverage of the band for which it is designed. Variation of frequency is effected by producing a physical change in the dimensions of the resonant cavities, which are each provided with a flexible diaphragm for this purpose. No variation, however, can be made in the physical dimensions of the drift space, therefore the initial beam velocity must be kept constant. This, of course, can be achieved by providing a stabilised voltage to the accelerator grid.

The Reflex Klystron Oscillator

A schematic diagram of the Reflex Klystron is shown in Fig. 2. It will be seen that there is one resonator only and this performs the dual function of " Buncher " and " Catcher."

The electron beam, after being accelerated, is velocity modulated by the " Rhumbatron." In the drift space the beam encounters a strong repelling field provided by a negative voltage on the reflector. It is thus caused to reverse its direction and return to the " Rhumbatron " where, providing the phasing is correct, the V.H.F. component of the beam current will produce excitation and thereby maintain oscillation. Typical electrode voltages are shown. The " Rhumbatron " is normally D.C. connected internally to the accelerator grid. Bunching takes place in the drift space, but the action of the reflector produces a phase change of 180 deg. during this procedure.

Electrons travelling faster than their initial velocity will penetrate further into the retarding field of the reflector before having their direction of travel reversed and will thus take a longer period of time to make the " round trip " than those electrons which, starting later but having less velocity, are more readily turned back by the reflector.

Phase Relationship for Optimum Power Output

For the resonator to absorb maximum power from the reflected beam then the centre of the bunches must pass through the gap at the time when it is

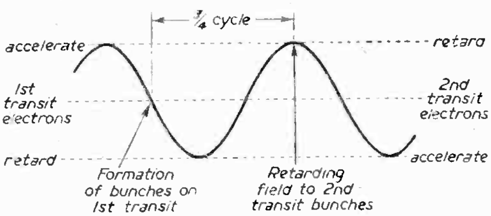


Fig. 3.—Phase relationship illustration.

exerting its most retarding effect upon them. Electrons at the centre of a bunch have travelled at a constant velocity and are those that pass through the gap on their first transit when the field was changing from an accelerating one to a retarding one. (This will actually cause low density areas which will become bunches after the 180 deg. phase change at the reflector.)

Since the reflected beam is travelling in the opposite direction, then the retarding effect upon them is not until three-quarters of a cycle later. Fig. 3 may help in explaining this rather complex function. The transit angle of the drift space will therefore be of the order :

$$\frac{3\pi}{2} ; \frac{7\pi}{2} ; \frac{11\pi}{2} \ldots\ldots\ldots\ldots\ldots\ldots \text{radians.}$$

It is not necessary for the physical distance between " Rhumbatron " and reflector to be critical as the effective drift space is determined by the mean distance from the " Rhumbatron " at which the reversal of the electron beam takes place, this being a function of reflector voltage.

Tuning Range of the Reflex Klystron

The Reflex Klystron, although less efficient than the two-cavity type, has a greater frequency coverage or tuning range over the band for which it is designed.

The variation of frequency can be effected by means of varying the reflector potential and also by

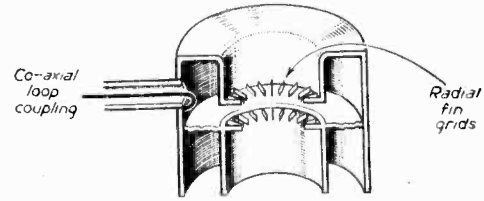


Fig. 4.—Detail of taking out the output.

mechanical means consisting of an adjustable probe which protrudes into the " Rhumbatron " chamber. The function of the probe is to vary the capacity of the resonator and thus the frequency. A relatively small variation of reflector voltage alters the impedance of the " Rhumbatron " gap and will produce a change of frequency over a limited range as a result. Too great a variation of reflector voltage will, of course, produce inadequate coupling between reflected beam and " Rhumbatron " so that oscillation will cease.

To maintain maximum power output when varying the frequency it is essential to adjust both probe and reflector voltage as the two are not inter-dependent. However, the frequency can be varied over a small portion of the band by varying the reflector voltage only and without serious diminution of power output.

Propagation of V.H.F. from Klystrons

The output power from the Klystron can be removed by means of a probe or loop which is inserted into the output resonator. This feeds directly into a concentric line. At these frequencies, of course, correct matching of feeder to resonator is essential.

The power can also be propagated through a glass window in the wall of the tube and thence into a wave-guide via a suitable matching cavity.

Uses

The Klystron as a voltage amplifier is of little use due to its high noise factor, but is finding increasing popularity as a power amplifier and pulse generator. Its main uses are, in Reflex Klystron form, as a Local Oscillator in micro-wave receivers and as a signal source in test equipment.

The efficiency of this class of valve is expressed as a figure of merit, this being the Gain-Bandwidth product.

This article is of an elementary nature dealing with the fundamental principles of Klystron operation. We have, therefore, purposely avoided any complex mathematical analysis having given a purely physical treatise in order that it be more clearly understood by those whose knowledge of this subject is limited.

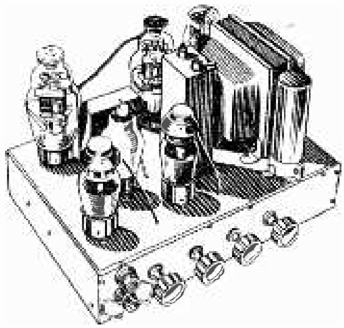
As a result of this, we beg to be excused by the more academically minded readers who, no doubt, delight in the practice of that " black art " known as mathematics.

R.S.C. 25 WATT QUALITY AMPLIFIER 9 Gns.

We firmly believe our AII " Push-Pull " Quality Amplifier to be by far the best value in amplifiers offered to-day. The volume of its high fidelity reproduction is completely controllable, from the sound of a quiet intimate conversation to the full, glorious volume of a great orchestra. Its sensitivity is so high that in areas of fair signal strength it can be operated straight from a crystal receiver. Entirely suitable for standard or long playing records in small homes or in large auditoriums. For electronic organ or guitar or for garden parties or dance bands. The kit is complete to the last detail, and includes easy to follow point-to-point wiring diagrams.

Outputs for 3 or 15 ohm speakers.

Twin volume controls with twin input sockets allow SIMULTANEOUS INPUTS for BOTH MICROPHONE and GRAM, or TAPE and RADIO. SEPARATE BASS and TREBLE CONTROLS, giving both LIFT and CUT. FOUR NEGATIVE FEEDBACK LOOPS with 15 db in the main loop from output transformer to voltage amplifier. Frequency response ± 3 db. 50-20,000 c.p.s. HUM and DISTORTION LESS THAN 0.5 per cent, measured at 10 watts, comparing favourably with most highest priced amplifiers. Six B.V.A. valves, Marconi/Osram KT series output valves. A.C. only. 200-230-250 v. 50 c cs. input. 420 v H.T. LINE. Paper reservoir condenser. Compact chassis. Matched components. Size 14 - 10 9in. Available in kit form at the amazingly low price of **9 gns.** Plus carriage 5/-. Or ready for use 50/- extra.



R.S.C. 8-10 WATT " PUSH-PULL " HIGH-FIDELITY AMPLIFIER A3

Complete with integral Pre-amp. Tone control stage (as AII 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. Two independently controlled inputs. Six B.V.A. valves. A.C. mains 200-230-250 v. input only. Outputs for 3 or 15 ohm speakers. Kit of parts complete in every detail. **£7 19 6.** plus 5/- carriage, or ready for use, **45/-** extra.

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. of 120 v, 90 v or 60 v at up to 40 mA. and fully smoothed L.T. of 2 v at 0.4 to 1 a. Price, complete with circuit, wiring diagrams and instructions, only **48/9.** Or ready to use, **7/9** 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. Outputs 90 v 10 mA and 1.4 v 250 mA, fully smoothed. For 4-valve receivers. Price complete with circuit. Only **35/9.** Or ready for use, **42 6.** Size of unit. 5¾ x 4 x 1¾ ins.

H.T. ELIMINATOR AND TRICKLE CHARGER KIT. Input 200-250 v A.C. Output 120 v 40 mA, fully smoothed, and rectified supply to charge 2 v acc. Price with steel case and circuit, **29 6.** Or ready for use, **8/9** extra.

BATTERY CHARGER KITS 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.

EX-GOVT VALVES (NEW)

	Each		Each		Each
IT4	8/9	6SK7Met	7 9		
1R5	8/9	6SJ7Met	7/9	25Z4G	9/6
1S5	8/9	6Q7G	9/11	25L6GT	9 6
3S4	9/9	6SN7GT	11/9	35Z4GT	10/6
5Y3G	8/9	6V6G	8/9	35L6GT	9 11
5U4G	10/6	6V6GT	8 9	UY41	8 11
5Z4G	9/6	6X5GT	8/9	EF36	4/11
6AL5	9/9	8D2	2/11	EB91	8 9
6F6G	7/9	807	6/11	EF91	9 9
6AM6	9/9	9D2	2/11	MU14	9 6
6J5G	5/11	12A6	7/9	MS/Pen	5 9
6J7G	7/6	12K7GT	10/6	SP4	5 9
6K7G	6/11	12Q7GT	10/6	SP61	2/9
6K8G	10/9	15D2	5/9	VU120	2 11

ELECTROLYTICS (Current production. Not ex-Govt.).

Tubular Types			
8μF 350 v	1/9	8μF 500 v	2/11
8μF 450 v	1/11	16μF 450 v	2 9
8μF 500 v	2/9	24μF 350 v	2 11
16μF 350 v	2/3	32μF 350 v	2 11
16μF 450 v	2/9	32mfd 450 v	4/9
24μF 350 v	3/6	40μF 450 v	4/11
32μF 350 v	3/6	64μF 450 v	4 9
25μF 25 v	1 3	8-8μF 350 v	3 9
50μF 12 v	1/3	8-8μF 450 v	3 9
50μF 50 v	2/3	8-15μF 450 v	3 9
		8-16μF 450 v	4 6
Can Types		16-16μF 450 v	4 11
		16-32μF 350 v	5/3
8μF 450 v	2 3	32-32μF 450 v	5 11

RECORDING TAPE. Best Quality. Plastic, 1,200 ft. Reels only **18 9.**

A PUSH-PULL 3-4 watt HIGH-GAIN AMPLIFIER FOR £3/12 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. (We can supply a suitable 10in. unit by Rola at 29 6.) The amplifier can be supplied ready for use for **25 -** extra. Carr. 2/6. Full descriptive leaflet, **7d.**

BRAND NEW COLLARO 3 SPEED AUTOMATIC RECORD CHANGERS. Type RC3/521, complete with P.U. (2 plug-in crystal heads). Mains input 200-250 v. Limited number at only **£9.15.0.**

COLLARO SINGLE SPEED RECORD PLAYER UNITS. Type AC514, with Crystal Pick-up. Mains input 200-250 v A.C. Brand New. Only **£3.19.6.** plus carr 5 -.

P.M. SPEAKERS. All 2-3 ohms. 6½in. Goodmans, **16 9.** 8in. Plessey, **15 9.** 10in. Plessey, **18/6.** 10in. R.A., **29 6.** 10in. Rola with trans., **31 6.** 12in. Truvox, **49 9.**

SILVER MICA CONDENSERS. 5, 10, 15, 20, 25, 30, 35, 40, 50, 100, 120, 150, 200, 230, 300, 400, 500, 1,000 (.001 mfd). 2,000 pfd. (.002 mfd.), **5d.** each ; **3/9** doz. One type.

FOUR STAGE FEEDER UNIT. Design of a High Fidelity Tuner Unit. L. & M. Wave. Full decoupling. Self contained heater supply. Detailed wiring diagrams and parts list, **2/6.** Total building cost, **£3.15.0.** Descriptive leaflet, **9d.**

EX-GOVT. SMOOTHING CHOKES.

250 mA 10 H 50 ohms	17/6
250 mA 20 H 250 ohms, trop....	14/9
150 mA 6-10 H 150 ohms tropicalised	7/9
100 mA 7-10 H 100 ohms	6/11
100 mA 5 H 100 ohms, tropicalised...	3/11
60m 5-10 H	3/9

COAXIAL CABLE, 75 ohms, ¼ in., **8d.** yard. Twin Screened Feeder, **9d.** yard.

CHASSIS. 16 s.w.g. Undrilled Aluminium Receiver Type 6 x 3 x 1½in., **2/6** ; 7¼ x 4½ x 2in., **3/3** ; 10 x 5½ x 2in., **3/9** ; 11 x 6 x 2½in., **4 3** ; 12 x 8 x 2½in., **5 3** ; 16 x 8 x 2½in., **7 6** ; 20 x 8 x 2½in., **8/11** ; Amplifier type (4 sided), 12 x 8 x 2½in., **7 11** ; 16 x 8 x 2½in., **10/11** ; 14 x 10 x 3in., **13 6** ; 20 x 8 x 2½in., **13/6.**

VOLUME CONTROLS with long (¼in.) spindles, all values, less switch **2 9,** with S.P. switch, **3 9.** D.P. sw., **4/6.**

R.S.C. MAINS TRANSFORMERS (FULLY GUARANTEED)

Interleaved and impregnated. Primaries 200-230-250 v 50 c/s Screened

TOP SHROUDED, DROP THROUGH

250-0-250 v 70 mA 6.3 v 2.5 a ...	12/11
260-0-260 v 70 mA, 6.3 v 2 a, 5 v 2 a...	14/11
350-0-350 v 80 mA, 6.3 v 2 a, 5 v 2 a..	17 9
275-0-275 v 80 mA, 6.3 v 2 a, 4 v 2.5 a	14 11
250-0-250 v 100 mA, 6.3 v 4 a, 5 v 3 a	23 9
300-0-300 v 100 mA, 6.3 v-4 v 4 a, c.t. 0-4-5 v 3 a	23/9
350-0-350 v 100 mA, 6.3 v 4 a, 5 v 3 a, ...	23 9
350-0-350 v 150 mA, 6.3 v 4 a, 5 v 3 a ...	29/11
350-0-350 v 150 mA, 6.3 v 2 a 6.3 v 2 a 5 v 3 a	29 11

FULLY SHROUDED UPRIGHT

250-0-250 v 60 mA, 6.3 v 2 a, 5 v 2 a, Midget type 2½-3-3in.	16/9
350-0-350 v 70 mA, 6.3 v 2 a, 5 v 2 a...	18 9
250-0-250 v 100 mA, 6.3 v 4 a, 5 v 3 a	25/9
250-0-250 v 100 mA, 6.3 v 6 a, 5 v 3 a, for R1355 conversion	29 9
300-0-300 v 100 mA, 0-4-6.3 v 4 a 0-4-5 v 3 a	25 9
350-0-350 v 100 mA, 0-4-6.3 v 4 a, 0-4-5 v 3 a	25/9
350-0-350 v 150 mA, 6.3 v 4 a, 4 v 3 a...	33/9
350-0-350 v 250 mA, 6.3 v 6 a, 4 v 8 a, 0-2-6 v 2 a, 4 v 3 a, for Electronic Eng. Televisor	67 6
425-0-425 v 200 mA, 6.3 v 4 a, C.T. 6.3 v 4 a, C.T., 5 v 3 a, Suitable Williamson Amplifier, etc. ...	49/9
Economy Quality Amplifier type...	49/9
450-0-450 v 250 mA, 6.3 v 6 a, 6.3 v 6 a, 5 v 3 a	65 9

ELIMINATOR TRANSFORMERS

Primaries 200-250 v 50 c/s, 120 v 40 mA	7/9
90 v 10 mA, 8-0-8 v 250 mA ...	8 11

FILAMENT TRANSFORMERS
All with 200-250 v 50 c/s primaries 6.3 v 1.5 a, **5 9** ; 6.3 v 2 a, **7/6** ; 0-4-6.3 v 2 a, **7/9** ; 12 v 1 a, **7/11** ; 6.3 v 3 a, **9 11** ; 6.3 v 6 a, **17/6** ; 12 v 3 a or 24 1.5 a, **17 6.**

CHARGER TRANSFORMERS
All with 200-230-250 v 50 c s Primaries : 0-9-15 v 1.5 a, **14 9** ; 0-9-15 v 3 a, **16/9** ; 0-9-15 v 6 a, **22 9** ; 0-4-9-15-24 v 3 a, **22/9.**

SMOOTHING CHOKES

250 mA 7-10 H 200 ohms, Shrouded...	16/9
250 mA 3-5 H 50 ohms	11/9
100 mA 10 H 175 ohms	6/11
80 mA 10 H 350 ohms	5/6
60 mA 10 H 400 ohms	4 11

E.H.T. TRANSFORMERS

2,500 v 5 mA, 2-0-2 v 1.1 a, 2-0-2 v 1.1 a, for VCR97, VCR517, etc.	35/-
5,000 v 5 mA 2 v 2 a	39/6

OUTPUT TRANSFORMERS

Midget Battery Pentode 66 : 1 for 3S4, etc.	3/9
Small Pentode 5,000Ω to 3Ω ...	3/9
Standard Pentode, 5,000Ω to 3Ω ...	4/9
Standard Pentode, 7/8,000Ω to 3Ω	4/9
Multi-ratio 40 mA, 30 : 1, 45 : 1, 60 : 1, 90 : 1, Class B Push-Pull ...	5/6
Push-Pull 10-12 watts 6V6 to 3Ω or 15Ω	15/9
Push-Pull 10-12 watts to match 6V6 to 3-5-8 or 15Ω	16/9
Push-Pull 20 watts, sectionally wound, 6L6, KT66, etc., to 3, or 15Ω	47/9
Economy Quality Amplifier type ...	47/9

Terms C.W.O. or C.O.D. NO C.O.D. under £1. Post 1 1 extra under £1. 1/9 extra under £3. Open 9 to 5.30 ; Sats. until 1 p.m. List 6d. Trade List 5d. S.A.E. please with all enquiries.

RADIO SUPPLY CO. (LEEDS) LTD. 32, THE CALLS, LEEDS, 2

SUPPRESSION OF ELECTRICAL INTERFERENCE

THE CAUSES AND CURES OF INTERFERENCE BY ELECTRICAL APPARATUS By A. E. Lofting

RADIO interference from one source and another is becoming an increasing nuisance and, if one is to enjoy radio listening, a serious attempt must be made to prevent or by-pass all objectionable " noises off," which can mar a good programme and ruffle the best of good humours.

The old adage of " prevention is better than cure " has its applications with interference, so we give a few hints first on how to prevent interference at its source, by far the most satisfactory remedy.

Among the most objectionable offenders are appliances using small fractional h.p. motors, such as in sewing machines, electric hand-drills, hair dryers, vacuum cleaners, etc. For these motors a pair of 0.01μF capacitors, one from each brush terminal to earth, will work wonders, being careful to wire them as near to the terminals as possible, and inside the end shield if there is one. This remedy is good for most fractional motors, but one may encounter a motor that requires extra attention in the way of an inductance in each lead to the motor, and possibly the screening of the complete motor. Screening may be required if only a bakelite casing exists. A suitable inductance for currents up to 1 amp. is a 1 or 2 millihenry coil of 24 s.w.g., dimensions of which are given in the table. These coils will prove most effective if wired in conjunction with capacitors, as shown in Fig. 1. For screening purposes a gauze or punched metal sheet is ideal, giving both ventilation and electrical screening. Points to note are that the joints of the screen should be well bonded together, by solder, rivets or small bolts, and most important of all that the screen is connected to a reliable earth.

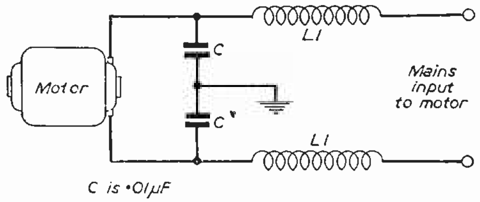


Fig. 1.—How to suppress a brush-type motor.

This question of a good earth is of vital importance with suppression. No matter how many capacitors and inductors are added they will not give satisfactory reduction of interference unless the electrical oscillations are led away to earth. Inductors, etc., will keep the oscillations from travelling down the mains lead, but unless earthed they will " bottle up " as it were and re-radiate causing as much trouble as before.

Radiations

Many appliances do not have an earth wire, so before fitting any suppressor to these appliances be sure to fit one, and have a three-pin plug and socket with the earth socket to earth!

So much for commutator suppression. Now we are left with a good deal of apparatus most of which give out a fair amount of interference, such as electric refrigerators, thermostats for water heaters, sewing machine foot switches and other switches having a regular usage. Most of these can be suppressed by an arrangement as in Fig. 2. Component values are given in the table on the following page. Incidentally, all capacitors for this connection should have a working voltage of 350 A.C. or more, and should withstand a 2,000 volt D.C. test. Therefore, only the most reliable components must be used. But an easy safeguard against this is to have a fuse of about 100 mA. inserted as shown by X in Fig. 2, these being readily obtainable.

With some switches this suppressor would be too cumbersome. An alternative is to use only the capacitor and fuse, the residual interference being reduced by a suppressor next to the radio itself.

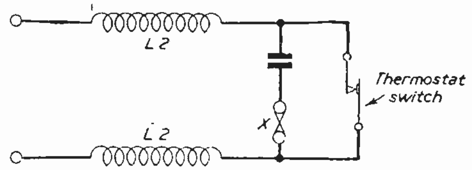


Fig. 2.—Suppressing a contact device such as a thermostat.

Cures

Now we come to the " cure " category, which will apply to most of us. In some cases, when a house is isolated from its neighbours and other sources of interference, an effective cure is achieved by placing a capacitive suppressor at or near the main house fuse box, shown in Fig. 3.

A reliable suppressor to be fitted on or near the radio receiver is shown as Fig. 3. If fitted within the receiver it should be wired immediately after the fuses, when wired outside the receiver a pair of fuses should still be incorporated, shown by dotted line in Fig. 3. Fig. 4 shows coil former details. The central supports are of ½in. dia. ebonite or wood, the discs of ⅛in. thick paxolin, alternatively these could be square, making construction somewhat simpler. Two of the discs are drilled to allow the wire ends to be led out and secured. The whole coil assembly is drilled with a 4 B.A. clearance hole through its centre for fixing purposes. The wire is 20 s.w.g. enamelled copper and wound to fill the bobbin each side.

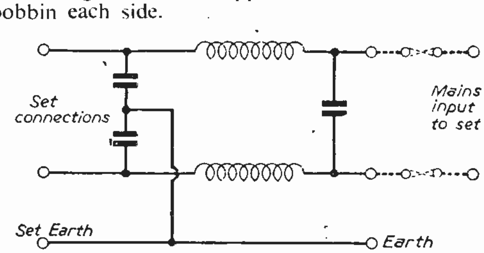


Fig. 3.—A filter circuit for use with a receiver. The condensers should be 0.1μF components.

This suppressor is very effective for mains borne interference. If a considerable amount of interference exists throughout the house and neighbourhood then the whole receiver will require attention to prevent direct pick-up on to the chassis and possibly the H.F. circuits. First and foremost, earth the chassis (if an A.C./D.C. type then earth through a 0.1 μF

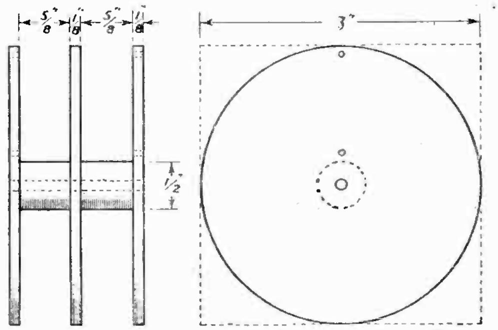


Fig. 4.—Details of a former for the chokes in Fig. 3.

capacitor). Next, ensure that all the screening cans are well bonded to the chassis. If the tuning capacitors and coils are not screened it is advisable to screen the whole receiver. This is done by lining the inside of the receiver cabinet with a metal foil such as aluminium. The foil can be glued into place, taking care to make good metallic contact at every joint and leaving sufficient holes for ventilation. The foil should be connected to earth.

Now the receiver is screened, but the most important and most sensitive part is still exposed to interference, the aerial downlead. The best solution is to use a screened cable as the downlead, but some matching arrangement is necessary to balance the low impedance of the screened cable to the high impedance of the receiver input, otherwise little signal input will reach the receiver circuit. For this purpose a pair of H.F. matching transformers will be required, shown in Fig. 5. Suitable iron-dust cores for the coils can be found in many ex-W.D. units. Dimensions are ⅜in. dia. by ⅞in., but a near approximation to this size will be satisfactory. To construct the coils, first place a strip of thin paper around the core, sticking it in place with good

Coil	Current	Wire	D	L	N
L1	Up to 1 amp.	24	0.75"	4"	160
L2	Up to 1 amp.	24	0.75"	4"	160
L2	Up to 3 amp.	18	1.0"	5"	100

Where D = Diameter.
L = Length.
N = Number of turns.
All wire is enamelled copper.

insulating shellac. Wind L1, secure in place with another strip of paper glued firmly down. Repeat for L2. A serviceable screening can is the zinc casing of a U2 battery cell, removed by sawing near the top joint, and cleaned by boiling in water. The same sized can must be used over each coil. A brass bolt keeps the coil in place within the can, and serves to secure the whole to a bracket for outdoor mounting, shown in Fig. 5. Some loss in signal will be

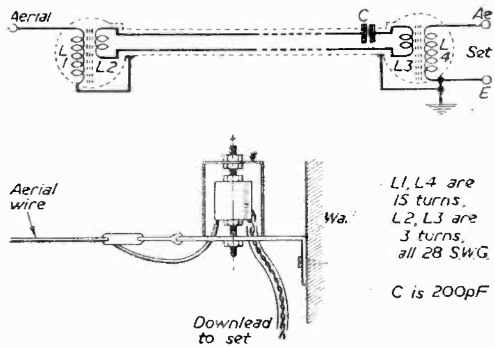


Fig. 5.—Details of an interference-free aerial system.

noticed with this transformer, but the freedom from interference will make up for that. The best aerial to use with these transformers is a vertical one, from 10ft. to 15ft. long. This is because interference has a larger horizontal component than vertical. Thus, if a vertical rod aerial be mounted as high as possible on the roof, the very minimum of interference is picked up.

New Mullard U.H.F. Valve

THE new Mullard double triode, PCC84, has several novel features. It has been specifically designed for operation as a series connected cascode amplifier on the V.H.F. with an H.T. supply of 180 v. In the cascode circuit, the first triode operates as a neutralised grounded-cathode amplifier and the second as a grounded-grid amplifier. This arrangement results in a considerable improvement in noise factor over pentodes at frequencies of hundreds of Mc/s. The series-connected cascode amplifier, in which the anode of the neutralised stage is coupled directly to the cathode of the grounded-grid stage, leads to a simpler circuit than when the two triodes are connected in parallel across the H.T. line. This is particularly attractive at ultra-high frequencies since it is not necessary to change the anode circuit of the input triode when switching from one frequency to another. A simple "series peaking" coil of the type familiar in video stages, inserted between the anode of the neutralised stage and the cathode of the grounded-grid stage, acts to maintain the response over the whole band.

Series connection results, however, in two disadvantages : a high voltage is placed across the heater-cathode insulation of the grounded-grid stage, and the amount of H.T. available for either triode is only half the total H.T., which can result in a low amplification factor and mutual conductance. The PCC84 has been carefully designed to avoid these disadvantages. The heater-cathode voltage rating is −250 v. and +90 v. peak, the maximum D.C. component being 180 v. Each triode can therefore be operated with a maximum H.T. of 180 v. (total HT = 360 v.). With an H.T. line of 180 v. the valve is therefore operating well within its maximum ratings. The amplification factor (mu) is 24 and the mutual conductance (gm) is 6 mA./V. with an H.T. of 90 v. per valve.

Volume Controls Midget Ediswan type. Long spindles. Guaranteed 1 year. No. Sw. 3/- S.P. Sw. 4/- D.P. Sw. 4 9

ALL VALUES.—10,000 ohms to 2 Megohms.

80 ohm CABLE COAX STANDARD ¼in. diam. Polythene insulated. GRADE A **9d.** yd. Stranded core GRADE B **7d.** yd. Single core

COAX PLUGS, 1 2 each. **SOCKETS** 1/2 each. **LINE CONNECTOR**, 1 2. **OUTLET BOXES**, 4 6.

W/W EXT. SPEAKER CONTROL 10Ω, 3/-.

BALANCED TWIN FEEDER per yd. 6d. } 80
TWIN SCREENED FEEDER per yd. 1/- } ohms

50 OHM COAX CABLE, 8d. per yd. ¼in. dia.

TRIMMERS, Ceramic, 30, 70 pf. 9d. 100 pf. 150 pf. 1 3; 250 pf., 1 6; 600 pf., 1/9.

RESISTORS.—All values: ¼ w., 4d.: ½ w., 6d.; 1 w., 8d.; 2 w., 1/-; High Stability, ½ w. 1%, 2 -; 2%, 1/6, ex. stock.

WIRE-WOUND RESISTORS.—Best Makes Miniature Ceramic Type—5 w., 15 ohm to 4 K., 1 9; 10 w., 20 ohm to 6 K., 2 3; 15 w., 30 ohm to 10 K., 2,9; 5 w. Vitreous, 12 K. to 25 K., 3/-.

WIRE-WOUND POTS. 3 WATT. FAMOUS MAKE
Pre-Set Min. TV. Type. Knurled Slotted Knob. All values 25 ohms to 30 K., 3/- ea. 50 K., 4/-. Ditto Carbon Track 50K. to 2 Meg., 3/-.
Standard Size Pots, 2¼in. Spindle. High Grade. All Values. 100 ohms to 50 K., 5/6; 100 K., 6/6.

O/P TRANSFORMERS.—Small Tapped p.m. pentode 3/9. Heavy duty 70 ma., 4/6. Ditto. tapped, 4.9. **L.F. CHOKES** 10 h. 65 ma., 4 6. 20/25 h. 100/150 ma., 12/6. 5 h. 250 ma., 15/-. 15 h. 100 ma., 10/6.

LYNX, choke 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. Heater Trans., tapped prim. 0-200 v/. 250 v., 6.3 v. 1½ amp., 7 6; ditto 6.3 v. 3 amps., 10 6; ditto, 12 v., .75 a. 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, 21/-. Viewmaster, 35/-. Teleking, 30/- Lynx, 30 -. Coronet, 30 -. Super Visor, 30 -. Simplex, 35/-.

SOUNDMASTER SPECIALS.—Mains Trans., 35/-. L.F. Choke, 10 6. O/P Trans., 5/6. Envelope 6 6 Specified Wafer Switches, 12 6 per set of 3.

GOODMANS WIDE ANGLE DUOMAG FOCUS. UNIT. Centraliser and Vernier Focus Adjuster, 35/-.

ELAC ION TRAPS. 1 IT6 for 35 mm. Tubes. 2,6 ea.

TAPE RECORDING BARGAINS

Mfrs. new surplus stocks.

LIGHTWEIGHT XTAL HAND MIKES. Chrome finish Quality and sensitivity for only 25/-.

PLASTIC RECORDING TAPE by G.E.C. 1,200 ft. complete with spool. Ideal Soundmaster, etc., 19/6, post free.

WOODEN WALNUT CABINET.—12in. x 7in. x 5in. complete with punched chassis. TRF or superhet dial, back-plate, drum, drive, spring, pointer, etc., 28/6, plus post 2/-.

TYANA. —Midget Soldering Iron. 200/220 v. or 230/250 v., 14 11. **TYANA TRIPLE THREE.** — Complete with detachable bench stand, 19 6.

NEW SOLON MIDGET IRON.—25 w., 19/6. IDEAL FOR RADIO CONSTRUCTORS.

C.R.T. HEATER ISOLATION TRANSFORMER. — Low leakage winding with 25% sec. boost, 2 v., 10 6; 4 v., 10 6; 6.3 v., 10 6; 12 v., 10 6.

MIKE TRANSF.—Ex-Govt. Ratio 50 : 1, 3 9 ea.

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

TV AERIALS.—Full range popular types in stock. Aerialite, etc. All channels. Indoor loft type Inv. T., 13/6. Outdoor single dipole, 37/6. H-type with chimney lashings, etc., 92 6. X-type Dublex, 7ft. mast chimney lashings, etc., 88/6.

TOGGLE SWITCHES EX-GOVT. "On-Off," 9d. Ersin M'core solder 60 40, 16G., 5 6 ½ lb.; 4d. yd.; T.C. wire 18 to 22 s.w.g., per yd., 2d. PVC Connecting wire, 10 colours. Single or Stranded 2d. yd. B7G Valveholder and Screening Can., 1 6; V'holders, octal, pax., 4d.; moulded, 6d.; EF50, B7G, moulded, 9d.; ceramic, 1/-; B8A, B9A, 1/-; B12A (CRT), 1 3; VCR97 moulded holders, 2/6. 2 K. 5 w. H.D. w.w Pots, 4/6. 10 K., 25 K., Colvern w w Pot, 1in. spindle, 3 6. **SCREENED GRID CAPS** I.Oct., or Mazda, 6d. ea. **BULGIN HIGH VOLTAGE VALVE CAPS**, I.Oct., 1/-.

FUSES.—1¼in. all values 60 ma. to 10 a., 6d.

ALADDIN FORMERS and cores, ¼in., 8d.; ⅜in., 10d.

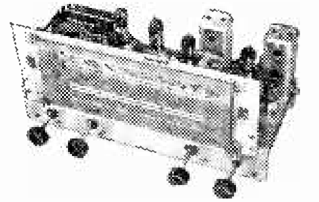
SLOW MOTION DRIVES.—Epicyclic ratio 4 : 1, 2/3.

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

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

EXT. L.S.—Switched Socket, on-off and parallel switching, complete with plug, 2/-.

COPPER PLATED AERIAL RODS. ⅜in. x 12in., push fitting, 2 6 doz.



ALL WAVE RADIOGRAM CHASSIS

THREE WAVEBANDS		FIVE VALVES
S.W.	16 m.—50 m.	LATEST MULLARD
M.W.	200 m.—550 m.	ECH42, EF41,
L.W.	800 m.—2,000 m.	EBC41, EL41, EZ40

Brand New and Guaranteed, with 10in. P.M. Speaker, 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 4.2 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, £10/15/0. Carriage and Insurance, 4 6. (Without 10in. Speaker, £9 15 0. Carr. & Ins., 4 6.)

BARGAIN OFFERS

RECOMMENDED FOR ABOVE CHASSIS GREAT REDUCTIONS

Brand new Plessey 3-speed Autochanger Mixer Unit for 7, 10 and 12in. Records. Twin Hi-Fi Xtal Heads with Duopoint sapphire stylus. Plays 4,000 records. Sprung mounting. Superb Quality. Bargain Price, 9½ gns. post free.

Ediswan 78 r.p.m. Single-player Gram Unit. High Impedance Magnetic Pick-up. Press lever start for 10in. or 12in. records. auto stop. Listed 7 gns. Our Price £4 10/-. Few only left.

NEW BOXED **VALVES** **ALL GUARANTEED**

1A5	5/6	6J5	7/6	12Q7	10/6	EF50 Equip	5 6
1R5	8	6J7	8 6	12SH7	5/6	British	7 6
1S5	8/-	6K6	7,6	35L6	10/6	Sylvania	
1S4	8/-	6K7	6 6	35Z4	10/6	Red	10 6
1R5	8/	6K8	9	OZ4	8/6	EF91	8 -
3S4	9	VT127 } Pen45 }	9 -	50L6	9/6	EF92	9 6
3V4	8 -	EF80	10 6	807	10/6	EL32	9 6
3D6	2 6	6L6	10 6	GZ32	15/-	7C6	9 6
5U4	10 6	6P25	15 -	9001	7/6	EY51	12 6
5Z4	9 -	6Q7	9/6	9006	7/6	EY91	8 6
6X4	7 6	6SA7	8 6	CV6	3/6	HVR2a	7 6
6AG5	7 6	6SH7	6 6	DET18	8/6	MS PEN	6 6
6AM6	9/-	6SL7	9 -	DK91	8/-	PY80	11 6
6AT6	10 6	6SN7	11 -	DF91	8/-	PY81	11 6
6B8	7/6	6U5(Y63)	8/-	DAF91	8/-	PY82	10 6
6BA6	8 6	6V6	8 -	DL92	9/-	PEN25	8 6
6BE6	10 6	6X5	9 -	DL94	8/-	SP61	8 6
6BW6	10 6	6AK5	10 6	EH48	4/6	U22	9 6
6C4	7 6	7S7	9 6	EA50	2/-	VP23	7 6
6C6	7/6	8D3	9	6AL5	7/6	VR116	6 6
6D6	7 6	9D2	5 6	EB91	7/6	ECL80	12 6
6F6	9 6	12A6	7 6	EBC33	9 6	25L6	10 6
6F12	9	12AX7	10 6	EC91	7/6	25Z6	10 6
6G6	6 6	12K7	10/6	EF36	7/6	25Z4	10 6
6H6	3 6	12K8	10/6	EF39	9/-		

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

SPECIAL PRICE PER SET

1R5, 1T4, 1S5 and 3S4 or 3V4 ... ... 30 -
6K8, 6K7, 6Q7, 6V6, 5Z4 or 6X5 ... 37 6

VIEWMASTER. 12 valves, **£6 10 -.** With EY51, **£7. TELEKING.**—17 valves, **£9 10/-. LYNX.** 17 valves, **£9. CORONET.**—4 valves, **45/-.**

SUB MINIATURE VALVES

WIRE ENDS

★ Fil. Volts, .625. ● Fil. Volts, 1.25. Brand new. Ex Deaf Aid Apparatus, by Mullard and Hivac. Types :—

★ DF66 ★ XFW20
★ DF70 ★ XFW30
● DL66 ● XFY11
● DL72 ● XFY21

all at **7/6** each post free

CRYSTAL DIODE.—Very sensitive. G.E.C., 3 6.
H.R. PHONES.—(Hi-grade Amer.), 15 6 pr. **S. G. BROWN'S**, 4,000 ohms, 15 6 pr.

T.R.S. RADIO COMPONENT SPECIALISTS

THO 1665 Buses 133 or 68 pass door.
307, WHITEHORSE ROAD, WEST CROYDON.
Mail Order: **71, MEADVALE RAOD, EAST CROYDON.**
P. and P., 6d. £1 orders post free. Lists 3d.
ALL MAINS TRANS.—1/- extra postage.

ELECTRODYNAMIC MIKE INSERT.—U.S.A. make, precision engineered. Size only 1in. diam. by ⅜in. Bargain Price 3/9. Matching Trans, 3 9.

CONDENSERS.— New stock best makes, .001 mfd. 6 kV. T.C.C., 5 6. Ditto, 12.5 kV., 9/6; 2 pf. to 500 pf., **6d.**; .001, .005, .01, T.C.C. 500 v., .01 Sprague 500 v., .02 N.S.F. 500 v. .1 mfd. 350 v. Micamould Tub., **9d.**; Hunts Moldseal 500 v. .05 mfd. and 1 mfd., 1 -; .25 mfd., 1 6; Tubular .5 mfd., 350 v. 1/9.

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 1 000 pf., 2/-.

ELECTROLYTICS ALL TYPES NEW STOCK

Tubular Wire ends		Can Types, Clips, 3d. ea.	
1 275 v. B.E.C.	2/-	16,450 v. T.C.C.	3/6
2 450 v. B.E.C.	2,3	32/350 v. B.E.C.	4/-
4 350 v. Dub.	1/6	60/350 v. T.C.C.	6/6
4 500 v. Hunts	2/-	250/350 v. B.E.C	8/6
8 450 v. B.E.C.	2/3	8+16/450 v. B.E.C.	5/-
8 500 v. Dubilier	2/9	8+16/500 v. Dubilier	5 6
16 500 v. Dubilier	2/6	16+16/450 v. B.E.D.	5/6
16 500 v. Dubilier	4/-	16+16/500 v. Dub.	6/-
8—8 500 v. Dubilier	4/6	32+32/450v. B.E.C.	6 6
16 350 v. B.E.C.	3/-	32+32/350 v. +25 25 v. in same can B.E.C.	6 6
32 350 v. Dubilier	4/-	60+100 350 v. Hunts	11/6
32/500 v. Dubilier	5/-		
32+32 350 v. Dub.	5/6		
25 25 v. Dubilier	1 9		
50 25 v. Plessey	1/9		
50,50 v. Plessey	2/-		

SPECIALS.—Can Types. 500 mfd. 12 v., 3 - 1,000 mfd. 12 v., 5 -; 1,000 v. mfd. 6 v., 4 6; 16 mfd. 700 v. Hunts, 6 6; .1 mfd. 2.5 kv., 4,6; .5 mfd. 3.5 kv., 5 6.

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 -.

KNOBS. GOLD ENGRAVED.—Walnut or Ivory, 1½ in. diam., 1 6 each. "Focus," "Contrast," "Brilliant," "Brilliance—On-Off," "On-Off," "Volume," "Vol.—On-Off," "Tone," "Tuning," "Treble," "Bass," "Wavechange," "Radio-Gram," "S., M., L., Gram.," "Record-Play," "Brightness." Ditto not engraved, 1/- each.

POINTER KNOBS.—Brown or black with white marking line, small, 9d., large, 1 -.

COILS.—Wearite "P" type, 2 6 each. Osmor "Q" Type, adj. dust core, 3 6 each. All ranges.

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

SURPLUS MAINS TRANS.—Prim. 0-200/250 v.; Sec. 275-0-275 v., 60 ma., 6.3 v. 3 a., 6.3 v. 1 a., 10 6; ditto, 260-0-260 v. 80 ma., 6.3 v. 3 a., 4 v. 1 a., 12 6. Oscilloscope Transf. Prim. 0-230 v. Sec. 800 v. 15 ma., 5 v. 2 a., 5 v. 2 a. 4 v. 1 a., 17/6

E.H.T. TRANSF.—4 Kv. A.C., 2 v. 2 a., 45/-.

VIBRATOR TRANS.—6 v. input, 230 v. 50 ma. output, 9 6. P. & P., 1/-.

BATTERY CHARGER.—200/250 v. Output 6 v. and 12 v. 1½ amps., in steel case, complete with fuse and leads, ready for use. **OUR OWN MAKE. FULLY GUARANTEED, 35/-.** 3 amp Heavy Duty Model with Charging Indicator, £3/15/-. P. & P., 1 -

CHARGER TRANS. PRIM.—0-200/250 v., Sec 0-9 v.-17 v. 1 a., 13 6; 2 a., 16/-; 3 a., 18,6; 4 a. 21 -; 6 a., 26 -.

FULL WAVE BRIDGE SELENIUM RECTIFIERS.— 6 or 12 v. 1½ amps., 8 9; 2½ a., 12/6; 6 a., 23 6. Ditto F.W. only 6 v., 1 a. (9 v.-0-9 v. A.C.), 5 6.

ACID HYDROMETER.—New ex-Govt. Unbreakable. Packed in metal case, 7in. x 1½in. dia., 4 6.

H.F. MIDGET CHOKES.—14 M.H., 2 6 each.

BRIMISTORS.—CZ1 for .3 a. heater chains, 3 6. CZ2 for .15 a., or .2 a., 2,6.

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.

5in. RADIO SCREWDRIVERS.—Sheffield made blade, 2½in. x ⅛in. Ins handle, 5,000 v., 4½d. each.

TWIN GANG TUNING CONDENSERS.—.0005 mfd. midget with trimmers, 8/6; 375 pf. midget less trimmers, 6 6; .0005 standard size with trimmers, 9,- ; less trimmers, 8/-; ditto, soiled, 2/6.

BULGIN MAINS PLUGS.—Re-entrant safety type, complete with plug. 3 way, 3/6; 6 way, 5 6.

LOUDSPEAKERS P.M., 3 OHM. 3in. Plessey, 12 6. 5in. Goodmans, 13/6. 6½in. Elac, 14/6. 8in. R. & A., 17 6. 10in. Plessey, 25,-. 12in. Truvox, 55 -.

I.F. TRANSFORMERS

465 Kcs Slug tuning Miniature Circular. Can, 2¼in. by 1¼in. diam. Fits octal V-holder cut out. High Q and good bandwidth. By Pye Radio. Two mounting feet.

BRAND NEW 6/9 PAIR

RADIO BARGAINS—

NEW, SURPLUS, CLEAN COMPONENTS

SPEAKERS.—5in. P.M. Boxed, **15/6.** 5in. M.E. 1,000 ohm field with Pen. trans., **15/-.** 6½in. P.M. **15/6.** (A few 3½in. Heavy cast type P.M. Speakers, **8/6.**) All above 2-3 ohm.

RADIO COILS.—Crystal Set Coil, **2/6.** H.F. Coil, **4/-.** T.R.F. Pair, **8/-.** These are all midget Polystrene type and are supplied boxed with suggested circuits enclosed. We stock also: Denco, Osmor, Weymouth, Wearite.

SPEAKER TRANSFORMERS.—New Goodman's Standard Pentode type, **4/6.** Triode type, 30 : 1, **3/6.** Midget Mains Pentode, **3/9.** Super Midget Battery 1S4, 3S4, DL92, etc., **5/-.** 6V6 P/pull Elstone MR7, **18/9.**

MISCELLANEOUS.—Pair of test Prods, **1/9.** 2 gang .0005 mfd., **6/-.** Crystal Diodes, **1/6.** Tyana Soldering Iron, **14/11.** Adcola Pencil Bit Iron, **25/6.** Henley Instrument Iron, **18/9.**

BOOKS.—Radio Servicing Instruments, **4/6.** How To Make Electronic Gadgets, **3/6.** T.V. Fault Finding, **5/-.** Personal Receivers and Power Packs, **5/-.** The Oscilloscope Book, **5/-.** Book of Valve and Tube Equivalents, **5/-.** Valve Data Book No. 1, **5/-.** No. 2, **5/-.**

HIGH STABILITY PRECISION RESISTORS.—½ w., 2%, 100 ohms to 2 mg. (preferred values), **1/6** each. ¼ w. and ½ w. Standard Resistors, **4d.** each. Midget, **6d.** 1 w., **8d.** Wirewound 7 watt max., **2/3.** 10 w. max., **2/9.** (Up to 10K only.)

RECORD CHANGER.—Plessey 3 speed Mixed Autochanger, new and boxed. (List Price £23.) Our Price, **£12.** A few only left.

VOLUME CONTROLS.—Long Spindles, less switch, **2/6.** With S.P. switch, **4/-.** D.P. switch, **5/9.** (Any standard value.) Wirewound Colvern Pre-set type CLR901, 250 ohms to 30K, **3/2** each. Midget Wirewound for L/speaker controls, 25 ohm, 100 ohm, 50 ohm, **5/6** each.

ELECTROLYTICS.—New. Wire-end. 8 mfd. 450 v., **2/6.** 16 mfd. 450 v., **3/6.** 32 mfd. 500 v., **6/6.** Special Offer of French 8 mfd. 500 v., **1/6** each, four for **5/-.** 100 mfd. 25 v., **4/-.** 25 mfd. 25 v., **1/6.** 25 mfd. 50 v., **1/6.** 50 mfd. 12 v., **2/-.** 50 mfd. 50 v., **2/-.** 8-16 mfd. 450 v., **5/-.** 8-8 mfd. 500 v., (chassis type), **4/6.** 16-24 mfd. 350 v., **5/6.** 2 mfd. 350 v., **1/3.**

VALVES.—6X5GT, **7/6.** 6V6C, **7/6.** 6U5, **7/-.** 6BW6, **8/-.** MS/PEN, **6/6.** KTZ41, **5/-.** 6K7G, **7/-.** 6K7GT, **7/6.** VU39A, **8/-.** FCC40, **10/-.**

CONDENSERS.—.0001, .0002, .0003, .001, .005, .01, .02, .05, .1 mfd., **6d.** each. .25 mfd., .5 mfd., **1/-** each. .5 mfd. 400 v., (large type), **8d.** each, **5/-** per doz.

S.A.E. for List or Quote.

Post **6d.** up to **5/-**, **1/-** up to **£1**, **1/6** to **£2**. C.O.D. (over **£1**).

RADIO SERVICING CO. 82, SOUTH EALING ROAD, LONDON, W.5.

EALING 5737. Next to South Ealing Tube Station.

Introduction to

Ultra-High-Frequency Radio Engineering

By S. A. Knight, F.R.S.A. A guide to the methods and techniques of modern ultra-high-frequency radio and radar engineering written primarily for engineers, students and members of the technical branches of the services who want to obtain a working knowledge of the subject—without complicated mathematical theory. 21/- net.

Sir Isaac Pitman & Sons, Ltd.
Parker Street . Kingsway . London, W.C.2

HERE IS RADIO'S SIMPLEST & CHEAPEST VALVE SET!

THE "COCOA-TIN SPECIAL"

This receiver, as the name indicates, is constructed from scrap materials such as odd pieces of bakelite and plywood, screws, discarded cocoa tins, etc., found around the house and in the junk box. Two circuits are available, a single-valver for use with headphones, and a two-valver for loudspeaker reception. The original one-valve set, apart from the valve, cost less than 5/- to build; the loudspeaker set can be constructed by the addition of another valve and a few simple components. Both sets work from small dry batteries, cover long and medium waves, and require only an indoor aerial. They give results equal to sets built in the orthodox manner. Full instructions for building both sets, including point-to-point wiring diagrams—

PRICE 3/6 POST FREE

This offer is confined to Great Britain, Irish Republic and Northern Ireland.

RADIO DESPATCH SERVICE
137, COTHAM BROW, BRISTOL, 6. *Orders by post only.*

"ADCOLA" SOLDERING INSTRUMENTS

Regd. Trade Mark

Regd. Design No. 800302
(British, U.S. and Foreign Patents)

For Wireless and Television Assembly

The advanced design of the Adcola Instruments meets the modern requirements of **Television, Telecommunication and Radar Engineers**

SUPPLIED FOR ALL VOLT RANGES FROM 6/7v. to 230/250v.

3/16in. dia. Bit. Standard Model	25/6
¼in. dia. Bit. Standard Model	28/-
3/16in. dia. Detachable Bit. Model	33/6

Sole Manufacturers:

ADCOLA PRODUCTS LIMITED

GENERAL OFFICES & WORKS: **CRANMER COURT, CLAPHAM HIGH STREET, LONDON, S.W.4.** *(MACaulay 4272)*

LOUDSPEAKERS All new and boxed

5in. p.m. 3 ohms ideal for portables	14/9
6in. p.m. 3 ohms Richard Allen	18/10
8in. p.m. 3 ohms Richard Allen	23/9
Postage and packing on above 1/6.	
8in. W.B. Stentorian S.808 3 ohms	33/6
8in. Goodmans 101 Axiom 15 ohms	£6.12.6
10in. Elac 3 ohms	£1.7.6
10in. Wharfedale bronze 3 or 15 ohms	£4.12.8
10in. Wharfedale golden 3 or 15 ohms	£7.12.3
12in. Goodmans Audiom 15 ohms	£8.12.6

Despatched by return C.W.O. or C.O.D.
Send s.a.e. for full details of our full range of speakers.

SPECIAL. Garrard autochanger for **A.C.** and **D.C.** mains. Brand new RC75A complete with all accessories. Limited number only £24 each.

HOME RADIO OF MITCHAM

187, LONDON ROAD, MITCHAM, Surrey. ***MIT. 3282.***
Buses 77, 80, 115. Trolleybus 630 pass the door.

ALUMINIUM CHASSIS

18 S.W.G. with Folded Fitted and riveted ends.

8 x 6 x 2½"	7/5 each
10 x 6 x 2½"	8/3 ,,
12 x 6 x 2½"	8/7 ,,
12 x 8 x 2½"	9/5 ,,
14 x 8 x 2½"	10/4 ,,
14 x 10 x 2½"	11/1 ,,
17 x 10 x 2½"	12/5 ,,

Post Free. Metalwork to order. Trade terms on application.

CABINETS — PANELS — METER CASES and RACK ASSEMBLIES

Latest illustrated catalogue on application.

BURN ENGINEERING

Produce Exchange Buildings, 8 Victoria Street, Liverpool 2.

SOUND MASTER SERVICE

The Sound Master is an entirely new Portable Tape Recorder which has been produced especially for the Home Constructor by the designer of the famous View Master Televisor.

Full constructional details are now available.
INSTRUCTION ENVELOPE,
6/6d. post free.

WRITE NOW for our fully detailed price list.
We carry full stocks of all items needed for the Sound Master and can offer a

RETURN OF POST SERVICE.
FULL HIRE PURCHASE FACILITIES AVAILABLE
on complete or part kits.

WATTS RADIO
(Weybridge), LTD.
8, BAKER STREET, WEYBRIDGE, SURREY

CROSS-OVER NETWORKS

PRINCIPLES AND DETAILS OF CONSTRUCTION OF FILTERS FOR FEEDING DUAL LOUDSPEAKERS

By W. J. Delaney (G2FMY)

THERE is a greatly increased interest in high-fidelity reproduction, and we continually receive requests for details of filter or cross-over networks suitable for use with a bass and "tweeter" speaker. We have, of course, dealt with this subject on many occasions in the past, but unfortunately all the appropriate issues are now out of print, so we are giving the essential data again for those who wish either to purchase or make-up suitable units.

There are two main circuits which are in general use, although there are various combinations of these which may be employed. The simplest scheme is that shown in Fig. 1, whilst the most popular variation is that shown in Fig. 2. The network or filter is connected between the output stage and a pair of speakers chosen for their efficiency in reproducing either the bass or treble (high notes). The most common procedure is to use a 12in. bass speaker—either one of those specially manufactured for the purpose or a standard 12in. unit which gives really good low-note reproduction or has been modified for the purpose, together with a small cone speaker, say about 5in. to 8in. in diameter, or one of the small horn-units, again specially designed for the purpose.

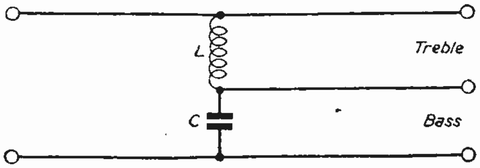


Fig. 1.—The simplest cross-over arrangement.

Cross-over Frequency

The principle is that the output from the amplifier or receiver is split up in the network and all frequencies above a predetermined value are fed to the high-note unit, whilst all below are fed to the bass unit. The reason for using a filter is that without it it is very difficult to find a speaker which will handle satisfactorily the entire range of musical frequencies delivered by a good quality amplifier. Hence, the arrangement is of little value unless a really good amplifier is being used. If the two speakers are connected without a suitable network there is a risk of the small speaker being damaged by the large amplitudes fed to it in the bass range, and the large speaker may produce spurious tones due to intermodulation resulting from the high frequencies beating with the low ones, or the speaker will not deliver the very high notes. By separating them through the network the bass unit is called upon to handle only those frequencies which it can handle satisfactorily, and the high note unit—sometimes referred to as a "tweeter"—will not be damaged by trying to handle low notes of large amplitude. Opinions differ as to the most satisfactory frequency at which to make the cross-over, some designers preferring a reasonably low frequency, say 800 to 1,000 c.p.s. whilst others prefer about double this value.

It is important to remember that the network must be chosen according to the output impedance of the output transformer and the impedance of the speakers, and as a general rule these should be identical. The most common impedance now met with is 15 ohms and, therefore, the following data apply to this type of output only.

The filters should cut-off fairly sharply and as will be seen all that is required is a suitable choke and condenser. In the simplest arrangement of Fig. 1 only one of each of these components is required, whilst for the more elaborate system of Fig. 2 two of each are used. It will be seen from the diagrams that the choke is connected across the high-note unit and the capacity across the low note, the two components also being connected in series in the second arrangement.

Suitable Values

Where it is desired to make the cross-over frequency at 1,000 c.p.s. the capacity should be about 10 μF and the choke from 2 to 3 millihenries. For a cross-over at 2,000 c.p.s. the capacity and inductance values would be halved. No difficulty should be experienced in arranging for the capacity values, as standard paper condensers may be connected up in parallel to any desired value, using 2 or 4 μF units, with 1 μF components to make a required odd value. The inductances do present a problem as they must be at low resistance and air cored and consequently become bulky items. For those who wish to wind their own, a 1.5 mH choke would consist of about 200 turns of wire on a 3in. diameter former, whilst space could be saved for the larger component by using slightly thinner wire so that the larger number of turns would not occupy very much greater space. The gauge of wire must, however, be sufficiently large to provide the lowest possible resistance and therefore ordinary commercial tuning coils or similar components will not, as a rule, be found satisfactory. It is possible to purchase these coils ready-made now from such firms as Webb's Radio, and obviously in view of the large amount of wire used they are expensive, costing round about 15/- each.

Connections

The complete network is connected between the output transformer and the two loudspeakers, and it is essential to mount the two speakers as close to each other as possible. It is also desirable that the two speakers should be "phased" correctly, that is, that

(Concluded on page 314)

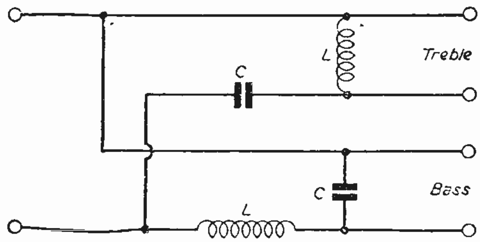
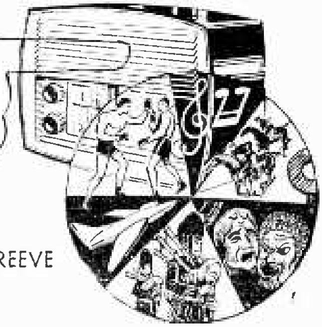


Fig. 2.—A more efficient circuit, and one which is in general use.

Programme Pointers



By MAURICE REEVE

National Radio Awards

THE *Daily Mail* national radio awards for 1953 have been announced and made and once again Gilbert Harding finds himself the "Personality of the Year." Few will dispute that this is on merit. Wilfred Pickles was bound to suffer through the substitution of "Have a Go" for "May I Come In?" Now that the former is back again, Wilfred's hour may yet return.

Tom Jenkins, as a musical entertainer, is preferred to all his more highbrow colleagues, whose programmes are regularly broadcast, and Marjorie Westbury and James McKechnie are signalled out from drama. "The Name's the Same" was obviously the best new programme of the year and I hope it will soon be back on straight radio.

It is when we come to "the most entertaining programme of the year" that I am at a loss to understand public taste. "Take It From Here" and "The Archers" tie for first place! (Mrs. Dale, apparently, cannot compete with Dan and Doris Archer.) As regular entertainment features, in addition to being both instructive and enlightening, I would consider "The Critics," "Any Questions?" and "Music Magazine" to be far and away superior. One is always sure of both a good laugh as well as some new information, although this type of programme never gets a look in any more than "Twenty Questions" does. "We Beg to Differ," too, is excellent entertainment. I suppose "Take It From Here" is about the best of the regular half-hour medleys. But as the others are mostly too dreadful to permit of quiet discussion in polite circles, it really has no competition except perhaps from "Life with the Lyons," which has worked hard for a long time now. A vast amount of the success of all radio must depend on the script, and this is obviously where the two winning programmes score over their rivals, as did "Itma" before them.

Bermondsey Enquiry

"Riverside Borough," an autobiographical sketch of a community—Bermondsey—collected and edited by Tom Hopkinson, was in four half-hour programmes. Excellently produced and compiled, one was made to feel one with the burgesses and not, as is so often the case, a keyhole or fanlight trespasser. Opinions violently differ as to the propriety of asking people to disclose the most intimate secrets of both their income and its disposal. Also of their social habits and customs (one lady said she had had nine children, three of them married!). But as people are much less shy of admitting they have seven pounds a week than they are of having seven thousand a year, this side of the enquiry may not be so conclusive as would seem.

"Those Were the Days"

The five hundredth performance of "Those Were the Days" confirms the justified success and popularity of a very pleasant show.

"Talk About Jones," a new series in which Peter Jones is with Lind Joyce, Mary Mackenzie, etc., but without Peter Ustinov, was very funny on the two occasions on which I heard it. Similar in style and format to the Ustinov-Jones shows. Let us hope it maintains its early promise.

Drama

I was very disappointed in "The Pirate," by S. N. Behrman, which Sam Wanamaker chose for his starring vehicle and for which the *Radio Times* gave such a lush blurb. It is obviously a comedy of situation and spectacle, and without these adjuncts the wit was not sufficient to sustain one's interest or keep one amused for an hour and a half. The mesmerising scene could be very amusing in the theatre. Mr. Wanamaker, Marjorie Westbury and the others laboured very successfully against invisibility.

"Robert's Wife," by St. John Ervine, on the other hand, has a plot, a dialogue and poses issues of sufficient interest to overcome this handicap. A very good and interesting play of ideas in the Shavian manner, beautifully played by Dame Edith Evans with Patrick Barr, Kynaston Reeves and Cyril Chaps. The Church, pacifism and careers for married women were the chief subjects discussed by the protagonists. The way Robert's wife, a doctor practising birth control—Robert is a clergyman—is, in the dying moments of the play, removed from her profession back to the domestic fold, as it were, bodily, is both a splendid coup de theatre and a lesson in how such things should be done.

In Strindberg's "Queen Christina" I found an absorbing play, history and the author's famous anti-feminism. Yvonne Mitchell was quite brilliant as the youthful Queen who was both a menace to her country and to each of the many men who fell under the spell of her charms.

"The Tenth Man" is early and good Maugham. What would any of us do who unhappily found ourselves confronted with the one chance in ten? Eric Portman was most powerful as George Winter and gave quite a tour de force. He was splendidly supported by the whole company.

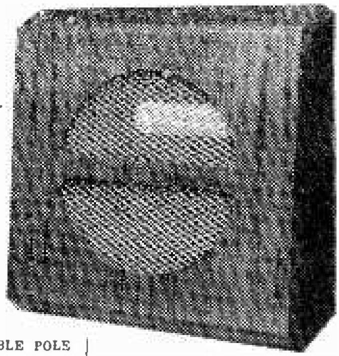
Final Thought

Why not Alistair Cooke for a radio oscar?

ALPHA

LOUDSPEAKER CABINETS

Available for 6½in. and 8in. Speaker units. Polished walnut finish. A very attractive cabinet at quarter of to-day's prices.
Price : 6½in. Type Cabinet. 15/6 each.
Price : 8in. Type Cabinet. 19/6 each.



STANDARD CAN CONDENSERS (CLIP FIXING)

Manufacturer	Type No.	Capacitance and Volts	Price
T.C.C.	CE27P	12 × 4 mfd. 450 v.	2/- ea.
T.C.C.	CE28L	24 × 8 mfd. 350 v.	2/6 ea.
T.C.C.	CE10P	24 mfd. 450 v.	3/3 ea.
T.C.C.	CE27L	16 × 8 mfd. 350 v.	3 6 ea.
B.E.C.	CE627	32 × 32 × 8 mfd. 350 v.	6/9 ea.
B.E.C.	CE15164	8 × 16 mfd. 350 v.	3/9 ea.
B.E.C.	CE916	32 × 32 mfd. 350 v., 25 mfd. 25 v.	6 9 ea.
B.E.C.	CE642	64 mfd. 350 v.	2 - ea.
B.E.C.	CE10610	16 mfd. 450 v.	3 6 ea.
B.E.C.	CE603	32 × 22 μF 450 v.	7/- ea.
B.E.C.	CE15749	8 × 32 mfd. 475 v.	3 9 ea.
B.E.C	CE15652	16 × 16 mfd. 350 v.	2/9 ea.
T.M.C.	—	16 mfd. 450 v. (surge limiting)	2/9 ea.
Ediswan	—	8 × 8 mfd. 450 v.	4/- ea.
Dubilier	—	20 × 20 mfd. 500 v.	3/6 ea.
Dubilier	—	32 × 16 mfd. 350 v.	3/6 ea.
Dubilier	—	24 × 16 mfd. 350 v.	4/3 ea.
Dubilier	—	8 × 8 mfd. 350 v.	3 - ea.
T.C.C	—	A.C. Cond. 50-100 c/s. 1 mfd. 230 v.	1/3 ea.

MIDGET CAN CONDENSERS

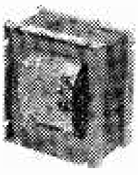
Manufacturer	Type No.	Capacitance and Volts	Price
Sprague	—	8 mfd. 500 v.	3/- ea.
T.C.C.	CE19B	250 mfd. 12 v.	1/9 ea.
T.C.C.	CE26L	16 mfd. 350 v.	2/9 ea.
T.C.C.	CE35L	24 mfd. 350 v.	3/6 ea.
T.C.C.	CE24L	8 mfd. 350 v.	1/1 ea.
Dubilier	—	8 × 8 mfd. 350 v	3 6 ea.
Dubilier	—	8 mfd. 500.v.	3/3 ea.
Dubilier	—	100 mfd. 25 v.	1/9 ea.
B.E.C.	CE517	32 mfd. 450 v.	2/1 ea.
B.E.C.	CE15653	32 mfd. 350 v.	1/9 ea.
B.E.C.	CE512	16 × 16 mfd. 450 v.	4/6 ea.
Ediswan	—	8 × 16 mfd. 450 v.	4/- ea.

CARDBOARD COVERED WIRE-ENDED CONDENSERS

Manufacturer	Type No.	Capacitance and Volts	Price
Dubilier	BR850	8 mfd. 500 v.	2 3 ea.
Dubilier	BR1650	16 mfd. 500 v.	3/6 ea.
Dubilier	BR2050	20 mfd. 500 v.	3/6 ea.
B.E.C.	CE508	8 mfd. 450 v.	2/1 ea.
B.E.C.	CE404	25 mfd. 25 v.	1/9 ea.
Ediswan	—	50 mfd. 50 v.	2/3 ea.

MAINS TRANSFORMERS

3-way Mounting type.



MT1. Primary 0-210-230-250 v. Secondary 250-0-250 v. 80 mA., 4 amps. 4 v. 2 amps with taps at 4 v. on filament winding. Price 17/6 each. MT2. Primary 0-210-230-250 Secondary 350-0-250 v. 80 mA. 6.3 v. 4 amps. 5 v. 2 amps. Both filament windings tapped 4 v. Price 17 6 each.

MT3. Low Voltage Transformer. 30 v. 2 amps. with tappings at 3-4-5-6-8-9-10, 12-15-18-20-24 volts. Price 17/6 each.

Moulded Mica Condensers

All wire ends .0001, .0002, .0004, .0005, .01, .001, .005, .00027 .0008, .00005, .003, 4 6 doz.

Goldring Pickup Heads

Pickup head type No. 112 (2,000 ohms), complete with lead. Price 15/- each.

Metal Rectifiers for Chargers

12 v. ½ amp., 1/6 ; 12 v. 1 amp., 4/9 ; 2 v. 1 amp., 3/- ; 12 v. 2 amps., 10/6 ; 12 v. 3 amp., 13/- ; 12 v. 5 amp., 18/6

HALF-WAVE 1mA. PENCIL RECTIFIERS

K3/25—665 v.	5/8
K3/40—1 kV.	7/6
K3/45—1.140 kV.	8 2
K3/50—1.260 kV.	8 8
K3/60—1.5 kV.	9 8
K3 100—2.550 kV.	14 8

STANDARD S.T.C. RECTIFIERS

RM1 125 v. 60 mA. ...	3 11 ea.
RM2 125 v. 80 mA. ...	4/3 ea.
RM3 125 v. 100 mA. ...	6 - ea.
RM4 125 v. 250 mA. ..	16 - ea.

RECEIVER 1132A

Contains EK32 ; 4 EF39 ; 6H6 ; 6J5 ; 3 SP61 ; P61 in good condition. Fitted with tuning meter. Slow motion drive calibrated dial complete with circuit diagram. 45/- each. Carriage and packing, 7/6.

HAND MICROPHONE by " REGENT "

complete with screened lead and plug—Crystal insert, nickel chrome plated head. Listed at 2 gns. Our price, 21 - each.

J.B. DRIVES, ETC.

SL8 Spin Wheel Drive ...	27/6
Airplane Drive	13/-
Full Vision Drive	13/-
Square Plane Drive	12 9
S15 RV Drive	26 6

Send for catalogue of drives, condensers, etc.

VOLUME CONTROLS

WIRE WOUND CONTROLS

5 Ω, 200 Ω, 2K Ω, 5K Ω, 10K Ω, 10K Ω double, 25K Ω, 20K Ω, 50K Ω, 50K Ω, 500 Ω, all 2 4 each.

COLVERN CLR901, 1,000 Ω, 1 9 each.

COLVERN SLIDER TYPE CLR801.—3K Ω and 5K Ω Double Unit, 1/9 each. 20K Ω, 10K Ω, 20 Ω, 1/3 each.

CONTROLS WITH DOUBLE POLE SWITCH

25K Ω, 2 Meg Ω, ½ Meg Ω, 1 Meg Ω, Log. ½ Meg Ω, 1 Meg Ω, 50K Ω, 20K Ω, all 3/9 each.

VOLUME CONTROLS SINGLE POLE SWITCH

500 Wire Wound 2/10 each.
5K Ω, 10K Ω, 100K Ω, ½ Meg Ω, ½ Meg. Ω Log, ¼ Meg. Ω, 1 Meg. Ω, 1 Meg. Ω Log, 2 Meg. Ω, all 3 9 each.

STANDARD CONTROLS LESS SWITCH

50K Ω, ½ Meg. Ω, 1 Meg. Ω, all 2 6 each.
Yaxley Switch 1 pole 7-way ... 1 6 ea.
Multi Ratio O Put Xformer... 6 6 ea.
Yaxley Switch 4 pole 3-way... 2 6 ea.

EX. GOVT. CONTROLS ALL CARBON TRACK

500 Ω, 600 Ω, 1,500 Ω, Double type, 2K Ω, 5K Ω, 10K Ω, 20K Ω, 25K Ω, 50K Ω, 200K Ω, 100K Ω, 100K Ω, ¼ Meg. Ω, ½ Meg. Ω, 1 Meg. Ω, 2 Meg. Ω, 25K Ω, Double type, 50K Ω Double type, 1/2 each.
B.E.C. 8 mfd. 350 v. Wire Ends ... ... 2/- ea
Battery Charger Bulldog clips 3d. ea
465 kc/s I.F. transformers ... 6 3 ea.
Varnished Cotton Sleeving, doz. yds. 1 6
Wearite 12 v. Vibrators 4-pin 6/6 ea.
Crystal Diodes Wire Ends ... 1/8 ea.
Can type 20 x 20 mfd. 500 v.... 3 6 ea.

FOR TERMS SEE OUR ADVERTISEMENT ON PAGE 316

VALVES GUARANTEED NEW AND BOXED

0Z4	6/-	6H6	4 6	80	8 6	DH73M	9/-	PY81	11/6
1A5GT	6/6	6J5G	5/-	807	8/3	E1148	2/-	QP22B	7 6
1C5GT	8/-	6J5GT	5 6	8D2	2/9	EBC41	11/-	QP21	7 6
1L4	7/6	6J5M	6 6	954	2/-	EL42	11/6	TP22	9 -
1R5	7 9	6J7G	6 6	955	4/9	ECH42	10 6	U22	8/-
1S4	7 9	6K7G	6/-	956	3 6	ECH35	13/-	U10	9/-
1S5	7 9	6K7M	6/9	9001	6/-	EBF80	11/6	U81	10/-
1T4	8 -	6K7GT	6/6	9002	6/-	EB41	11/-	UB41	9 6
1U5	10/-	6K8G	8 9	9004	6/-	ECL80	11/6	UBC41	11 6
220VSG	6/9	6K6GT	6/6	9006	6/-	EF36	6/6	UCH42	12/6
2X2	5/-	6K8GT	9/-	10C1	11/-	EF41	10/-	UF41	12/-
3A4	9 -	6J6	8 6	10F9	11/-	EF80	11/6	UY41	10/-
3Q4 (N18)	9/-	6L6G	9/-	10LD11	11/-	EZ40	11/-	EF39	6 6
3D6	5 -	6L7G	7 6	12A6	6 9	EM31	9/-	EB34	2 6
3S4	8/6	6N7	7 6	12AU7	9/-	EY91	9/-	EBC33	7 6
3V4	8/-	6Q7G	9 -	12AT7	9 6	EY51	13/-	EF36	6 6
4D1	3/-	6Q7GT	9 -	12C8	8/-	EZ41	11/-	SP61	3 9
42	8/-	6SA7GT	8 6	12H6	5/-	FC13	9/-	EK32	8/-
5U4G	8/6	6SG7	7 6	12J5	6/-	HD14	10/-	SP41	3 6
5Y3GT	8/-	6SH7	6/-	12K7	9/-	H63	7/9	P61	3 9
5Z3	8/6	6SJ7GT	8 6	12K8GT	9/-	H30	8/-	EF50	6 -
5Z4G	8 6	6SK7	6 9	12SG7	5/6	HL23DD	8/-	EF50 Syl	8/-
6A7	9 6	6SL7	8 -	12SH7	5/6	HL21DD	8/-	EA50	2/-
6A8G	9 6	6SN7GT	9 -	12SJ7	7 6	KT2	5 -	VR116	4/-
6A8GT	10 6	6SQ7	9 -	12SC7	7/6	KT33C	10/6	DDL4	4 -
6AC7	6 6	6SS7	8 -	12SK7	6/6	KT74	8/-	EF8	6 6
6AG5	7 6	6U5G	8 6	12SR7	7 6	KT66	10/6	EF54	7/-
6AK5	9/-	6V6G	7 6	12SQ7	8 6	KT76	10/-	EC52	5 9
6AL5	8/-	6V6GT	7 6	12Q7	9/-	KTW61	7 6	VR105/30	9/-
6AM6	8 -	6X4	8 -	15D2	4 -	KTZ41	6/9	VR150/30	9/-
6AT6	10/-	6X5GT	7 6	20D1	10/6	KTZ63	6/6	EL32	8 -
6AM5	9/-	6X5G	7 6	25A6G	9/-	MH4	5/6	TT11	6 -
6B8G	4/-	7B7	8 6	25L6GT	8/6	MS/PEN	5/-	VP23	8/-
6BE6	11 -	7B6	8 6	25Z4G	9/-	OM9	9/-	VU39	8 6
6C4	8 -	7C5	8 6	25Z6GT	8/6	PEN25	8/-	VU111	3 6
6C5GT	7 6	7C6	8 6	35L6GT	8/9	PEN46	8/6	VU120A	3 6
6C6	6 6	7H7	8 6	35Z4GT	8/6	PEN220A	4/9	VU133	3 6
6C9	8/-	7R7	8 6	50L6GT	8 6	PL33	9 6	W77	8 6
6D3	7/6	77	8 -	ATP4	6/6	PL83	13 -	W81	10 -
6D6	7/3	7S7	8 6					X65	10 -
6F6G	7/6	7Q7	8 6	AC6PEN	5 6	PL82	11 6	X66	11 6
6F8G	7/-	7Y4	8 6	CV66	6 -	PY82	11 6	Y63	9/-
6G6G	6/6	75	10 -	CV71	1/-	PY80	11 6	Y61	9/-

A SPECIAL PURCHASE OF TUNGSRAM VALVES ENABLES US TO OFFER THE FOLLOWING :

25Z5	9/-	6V6G	9 -	AS4125	11 6	25Y5	9 -	LD210	6/-
HP4101	11 6	6V6GT	9/-	EBF11	6 3	6U7G	8/6	SP220	6/-
6J7G	8 6	99	9/-	PY30	9 -	LP220	6 -	HP210	5 9
								HR210	5 9

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

Mathematics and the Service Engineer

SOME OF THE SIMPLER FORMULÆ EXPLAINED

By F. E. Apps

FOR the radio and/or television service engineer to be really efficient, it is necessary for him to keep up to date with all the advances of science in his particular job. To do this, he must read and thoroughly understand the various technical articles given in the many technical journals and books that are published from day to day. For a real understanding of these articles, it is imperative for him to know quite a reasonable amount of mathematics. This is because practically all these textbooks and articles give formulæ. Now formulæ in a technical article are as necessary as maps in a book on geography. They illustrate to a discerning mind the main points of the text, and for a reader to peruse one of these articles without the faintest idea what

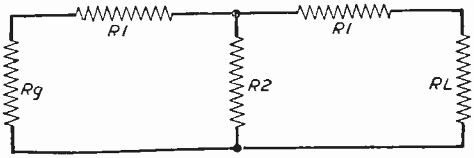


Fig. 1.—A "T" Attenuator.

these formulæ mean is a waste of time, as he cannot really follow the gist of the article if he does not understand them.

Now, if the foregoing is accepted, then it is necessary to find out what mathematics, etc., are needed by the service engineer, and also how far it is necessary for him to go in his studies.

Most service engineers, I believe, have an education up to the ordinary national certificate, which enables them to solve ordinary arithmetical problems; but more is required, especially now that complicated circuitry is being employed, for instance, in television and pulse circuitry notably. The subjects required are, in my opinion, geometry, algebra, trigonometry, indices, graphs and logarithms. Also a knowledge of the standard symbols used, including the Greek and English letters used as such. A list of books suggested may be obtained from this office.

Geometry and Trigonometry

These two subjects are, of necessity, bound up with each other and are required for the purpose of understanding angles of lead and lag, and vector diagrams. Some of the simpler trigonometrical formulæ should be memorised, such as

$$\cos^2\theta + \sin^2\theta = 1$$

$$\sin\theta = \sqrt{1 - \cos^2\theta}$$

$$\cos\theta = \sqrt{1 - \sin^2\theta}$$

$$\tan\theta = \frac{\sin\theta}{\cos\theta}$$

$$\text{Power factor} = \frac{EI\cos\theta}{EI} = \cos\theta =$$

cosine of the angle of phase difference between the line voltage and the current.

Indices

To be conversant with these is very necessary. One often meets such things as this in formulæ

$$2.3 \times 10^{-6}$$

3×10^8, etc., etc.

Only a short period is required to know this quite thoroughly, but unless you understand them the whole thing might just as well be written in Chinese.

Graphs

Most articles on electronics have at least one graph. They are mostly connected with valve characteristics, acoustical response of loudspeakers, and also vision response curves of television receivers. To be able to read these as easily as the written word is of enormous value to the engineer. It is helpful in studying graphs to make up some of your own, using any two associated factors and reading the resultant off on a curve and then proving same mathematically.

Algebra

This is definitely a "must," and should go at least as far as simultaneous equations and on to quadratics, if possible. I do not think the "j" factor or the calculus need be included.

Here are a few formulæ showing the need for algebraical knowledge.

For a T attenuator as Fig. 1

$$R_1 = RL\left(\frac{\alpha - 1}{\alpha + 1}\right)$$

$$R_2 = RL\left(\frac{2\alpha}{\alpha^2 - 1}\right)$$

For a Wien Bridge measuring audio frequencies as Fig. 2

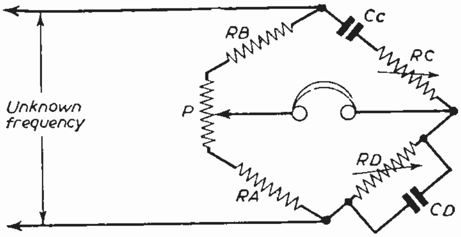


Fig. 2.—A Wien Bridge measuring audio frequencies.

$$f = \frac{1}{2\pi\sqrt{RC\,RD\,CC\,CD}} \quad \text{also}$$

$$\frac{CD}{CC} = \frac{RB}{RA} - \frac{RC}{RD}$$

When CC = CD, RC = RD and RA/RA = 2

$$\text{Then } f = \frac{1}{2\pi\,RC\,CC}$$

Now beyond all this, there are many formulæ that apply particularly to electronics with which it is necessary to be very conversant. Amongst them the following will be found necessary.

Ohms Law for D.C. $I = \frac{E}{R}$

Ohms Law for A.C. $I = \frac{E}{Z}$

Impedance $Z = \sqrt{R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2}$

RMS value $= \frac{1}{\sqrt{2}} \times$ max. value

Resistances in series, parallel or series parallel.
Condensers in series, parallel or series parallel.
Inductances the same.
The relationship of frequency to wavelength

$$WL = \frac{\text{Velocity}}{\text{Frequency}}$$

Capacity of parallel plate condenser

$$C = \frac{NKA}{4\pi d}$$

The charging of a condenser where $Q=CV$ and the energy stored is $\frac{1}{2}CV^2$. The time constant of circuit containing C and R = CR seconds. The wavelength of an oscillatory circuit

$$WL = 1885\sqrt{LC}$$

Inductance of a single wound coil

$$L = \pi^2 d^2 n^2 lK \times 10^{-3}$$

Now this list may seem formidable, but it is only a very few of those required. Many a service engineer will, no doubt, say that all this knowledge will not assist him in locating an intermittent fault in a radio or television receiver any quicker. That may be so directly, but indirectly it will help because with this knowledge he is able to read more about his own particular branch of science and be able to set about the job in a more knowledgeable manner.

Test Equipment

With the more complicated circuitry now employed, more elaborate testing equipment is necessary. Now the price of instruments, such as the oscilloscope, the Q meter, and inductance and capacity bridge, puts them beyond the reach of many service engineers, so they have to make do with instruments they have built themselves. Now although many circuits are given of test equipment in PRACTICAL WIRELESS and *Practical Television*, many engineers may wish to alter these designs to suit their own particular requirements. To do so may mean circuit alteration that may have a deleterious effect upon the efficiency of the instrument concerned. This is where " maths " can help by enabling the engineer to work out the correct value of the required new components and estimate very accurately their effect upon the circuit as a whole.

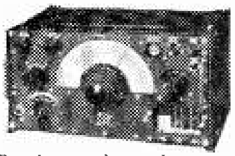
Then, again, many service engineers have " brainwaves " about how to achieve a certain result with an entirely new circuit idea. In most of these cases many, many hours of work and much heartbreak would be avoided, when it is finally found that it does not work, if the engineer in question had only worked it out mathematically beforehand and seen he was attempting the impossible.

A Charter for Mobile Radio

THE following points are put forward by the Mobile Radio Users' Association as being of paramount and urgent importance from the point of view of users of mobile radio :

1. The Government should recognise mobile radio as a service of great importance which has a real contribution to make to the national economy.
2. The Government should state that it will do all in its power to encourage the full use and extension of mobile radio.
3. The Government should undertake that the views of users of mobile radio will be considered when decisions affecting them are taken, and that the Mobile Radio Users' Association will be officially recognised and called into consultation together with other interested bodies.
4. The Government should maintain available an adequate supply of frequencies upon which the mobile radio services can operate effectively.
5. The Government should undertake that frequency allocation shall be conducted in accordance with the following principles :
   - (*a*) The total bands available for mobile radio should be clearly and publicly defined, in order to give security to users and manufacturers. This is essential, particularly for long-term development.
   - (*b*) The block allocation of frequencies should be made for a stated period, to be not less than 10 years, and then in the event of a change of frequency, due to Government action, the principle of compensation should apply.
   - (*c*) The use to which all individual frequencies within a particular block are put should be made public.
   - (*d*) The blocks of frequencies available to mobile radio should, as far as possible, be protected from interference by users in adjacent blocks.
   - (*e*) There should be recognition of the fact that although a large number of channels can be made available for mobile radio, the number is not unlimited, and due regard must be paid to this fact in allocating frequencies, in order to prevent overloading of channels.
   - (*f*) In making more frequencies available to mobile radio, the Government should recognise that many classes of user would be satisfied with a frequency made available on a strictly peace-time basis. It is believed that there are many frequencies, at present allocated to military purposes and unused in time of peace, which could readily be made available to civil users.
6. At a time when Ministers are calling upon transport and industry to reduce costs in the face of foreign competition, and in view of the acceptance by Government publications and Government-sponsored Productivity Committees of the importance of mobile radio in providing an economic means of communication, and in view of its importance to health and safety, all the above points should be treated by the Government as matters for urgent decision.

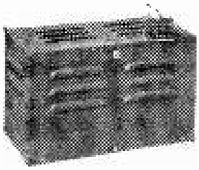
EX-A.M. RECEIVER TYPE R1155



Brand new and unused 5 Frequency ranges: 18.5-7.5 Mc/s; 7.5-3.0 Mc/s; 1.500-600 Kc/s; 500-200 Kc/s; 200-75 Kc/s. Supplied in maker's original wood transit case. LASKY'S PRICE. £11/19/6 Complete. R.1155 Receivers. Secondhand aerial tested. £7/19/6.

Carriage and packing 12/6 per unit extra, including 10/-, which will be refunded on return of packing case.

ASSEMBLED POWER PACK/OUTPUT STAGE FOR R.1155 RECEIVER



For use on 200-250 v. A.C. mains. Complete with 2 valves. In metal case size: 12 x 7 x 5½ins. LASKY'S PRICE, 79/6. Carr. 5/- extra

Power Pack as above. Fitted with 6½in. p.m. speaker. LASKY'S PRICE. £5/5/-. Carriage 5/- extra.

PORTABLE RECORD PLAYERS

Containing a new Plessey single speed automatic record changer. (78 r.p.m.). Magnetic pick-up, and 2 valve amplifier, with metal rectifier. For use on 200-250 v. A.C. mains. Amplifier uses EF.36 and EL.32 giving 3-watts output, tone and volume controls, 5 in. speaker. In rexine covered cabinet, size: 17 x 17 x 8ins. With carrying handle. LIMITED QUANTITY. LASKY'S PRICE. £10/19/6. Carriage 10/6 extra. Though store soiled, these players are new and every one is fully tested before despatch.

MAINS TRANSFORMERS

All 200-250 v. 50 c.p.s. primary Finest quality, fully guaranteed.

MBA/3. 350-0-350 v. 80 mA 6.3 v. 4 a., 5 v. 2 a. Both filaments tapped at 4 volts. An ideal replacement trans. Price. 19/-.

MBA/6. 325-0-325 v. 100 mA. 6.3 v. 3 a., 5 v. 2 a. With mains tapping board. Price. 22/6.

MBA/7. 250-0-250 v. 80 mA. 6.3 v. 3 a., 5 v. 2 a. Both filaments tapped at 4 volts. Price. 18/-.

MBA/8. SPECIAL OFFER. Drop through type. 235-0-235 v. 60 mA. 6.3 v. 3 a., 12/6.

MBA/9. 400-0-400 v. 60 mA. 6.3 v. 1 a., 4 v. 2.5 a. Price, 12/6.

AT/3. Auto transformer. 0-10-120, 200-230-240 volts 100 watts. Price 17/6.

AERIAL ROD SECTIONS

Steel, heavily copper plated. Each rod is 12in. long, ½in. diameter. PRICE 2/6 per dozen. Post free.

COLLARO 3-SPEED CHANGERS

Studio xtal. turnover p.u. £9/19/6.

CRYSTAL DIODES

Glass type. Wire ends. 1/6 each.

LINE FLYBACK E.H.T. TRANSFORMER

Output 7-9 kV. E.H.T. with heater winding for EY51. 19/6.

P.M. FOCUS MAGNETS

35mm. With vernier adjuster. Tetrode 15/-. Triode 17/6.

Less vernier.. All types 12/6. 38mm. Wide angle, with vernier and picture shift control. 25/-.

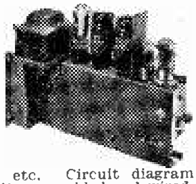
VALVES. 10,000 IN STOCK AT THE LOWEST POSSIBLE PRICES.
SOME EXAMPLES

6V6	7/6
35Z4	9/-
6AM6	7/6
6H6	2/6
EF50. Red New Sylvania	10/-

SPECIAL OFFER. 4 Valves: 1 each 1R5, 1T4, 1S5 and 3S4.
LASKY'S PRICE 30/-
POST FREE

1S4	7/6	1A5	9/-	6J7	6/6	EF39	7/6
3S4	9/-	12K8	8/6	OZ4	6/-	12K7	10/6
1T4	7/6	12Q7	8/6	KT2	3/6	6L6	10/6
1R5	7/6	6AL5	9/-	6K8	8/6	EA50	2/6
1S5	7/6	6K7	4/6	U50	7/6	EBC33	7/6
1C5	7/6	1D5	8/6	ECH35	13/6	35L6	10/-

J/RA/3 AMPLIFIER

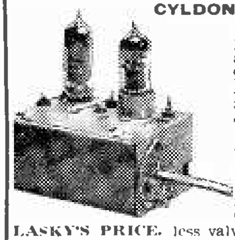


6 VALVES. 12-15 WATTS OUTPUT. Originally made for talkie film projectors. In carrying case. Chassis size: 14½ x 10 x 4 ins. For use in 100-110 volts A.C. mains. Grey crackle finish. Fitted with volume and tone controls. Resistance capacity coupled circuit. Output 2 KT66 in push-pull. High quality components used throughout. In black rexine covered wood case, size 15½ x 13½ x 9½ ins. giving plenty of room for speaker, etc. Circuit diagram available. Complete with 6 valves, fully assembled and wired.

LASKY'S PRICE **£8.19.6** COMPLETE Carriage 15/- extra.

Suitable 150 watt auto-trans. for 250/250v. 18/6.

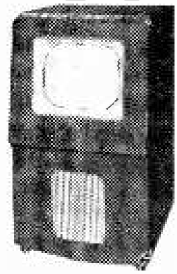
CYLDON 5-CHANNEL SWITCHED TELETUNERS



Instant and positive selection of any one of the 5 B.B.C. television channels, by a single control knob. Uses EF.80 RF. pentode and ECC81 or 12AT7 Double Diode Triode as frequency changer. Tuning is obtained by switching incremental inductances. Size: 4½ x 2½ x 2½ins. Spindle 2½in. long. ¼in. diameter. I.F. Output 9.5-14 Mc/s., noise figure on all channels better than 10.5dB., I.F. rejection better than 45dB on all channels. Power gain 24dB.

LASKY'S PRICE. less valves. 12/6. P. and P. 2/6 extra.

DE LUXE T.V. CABINETS



Our new 1954 Mark 11 model. For 12in. c.r. tubes. Finished in beautiful figured walnut veneer, with either light, medium or dark polish. Supplied complete with mask glass, back, speaker, baffle and fret, castors and c.r.t. neck protector. Inside dimensions: 16½in. deep. 17½in. wide. 28in. high. Overall height 32in. and width 18½in.

LASKY'S PRICE. £8/10/0. Carriage 12/6 extra.

This cabinet can be supplied with aperture for 16in. or 17in. c.r.t. at no extra charge.

METAL RECTIFIERS

6 and 12 volt F.W.

2 a.	9/-	RM.1	3/10
3 a.	9/11	RM.2	4/3
4 a.	12/-	RM.3	5/-
6 a.	21/11	RM.4	18/-

6 Volt		12 Volt	
½ amp.	2/6	½ amp.	3/11
1 amp.	4/6	1 amp.	6/6

TELEVISION SELENIUM RECTIFIERS

The very latest "Sentercell" S.T.C. range.

K3/40, 3.2 kV	6/-
K3/45, 3.6 kV	8/2
K3/50, 4.0 kV	8/8
K3/100, 8.0 kV	11/8
K3/160, 12.8 kV	21/6

LASKY'S RADIO

Lasky's (Harrow Road), Ltd.,
370, Harrow Road, Paddington, London, W.9

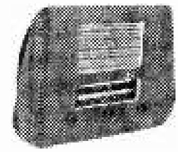
Telephones: CUNningham 1979-7214. All Depts.

MAIL ORDER AND DESPATCH DEPARTMENTS: 485-487, HARROW ROAD, PADDINGTON, LONDON, W.10.

Hours: Mon. to Sat. 9.30 a.m. to 6 p.m.; Thurs., half day, 1 p.m. Postage and packing charges (unless otherwise stated); on order value £1—1s. 0d. extra; £5—2s. 0d. extra; £10—3s. 6d. extra over £10 carriage free unless specifically stated otherwise. All goods fully insured in transit.

LASKY'S RADIO

THE HARROW BAFFLE CABINET



Build a "second set" to be proud of. Pleasing design cabinet, with drilled chassis, dial, drive and back. Finished in satin mahogany veneer. Outside dimensions: 17½in. wide. 11½in. high, 5in. deep. Receiver design uses 2-6K7, 6V6 and 5Z4. Total cost to build is less than £5/10/-.

LASKY'S PRICE FOR THE CABINET AND FITTINGS, 36/6. Carriage 2/- extra. Circuit for receiver 1/-

R.1132 RECEIVERS

With all valves. In metal case.
Grade 1. Brand new.........79/6
Grade 2. Soiled 49/6
Grade 3. Secondhand 39/6
Carriage 10/- each extra.

PLESSEY SINGLE RECORD PLAYER UNITS

Slightly soiled. 78 r.p.m. For use on 200-250 v. A.C. mains. Complete with 10in. turntable and magnetic pick-up. Auto stop and record selector start. LESS THAN HALF PRICE. LASKY'S PRICE 69/6. Carriage 2/6 extra.

SPECIAL OFFER

Magnetic recording tape, on Cyldon metal spools. By famous British manufacturer.
600 feet 6/11 Post 1/6
1,200 feet 14/11 Post 1/6
LIMITED QUANTITY. BUY NOW AND SAVE CASH.

PLASTIC ESCUTCHEON MASKS

With dark screen filter.
12in. ... 12/6
16in. ... 25/-

WIRE MESH DINGHY AERIALS 5/-

SHADED POLE GRAM MOTORS

Rim Drive. 9/6.

I.F. TRANSFORMERS

MINIATURE TYPE 465 Kc/s. ¾ x ¾ x 2½ins. PRICE 9/6 pair.
MIDGET TYPE 465 Kc/s. 1 x 1½ x 2½ins. PRICE 8/6 pair.
WEARITE TYPE 550. 445-520 Kc/s. 8/6 per pair.
WEARITE TYPE 500. 450-470 Kc/s. 8/6 per pair.

LOUDSPEAKERS

First Quality. All 3 ohms speech coil. Less output trans.

3in.	14/6	6½in.	15/-
4in.	10/6	8in.	15/-
5in.	13/6	10in.	17/6

Now available. 12in. Goodmans heavy duty 15 watts. 15 ohms.
LASKY'S PRICE £5/19/6. Carriage 3/6 extra.

Surplus Frequency-changer Valves

DETAILS OF EX-SERVICE VALVES, WITH BASE CONNECTIONS

By E. G. Bulley

VALVES of this design are so named because when installed in a suitable circuit they convert an alternating current at a certain frequency into a current of lower or higher frequency without any undue distortion. They are, of course, found in superheterodyne circuits, wherein the frequency of the incoming signal is converted to that of an intermediate frequency. The latter is then amplified before being rectified in the second detector stage.

The essential requirement of a frequency-changer valve is that it has an oscillator section as well as a mixing part.

The input to the actual valve consists of two frequencies, namely, that from the local oscillator and the other from the incoming signal. These frequencies are combined and converted as previously mentioned. However, the output consists of many more frequencies, the main ones being the sum of the two input frequencies, the difference of the two input frequencies and, furthermore, the oscillator frequency. Nevertheless, one must not overlook the fact that these frequencies generate harmonics which will generate still more frequencies of different values.

Various Types

There are numerous types of valves for frequency changing, but as we are only concerned with those available upon the surplus market, they will, therefore, only be dealt with in this article.

With reference to the tabulated list of valves, the reader will note that there are several triode-hexodes. Such valves, however, consist of a triode and mixing section in one envelope. The latter section has a separate anode and four grids, the cathode being common to both the triode and hexode parts of the valve.

It is usual practice, however, for G1 to be the control

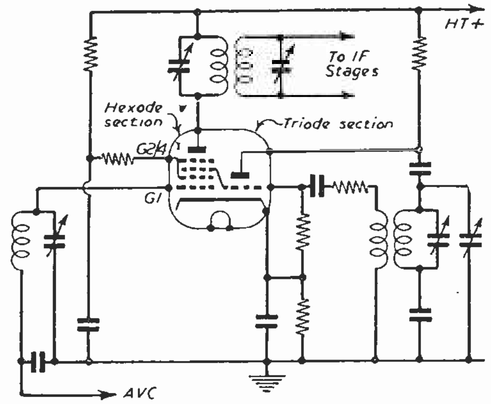


Fig. 1.—Basic triode-hexode circuit.

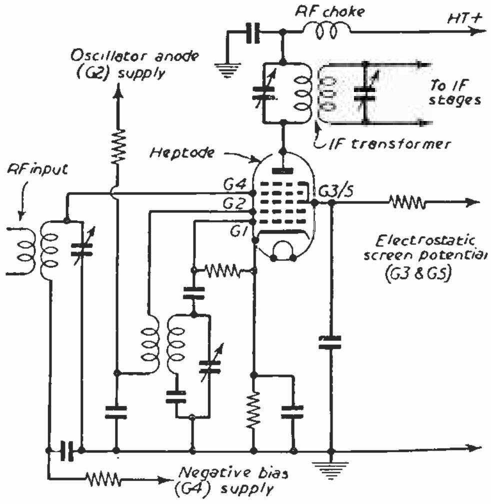


Fig. 2.—Basic circuit of heptode frequency changer.

SURPLUS FREQUENCY-CHANGER VALVES

British Type	Cathode	Vf	If (amps)	Va (Max.)	Ia	Vg_2 Max.	Base
ARH1	I.H	6.3	0.3	250	—	150	0 (Hept)
ARTH2	I.H	6.3	0.3	150 (Triode) 300 (Hex)	2.2	100	0 (Triode Hex)
VR57A	I.H	6.3	0.2	300	1.0	225	0 (Octode)
VR99A	I.H	6.3	0.3	100 (Triode) 300 (Hex)	3.0	200	0 (Triode Hex)
VT147	I.H	4.0	1.2	150 (Triode) 250 (Hex)	—	80	B7 (Triode Hex)
U.S.A.							
VT151	I.H	6.3	0.3	330	3.6	220	0 (Hept)
VT151B	I.H	6.3	0.3	330	3.6	220	0 (Hept)
VT87	I.H	6.3	0.3	330	3.5	110	0 (Hept)
VT208	I.H	7.0	0.3	300	3.5	100	LOK (Hept)
VT194	I.H	6.3	0.3	275 (Triode) 300 (Hex)	6.0	110	0 (Triode Hex)

grid and G3 as the injector grid. This grid is internally connected to the grid of the triode unit. The injector grid is shielded by G2 and G4: these grids are internally strapped and so prevent electrostatic interaction between the oscillator and signal grids.

BASING

Type	1	2	3	4	5	6	7	8	TC
ARTH2	M	H	A	G2–G4	G1–G3	A1	H	C	G1
VR57A	M	H	A	G3–G5	G1	G2	H	C & G6	G4
VR99A	—	H	A	G2–G4	G1–G3	A1	H	C	G1
VT147	A	G1–G3	G2–G4	H	H	C	A1	—	G1
VT151	S	H	A	G3–G5	G1	G2	H	C	G4
VT151B	S	H	A	G3–G5	G1	G2	H	C	G4
VT87	S	H	A	G2–G4	G3	—	H	C & G5	G1
VT208	H	A	G2	G1	G3–G5	G4	C	H	—
VT194	H	A	A1	G1–G3	G2–G4	G1	C & G5	H	—

A basic circuit using a triode-hexode is shown in Fig. 1, and may prove of interest to the newcomer to radio.

Another type of frequency changer that seems to be in plentiful supply is the heptode, or pentagrid as it is sometimes called. Such a valve has seven electrodes, namely, the anode, cathode and five grids. These valves are so constructed that they have a tetrode and triode unit, both sections being coupled by a common electron stream.

This electron stream is accelerated through G1 (oscillator grid) by the positive potential on G2, otherwise called the oscillator anode. However, some of the electrons shoot past G2 and G3 and approach G4, which is, in effect, the modulation electrode or grid of the tetrode unit.

Furthermore, G4 is operated at a negative potential and does, therefore, retard the electrons that have passed through G2 and G3. This phenomenon creates a cloud of electrons between G3 and G4 and forms what is known as a virtual cathode. Electrons are, therefore, drawn from this source similar to the process in which they were accelerated from the cathode proper.

The R.F. signal voltage is fed to G4 and the I.F. output circuit is connected in the anode proper. It may be as well to mention, however, that G3 and G5 are internally strapped and form the electrostatic screen.

Such a valve can be connected in a circuit as shown in Fig. 2, wherein the tetrode unit is modulated by the oscillator section, solely by the variation of the electron stream from the cathode. Valves of this type are to-day very popular and will prove interesting to those who wish to experiment with frequency changer circuits.

News from the Clubs

CLIFTON AMATEUR RADIO SOCIETY

Hon. Sec.: C. H. Bullivant (G3DIC), 25, St. Fillans Road, S.E.6.

ATTENDANCE remains at a high level and several new members were welcomed during the past few weeks. Meetings continue to be held every Friday at 7.30 p.m. at the clubrooms, 225, New Cross Road, S.E.14.

It is hoped to run a series of DF events again this summer, when members will compete for the DF shield, and an evening will shortly be devoted to a talk, with hints and tips, by last year's winner. Transmitting and listening contests continue to be popular and the next is scheduled to be held in April.

EDINBURGH AMATEUR RADIO CLUB

Hon. Sec.: D. Black, 16, Edina Place, Edinburgh, 7.

THE Club meets every Wednesday at 7.30 p.m. in the clubrooms, 16, Bothwell Street (off Easter Road), Edinburgh.

Morse and Radio Theory classes for the Radio Amateur Examination are held every week and all interested are invited to attend. Fuller particulars may be obtained from the Hon. Secretary.

BRIGHTON AND DISTRICT RADIO CLUB

Hon. Sec.: T. J. Huggett, 15, Waverley Crescent, Brighton, Sussex.

THE club Tx. under the call-sign G3EVE is on the air on both phone and C.W., 180 metres and top band.

Morse instruction is now a regular feature and Mr. E. Bannister has commenced a series of talks on "Radio Mathematics."

The Club meets every Tuesday at 7.30 p.m. at the "Eagle Inn," Gloucester Road, Brighton.

LEEDS AND DISTRICT AMATEUR RADIO SOCIETY

Hon. Sec.: B. A. Payne, 454, Kirkstall Road, Leeds, 4.

MEETINGS are held on Wednesday evenings at the Swarthmore Educational Centre, where visitors are always welcome. Recent events were a visit to the Radiotherapy Dept. of the Leeds General Infirmary on March 17th and a talk, "Realistic Sound Reproduction," by Dr. K. A. Exley, on March 31st.

SOUTHEND AND DISTRICT RADIO SOCIETY

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

MR. W. A. SMITH, B.Sc., of Hockley, continued his talks on "Aerials and Wave Guides" on March 5th in Room L, Queens Road Laboratories of the Municipal College. He pointed out and illustrated how an unmatched aerial causes "standing waves" to appear on the aerial system, resulting in loss of radiation on the true frequency of a transmitter and inferior reception on a receiver. He also showed how, by a simple device, reflections from the aerial the cause of these obnoxious "standing waves" could be eliminated.

Mr. J. L. Goss presided.

ACTON, BRENTFORD AND CHISWICK RADIO CLUB (G3IIU)

Hon. Sec.: R. Hindes (G3IGM), 85, Inverness Terrace, W.2.

CLUB meetings at high level are held each Tuesday evening at the A.E.U. Rooms, 66, High Road, Chiswick, W.4, from 7 to 10.

February activities included a lecture, "Radio in Aviation," given by G3BPM, also a visit to the L.P.T.B. power station at Lots Road was ably organised by G3GEH.

Future events include lectures on "DX peditions" and "History of Amateur Radio" to be given by G6LX and G3VA respectively.

WEST LANCS RADIO SOCIETY

Hon. Sec.: S. Turner, 5, Balfe Street, Seaforth, Liverpool, 21.

THE annual general meeting of the club took place on Tuesday, March 9th. Officers elected were Mr. T. Searle (president), Mr. S. Turner (secretary) and Mr. F. Clasby (treasurer). After the formal business of the meeting was over, a lively discussion took place regarding future programmes: everything of interest was suggested, e.g., Practical, Technical and Morse classes and Talks, Films and Visits. The building of the club's transmitter was also discussed. A temporary rig for top-band C.W. is in use, call sign G3JQA. The club meets every Tuesday evening at 8 p.m. over Gordon's sweetshop, St. Johns Road, Waterloo, Liverpool 22. New members and visitors warmly welcomed.

LYONS RADIO
LTD.
3, GOLDHAWK ROAD, Dept. M.P., SHEPHERDS BUSH, LONDON, W.12.

Telephone: SHEpherds Bush 1729

RECEIVERS TYPE R.3084. Suitable for TV. or 2-metre band conversion. Fitted with 14 valves (1 each of VR92, VR137, VU134, VU39, 2-VR136's, 7-VR91's), 30 Mc. I.F. strip, aerial switching motor, etc. In condition as new and unused. PRICE, 75/-, carriage 3/6.

2mfd. HIGH VOLTAGE CONDENSERS. Working volts 5,000 v. D.C. Test 10,000 v. D.C. Overall size 14 x 9 x 6ins. PRICE, 15/-, carriage 5/-.

POWER UNITS TYPE 87. Rotary converter units for 24 v. D.C. input and having a twin D.C. output of 6.5 v. at 2.5 A. and 250 v. at 50 mA. Can be operated in reverse from 6 v. accumulator or D.C. mains. Totally enclosed in neat metal cases 8½ x 6½ x 4½ins. In good condition and working order. PRICE 9/6, post 2/6. Rotary convtr. only less case. PRICE, 5/-, post 2/-.

VALVE SPECIALS. All as new and guaranteed
6B4G, 7/6. 6L7metal, 7/6. 6H6metal, 3/6. 6SK7GT/G, 7/6. EBC33, 8/6. 6SN7GT/G, 9/-.

5 CORE METALISED CABLE. Ex Air Min. Quintomet 4, approx. 5/16in. outside dia., each conductor 9/012 copper rubber covered. PRICE, 1/6 yard post any qty., 1/6. Trade enquiries invited for 100 yd. coils at reduced prices.

D.C. VOLTMETERS. 0/3500 v. moving coil projection pattern with built-in resistance, 3½in. dia., basic movement 5 mA. In brand-new condition. PRICE, 25/-.

BARGAINS BULLETIN of "Selected Surplus" now ready for circulation. Please send stamps.

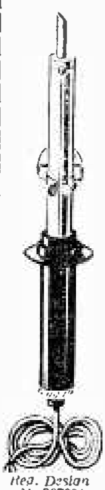
Here is the N.E.A.L. INTERCOM. ADAPTOR

Fitted to your Radio or Amp. gives you two-way talk between Main and Ext. Speakers. Ideal for Baby Listening, Shops, Offices, etc. Used as Speaker Control provides Main only—Ext. only, or both. Supplied as complete kit—32/6d. or ready-built 37/6d. *Descriptive leaflet—S.A.E. please.*

N.E.A.L. ACOUSTICS, LTD. Court Street, Leamington Spa

Introducing the :—

TYANA TRIPLE THREE



Reg. Design No.867804

MAKE SOLDERING A PLEASURE

SMALL

SOLDERING IRON

Complete with detachable BENCH STAND **19/6**

The smallest high-power soldering iron. Length only 8½"; adjustable long bit dia. 3/16"; mains voltages 100/110, 200/220, 230/250.

The "STANDARD" Popular Soldering Iron now reduced to 14/11.

Replacement Elements and Bits for both types always available.

KENROY LIMITED
152/297 UPPER ST., ISLINGTON, LONDON, N.1.
Telephone : Canonbury 4905-4663

IMMEDIATE DELIVERY

RADIO & TV SPARES

Transformers, Timebase Components, Wirewound Controls, Electrolytics, Chokes, Coils, Coil Packs, Scanning Components, Focus Magnets, Condensers, Resistors, Specified Components for "View Master" and "Sound Master," Tape Recording Accessories, 3-, 5-, 8- and 12-watt Amplifiers, Tone Controls and Radio Feeder Units, Microphones, Quality Loudspeakers, etc., etc.

MONTHLY PRICE SUPPLEMENTS

SPECIAL.—Miniature Mains Transformers for use in Pre-amps, Tone Controls, etc. Input 230/240 v. Output 0-250 v. at 30 mA. 6.3 v. at 1 A. New and Guaranteed. 14/9, plus 1/- postage and packing.

Solon Miniature Soldering Irons, 19/8.

Ronette "Coronation" Microphones, 52/-.

Scotch Boy 1,200 ft. Recording Tape, 35/-.

Lane Bias and Erase Generators (complete), 70/-.

"Quality" Amplifiers, from £10/10/-.

SERVICE & SPEED

CITY & RURAL RADIO
101, HIGH STREET, SWANSEA
Telephone : 4677

BC221.

£28 paid for these units in good condition if offered before end April.

Box No. 244, c/o Practical Wireless.

COVENTRY RADIO
189, DUNSTABLE ROAD, LUTON

Tel. : Luton 2677

COMPONENT SPECIALISTS SINCE 1925

All B.V.A. and Tungsram Valves in Stock.

EDDYSTONE COMMUNICATION SETS AND COMPONENTS

Short Wave Components Catalogue 1/-, plus 3d. postage.

We are preparing an entirely new Components Catalogue 1954, which will be interesting and helpful, ready shortly. Price 1/-.

Our No. 1 and No. 2 Circuits, 5 Valve Superhet and 4 Watt Amplifier, 1/-, plus postage.

Special quotations on kits of parts or large orders.

W. B. SUPPLIES
100, OLDHAM ST., MANCHESTER, 4.

Terms : Cash with Order. Orders under 20/- add 6d. postage. Over 20/- add 1/- postage.

Relays. G.P.O. Type. 765Ω 4 make 1 break. 3/6 ea. Switch magnetic relays, totally enclosed 9-14 volts 40 amps., 3/6 each.

Transformers. 12 volt 1 amp., 8/6; 12 volt 2 amp., 13/6; 6.3 volt 2 amp. (Heater Transformer) 6/11. Brand New.

Rectifiers. 12 volt 50 mls., 1/-; 250 volt 75 mls., 7/6.

Control Unit. Type 4A, with 16 Dial Lamps, 8 Press Buttons, with release Volume control and Send-Receive switch. Complete with 10½ ft. 85 core cable, 12/6 and 2/6 Carriage.

Germanium Diodes. G.E.C. 1/9 each. 2 for 3/-.

Tyana Electric Soldering Irons, 230/250 volt, 14/9.

Variable Condensers. Air spaced 50 pF., 1/-; 115 pF., 2/6; .0005 mfd. New Midgets, 5/-.

Speaker Fret. Woven Fabric, 12in. x 12in., 2/6; 12in. x 18in., 3/9. Expanded Metal (Gold), 12in. x 12in., 5/-; 12in. x 18in. 6/11.

Rheostats. Totally enclosed, with knob and pointer, suitable for battery chargers, train sets, etc., 5/-.

Yaxley Type Switches. 2 pole 6 way, 1 pole 10 way, 4 pole 2 way, 2/3 ea. 4 pole 3 way Midgets, 1/6.

Signal Generators. 230 volt input. Covering TV Frequencies. 20 to 86 Mc's. on fundamentals. Crystal check. Complete with valves and crystal. Ideal for the serviceman, special offer at £9-10-0.

Micro Switches. 2/6 ea. Heavy Press Switches, 250 v. 5 amps., suitable for motors, etc., 2/6. L.F. chokes 10 Hys. 100 mls., 7/6; 20 Hys. 80 mls., 7/-; 5 Hys. 200 mls., 7/6.

"Vee" Belts for Motors 72in., 2/11. Coil springs for models, etc., 3/8in. wide, coil diameter 3in. (Gram. type) only 1/- ea.

Valves. VS70, 2/-; 6V6GT, 6/11; EF50, 4/- (3 for 10/9).

Hacksaws. Sheffield make. 12in. Blades, 3/6

All orders despatched same day.

TESTOSCOPE *Mains Tester*

For high and low voltage testing :—1-30 and 100-850 volts A.C. or D.C. Write for interesting leaflet 29F

RUNBAKEN - MANCHESTER

BENTLEY ACOUSTIC Corp., Ltd.,
38, Chalcot Road, N.W.1. *PRImrose 9090*

OZ4	5/6	6SG7	7/-	50L6	8/-
1A5	5/-	6SH7	4/6	75	8/-
1G6	6/-	6SJ7	7/6	80	8/-
1L4	6/-	6SK7	6/6	85A2	10/6
1LD5	4/-	6SL7	7/6	210LF	2/-
1LN5	4/-	6SN7	8/6	807	7/6
1T4	6/6	6U5 (Y63)	5/6	5763	8/6
2A3	6/6	6V6	7/-	EB91	5/6
2X2	4/6	6X5	7/-	ECC33	10/-
3D6	2/-	7B7	7/-	ECC34	9/-
5U4G	7/6	7C5	7/-	ECC35	9/-
5Y3	7/6	7C6	7/-	ECC81	8/-
5Z4M	8/6	7C7	8/-	EM34	10/-
6A8	8/-	7H7	7/-	EF39	6/-
6B8M	5/6	7Q7	8/-	MVSPen	6/6
6BA6	7/-	7R7	8/-	MH4	5/-
6BE6	7/-	7S7	7/-	ML4	6/6
6BJ6	7/-	7Y4	8/-	QP21	7/-
6BW6	7/-	8D2	3/-	VR53	5/-
6CH6	6/6	9D2	3/-	VR55	7/-
6C6	6/-	12AT7	7/-	VR57	7/-
6C8	7/6	12AU7	10/-	VR91	5/-
6D6	5/6	12AX7	7/-	VR136	5/6
6H6M	3/-	12BE6	7/-	6Z4/84	7/-
6J5	5/-	12C8	7/-	UBL21	13/-
6J7	6/-	12K7	8/-	UCH21	13/-
6K6	7/-	12K8	8/-	LP2	4/-
6K7	5/-	12Q7	8/-	X24	10/6
6K8	8/-	12SK7	6/-	MSPen	6/6
6N7	7/-	12SQ7	8/-	SP2	8/-
6Q7	8/6	25L6	8/-	RK34	2/-
6SA7	7/6	35L6	7/6	KT2	3/-

SPECIAL OFFER. Six 12AT7's or 6 output valves (6CH6) for 36/-. Post Extra. Min. C.O.D. Charge 2/3. 24hr. Service. Refund Guarantee. S.A.E. Free List.

OPEN TO DISCUSSION

The Editor does not necessarily agree with the opinions expressed by his correspondents. All letters must be accompanied by the name and address of the sender (not necessarily for publication).

The "Gothic"

SIR,—Your article in the January issue describing the wireless installation in the *Gothic* said that the 7 kW. transmitter was believed to be the most powerful ever fitted to a merchant vessel. The old Cunarder *Caronia* was fitted for some years with a 10 kW. Poulson Arc transmitter. It was scrapped in 1925.—A. R. COOMBER (Maidstone).

Extended Use of Tape Recordings

SIR,—With reference to your issue dated February, 1954, we would venture to observe that this Company has supplied the British Broadcasting Corporation with portable high-grade magnetic-tape recording equipment, certain of which is at present being used on the Royal Australasian Tour. This Company has also supplied the Corporation with certain tape recording accessories including a quantity of our bulk erasers, the LeeRaser.—J. F. J. COOPER (Sales Manager, Leevers-Rich Equipment Limited).

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.

A.C. or D.C.?

SIR,—I am writing to you having received some encouragement from February's issue of PRACTICAL WIRELESS to ask you to add my name to the list of D.C./A.C. enthusiasts. Although I am only a "potterer" as far as radio goes I would most certainly welcome circuits that would allow me to make use of my D.C. mains. At the same time I realise that to cater for us D.C. people must present some problem. For we are a small number and continue to grow smaller.

In the past the PRACTICAL WIRELESS gave considerable circuits of battery and A.C. receivers, but few for D.C. stuff. I rather feel there must have been a reason for this and that you have tried to cater for the majority. Nevertheless I'll add my plea for a D.C. circuit and point out that the commercial people can produce some very fine radios and television sets that are worked by the old "Steam" D.C. Surely us D.C. users are a worthwhile market?—C. JEWELL (London, N.1.).

Improving Superhet Performance

SIR,—With reference to my article in the March issue, "Improving Superhet Performance," I must apologise for an omission from the text. The tuning indicator I have shown in Fig. 6 is really an output watt-meter and the needle will oscillate in sympathy with the signal being received. It is necessary to steady the needle by careful use of the meter set and audio gain before commencing any adjustments. If this is done I have found the meter quite useful for the purpose indicated.—K. C. IRELAND (Ealing).

Radio Sales Losses

SIR,—Reading in the March issue of PRACTICAL WIRELESS about Philips Electrical Ltd. wishing to re-establish the popularity of sound radio, here is one reason why the public will not buy sound radio communication receivers.

I wish to buy a three or four valve set for my nephew, who is in the Boy Scouts, so that he can practise receiving messages in the Morse code. He wishes later on to become a radio officer at sea.

I am unable to buy a communication receiver complete; all I am offered is a blueprint to build one for him and a list of several items to make a set.

Personally, I do not know anything of the mysteries of a wireless set, and even if I did I have not the time to build this receiver.

If I wished to make a present of a bicycle or electric train set, I am not offered a blueprint and told to build it myself, buying wheels at one shop, frame, lamps, bell, dynamo, etc., at others. I can buy these articles complete and ready for use.

So why cannot one buy a simple communication receiver for a learner all complete and ready for use by plugging in on the electric mains?

According to advertisements there is a big shortage of radio officers for the Merchant Navy and the Forces, so there should be a good market for learners' receivers; every Scout and Girl Guide needs them to practise the receiving of radio code messages.

Probably the wireless companies who are in need of learners will see that some of these sets are placed on the market for amateur use.—H. M. GARDNER (Portslade).

Radar Reporting Unit

SIR,—The Commanding Officer, Wing Commander Fennessey, asked me before he went abroad to convey his personal thanks to you for printing the paragraph on this unit. This has resulted so far in 61 men applying to join this unit, and, moreover, of exactly the type that we find we can train quickly and efficiently. As the training of radar operators is of paramount importance you have done the country good service by helping in this matter.—R. L. ROBERTS, Fg. Off. (Recruiting Officer, for Officer

Commanding 3700 Radar Reporting Unit, Royal Auxiliary Air Force).

Modification of the 38 Set

SIR,—Some readers might be interested in alterations I made to the receiver section of the type 38 ex-Army "walkie-talkie."

I found that the sensitivity was rather poor; only two or three stations were obtainable in the set's frequency range (7.4-9 Mc/s). This was due largely to a rather insensitive copper-oxide rectifier located near the I.F. coils. When this was replaced by two germanium diodes in parallel, the sensitivity was excellent.

By manipulation of a trimmer near the tuning condenser I was also able to extend the range to 7 Mc/s: consequently the set is very useful for listening on the "40" band.—M. H. I. BAIRD (Helensburgh).

Battery Receivers

SIR,—I was very interested in "Thermion's" article in the March issue on "How Many Battery Set Users?"

I think many people prefer a battery set because it is much quieter in operation, but go for a mains set because the majority of battery sets give such poor reproduction. Surely with the vast strides which have been made in valve construction it should now be possible to manufacture a battery set capable of giving first-class reproduction for a very low battery consumption. What has happened to push-pull output in battery receivers? Why cannot a manufacturer produce a set with push-pull output and a phase inverter preceding it? In my view there is a vast field still unexplored for battery sets, always provided the quality of reproduction is comparable with a mains receiver. A receiver badly needed by the over 60s in both battery and mains is a three-button job, marked Off, Home, Light, with first-class quality using at least a 10in. speaker. —H. WHETTER (St. Austell).

A.C./D.C. Retrograde?

SIR,—In the February issue of PRACTICAL WIRELESS I read with concern your comments about making all your designs A.C./D.C. I sincerely hope you are not going to adopt this questionable practice just to please a small minority who must be outnumbered by ten to one.

It is generally admitted that A.C./D.C. circuitry is a compromise, and in addition it presents a number of difficulties in practice. Live chassis, hum and limitation of H.T. volts are only too well known. To resort to this in a country where the grid system supplies 230 volts, 50 cycles A.C. over a vast area is, in my opinion, a retrograde step to say the least.

It may just as well be argued that all circuitry published should be A.C./D.C./Battery in order to pacify those readers who have no mains at all. Then, in theory, you please everyone. No, your best policy is to continue as before and follow up an important A.C. design, e.g., the "Coronet," with an A.C./D.C. version. Surely no reader on A.C. mains would complain of the space devoted to this.

If you give way and cease to publish A.C. designs in order to gain the support of a few hundred D.C. readers, you may well lose the support of thousands of A.C. readers in the process.—L. D. C. PARKER (Bath).

Long-range F.M.

SIR,—For the last year I have been in possession of a simple super-regenerative V.H.F. receiver which, in spite of many modifications, covers 85 to 130 Mc/s fairly comprehensively. This band, of course, includes both the Wrotham F.M. and A.M. stations as well as many police, fire, ambulance and aircraft services. However, being a Leeds operator, I did not expect to hear anything from a station as far away as Wrotham (at least 200 miles), especially since there is no R.F. amplifier, and the aerial is a dipole with no directive properties whatsoever. Consequently on hearing music issuing from the speaker one morning I thought nothing of it, thinking that it was a break-through on the wiring from my R1155. Imagine my surprise when I heard a voice announcing that "This is Wrotham; we are now closing down." Fortunately I had the tape recorder running at the time and have this announcement as a treasured possession, although since that date I have heard Wrotham often, the set picking up each sideband of the F.M. transmission separately to give reasonable results, and the A.M. transmission also. The signal is quite weak, and I can receive it only at certain times, but to receive it at all at that distance with only one R.F. stage seems quite a feat. What do your readers think?—C. B. HANSON (Leeds University).

CROSS-OVER NETWORKS

(*Concluded from page 301*)

when the cone of one speaker moves forward that on the other should also move in the same direction. A reduction in volume will be noted if they are incorrectly phased, whilst it is also possible to introduce a form of distortion from the same cause. The leads to the speakers should, therefore, be of red and black flex and they should be fitted after testing the movement by means of a low-voltage cell.

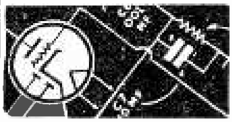
Separate Amplifiers

For those who wish to go farther in the direction of high-quality reproduction there is the possibility of using two separate channels for the two frequencies, again using the same principles as in the cross-over network, but including the components after, say, the first audio stage. The separate channels would then be fed into further audio stages with the output stages chosen according to the channel used, i.e., push-pull triodes for the bass and perhaps a single pentode for the treble unit.

Editorial and Advertisement Offices:
"Practical Wireless," George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2. 'Phone: Temple Bar 4363.
Telegrams: Newnes, Rand, London.
Registered at the G.P.O. for transmission by Canadian Magazine Post.

The Editor will be pleased to consider articles of a practical nature suitable for publication in "Practical Wireless." Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed: The Editor, "Practical Wireless," George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2. Owing to the rapid progress in the design of wireless apparatus and to our efforts to keep our readers in touch with the latest developments, we give no warranty that apparatus described in our columns is not the subject of letters patent.

Great Britain's Valve Mail-Order House



SERVICE SHEETS

The one you require enclosed if available in a dozen assorted of our best choice. **10/6**

7/6 REDUCED FROM 21/- **7/6**

Pre-heated Electric Soldering Irons. 24 v. 36 watts. Press button switch fitted. Corrosion free Bit. Specially designed for fine work. Limited quantity at 7/6.

TYANA TRIPLE THREE

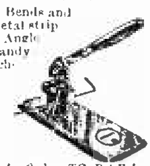
Small Soldering Iron. Latest development. Complete with detachable bench stand, Post 1/-. **19/6**

B.T.H. GERMANIUM CRYSTAL DIODE. Complete with Blueprint and operating instructions. **3/-**

"WONDER" HAND TOOL
6 TOOLS IN ONE

10/- Plus 1/6 post and pkg. (reduced from 20/-).

Punches, Bends and Shears Metal strip Rod and Angle Every Handy man, Mechanic and Service Engineer needs one! 1,000 used! *Unique! Order TO-DAY!*



CONDENSER TESTERS & RECTIFIER UNITS

Plugs straight into A.C. mains, 200/240 v., and is indispensable for examination of condensers. Very slight and intermittent leakages which cannot be discovered by conventional instruments can be traced by this unit. Complete. Post 1/-. Supplies are becoming limited. **39/6**

MORSE BUZZER OUTFITS

Consisting of a buzzer, a morse key and a battery compartment, all mounted on a polished baseboard. All parts high grade ex-Air Ministry. An excellent gift for a boy. Post free **6/-**

TAYLOR 7-Range Multi-meters, A.C. D.C. 3 amp. precision M/I movement. 0-6-30-150-300 volt. 0-30 mA—300 mA. **50/-** POST FREE

Contemporary Speaker FABRIC, attractive colour and design. Special offer, 2/- per square foot. Send for large sample. **6d.**

Blowlamp or Electrostrip?

Unique Electric Paint Stripper outdates & outstrips Blowlamp. No smell, no mess. cost ½d. per hour One year guarantee Unique. **37/6**

Electric Paint Sprayer

Tax Free **75/-** Post 2/-.

Deposit 10/- Monthly

BLACK & DECKER HANDY-UTILITY ¼in. Portable Electric DRILL.

Deposit £2 **10/6**
CASH PRICE £5.19.6
or 9 easy payments. Monthly

ROD Antennas. 1ft. sections, interlocking and extending, copper plated steel. BARGAIN. **2/6** dozen.

GEC HOME BROADCASTER operates through pick-up sockets of Radio Set. Suitable as Baby alarm. With matching transformer. **42/-**

EASY TERMS ON ALL TAYLOR METERS. Terms up to 10 months and very near Cash Price. Please ask for full list. Terms and Proposal Form.

VCR97 Carr. & Pack. 2/- **20/-**

SCRATCH REMOVER KITS Complete **6/6**

NEON-TESTERS
A.C. D.C. at **11/6 & 5/-**

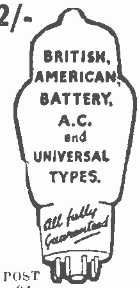
Q-MAX CHASS CUTTER

The easiest and quickest way of cutting holes in sheet metal. The cutter consists of three parts: A die, a punch and an Allen screw. The operation is quite simple. Prices, incl. key: ⅝in. 12/4; ¾in. 12/4; ⅞in. 13/4; 1in., 1⅛in. and 1¼in., 16/- each; 1⅜in. and 1½in., 18/- each; 1⅝in., 19/9; 2 3/32in., 31/9; 2½in., 36/9; 1in. square 24/3. Post 1/-.

RADIO BULL'S VALVES
246 HIGH ST. HARLESDEN NW10

VALVE BARGAINS from 2/-

01A	2/-	4TSP	5/-
1B4	3/-	13SPA	5/-
1H6	3/-	41MTL	3/-
1LN5	7/-	71A	2/-
2A6	2/-	202STH	8/-
2A7	3/-	215P	2/-
2B7	2/-	220PT	4/-
6F7	6/-	ACHLDDD	6/-
6J7	5/-		
9D2	7/-	EF6	17/6
12A	2/-	KTZ63	5/-
12SF5	6/-	MSP4	5/-
31	2/-	MSPen	5/-
34	3/-	MSPenB	5/-
35L6	8/-	P2	3/-
48	4/-	P215	2/-
50Y6	8/-	PM12M	3/-
954	2/-	PX25	10/-
117Z6	7/-	SP13	4/-
4TSA	6/-	VP13C	7/-



POST 9d.

23 "Demobbed Valves Manual" Giving equivalents of British and American Service and Cross Reference of Commercial Types with an Appendix of B.V.A. Equivalents and Comprehensive Price List. We have still some Valves left at very old Budget Rates (33⅓%)

HIVAC MIDGET AND SUB-MINIATURE VALVES

MIDGET TYPES

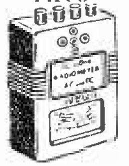
XSG	15/6	XL	10/6
XW	15/6	XLO	10/6
XK	10/6	XP	12/6
XD	10/6	XY	15/6

The above can be supplied for 2 volts at the same prices, also Type **XVS** 2.0v at **15/6**.

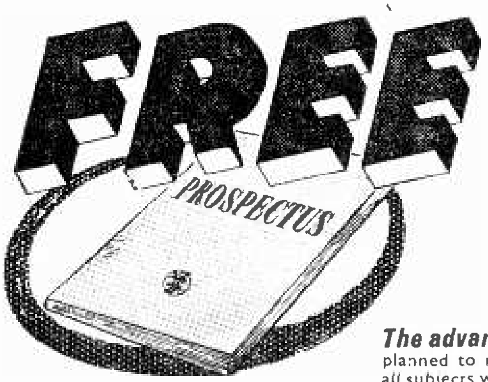
SUB-MINIATURE TYPES

XWO.75B	17/6	XFY10	17/6
XY1.4B	17/6	XFY11	17/6
XY1.4C	17/6	XFY12	17/6
XFW10	17/6	XFG1	21/4

PIFCO



All-in one Radiometer A.C. D.C. Tests everything in Radio. Complete with Test prods. Post 1/6 **29/6**



POST THE COUPON TODAY FOR OUR BROCHURE ON THE LATEST METHODS OF HOME TRAINING FOR OVER 150 CAREERS & HOBBIES

PRIVATE AND INDIVIDUAL TUITION IN YOUR OWN HOME

City and Guilds Grouped Certificates in Telecommunications: A.M. Brit. I.R.E. Examination, Radio Amateur's Licence, Radio and Television Servicing Certificates, General Radio and Television Courses, Radar, Sound Recording, etc. Also Courses in all other branches of Engineering and Commerce.

The advantages of E.M.I. training. ★The teaching methods are planned to meet modern industrial requirements. ★We offer training in all subjects which provide lucrative jobs or interesting hobbies. ★A tutor is personally allotted by name to ensure private and individual tuition. ★Free advice covering all aspects of training is given to students before and after enrolling with us.

NEW LEARN THE PRACTICAL WAY. With many of our courses we supply actual equipment. Courses include: Radio, Television, Electronics, Draughtsmanship, Carpentry, Photography, and Commercial Art. etc.

Courses from £1 per month

POST THIS COUPON TODAY

Send without obligation your FREE book.
E.M.I. INSTITUTES, Dept. 32K
43 Grove Park Road, London, W.4.
Phone: Chiswick 4417/8.

NAME ....

ADDRESS ....

....

SUBJECT(S) OF INTEREST ....

EMI INSTITUTES
The only Postal College which is part of a world-wide Industrial Organisation.

IC18

RECEIVERS & COMPONENTS

RADIO SUPPLY CO. (LEEDS) LTD., 32, The Calls, Leeds, 2. Ex-Gov. Transmitter Receivers type TR9, complete with all valves, **47/6,** plus 5/- carr. M/C Meters, 0-5 amps, **11/9;** Selenium Rectifiers, F.W. Bridge types, 6/12v, 1a, **5/9;** 6/12v, 2a, **9/9;** 6/12v, 4a, **14/9;** H.T. types, 250v, 50 m.a., H.W., **5/9;** 250v, 100 m.a., H.W., **7/9;** M.E. Speakers, all 2-3 ohms, 6½in. Rola, 600 ohm field, **11/9;** 10in. R.A. field, 600, 1,000, or 1,500 ohms, **23/9;** ex-Govt. C.R.T.s, VCR517, **29/6;** carr. 5/-; ex-Gov. .02mfd, 5,000v, **1/9;** .02mfd, 8,000v, **1/11;** .5mfd, 3,500v, **3/3;** .1mfd, 2,000v, **2/9;** .25mfd, 5,000v, **4/9;** unused Accumulators, 2v, 16 A.H., with non-spill vents, **5/9;** top-shrouded main Trans. Primary, 220/240v, 50 c/s, secs, 250-0-250v, 70 m.a., 6.3v, 3a, **12/11.** All goods guaranteed; c.w.o. or c.o.d. over £1; postage under £1 1/1, under £3, 1/9.

CLEARANCE OFFERS, our selection, p. extra: Cond., moulded and wax mica, **1/6** doz., **15/-** gross; Blocks, 3/- doz.; Variables, **1/6** doz.; Res. ¼, ½, 1 and 2w, **1/6** doz., **15/-** gross; Dynamotors, 24v/250v, .6a, 6v, 2a, **3/-;** ex-Gov. Valves, **6/-** doz.; sample lots incl. Res., Cond., N. and Bolts, V'holders, T/F's, etc., etc., **2/6, 5/-** and **10/-.** H. & W., 16, South Drive, Chaddesden, Derby.

1155A, fitted 6V6, **£6 10/-,** VCR97, **20/-;** buyer collect. "WINDERMERE," Highfield Lane, Hemel Hempstead, Herts.

PHILIPS Table Radio (4 valve), **35/-** and 5/- carriage. 45, Weelsby St., Grimsby, Lincs.

ELECTROLYTICS, capacity, voltage, size, type of mounting; price post paid; 8, 450v, 1 x 2, clip, **2/-;** 50, 12v, ¾ x 1⅛, tag, **1/6;** 150, 25v, ¾ x 1¾, clip, **2/-;** 250, 12v, ¾ x 1¾, wire, **2/3;** 350, 25v, 1 x 2¼, clip, **2/6;** 16 + 16, 450v, 1⅜ x 2, clip **4/-;** 40 + 40, 275v, 1⅜ x 2, clip, **3/3;** 24 + 24 + 16, 350/425v, 1⅜ x 2, clip, **4/9;** 60 + 200, 275/350v, 1¾ x 4½, clip, **6/6;** 4, 150v, ⅝ x 1¼, clip, **1/1;** 500 12v, 1⅜ x 2¾, clip, **2/-;** 8, 350v, ¾ x 2, clip, **1/9;** 100 + 175, 275/350v, 1¾ x 4½, clip, **6/6;** 32 + 32, 350/425v, 1⅜ x 2, clip, **5/-;** 8 + 16, 450/525v, 1 x 2, clip, **4/-;** 2, 450/525v, ¾ x 1¾, tag **1/6;** 2, 350v, ¾ x 1¼, tag, **1/3** 1,000, 6v, 1 x 2¾, clip, **2/9;** 6,000, 6v, 1¾ x 3, clip, **4/9;** 8, 450v, ¾ x 2, clip, **1/9;** 32 + 32, 450/525v, 1¾ x 3, W/E, **5/6;** 16 + 16, 450/525v, 1⅜ x 2, W/E, **4/6;** all alicans. Some with sleeves, all voltages wkg., surge where marked, new stock, guaranteed. Set of 3 Components, comprising line output trans. with E.H.T. winding to give 7K5, using EY51 (heater winding for EY51 also included), and fitted with width control. Scanning coils low impedance line and frame, focus coil, optional high (10,000Ω) or low (200Ω). Set of 3, **42/-,** plus 2/- postage. Diagram of line trans. supplied. Mains Trans. **PRI 0-110-210-240. SEC 250-0-250v. 80ma 6.3v,** 2.5a; 6.3v, .06a, **12/-;** Mains Trans., PRI 200-250v, SEC'S 305-0-305, 80ma, 800v, 5ma, 6.3v, 4.2a, 6.9v, 0.4, 2v, 2a, 4v, 1.1a, 5v, 2.3a. These Trans. have been taken from ex-Govt. equip.; some may have tag panels broken, but all guaranteed O.K. Ideal for 'scopes, **12/-,** post paid. Mains Trans., PRI 0-210-230-250v, SEC 250-0-250, 80ma, 6.3v, 2.5a, 6.3v, 0.6a; new; unused: **12/-** post paid. RADIO CLEARANCE LIMITED, 27, Tottenham Court Road, London, W.1. (Telephone: Museum 9188.)

RATES

5/- per line or part thereof average five words to line, minimum 2 lines. Box No. 1/- extra. Advertisements must be prepaid and addressed to Advertisement Manager, "Practical Wireless," Tower House, Southampton St., Strand, London, W.C.2.

RECEIVERS & COMPONENTS

ALL EX-EQUIP., guar'd perfect; 465 kcs IFTs, dust iron cored, bench superhet tested, wiring instruction, pair **4/-,** post 6d.; Variable Condensers, all 1in. spindle, 500pf, p. gang, single, **1/6,** post 8d.; superhet twin, **3/6,** post 9d.; normal four, **2/6,** post 1/2; s. midget four, **4/-,** post 1/-; close tolerance resistances, multiway switches, components and parts. S.A.E. list. RADELECTRIC CO., Lr. Bullingham, Hereford. (Phone: 4857.)

EVERYTHING for radio constructors. Condensers, Coils, Valves, Resistors, etc. Send stamp for list. SMITH, 98, West End Road, Morecambe. Quick service.

AMATEUR selling out: Equipment and Service Sheets; s.a.e. for list. DEAN, 128, Lowther Rd., Prestwick, Lancs.

R3170A, brand new, **75/-** (carr. 7/6). Responser R3118, with 50 cycle power pack, **77/6** (carr. 7/6). Wavemeters, new, 140-250 mcs., 7 valves (less meter), **30/-** (carr. 5/-). RFUs, type 26, 27, **45/-** (broken dialplate), **35/-;** type 24 **15/-,** 25 **18/-** (carr. 2/-). Everything for the Radio/TV Constructor. Lists 1½d. S.A.E. and enquiries. Cash with order, immediate delivery. Post / Callers:—W. A. BENSON, 308, Rathbone Rd., Liverpool 13. Callers: 116, Whitechapel, Liverpool.

2 VALVE Battery Audio Generator, type 2, Inc., 5 pos. note selector switch, volume control and phone jacks, size 9 x 8 x 8½in. (less valves VR21, 22 and Ind. lamp), price **8/6,** post 2/-, hardly the price of the 2 L.F. Xformers in the cct. Servio's now famous chassis service. Blank Ali Chassis made to the exact size you require; any length up to 17in., any width up to 12in., any depth up to 3in. Cost: 1d. per sq. in. of the Top Surface only, ignore the depth; e.g., Chassis, 9 x 5 x 2½in. = 9 x 5 = 45 sq. in. = 45d. = 3/9; 6 pole, 5-way Meter Switches (3 banks of 2 poles 5 ways), **5/-** each. Write for free list if you are not on our mailing list. SERVIO RADIO, 156-8, Merton Rd., Wimbledon, S.W.19. (LIBerty 6525.)

OSMOR for really efficient coils, coil packs, and all radio components, as specified for many "Practical Wireless" circuits. See our advert. on page 259 of this issue for free circuit offer, or send 5d. stamp to address below. OSMOR RADIO PRODUCTS, LTD. (Dept. PC6), Borough Hill, Croydon, Surrey. (Tel.: Croydon 5148/9.)

FREE OFFER with Tape Desks and Kits, Tape, Microphones, Amplifiers, Gram Equipment, Components; carriage free: lists s.a.e. Box 246, c/o PRACTICAL WIRELESS.

THE P.W. ELECTRONIC ORGAN and other equipment you make needs Mains and Audio Transformers. Write for quotations to H. L. BROWN, 16, Rowan Rd., Walsall. (Phone: 4888.)

EDUCATIONAL

WIRELESS.—Day and Evening Class instruction for P.M.G. Certificate of Proficiency and Amateur Wireless Licence. Morse instruction only if required, also postal courses. Apply B.S.T. LTD., 179, Clapham Rd., London, S.W.9.

THE INSTITUTE of Practical Radio Engineers Home Study Courses are suitable coaching text for I.P.R.E. and other qualifying examinations. Fees are moderate. Syllabus of seven modern courses post free from SECRETARY, I.P.R.E., 20, Fairfield Road, London, N.8.

MERCHANT NAVY and Air Radio.—Here is an opportunity to train as Radio Officer. The big liners are open to you, but you must qualify for the P.M.G. Certificate. Day, Evening and "Radiocerts" postal courses. Estd. 30 years; s.a.e. for prospectus from Director, THE WIRELESS SCHOOL, 21, Manor Gardens, London, N.7. (Tel.: ARC. 3694.)

WORLD TRAVEL and adventure in the Merchant Navy. Young Men 15 years upwards, required for training in Marine Wireless and Direction-finding at sea. (Trainees in forthcoming Registration Groups are eligible for Deferment of Military call-up.) Immediate sea-going positions on completion of training. Suitable candidates will be entered as Officers and must be prepared to sail to all parts of the world. Courses: Full or Part-time, also by Correspondence. Recognised by Ministry of Education. Scholarships available. Boarding and modern canteen facilities; low training fees. Send 1/- P.O. (stating age and height, etc.) for complete prospectus to: OVERSEAS HOUSE (Dept. 14), Brooks' Bar, Manchester, 16. (Tel.: MOSs-Side 2047.)

FREE! Brochure giving details of Home Study Training in Radio Television, and all branches of Electronics! Courses for the hobby enthusiast, or for those aiming at the A.M.Brit.I.R.E., City and Guilds Telecommunications, R.T.E.B., and other professional examinations. Train with the College operated by Britain's largest electronic organisation; moderate fees. Write to E.M.I. INSTITUTES, Postal Division, Dept. PW28, 43, Grove Park Road, London, W.4.

SEE THE WORLD as a Radio Officer. Short training period; low fees; scholarships, etc., available. Boarding and day students. Send 2d. stamp for prospectus. WIRELESS COLLEGE, Colwyn Bay.

THERE'S A FUTURE in Radio and Electronics! Excellent land and sea appointments assured; ages 15 to 40. (Students and Merchant Navy Radio Officers are not called for military service.) Approved Centre: NORTHERN COUNTIES WIRELESS SCHOOL, Lancaster Road, Preston, Lancs.

SITUATIONS VACANT

The engagement of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18-64, inclusive, or a woman aged 18-59, inclusive, unless he or she, or the employment, is excepted from the provisions of the Notification of Vacancies Order, 1952.

BLACKBUSHE AIRPORT.—Capable men for Radio Approved Overhaul and Maintenance. Licence not essential. Write: SILVER CITY AIRWAYS LIMITED.

AIRCRAFT Radio Mechanics skilled in workshop practice or aircraft installations to work at Stansted Airport, Essex; hostel accommodation available; minimum hourly rates 3/9. Write to the PERSONNEL MANAGER, 7, Berkeley St., W.1.

A.M.I.MECH.E., A.M.Brit.I.R.E., City and Guilds, etc., on "no pass—no fee" terms; over 95% successes. For details of exams. and courses in all branches of engineering, building, etc., write for 144-page handbook, free. B.I.E.T. (Dept. 242B), 29, Wright's Lane, London, W.8.

T/V AND RADIO.—A.M.Brit.I.R.E., City and Guilds, R.T.E.B. Cert., etc., on "no pass—no fee" terms. Over 95% successes. Details of exams. and home training courses in all branches of radio and T/V; write for 144-page handbook—free. B.I.E.T. (Dept. 242G), 29, Wright's Lane, London, W.8.

CITY AND GUILDS (Electrical, etc.) on "no pass—no fee" terms. Over 95% successes. For full details of modern courses in all branches of Electrical Technology send for our 144-page handbook—free and post free. B.I.E.T. (Dept. 242A), 29, Wright's Lane, London, W.8.

WIRELESS STATION SUPERINTENDENT required by the Nigeria Government Posts and Telegraphs Department for one tour of 18 to 24 months in the first instance. Option of appointment (a) on temporary terms with salary, etc., according to experience, in scale £864 rising to £1,392 a year and gratuity of up to £150 a year, or (b) with prospect of pensionable employment with salary, etc., in scale £750 rising to £1,175 a year; outfit allowance, £60; free passages for officer and wife; assistance towards cost of children's passages or grant of up to £150 annually for their maintenance in the U.K.; liberal leave on full salary. Candidates must have had wide practical experience of modern radio techniques and equipment, in particular V.H.F. equipment, and preferably also V.H.F. multi-channel equipment. Write to the CROWN AGENTS, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience, and quote M2C/28927/PU.

BOOKS

BOOKLETS: "How to Use Ex-Gov. Lenses and Prisms." Nos. 1 and 2, price 2/6 ea. Ex-Govt. Optical lists free for s.a.e. H. ENGLISH, Rayleigh Rd., Hutton, Brentwood, Essex.

AMERICAN MAGAZINES.—One-year "Audio Engineering," 28/6, specimen copy, 3/-; "Popular Science," 28/6; "High Fidelity," 50/-, specimen copy, 4/6. Free booklet quoting others. WILLEN LTD., Dept. 40, 101, Fleet Street, London, E.C.4.

I.P.R.E. TECHNICAL PUBLICATIONS. 6,500 Alignment Peaks for Superheterodynes, 5/9, post free. Data for constructing TV Aerial Strength Meter, 7/6. Sample copy The Practical Radio Engineer, quarterly publication of the Institute, 2/-; membership and examination data 1/-; Secretary, I.P.R.E., 20, Fairfield Rd., London, N.8.

WANTED

ALTHAM RADIO CO. pay highest prices in the trade for all American equipment, including Test Sets, Transmitters, Receivers, etc. JERSEY HOUSE, Jersey Street, Manchester, 4. (Tel.: Central 7834-5-6.)

NEW VALVES WANTED, small or large quantities, 3Q4, 6V6, 5Z4, ECL80, EF80, EY51, PL81, PY82, KT61, 6L6G, VR150 30, 5R4, 80, etc., etc. Prompt cash. WM. CARVIS, 103, North Street, Leeds, 7.

PROMPT CASH PAID for any quantities of VR75A's, ARP26's or equivalent. RADIO SUPPLY CO. (LEEDS), LTD., 32, The Calls, Leeds, 2.

ALL TYPES of Valves required for cash; state quantity and condition. RADIO FACILITIES, LTD., 38, Chalcot Rd., N.W.1. (PRImrose 9090.)

WANTED, "Trophy" Battery 3 or similar. W. SPEARMAN, Stansfield, Sudbury, Suffolk.

STAN WILLETTS

43, SPON LANE, WEST BROMWICH, STAFFS. **Tel.: WES. 2392.**

VALVES.—Brand New Every One Guaranteed. R10, **8/6**; 6J6, **9/6**; 3D6, 1/11; 954, **1/6, 15/-** doz.; RK34, **1/9, 17/6** doz.; EA50, **1/9, 15/9** doz.; SP61, VR65, **3/3**; 6V6GT, **7/6**; 6F6G, **5/9, 60/-** doz.; VT52, EL32, **5/9, 59/-** doz.; 6AM6, **6/6**; W77, 5/-; ATP4, **3/6, 35/-** doz.; MU14, VU39, **7/11**; 6C4 **5/9**; 5Y3GT, **7/9.** Post extra.
IT4, IS5, IR5, 3S4, All Brand new, **27/9**, Set of 4, **7/6** each.

VOLUME CONTROLS with switch.—50 K., ¼ meg., ½ meg., 1 meg., 2 meg., Brand new, 2/9 each. Post 4d.

GERMANIUM XTAL DIODES.—G.E.C. Brand new, **1/6** each, **15/-** doz. Post 6d. .5 mfd., 3.5 K.v. Working, Brand new. **3/6** each. Post 6d.

COMPLETE KIT of parts for a 2 Wave Band Crystal Set, **9/6.** Post 6d.

WANTED

VALVES. C.R.T. GOOD PRICE PAID.

AMATEUR'S ex-Gov. Units; Radio, TV, Tape, Components, Workshop Items. S.A.E. list. Box No. 245, c/o PRACTICAL WIRELESS.

WALNUT Radiogram Cabinets of distinction; stamp details. R. SHAW, 69, Fairlop Rd., E.11.

UNUSED surplus Test Meters complete with leads in leather cases with straps, by A.V.O.; D.C. volts 0-2-4-20-40-200-400-1,000-2,000, m/a 0-20-100-200. Amps. 2-20. Resistance 0-10,000 ohms; case and scale similar to Universal Minor; £3/10/- each; cash returned if not satisfied. W. H. TOMBS, "Long Acre," Pendoylan, nr. Cowbridge, Glam.

OUR NEW 76-page Illustrated Catalogue of Government Surplus Equipment, 1/-, post free. A. T. SALLIS, 93, North Road, Brighton, Sussex.

VALVES

WINWOOD FOR VALUE.—New boxed Valves, 6V6GT, 6K7M, 6J7M, 6X5GT, 6F6G, 6C5M, **6/3** each; 6K8, 6Q7, 12K7, 12K8, 12Q7, 35L6, 35Z4, 25Z4, 25Z6, 6SN7, **8/9** each; 1T4, 1S4, 1S5, 1R5, 3S4, 3V4, **7/9** each; 6AM6, 6AL5, **7/6** each. New valve/component list free. WINWOOD, 12, Carnarvon Road, Leyton, E.10. Mail only.

6V6G AND GT, matched in pairs, new, boxed, 17/- per pair; p. and p. 1/-. R. J. COOPER, 32, South End, Croydon, Surrey.

"VIEWMASTER" Valves, exact to specification, guaranteed new and boxed, set of 12 **£6/2/6,** post free; 6AM6, EF91, 6F12, Z77, 8D3, 6AM5, EL91, 1C5GT, DL35, **7/9;** any 8 for **56/-;** EB91, 6AL5, 6X5GT, EF39, HVR2A, **6/9;** 1.4v. miniatures, 1S5, 1R5, 1T4, 3V4, 3S4, 1S4, DK92, DL93, **7/6;** any 4 for **27/6;** 6V6G, 6V6GT, 6F6G, KT63, U22, EBC33, EF50, 7B7, 7C5, 7C6, 7H7, 7S7, **7/6;** 5Z4G, 5Y3GT, U50, 7Y4, 12AT7, ECC81, U78, DH77, 6AT6, 6J6, 25Z5, 25Z6GT, 25L6GT, 35L6GT, 50L6GT, 35Z4GT, 80, 6U5G, 6X4, 6BA6, 6BE6, 6BW6, EC91, Pen46, PY82, 6LD20, **8/6;** PL38, EL38, **22/6;** PZ30, 6U4GT, UU8, **17/-;** GZ32, DK32, 1A7GT, EF42, 6P25, EL33, N78, **15/-;** U25, UF42, UBF80, EBF80, R19, UCH21, UBL21, **13/6;** EY51, U16, EM34, PL83, N339, 1H5GT, DAC32, 1N5GT, DF33, 3Q5GT, DL33, CY31, ECC91, **12/-;** X65, PL81, PL82, PY81, **11/-;** ECL80, EF80, 6F1, 10C2, 6F15, 6C9, 10F1, UCH42, EAF42, R10, **10/6;** PY80, EL41, ECH42, EBC41, UBC41, UF41, EZ41, 10LD11, 10F9, U309, U319, **10/-;** 25Z4G, 25A6G, 6K8G, 6Q7GT, 12K8GT, 12K7GT, 12Q7GT, 6BW7, 6SN7GT, UY41, UL41, EF41, EZ40, EAC91, UU9, U404, **9/-;** 6K7G, 6K7GT, EF8, 3A4, **6/-;** EF92, W77, **5/6;** all new and boxed; postage 4d. per valve extra. READERS RADIO, 24, Colberg Place, Stamford Hill, London, N.16. (STA. 4587.)

CABLE/FLEX CHEAPER IN ODD LENGTH COILS

No coil under 20 yds. Prices per 100 yd. lot, less supplied, just add 5%.

Twin Flat	1/044	3/029	Do. W/E	3/036	Do. W/E	7/029W/E	7/044	Do. W/E
RUBBER	39/-	49/-	59/-	68/-	74/-	101/-	156/-	198/-
PLASTIC	36/-	49/-	57/-	67/-	73/-	99/-	155/-	196/-
SINGLE V.I.R. ...	17/-	21/-	—	27/-	—	34/-	66/-	—
SINGLE PLASTIC ..	13/-	22/-	—	29/-	—	38/-	72/-	—

Circular	Twin 14/36	23/36	40/36	2 Core 23/36	40/36	70/36
RUBBER ...	54/-	61/-	76/-	75/-	100/-	140/-
PLASTIC	41/-	54/-	76/-	63/-	89/-	133/-
PADD./BRAID ..	35/-	42/-	53/-	53/-	68/-	123/-

100 yd. Coils Twin Transp. Plastic 15/-. Maroon T.T., D.V. 27/6.

BRITISH DISTRIBUTING (PW), 591, Green Lanes, London, N.8. MOU. 0055/6.

TELETRON SUPER INDUCTOR COILS
WITH MINIATURE DUST CORES

Type HAX.—Triple wound for Xtal diodes. No overlap. Ideal Radio "Head" for Recording and Quality Amplifiers. 3/- ea. Coils of guar. performance for every purpose. 3d. stamps for full range, data and circuits.
THE TELETRON CO., 266, Nightingale Rd., London, N.9.

Practical Wireless BLUEPRINT SERVICE

PRACTICAL WIRELESS

No. of Blueprint

CRYSTAL SETS

1/6d. each

1937 Crystal Receiver ... PW71*
The "Junior" Crystal Set PW94*

2s. each

Dual-Wave "Crystal Diode" PW95*

STRAIGHT SETS

Battery Operated

One-valve : 2s. each.

The "Pyramid" One-valver (HF Pen) ... PW93*
The Modern One-valver PW96*

Two-valve : 2s. each.

The Signet Two (D & LF) PW76*

3s. each.

Modern Two-valver (two band receiver) ... PW98*

Three-valve : 2s. each.

Summit Three (HF Pen, D, Pen) PW37*
The "Rapide" Straight 3 (D, 2 LF (RC & Trans)) PW82*
F. J. Camm's "Sprite" Three (HF, Pen, D, Tet) PW87*

3s. each.

The All-dry Three ... PW97*

Four-valve : 2s. each.

Fury Four Super (SG, SG, D, Pen) PW34C*

Mains Operated

Two-valve : 2s. each.

Selectone A.C. Radiogram Two (D, Pow) ... PW19*

Three-valve : 3s. 6d. each.

A.C. Band-Pass 3 ... PW99*

Four-valve : 2s. each.

A.C. Fury Four (SG, SG, D, Pen) ... PW20*
A.C. Hall-Mark (HF Pen, D, Push Pull) ... PW45*

SUPERHETS

Battery Sets : 2s. each.

F. J. Camm's 2-valve Superhet PW52*

Mains Operated : 3s. 6d. each.

"Coronet" A.C.4 ... PW100*
AC/DC "Coronet" Four PW101*

No. of Blueprint

SHORT-WAVE SETS

Battery Operated

One-valve : 2s. each.

Simple S.W. One-valver PW88*

Two-valve : 2s. each.

Midget Short-wave Two (D, Pen) PW38A*

Three-valve : 2s. each.

Experimenter's Short-wave Three (SG, D, Pow) PW30A*
The Prefect 3 (D, 2 LF (RC and Trans)) ... PW63*
The Band-spread S.W. Three (HF Pen, D (Pen), Pen) PW68*

PORTABLES

1s. 6d.

The "Mini-Four" All-dry (4 valve superhet) *

MISCELLANEOUS

2s. each.

S.W. Convertor-Adapter (1 valve) PW48A*

(2 sheets), 7s. 6d.

The P.W. 3-speed Autogram ... ... *
The P.W. Electronic Organ (2 sheets), 7s. 6d. *

TELEVISION

The Practical Television Receiver, (3 sheets), 10/6
The "Argus" (6in. C.R. Tube), 2/6*
The "Super-Visor" (3 Sheets) 7/6*

All the following blueprints, as well as the PRACTICAL WIRELESS numbers below 94 are pre-war designs, kept in circulation for those amateurs who wish to utilise old components which they may have in their spares box. The majority of the components for these receivers are no longer stocked by retailers.

AMATEUR WIRELESS AND WIRELESS MAGAZINE

STRAIGHT SETS

Battery Operated

One-valve : 2s.

B.B.C. Special One-valver AW387*

Mains Operated

Two-valve : 2s. each.

Consoelectric Two (D, Pen), A.C. AW403

SPECIAL NOTE

THESE blueprints are drawn full size. The issues containing descriptions of these sets are now out of print, but an asterisk denotes that constructional details are available, free with the blueprint.

The index letters which precede the Blueprint Number indicate the periodical in which the description appears. Thus P.W. refers to PRACTICAL WIRELESS, A.W. to *Amateur Wireless*, W.M. to *Wireless Magazine*.

Send (preferably) a postal order to cover the cost of the Blueprint (stamps over 6d. unacceptable) to PRACTICAL WIRELESS, Blueprint Dept., George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.

No. of Blueprint

SHORT-WAVE SETS

Battery Operated

One-valve : 2s. each.

S.W. One-valver for American AW429*

Two-valve : 2s. each.

Ultra-short Battery Two (SG, det Pen) ... WM402*

Four-valve : 3s. each.

A.W. Short Wave World-beater (HF Pen, D, RC Trans) AW436*
Standard Four-valver Short-waver (SG, D, LF, P) WM383*

Mains Operated

Four-valve : 3s.

Standard Four-valve A.C. Short-waver (SG, D, RC, Trans) WM391*

MISCELLANEOUS

Enthusiast's Power Amplifier (10 Watts) (3/-) WM387*
Listener's 5-watt A.C. Amplifier (3/-) ... WM392*
De Luxe Concert A.C. Electrogram (2/-) ... WM403*

QUERY COUPON

This coupon is available until May 4th, 1954, and must accompany all Queries, sent in accord with the notice on page 313.

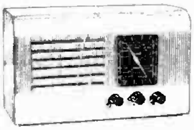
PRACTICAL WIRELESS, May, 1954.

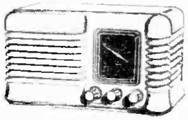
Published on the 7th of each month by GEORGE NEWNES, LIMITED, Tower House, Southampton Street, Strand, London, W.C.2, and printed in England by W. SPEAIGHT & SONS, Exmoor Street, London, W.10. Sole Agents for Australia and New Zealand: GORDON & GOTCH (A/sia), LTD. South Africa: CENTRAL NEWS AGENCY, LTD. Subscription rate including postage, for one year: Inland and Abroad 13s. 6d. (Canada 13s.) Registered at the General Post Office for the Canadian Magazine Post.

BARTON'S (Radio) LIMITED

(Dept. PW), 42 TOTTENHAM CT. RD., LONDON, W.1.
Telephones : LANGHAM 1151/2

SENSATIONAL PRICE REDUCTION FOR RADIO CONSTRUCTORS!





We can supply all the parts (including valves, 5in. moving coil speaker, cabinet, chassis, and everything down to the last nut and bolt) to enable YOU to build a professional-looking radio. The chassis is punched and drilled ready to mount the components. There is a choice of any of three attractive cabinets 12in. long, 5in. wide by 6in. high, as follows : either ivory or brown bakelite, or wooden, finished in walnut. Complete and easy-to-follow point-to-point and circuit wiring diagrams supplied.

MODEL 1. T.R.F. RECEIVER

This is a 3 valve plus metal rectifier TRF receiver with a valve line-up as follows : **6K7 (HF), 6J7 (Det) and 6V6 (Output)**. The dial is illuminated and when assembled the receiver presents a very attractive appearance. Coverage is for the Medium and Long Wave bands. Operates on 200/250 volts AC Mains.

Plus 2/6 Packing, Carriage, Insur. **£5. 10. 0.**

MODEL 2. SUPERHET RECEIVER

This is a powerful midget 4 valve plus metal rectifier Superhet Receiver with a valve line-up as follows : **6K8, 6K7, 6Q7, 6V6**. The dial is illuminated and coverage is for the Short Wave bands between 16-50 metres, the Medium Wave bands between 190-540 metres, and the Long Wave bands between 1,000-2,000 metres. Operates on 200/250 volts AC mains.

Plus 2/6 Packing, Carriage, Insur. **£7. 19. 6.**

T.R.F. RECEIVER. We can supply this Receiver ready built at £6. 15. 6. plus 3/6 p.c.

ALL COMPONENTS SUPPLIED ARE GUARANTEED FOR ONE YEAR

NOTE : We would respectfully suggest to those interested in building this receiver that they send for OUR Instruction Booklet. Intending constructors can then judge for THEMSELVES how comprehensive this Booklet is.

Instruction Booklet and price Parts List for either of the above available separately at 1/-. This money will be refunded if circuit diagram is returned as NEW within 7 days. *When ordering please state Model No.*

The increasing popularity of our

T.R.F. RECEIVER

and the tremendous demand for the component parts to build it, have enabled us to purchase the components in larger quantities than ever before. Due to this bulk buying we have bought at keener prices. Therefore, in accordance with our advertised policy of a "New Deal for Mail Order Shoppers," and as evidence that we are determined to maintain the reputation we have gained for fair and honest trading, we are passing this advantage on to our customers.

All the parts to build the receiver illustrated can now be supplied at

£5.10.0.

Plus 2/6 Carr. & Ins.

BATTERY CHARGER KIT

Incorporates metal rectifier. Transformer is suitable for A.C. mains 200/250 volts. Charges either 12, 6 or 2 volt accumulator at 1 amp. Complete with circuit diagram. Price 22/6, plus 1/6 post and packing.

CHARGER TRANSFORMERS

Primaries Tapped 200/250 volts. **Type MT5B** to charge 12, 6 and 2 v. batteries at 2½ amps. 18/-, plus 1/6 pkg., ins. **Type MT5** to charge 12, 6 or 2 v. batteries at 4 amps. 22/-, plus 1/6 pkg., ins.

METAL RECTIFIERS (FULL WAVE)

12 v. 1 amp. (Bridge Type), 7/6 ; 12 v. 2 amp., 11/3 ; 12 v. 3 amp., 12/- ; 12 v. 4 amp., 15/-. Suitable for use with the above transformers.

MAINS NOISE SUPPRESSOR KIT

Consisting of 2 specially designed chokes and 3 condensers. Extremely effective, cuts out all mains noise. Can be assembled in existing receiver or separately as desired. Complete with circuit diagram 4/11, plus 1/- P.C.

FILAMENT TRANSFORMERS

6.3 v. 1½ amp., 5/11 ; 6.3 v. 3 amp., 8/11 ; 6.3 v. (with 4 v. and 2 v. tappings), 1½ amp., 7/6. All plus 1/- p/p.

1 mA METER

D.C., 2in. sq., panel mounting, 16/6, plus 1/- post and packing.

THE FAMOUS RANGE OF

"DULCI"

RADIO/RADIOGRAM CHASSIS

All chassis 11½in. x 7in. x 8½in. high. Latest type valves 6BE6, 6BA6, 6AT6, 6BW6, 6X4. Flywheel tuning. Negative feedback over entire audio section. Engraved knobs. 3 tone positions for radio and gram.

Model B3.—Long, Medium, Short. 5 Valves. Output 3½ watts	£12 12 0
Model B3.—Plus Push Pull Stage. 6 Valves. Output 6 watts	£15 15 0
Model B3.—Double Feature with P Pull & R.F. Stage. 7 Valves. Output 6 watts	£18 18 0
Model B6.—Six Wavebands. Med., Long, 4 Short. (3 Band spread). 5 valves. Output 3½ watts	£15 15 0
Model B6.—Plus Push Pull Stage. 6 Valves. Output 6 watts	£18 18 0
Model B6.—Double Feature with P Pull & R.F. Stage. 7 Valve. Output 6 watts	£23 2 0

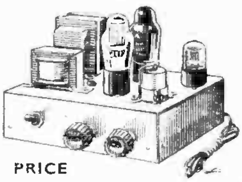
FULLY GUARANTEED. TAX PAID.
For A.C. Mains 100/120 and 200/250 v.
The Double Feature chassis are supplied with separate Power Packs.

4 watt AMPLIFIER KIT

This is a 3 valve 3 stage Amplifier for use with Gramophone, Microphone or Radio. *Valve line-up is as follows :* **6SL7 ; 6V6 ; 5Z4.** Negative feed-back. Tone control. Voltage adjustment panel incorporated. 4 watts output. For operation on A.C. Mains 200/250 volts.

The complete Kit includes every item down to the last nut and bolt, drilled and punched chassis, and comprehensive point-to-point wiring circuit diagram. Chassis dimens. : 8in. x 6in. x 2½in.

ALL COMPONENTS SUPPLIED ARE GUARANTEED FOR ONE YEAR



PRICE **£4. 19. 6.** *Plus 2/6 PACKING, CARRIAGE & INSUR.*

The Output Transformer supplied is for use with a loudspeaker of 3 ohms impedance and we would suggest that the output of the completed amplifier justifies the use of one of the latest W.B. H.F. Speakers which can be supplied as follows : 8in., 60/6 ; 9in., 67/- ; 10in., 73/6. All plus 2/6 pkg., carr., ins.

Circuit Diagram only, available separately at 1/-.

To those who require this Amplifier ready-built we can supply it at £5.19.6, plus 3/6 pkg., carr., ins.

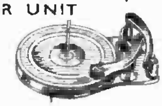
SPECIAL ANNOUNCEMENT

Our **NEW GRAMOPHONE RECORD Dept.** is now open for both personal and mail order shoppers. Your order for records will receive the careful attention and prompt despatch for which we are noted. When ordering please state record numbers.

TERMS OF BUSINESS :

Cash with order. Under £1 please add 1/6 pkg. and post. Over £1 post free.

Bargain Offer! **PLESSEY 3-Speed AUTO-CHANGER UNIT**



This famous unit incorporates these special features :— Will play 10in. and 12in. records intermixed. Latest turn-over pick-up head with separate sapphire styli for L.P. and Standard Recordings. Either head can be brought into use by simply turning a switch. Height above Base Board 5½in. Below Base Board 2½in. Overall dimensions of Board required 16in. x 12½in. *BRAND NEW in manufacturer's carton.* **£11. 19. 6.** *complete with instructions. Limited quantity only available.* Plus 5/- pkg. carr. ins. (Normal List Price £23.0.0.)

YOUR ENQUIRIES WELCOME AND PROMPTLY ANSWERED FOR ALL RADIO AND TELEVISION COMPONENTS.

ELECTROLYTIC CONDENSERS
BRAND NEW!

8 mfd. 500 volt. Aluminium Can. Height 2½in. x 1¼in. dia. Price 1/2 each, 12/- per doz., 140/- per gross.

TERMS OF BUSINESS : Cash with order (or C.O.D. Post items only) : all orders for small items totalling over £2 post free unless otherwise stated.

QUALITY GOODS • MONEY BACK GUARANTEE • PROMPT DESPATCH