A TWO-VALVE PORTABLE RADIOGRAM

PRACTICAL WIRELESS

1/3

MARCH
1958

EDITOR: F.J.CAMM

CONTENTS

C.R.T. ISOLATION TRANSFORMER
Type A. Low leakage windings. Ratio 1:1.25 giving a 25% boost on secondary. 2 v., 10/6 ; 4 v., 10/6 ; 6.3 v., 10/6 ; 10.8 v., 10/6 ; 13.3 v., 10/6.
Ditto with mains primaries, 12/6 each.
Type B. Mains input 220/240 volts. Multi Output 2, 4, 6.3, 7.3, 10 and 13 volts. Input has two taps which increase output volts by 25% and 50% respectively. Low capacity suitable for most Cathode Ray Tubes. 21 - Ditto for 6 v. C.R. Tubes only. 17/6.
Type C. Low capacity wound transformer for use with 2 volt Tubes with falling emission Input 220/240 volts. Output 2-2½-2½-2-3 volts at 2 amps. With Tag Panel, 17/6 each
NOTE.—It is essential to use mains primary types with T.V. receivers having series-connected heaters.

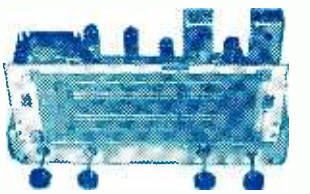
TRIMMERS, Ceramic. 30, 50, 70 pf., 9d. ; 100 pf. 150 pf., 1/3 ; 250 pf., 1/6 ; 500 pf., 750 pf., 1/9.
RESISTORS. Preferred values. 10 ohms to 10 meg., ½ w., 4d. ; ½ w., 6d. ; 1 w., 8d. ; 1½ w., 8d. ; 2 w., 1/-.
HIGH STABILITY. ½ w., 1%, 2/-. Preferred values 100 ohms to 10 meg. Ditto, 5%, 9d.
5 watt, 10 watt, 15 watt — **WIRE-WOUND RESISTORS** — 25 ohms—10,000 ohms 1/3, 1/6, 2/-
15,000 ohms—50,000 ohms, 5 w., 1/9 ; 10 w., 2/3.

12/6 PURETONE RECORDING TAPE
1,200 ft. on standard 7" Metal reels. 7" plastic 4/3, 7" metal, 2/3.
FERROVOICE 1,200ft. Plastic Tape 25/- on Plastic Spools.

O/P TRANSFORMERS. Heavy Duty 50 mA., 4/6. Multiratio, push-pull, 7/6. Miniature, 3S4, etc., 4/6
L.F. CHOKES 15-10 H. 60/65 mA., 5/- ; 10 H. 80 mA., 8/6 ; 10 H. 150 mA., 12/6.
MAINS TRANS. 350-0-350, 80 mA., 6.3 v. tapped. 4 v. 4 a., 5 v. tapped 4 v. 2 a., ditto 250-0-250, 22/6. Bargain 300-0-300 65 mA., 6 v. 4 a., 4 v. 2 a., 15/-.
HEATER TRANS. Tapped prim., 200/250 v. 6.3 v. 1½ amp., 7/6 ; tapped sec. 2, 4, 6.3 v., 1½ amp., 8/6 ; prim. 230 v. Sec. 6.3 v. 2 amp., 10/6.
ALADDIN FORMERS and cans, ½in., 8d. ; ¾in., 10d. 0.3in. **FORMERS** 5937/8 and **Cans** TV1/2. ½in. sq. x 2in. and ¾in. sq. x 1 in., 2/- ea., with cores.
TYANA.—Midget Soldering Iron. 200/220 v. or 230/250 v., 16/9. **Solon Instrument** Iron, 24/-.
MAINS DROPPERS. 3in. x 1½in. Adj. Sliders, 0.3 amp. 750 ohms, 4/3. 0.2 amp., 1,000 ohms, 4/3.
LINE CORD. .3 amp., 60 ohms per foot, .2 amp., 100 ohms per foot, 2-way, 6d. per foot. 3-way, 7d. per foot
LOUDSPEAKER, P.M. 3 OHM. 2½in. square, 17/6. 5in. Goodmans, 17/6. 7in. x 4in. Goodmans, 21/-. 3½in. square, Elac., 21/-. 8in. Plessey, 19/6. 6½in. Goodmans, 18/6. 10in. R. & A., 30/-. TSL Tweeter, LSH75, 8/6. 12in. Plessey, 30/-. 8in. M.E. 2.5k field, tapped O.P. transf., 24/6. 15 ohm Plessey 10 wt. 12in. with Tweeter, 97/6.
CRYSTAL DIODE G.E.C., 2/-. **GEX34,** 4/-.
HIGH RESISTANCE PHONES. 4,000 ohms, 16/6 pr.
MIKE TRANSF. 50 : 1, 3/9 ea. ; 100 : 1, Potted, 10/6.
SWITCH CLEANER Fluid squirt spout, 4/3 tin.
TWIN GANG TUNING CONDENSERS. 365 pf. miniature 1in. x 1½in., 10/-. .0005 Standard with trimmers, 9/- ; less trimmers, 8/- ; midget, 7/6 ; **SINGLE,** 50 pF., 2/6 ; 100 pF., 7/- ; 150 pF., 8/6. Solid dielectric 100, 300, 500 pF., 3/6.
SPEAKER FRET. Expanded Metal Silver, 15in. x 9½in., 2/- each.
GOLD CLOTH. 17in. x 25in., 5/- ; 25in. x 35in., 10/-. **Tygan** 4ft. 6in. wide, 10/- ft. ; 2ft. 3in. wide, 5/- ft.

All Boxed VALVES New & Guaranteed

1R5	8/6	6K8	8/6	EBC33	8/6	HABC80	
1S4	8/6	6L6	10/6	EBC41	10/6		12/6
1S5	8/6	6Q7	10/6	EBF80	8/6	HVR2A	7/6
1T4	8/6	6SA7	7/6	ECC84	12/6	MU14	10/6
2X2	3/6	6S67	8/6	ECF80	10/6	P61	6/6
3V4	8/6	6V6G	7/6	ECF82	10/6	PCC84	12/6
5U4	8/6	6V6GT	8/6	ECH42	10/6	PCC84	12/6
5Y3	8/6	6X4	7/6	ECL80	8/6	PCF80	10/6
5Z4	10/6	6X5	7/6	ECL82	12/6	PCF82	10/6
6AM6	8/6	12A6	7/6	EF39	7/6	PCL82	10/6
6B8	5/6	12AH8	10/6	EF41	10/6	PEN25	6/6
6BE6	7/6	12AT7	10/6	EF50	5/6	PL82	10/6
6BH6	10/6	12AU7	10/6	Equip.		PY80	10/6
6BW6	8/6	12AX7	10/6	EF50	5/6	PY81	10/6
6BW7	8/6	12BE6	10/6	Sylv.	8/6	PY82	10/6
6CH6	10/6	12BH7	10/6	EF80	10/6	SP61	5/6
6D6	7/6	12K7	8/6	EF92	5/6	UBC41	10/6
6F6	7/6	12Q7	8/6	EL32	5/6	UCH42	10/6
6H6	3/6	35Z4	10/6	EL84	10/6	UF41	10/6
6J5	6/6	80	8/6	EY51	11/6	UL41	10/6
6J6	7/6	954	1/6				
6J7	8/6	EA50	1/6	EZ40	10/6	UY41	10/6
6K6	6/6	EABC80	8/6	EZ81	11/6	U22	10/6
6K7	5/6	EB91	5/6	E1148	1/6	X79	10/6



1958 RADIOGRAM CHASSIS

THREE WAVEBANDS. **FIVE VALVES** S.W. 16 m.—50 m. LATEST MULLARD M.W. 200 m.—550 m. ECH42, EF41, EBC41, L.W. 800 m.—2,000 m. EL41, EZ40
12-month guarantee.
A.C. 200/250 v. 4-way Switch : Short-Medium-Long-Gram. A.V.C. and Negative feedback 4.2 watts. Chassis 13½ x 5½ x 2½in. Glass Dial 10 x 4½in., horizontal or vertical available. 2 Pilot Lamps, Four Knobs Walnut or Ivory. Aligned and calibrated Chassis isolated from mains.

10 gns. Carr. & Ins. 4/6.

TERMS : Deposit £5.5.0 and six monthly payments of £1.
MATCHED SPEAKERS FOR ABOVE CHASSIS. 8in., 17/6 ; 10in., 25/- ; 12in., 30/-.

RECOMMENDED FOR ABOVE CHASSIS
★ COLLARO ★
HIGH-FIDELITY AUTOCHANGER Model RC456
7in., 10in., 12in. Records
16, 33, 45, 78 r.p.m.
4 SPEEDS—10 RECORDS
With Studio " O " pick-up
BRAND NEW IN MAKER'S BOXES
OUR PRICE £9.15.0. post free
TERMS : Deposit £5.5.0 and six monthly payments of £1.
Space required 14in. x 12½in. 5in. above and 3in. below.
Suitable Player Cabinets, 49/6.
Amplifier Player Cabinets, 63/-.

GARRARD 4-SPEED SINGLE RECORD PLAYER 4SP
Brand new and fully guaranteed 12 months

AUDIO PERFECTION
Designed to play 16, 33, 45, 78 r.p.m. Records. 7in., 10in., 12in. Lightweight Xtal pick-up, GC2 turnover head, two separate sapphire styli, for Standard and L.P., each plays 2,000 records Voltage 200/250 A.C.
OUR PRICE £8.0.0 each. Post Free.
Terms : Deposit £5 and 4 monthly payments of £1. Space required 14in. x 12½in. 3in. above and 2½in. below.
Amplifier Player Cabinets, 45/-.

ALUMINIUM CHASSIS. 18 s.w.g. undrilled. With 4 sides, riveted corners and lattice fixing holes, 2½in. sides, 7 x 4in., 4/6; 9 x 6in., 5 9; 11 x 7in., 6/9; 13 x 9in., 8/6 ; 14 x 11in., 10 6; 15 x 14in., 12/6; 18 x 15 x 3in., 16/6.

TRANSISTORS. Audio, 10/-. R.F. 2.6 Mc/s, 21/-. Mullard OC71, 20/-.

SUPERHET COIL PACK. 27/6. Miniature size 2½in. x 2½in. x 1½in. HIGH " Q " Dust cored Coils. Short, Medium, Long, Gram Switching. Single hole fixing with connection diagram and circuit. 465 Kc/s I.F.

BUILD THIS REPRODUCER BARGAIN
Special Single Player Kits.
Famous maker's surplus stocks. 4-speed Gram. pick-up unit, £4 12 6.
Handsome portable case, 17½in. x 13½in. x 7in., £2/5 0.
Ready built powerful amplifier with valves and loudspeaker, £3/12 6.
All available separately or if all purchased together, £9/15/0, complete kit, post free.

CRYSTAL MIKE INSERT by Acos, precision engineered. Size only 1¼ x 3/16in. Bargain Price 6/6. No transformer required.

CHAMPION VHF (FM) TUNER, 88-96 mc/s.
5 Mullard valves and superhet tuning heart. Maroon and cream receiver styled cabinet 12 x 6 x 6in. Features : This is a self-powered 200/250 v. A.C. VHF (FM) Adaptor with operating and servicing data and a screened lead for connection to pick-up sockets of any radio, radio-gram or amplifier.
Brand new with 12 months' guarantee. List price, 16 gns. Our price, **10 gns.,** carr. 3/6.
Terms: Deposit £6 and 6 monthly payments of £1

Volume Controls
Long spindles. Guaranteed 1 year. Midget 10,000 ohms to 2 Meg. No Sw. S.P.Sw. D.P.Sw.
3 - 4/- 4.9
Linear or Log Tracks.

80 ohm CABLE COAX
Semi-air spaced Polythene insulated, ¼in. dia. Stranded core. Losses cut 50%. **9d. yd.**
Fringe Quality Air Spaced, **1/6 yd.**

COAX PLUGS ... 1/- **DOUBLE SOCKET** 1/3
SOCKETS ... 1/- **OUTLET BOXES** ... 4/6
BALANCED TWIN FEEDER yd. 6d. 80 or 300 ohms.
DITTO SCREENED per yd. 1/-. 80 ohms only.
WIRE-WOUND POTS. 3 WATT. Pre-Set Min. T.V. Type. All values 25 ohms to 30 K., 3/- ea. 50 K., 4/-. (Carbon 50 K. to 2 m., 3/-).
WIRE-WOUND 4 WATT. Pots 2½in. Spindle. Values, 100 ohms to 50 K., 5/6; 100 K., 6/6.
CONDENSERS. New stock. .001 mfd. 7 kV. T.C.C., 5/6; Ditto, 20 kV., 9/6; 100 pf. to 500 pf. **Micas** 6d.: Tubular 500 v. .001 to .01 mfd., 9d.; .05, .1, 1/-; .25, 1/6; .5/350 v., 1/9; 1/350 v., 9d.; .01/2,000 v., 1/9 ; .1 mfd., 2,000 volts, 3/6.
CERAMIC CONDS. 500 v., 3 pf. to .01 mfd., 10d.
SILVER MICA CONDENSERS. 10% 5 pf. to 500 pf., 1/-; 600 pf. to 3,000 pf., 1/3. Close tolerance (± 1 pF.) 1.5 pF. to 47 pF., 1/6. Ditto, 1% 50 pF. to 815 pF., 1/9; 1,000 pF. to 5,000 pF., 2/-.

I.F. TRANSFORMERS 7/6 pair.
465 Kc/s Slug tuning Miniature Can. 2¼in. x 1in. x 1in. High Q and good bandwidth. By Pye Radio. Data sheet supplied.
Wearite M800 IF 465 Kc/s 12/6 per pair.

NEW ELECTROLYTICS. FAMOUS MAKES

TUBULAR		TUBULAR		CAN TYPES	
1/350 v.	2/-	100/25 v.	2/-	8+16/500 v.	5 6
2/450 v.	2/3	8+8/500 v.	4/6	16+16/500 v.	6 -
4/450 v.	2/-	16+16/500 v.	5/6	25+20/450 v.	5 6
8/450 v.	2/3		6/-	32+32/350 v.	4/6
8/500 v.	2/9	CAN TYPES		32+32/450 v.	6/6
16/450 v.	3/6	Clips	3d.	50+50/350 v.	7/-
16/500 v.	4/-	16/450 v.	3/6	60+100/350 v.	11/6
32/450 v.	5/6	32/350 v.	4/-	100+200/275 v.	
25/25 v.	1/9	64/350 v.	5/6		12/6
50/25 v.	1/9	500/12 v.	3/-	1,000+1,000/6 v.	
50/50 v.	2/-	8+16/450 v.	5/-		6/6

SENTERCEL RECTIFIERS. E.H.T. TYPE FLYBACK VOLTAGE. K3/25 2 kV., 5/-; K3/40 3.2 kV., 7/-; K3/45, 3.6 kV., 7/6; K3/50 4 kV., 8/-; K3/100 8 kV., 14/6. 50 c.p.s. voltage, 30% of above.
MAINS TYPE CONTACT COOLED 250 v. 50 mA., 8 6; 250 v. 85 mA., 9/6. Selenium 300 v. 85 mA., 7 6.
COILS Wearite " P " type, 3/- each. Osmor Midget Q type adj. dust core, from 4/-. All ranges.
TELETRON. L. & Med. T.R.F., with reaction, 3 6.
FERRITE ROD AERIALS. M.W., 8/9; M. & L., 12 6.
T.R.F. COILS A/HF 7/- pair. **H.F. CHOKES,** 2 6.
FERRITE ROD 8in. x 3/8in. dia., 2/6.

JASON F.M. TUNER COIL SET. 26/-. H.F. coil, aerial coil, Oscillator coil, two I.F. transformers 10.7 Mc/s. Detector transformer and heater choke. Circuit book using four 6AM6 2/-. J.B. Chassis and Dial, 19/6.
Complete Jason F.M. Kit, £5.18.6.
With Jason superior calibrated dial, £6.15.0.

FULL WAVE BRIDGE SELENIUM RECTIFIERS; 2, 6 or 12 v. 1½ amp., 8/9; 2 a., 11 3; 4 a., 17/6.
CHARGER TRANSFORMERS. Tapped input 200/250 v. for charging at 2, 6 or 12 v., 1½ amp., 15/6. 2 amp., 17/6; 4 amp., 22/6.
VALVE and T.V. TUBE equivalent books, 5 -.
TOGGLE SWITCHES. S.P. 2/-. D.P. 3/6. D.P.D.T. 4/-
WAVECHANGE SWITCHES.
5 p. 4-way 2 wafer long spindle 6/6
2 p. 2-way 3 p. 2-way short spindle 2 6
2 p. 6-way 4 p. 2-way 4 p. 3-way long spindle 3 6
3 p. 4-way, 1 p. 12-way, long spindle 3 6
VALVEHOLDERS. Pax. Int. Oct., 4d. EF50, EA50, 6d. B12A, CRT, 1/3. Eng. and Amer. 4, 5, 6, 7, and 9 pin, 1/-. MOULDED Mazda and Int. Oct., 6d. B7G B8A, B8G, B9A, 9d., B7G with can, 1/6. VCR97, 2/6, B9G with can, 2/6. CERAMIC EF50, B7G, B9A, Int. Oct., 1/-. B7G with can, 1/9. BLACK CRACKLE PAINT. air drying, 3 - tin.

NEW AND ENLARGED SHOWROOMS NOW OPEN
OUR WRITTEN GUARANTEE WITH EVERY PURCHASE. Please address all Mail Orders correctly as below

RADIO COMPONENT SPECIALISTS
337 WHITEHORSE RD., WEST CROYDON
OPEN ALL DAY—(Wed. 1 p.m.) *Catalogue 6d.*

Tel. THO 1665. Buses 133 or 68 pass door. 48-hour postal service. *P. & P. 1/-, over £2 post free. (Export Extra.) C.O.D. Service 1/6.*

R.S.C. BATTERY CHARGING EQUIPMENT

All for A.C. Mains 200-250 v., 50 c/cs. Guaranteed 12 months.

ASSEMBLED CHARGERS

6 v. 1 amp..... 19/9
6 v. or 12 v. 1 amp..... 27/9
6 v. 2 amps..... 29/9
6 v. or 12 v. 2 amps..... 38/9
6 v. or 12 v. 4 amps..... 56/9
Above ready for use. Carr. 3/6. With mains and output leads.

SELENIUM RECTIFIERS

F.W. BRIDGE TYPES

6/12 v. 1 a, 4/11
6/12 v. 2 a, 9/9
6/12 v. 3 a, 11/9
6/12 v. 4 a, 14/9
6/12 v. 6 a, 19/9
6/12 v. 10 a, 25/9
6/12 v. 15 a, 35/9

L.T. Types H.W.

2-6 v. ½ a., 1/11
6-12 v. ½ a, H.W..2/9

H.T. Types H.W.

150 v. 40 mA, 3/9
250 v. 50 mA, 5/9
250 v. 80 mA, 7/9
250 v. 250 mA, 11/9

BATTERY CHARGER KITS

Consisting of Mains Transformer. F.W. Bridge, Metal Rectifier, well ventilated steel case. Fuses, Fuse-holders. Grommets, panels and circuit. Carr. 2/9 extra.

6 v. or 12 v. 1 amp..... 22/9
6 v. 2 amps. 25/9
6 v. or 12 v. 2 amps..... 31/6
6 v. or 12 v. 4 amps..... 53/9

BATTERY CHARGER KIT

Consisting of F.W. Bridge Rectifier, 6/12 v. 5 a. Mains Trans., 0-9-15 v. 6 a. output and Ammeter, 49/9. Post 3/9.

ASSEMBLED CHARGER

6 v. or 12 v. 2 amps. Fitted Ammeter and selector plug for 6 v. or 12 v. Louvred metal case, finished attractive hammer blue. Ready for use. With mains and output leads. Double Fused. Only Carr. 3/9. **49/9**

Assembled 6 v. or 12 v. 4 amps.

Fitted Ammeter and variable charge rate selector. Also selector plug for 6 v. or 12 v. charging. Louvred steel case with stoved blue hammer finish. Fused and ready for use with mains and output leads. Carr. 4/6. Credit Terms: Deposit 30/- and 4 monthly payments, 13/-. **75/-**

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

Interleaved and Impregnated. Primaries 200-230-250 v. 50 cc/s. Screened.

TOP SHROUDED DROP THROUGH

250-0-250 v. 70 mA, 6.3 v, 2 a, 5 v. 2a. 16/9
350-0-350 v. 80 mA, 6.3 v. 2 a, 5 v. 2a.... 18/9
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 a, 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. 100 mA, 6.3 v. 4 v. 4 a, C.T. 0-4-5 v. 3 a. 23/9
350-0-350 v. 150 mA, 6.3 v. 4 a, 5 v. 3 a. 29/9

FULLY SHROUDED UPRIGHT

250-0-250 v. 60 mA, 6.3 v. 2 a, 5 v. 2 a, Midget type 2½-3-3in. ... 17/6
250-0-250 v. 100 mA, 6.3 v. 4 a, 5 v. 3 a. 26/9
250-0-250 v. 100 mA, 6.3 v. 6 a, 5 v. 3 a. for R1355 conversion 31/-
300-0-300 v. 100 mA, 6.3 v. 4 a, 5 v. 3 a. 26/9
350-0-350 v. 100 mA, 6.3 v. 4 a, 5 v. 3 a. 26/9
300-0-300 v. 130 mA, 6.3 v. 4 a, 6.3 v. 1 a, for Mullard 510 Amplifier 35/9
350-0-350 v. 150 mA, 6.3 v. 4 a, 5 v. 3 a. 33/9
350-0-350 v. 150 mA, 6.3 v. 2 a, 6.3 v. 2 a, 5 v. 3 a. 35/9
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

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, 8/11; 6.3 v. 6 a, 17/6; 12 v. 3 a. or 24 v. 1.5 a. 17/6.

JUNCTION TRANSISTORS. Brand new R.F. Type 17/6.

VOLUME CONTROLS with long (1in. diam.) spindle all values less switch, 2/9; with S.P. switch, 3/9; with D.P. switch, 4/6.

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 2v. accumulator. Price with louvred metal case and circuit, 29/6, or ready for use, 8/9 extra.

ELIMINATOR TRANSFORMERS

Primaries 200-250 v. 50 c/s.
120 v. 40 mA, 5-0-5 v. 1 a. 15 9
90 v. 15 mA, 4-0-4 v. 500 mA. 9/9

CHARGER TRANSFORMERS

All with 200-230-250 v. 50 c/s Primaries; 0-9-15 v. 1½ a, 11/9; 0-9-15 v. 3 a, 16/9; 0-3-5-9-17 v. 3 a, 17/9; 0-9-15 v. 5 a, 19.9; 0-9-15 v. 6 a, 23/9.

SMOOTHING CHOKES

250 mA, 5 H 100 ohms 12/9
150 mA, 7-10 H 250 ohms... ... ... 11 9
100 mA, 100 H 200 ohms... ... ... 8/9
80 mA, 10 H 350 ohms 5 9
60 mA, 10 H 400 ohms 4/11

OUTPUT TRANSFORMERS

Midget Battery Pentode 66:1 for 3S4, etc.... ... ... 3/9
Small Pentode, 5,000Ω to 3Ω... ... 3/9
Small Pentode 7/8,000Ω to 3Ω ... 3/9
Standard Pentode 5.000Ω to 3Ω ... 4/9
Standard Pentode, 7/8,000Ω to 3 Ω... 4/9
10.000 Ω to 3Ω 4/9
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 EL84 to 3 or 15Ω 16 9
Push-Pull 15-18 watts, 6L6, KT66 ... 22 9
Push-Pull 20 watts, sectionally wound 6L6, KT66, etc., to 3 or 15Ω 47 9

MAINS TRANSFORMERS

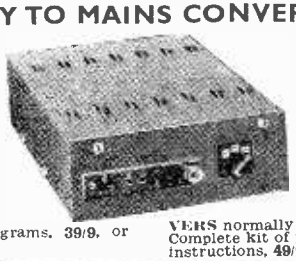
Manufacturers' surplus. Primaries 200-250 v. 50 cc/s. 250-0-250 v. 70 mA, 6.3 v. 2.5 a. Drop through type, 11/9. 375-0-375 v. 150 mA, 6.3 v. 4 a, C.T. 6.3 v. 1 a. Fully shrouded, 22/9. Postage 2/9 on either type.

SPECIAL OFFERS: Electrolytics. 32-32-32 mfd. 250 v. Dubilier small can, 2/9 ea. 150 mfd. 450 v., 3/9. Small .0005 mfd. 2-gang, 4/9 ea. Westinghouse Rectifiers 250 v. 250 mA, 7/9. **CO-AXIAL CABLE** 75 ohm, 1in. 8d. yd. Twin-Screened Feeder 11d.yd.

R.S.C. BATTERY TO MAINS CONVERSION UNITS

Type BM1. An all-dry battery eliminator. Size 5½ x 4½ x 2in. approx. Completely replaces batteries supplying 1.4 v. and 90 v. where A.C. mains 200-250 v. 50 c/s is available. **Suitable for all battery portable receivers requiring 1.4 v. and 90 v.** This includes latest low consumption types.

Complete kit with diagrams, 39/9, or ready to use, 46/9.



Type BM2. Size 8 x 5½ x 2½in. Supplies 120 v. 60 v. and 60 v., 40 mA. and 2 v. 0.4 a to 1 amp. fully smoothed. **Thereby completely replacing both H.T. batteries and L.T. 2 v. accumulators.** When connected to A.C. mains supply 200-250 v. 50 cc/s. **SUITABLE FOR ALL BATTERY RECEIVERS** normally using 2 v. accumulator. Complete kit of parts with diagrams and instructions, 49/9, or ready for use, 59/6.

MINIATURE MOTORS. 24-28 v. D.C. or A.C. made by Hoover Ltd., Canada. Size only 2½ x 1¼in. Spindle 1¼in. long, ¼in. diam. Brand New, 9/9.

HEADPHONES. Brand new. Low resistance. Only 6/9 pr.

EX-GOVT. 50 WATT SPEECH AMPLIFIERS. For normal 200-250 v. A.C. mains. Complete with hand 'mike' with good length of lead and all valves. Ready for use, in wood transit cases. Only 9 Gns., carr. 15/-.

TANNOY RE-ENTRANT 8 WATT SPEAKERS. For use with above, 27/6 ea.

EXTENSION SPEAKERS

Ready for use in walnut veneered cabinet.

8in. 2-3 ohms, 35/9. Very limited number.

EX-GOVT. METAL BLOCK (PAPER) CONDENSERS.

4 mfd. 350 v., 2/9; 4 mfd. 1,000 v., 4/9;
8 mfd. 500 v., 4/9; 10 mfd. 500 v., 3 9;

EX-GOVT. SMOOTHING CHOKES

300 mA, 20 H 200 ohms 19/9
250 mA, 5 H 50 ohms 12/9
150 mA, 10 H 100 ohms 11/9
150 mA, 6-10 H 150 ohms Trop. ... 6/9
120 mA, 12 H 100 ohms 9/9
100 mA, 5 H 100 ohms 3/11
80 mA, 10 H 150 ohms 3/11

EX-GOVT. E.H.T. SMOOTHING CONDENSERS. .02 mfd. 5,000 v. Cans, 2.9; .1 mfd. 2,500 v. Bakelite Tubulars, 3/3.

THE SKYFOUR T.R.F. RECEIVER. A design of a 3-valve Long and Medium wave 230-250 v. A.C. Mains receiver with selenium rectifier. It consists of a high gain H.F. stage and low distortion anode bend detector. Power pentode output is used. Valve line-up 6K7, SP61, 6V6G. Selectivity and quality are well up to standard, and simplicity of construction is a special feature. Point-to-point wiring diagrams, instructions and parts lists, 1/9. Maximum building costs £4/19/6, including attractive Brown or Cream Bakelite or Walnut veneered wood cabinet 12 x 6½ x 5½in.

EX-GOVT. DOUBLE WOUND STEP UP/STEP DOWN TRANSFORMERS. 10-0-100-200-220-240 v. to 5-0-75-115-135 v. or REVERSE. 80-100 watts. Only 11/9, plus 2/9 post. 10-0-100-200-220-240 v. to 9-0-110-122-136-148 v. or REVERSE. 200 watts, 35/9, plus 7/6 carr. Both 50 c.p.s.

EX-GOVT. MAINS TRANSFORMER. Primary 0-110-120-200-210-220-230-240-250 v. 50 c.p.s. Secs. 275-0-275 v. 100 mA, 6.3 v., 7 a, 5 v. 3 a. Govt. rating, 22/9. Following with 230-250 v. primaries, 400-0-400 v. 200 mA, 5 v. 3 a, 5 v. 2 a, 19/9; 230-0-230 v. 100 mA, 12.6 v. 1.5 a, 5 v. 2 a, 11/9; 12.6 v. 3 a, 5 v. 3 a, 9/9. Postage 2/9 on any type.

Primary 200-250 v. Sec. 0-16-18-20 v. 60 amps Suitable Welding or Soil Heating, 79/6, carr. 7/6.

EX-GOVT. CASES. Size 14-10-8½in. high. Well ventilated, black crackle finished, undrilled cover. IDEAL FOR BATTERY CHARGER OR INSTRUMENT CASE, OR COVER COULD BE USED FOR AMPLIFIER. Only 9/9, plus 2/9 postage. Size 8½ x 13½ x 6½ ins. with undrilled well ventilated cover, finished in stoved grey enamel. Suitable for charger or instrument case, 7/9, plus 2/9 post.

EX-GOVT. VALVES (NEW)

1T4	7/9	6J6	4/9	ECC91	4/9
1S5	7/9	6V6G	7/9	EF80	7/9
3S4	8/9	6X4	6/9	EB91	4/9
5Y3G	8/9	6X5GT	8/9	EF91	8/9
5U4G	8/9	6L6G	11/9	EF36	4.9
5Z4G	9/9	807	7/9	EL32	3/9
6K7G	5/9	12A6	7/9	KT44	8/9
6SJ7GT	6/9	15D2	4/9	EZ90	6/9
6SLGT	8/9	35Z4GT	8/9	EL84	10,6
6SN7GT	8/9	MH4	4/9	FW4/500	9/9
6AT6	7/9	ECC83	9/9	SP61	2·9

ELECTROLYTICS (current production) NOT EX-GOVT.

Tubular Types		Can Types	
8µF 450 v. ...	1/9	16 mfd. 350 v.	1.11
8 mfd. 500 v.	2/6	16 mfd. 500 v.	2/9
16µF 350 v. ...	2/3	16µF 450 v. ...	2/9
16µF 450 v. ...	2.9	32µF 350 v. ...	2/11
16µF 500 v. ...	3/9	32 mfd. 450 v.	4/9
32µF 350 v. ...	3/9	100 mfd. 450 v.	4/9
25µF 25 v. ...	1/3	8-8µF 450 v....	2/9
50µF 12 v. ...	1/3	8-16µF 450 v.	3/11
50 mfd. 25 v. ...	1/6	16-16µF 450 v.	4/11
50µF 50 v. ...	1/9	32-32µF 350 v.	4/9
100 mfd. 12 v.	1/9	32-32µF 450 v.	5/9
100 mfd. 25 v.	2/3	100-100 mfd.350v.	4/9
1,500 mfd. 6 v.	1/6	64-120 mfd.350v.	7.9
3,000 mfd. 6 v.	3/9	100-200 mfd.	
6,000 mfd. 6 v.	3/9	275 v. ...	6.9

Many others in stock.

TOP QUALITY FULLY GUARANTEED VALVES

ALL GOODS LISTED ARE ACTUALLY IN STOCK

EXPRESS SERVICE!!!
C.O.D. ORDERS RECEIVED BY 3.30 P.M. EITHER BY LETTER, PHONE OR WIRE, DESPATCHED THE SAME AFTERNOON. ALL ORDERS RECEIVED BY FIRST POST DESPATCHED SAME DAY

FOR ONLY 6d. EXTRA PER ORDER WE WILL INSURE YOUR VALVES AGAINST DAMAGE IN TRANSIT. ALL UNINSURED PARCELS AT CUSTOMER'S RISK.

1A3	3/-	6AT6	8/6	6K8GT/G		10P13	17/6	30P4	15/-	CV63	10/6	ECC33	8/6	EZ40	8/-	PCC85	12/6	UB41	17/7
1A5	6/-	6AU6	10/6		11/-	11E3	15/-	30P12	13/6	CV85	12/6	ECC35	8/6	EZ41	10/6	PCF80	14/-	UBC41	8/6
1A7	15/-	6B4G	6/6	6L6G	9/6	12A6	6/6	31	7/6	CV271	10/6	ECC81	8/6	EZ80	9/6	PCF82	12/6	UBF80	9/6
1D6	10/6	6B7	10/6	6L7M	8/-	12AH7	8/-	33A/158M		CV428	30/-	ECC82	7/6	EZ81	10/-	PCL82	12/6	UBF89	10/6
1H5	11/-	6B8G	4/6	6L18	13/-	12AH8	10/6		30/-	D1	3/-	ECC83	9/-	GZ30	10/6	PEN40DD		UCC85	10/6
1L4	6/6	6B8M	5/-	6N7	8/-	12AT6	10/6	35/51	12/6	D42	10/6	ECC84	10/-	GZ32	12/6		25/-	UCH42	11/-
1LD5	5/-	6BA6	7/6	6Q7G	10/-	12AT7	8/6	35A5	11/-	D63	5/-	ECC85	9/6	GZ34	14/-	PEN45	19/6	UCH81	11/6
1LN5	5/-	6BE6	7/6	6Q7GT	11/-	12AU7	7/6	35L6GT	10/-	D77	6/6	ECC91	5/6	H30	5/-	PEN46	7/6	UCL82	13/6
1N5	11/-	6BJ6	8/-	6R7G	10/-	12AX7	9/-	35W4	8/6	DAC32	11/-	ECF80	13/6	H63	12/6	PL82	10/-	UF41	9/-
1R5	8/6	6BR7	11/6	6SA7GT	8/6	12BA6	9/-	35Z3	10/6	DAF91	8/-	ECF82	13/6	HABC80		PL83	11/6	UF80	10/6
1S5	8/-	6BW6	8/6	6SC7	10/6	12BE6	10/-	35Z4GT	8/-	DAF96	10/-	ECH35	9/6		13/6	PM2B	12/6	UF85	10/6
1T4	7/-	6BW7	14/-	6SG7GT	8/-	12E1	30/-	35Z5GT	9/-	DF33	11/-	ECH42	10/-	HK90	10/-	PM12	4/-	UF89	10/6
1U5	7/-	6BX6	14/-	6SH7	8/-	12J5GT	4/6	41MTL	8/-	DF91	7/-	ECH81	9/-	HL23	10/6	PM12M	6/6	UL41	11/-
2A3	12/6	6C4	7/-	6SJ7	8/-	12J7GT	10/6	50C5	12/6	DF96	10/-	ECL80	14/-	HL41	12/6	PY80	9/-	UL46	15/-
2A7	10/6	6C5	6/6	6SK7GT	8/-	12K7GT	7/6	50L6GT	9/6	DH63	10/-	ECL82	14/-	HL133DD		PY81	9/-	UL84	11/6
2C26	4/-	6C6	6/6	6SL7GT	8/-	12K8GT		61BT	15/-	DH76	7/6	EF36	6/-		12/6	PY82	9/-	UY41	8/6
2D13C	7/6	6C8	12/6	6SN7GT	7/6		14/-	61SPT	15/-	DH77	8/6	EF37A	9/-	HVR2	20/-	PY83	9/6	UY85	10/6
2X2	4/6	6C9	12/6	6SS7	8/-	12Q7GT	7/6	72	4/6	DK32	15/-	EF39	6/-	HVR2A	6/-	QP21	7/-	V1507	5/-
3A4	7/-	6C10	12/6	6U4GT	14/-	12SA7	8/6	77	8/-	DK91	8/6	EF40	15/-	KL35	8/6	QP25	15/-	VLS492A	£3
3A5	12/6	6CH6	7/6	6U5G	7/6	12SC7	8/6	78	8/6	DK92	12/6	EF41	9/6	KT2	5/-	QS150/15		VMP4G	15/-
3B7	8/6	6D6	6/6	6U7	8/6	12SG7	8/6	80	9/-	DK96	10/-	EF42	12/6	KT33C	10/-		10/6	VP2(7)	12/6
3D6	5/-	6E5	12/6	6V6G	7/-	12SH7	8/6	83V	12/6	DL2	15/-	EF50(A)	7/-	KT44	15/-	QVO4/7		VP4(7)	15/-
3Q4	9/-	6F1	15/-	6V6GT	8/-	12SJ7	8/6	85A2	15/-	DL33	9/6	EF50(E)	5/-	KT63	7/-		15/-	VP13C	7/-
3Q5GT	9/6	6F6G	7/-	6X4	7/-	12SK7	8/6	150B2	15/-	DL92	8/-	EF54	5/-	KTW61	8/-	R12	12/6	VP41	7/6
3S4	8/-	6F6GT	8/-	6X5GT	6/6	12SQ7	8/6	807	7/6	DL94	9/-	EF73	10/6	KTW62	8/-	SD6	12/7	VR105/30	9/-
3V4	9/-	6F8	12/6	6Z4/84	12/6	12SR7	8/6	956	3/-	DL96	10/-	EF80	14/-	KTW63	8/-	SP4(7)	15/-	VR150/30	9/-
5U4	8/6	6F12	9/-	6Z5	12/6	12Y4	10/6	1203	7/-	DLS10	10/6	EF85	9/-	KTZ41	6/6	SP41	3/6	VT61A	5/-
5V4	12/6	6F13	13/-	6/30L2	12/6	12R7	10/6	4033L	12/6	DM70	8/6	EF86	14/6	KTZ63	10/6	SP42	12/6	VT501	5/-
5X4	10/-	6F16	9/6	7A7	12/6	14S7	14/-	5763	12/6	EA50	2/-	EF89	10/-	L63	6/-	SP61	3/6	W76	7/6
5Y3G	8/-	6F17	12/6	7B7	9/-	19AQ5	11/-	7193	5/-	EA76	9/6	EF91	9/-	LN152	14/-	SU61	12/6	X61	12/6
5Y3GT	8/6	6F32	10/6	7C5	8/-	19H1	10/-	7475	7/6	EABC80	9/-	EF92	6/6	LZ319	14/-	TP22	15/-	X65	12/6
5Y4	12/6	6F33	7/6	7C6	8/-	20D1	16/-	9002	5/6	EAC91	7/6	EL32	5/6	MH4	7/-	U16	12/-	X66	12/6
5Z3	12/6	6G6	6/6	7H7	8/-	20L1	13/6	9003	5/6	EAF42	10/6	EL41	11/-	MHL4	7/6	U18/20	12/6	X79	12/6
5Z4G	10/6	6H6GT/G		7Q7	9/-	25L6GT	10/-	9006	6/-	EB34	2/6	EL42	11/-	MHLD6	12/6	U22	8/-	XD(1.5)	6/6
5Z4GT	12/6		3/-	7S7	10/6	25Y5	10/6	AC6PEN	7/6	EB41	8/6	EL81	15/-	ML4	12/6	U31	10/-	XFW10	6/6
6A8	10/-	6H6M	3/6	7V7	8/6	25Y5G	10/-	AC/HL/		EB91	6/6	EL84	10/6	ML6	6/6	U43	12/6	XFY12	6/6
6AB7	8/-	6J5G	5/-	7Y4	8/-	25Z5	10/6	DDD	15/-	EBC33	7/6	EL91	5/-	MU14	10/-	U50	8/-	XH(1.5)	6/6
6AB8	14/-	6J5GTG	5/6	8D2	3/6	25Z4G	10/-	AC/P4	8/-	EBC41	10/-	EM34	10/-	OA10	12/6	U52	8/6	XSG(1.5)	6/6
6AC7	6/6	6J5GTM	6/-	8D3	9/-	25Z6G	10/-	AP4	7/6	EBF80	10/-	EM80	10/6	OA70	5/-	U76	8/-	Y63	7/6
6AG5	6/6	6J6	5/6	9D2	4/-	28D7	7/-	ATP4	4/-	EBF89	9/6	EY51		OA71	5/-	U78	7/-	Z63	10/6
6AJ8	9/-	6J7G	6/-	10C1	15/-	30	7/6	AZ31	12/6	EC52	5/6	EY51		OC72	30/-	U251	15/-	Z66	20/-
6AK5	8/-	6J7GT	10/6	10F1	15/-	30C1	14/-	BL63	7/6	EC54	6/-	(Small)	12/6	P61	3/6	U404	10/6	Z77	9/-
6AL5	6/6	6K7G	5/-	10F9	11/6	30F5	14/-	CK505	6/6	EC70	12/6	EY51		PABC80	15/-	UABC80		Z719	14/-
6AM6	9/-	6K7GT	6/-	10F18	12/6	30FL1	12/6	CK506	6/6	ECC31	15/-	(Large)	12/6	PC84	10/-	UAF42	10/6	Z729	14/6
6AQ5	7/6	6K8G	8/-	10LD3	8/6	30L1	12/6	CK523	6/6	ECC32	10/6	EZ35	6/6						

TERMS OF BUSINESS :—CASH WITH ORDER OR C.O.D. ONLY. ORDERS VALUE £3 OR MORE SENT POST/PACKING FREE. ORDERS BELOW £3 PLEASE ADD 6d. PER VALVE. C.O.D. ORDERS :—MINIMUM FEE, INCLUDING POST AND PACKING, 3/-. WE ARE OPEN FOR PERSONAL SHOPPERS. MON-FRI. 8.30-5.30. SATS. 8.30-1 p.m.

ALL VALVES NEW, BOXED, TAX PAID, AND SUBJECT TO MAKERS' GUARANTEE. FIRST GRADE GOODS ONLY, NO SECONDS OR REJECTS. GOODS ARE ONLY SOLD SUBJECT TO OUR TERMS OF BUSINESS, OBTAINABLE FREE ON REQUEST. CATALOGUE OF OVER 1,000 DIFFERENT VALVES 3d.

When comparing our prices, remember just what we offer. Bentley valves are not only "GUARANTEED NEW AND BOXED," and "GUARANTEED TESTED AT TIME OF DESPATCH," Bentley valves are NEW, BOXED, AND SUBJECT TO THE MAKERS' STANDARD GUARANTEE AS WELL. Only our enormous turnover enables us to select the products of the world's finest manufacturers at lowest prices and pass the benefits on to YOU.

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THE VALVE SPECIALISTS

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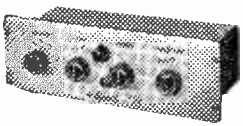
PRImrose 9090

PLEASE ENQUIRE FOR ANY VALVE NOT LISTED. 3d. STAMP, PLEASE.

COMPLETE KITS of PARTS for the "Hi-Fi" ENTHUSIAST

STERN'S REMOTE CONTROL UNIT



Designed in particular for use with the MULLARD 5-10 Main Amplifier

Ideally suited for simple domestic installation as an alternative to the more elaborate Pre-amplifier (shown and described opposite). Tone Control facilities are really excellent and in conjunction with the "5-10" Main Amplifier reproduction is of very high quality. Perfectly suitable for use with all the popular Record Players (B.S.R., Collaro, Garrard) and the modern Radio Tuner Units. Front Panel contains: (a) Coloured Indicator, (b) Separate BASS and TREBLE CONTROLS, (c) 3 position Selector Switch, (d) Volume Control. Inputs on back for Radio and Gram. and Gram. equalising is incorporated.

FULL DATA is contained in the 5-10 MAIN AMPLIFIER MANUAL at 1/6.

RECORD PLAYERS

THE VERY LATEST MODELS ARE IN STOCK

MANY AT REDUCED PRICES!!!

TRANSCRIPTION UNITS — AUTO-CHANGERS, SINGLE RECORD PLAYERS

Send S.A.E. for ILLUSTRATED STOCK LIST

SPECIAL CASH OFFERS!!

The Latest Collaro 4 Speed Single Record Player.

Incorporating the very popular STUDIO "O" CRYSTAL PICK-UP. For only. **£6.19.6**

(Plus 5/- carr. and ins.)

Incorporates Auto-Stop and Plays 78 r.p.m. and all types of L.P. Records.

The Collaro "Junior" Rim Drive 4 Speed Record Player

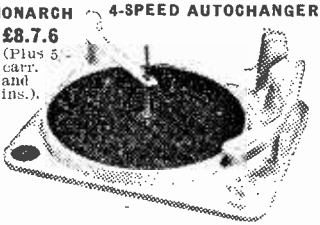
Offered complete with Collaro Crystal Pick-up. For **£4.10.0**

(Plus 4/- carr. and ins.)

We also offer . . . Gram Motor and Turntable at **£3.2.6.** Crystal Pick-up only, **£1.12.6.** (Carr. and Ins. 2/6 extra.)

THIS LATEST BRAND NEW B.S.R. MONARCH 4-SPEED AUTOCHANGER

£8.7.6 (Plus 5/- carr. and ins.).



● Minimum base-board size required 14in. x 12¼in. with height above 5¼in. & height below baseboard 2¼in.

WE ALSO HAVE A FEW ONLY

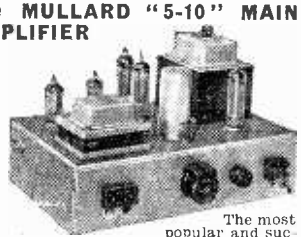
COLLARO 4-Speed "Mixer" Auto-changers. The Units are BRAND NEW and incorporate the STUDIO "O" Pick-up. PRICE, **£8.19.6** (Plus 5/- carr. and ins.)

109 & 115 FLEET ST., LONDON, E.C.4.

Telephone: FLEet 5312/3/4.

CORRESPONDENCE

The MULLARD "5-10" MAIN AMPLIFIER



The most popular and successful Amplifier yet designed and certainly needs no recommendation from us. Our kit is complete to MULLARDS specification including the latest PARMEKO ULTRA LINEAR OUTPUT TRANSFORMER and the recommended Mullard Valve line-up.

PRICE OF COMPLETE KIT OF PARTS (Plus 5/- carr. & ins.) **£9.10.0**

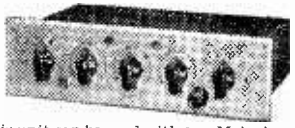
or alternatively we supply — FULLY ASSEMBLED and TESTED for **£11.10.0** (Plus 5/- carr. & ins.)

The ASSEMBLY MANUAL containing FULL SPECIFICATION is available for 1/6.

We also offer the "5-10" incorporating the latest PARTRIDGE ULTRA LINEAR OUTPUT TRANSFORMER for an extra ... £1.6.0

STERN'S "fidelity" PRE-AMPLIFIER TONE CONTROL UNIT

"A design for the Music Lover"



This unit can be used with any Main Amplifier. Briefly it has inputs for all types of MICROPHONES, HIGH and LOW GAIN PICK-UPS and a RADIO TUNING UNIT. It incorporates (a) GRAM EQUALISING CONTROL. (b) STEEPCUT FILTER. (c) Continuously variable BASS and TREBLE CONTROLS, a variable OUTPUT CONTROL which enables its use with any type of Amplifier, and Jack Sockets on Front Panel for TAPE RECORD and TAPE PLAYBACK.

Used with the "5-10" the reproduction is comparable to that normally associated only with the very expensive commercially made High Fidelity Amplifiers. PRICE OF COMPLETE KIT OF PARTS **£6.16.0** WE ALSO OFFER IT ASSEMBLED READY FOR USE. £8.10.0 (plus 5/- carr. & ins.) The ASSEMBLY MANUAL contains full specification and is available for 1/6.

SPECIAL PRICE REDUCTIONS . . . WE OFFER YOU . . .

PRICES ARE SUBJECT TO £1.6.0. EXTRA IF PARTRIDGE TRANSFORMER IS PREFERRED.

(a) **The COMPLETE KIT of PARTS** to build both the **MULLARD 5-10** and the **REMOTE CONTROL UNIT** for..... **£11.11.0**

(b) **The COMPLETE KIT of PARTS** to build both the **MULLARD 5-10** and the "Fidelity" **PRE-AMPLIFIER TONE CONTROL UNIT** for..... **£15.15.0**

ALTERNATIVELY WE WILL SUPPLY ASSEMBLED and FULLY TESTED, as follows—

(a) **The MULLARD 5-10** and the **REMOTE CONTROL UNIT** for..... **£14.0.0**

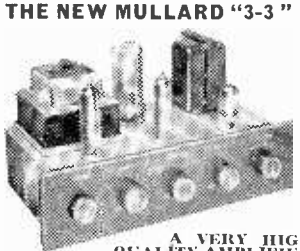
CREDIT SALE TERMS, £3.10.0 Deposit and 9 monthly payments of £1.5.8. H.P. TERMS, £7 Deposit and 9 monthly payments of 17/9.

(b) **The MULLARD 5-10** and the "Fidelity" **PRE-AMPLIFIER-TONE CONTROL UNIT FOR**..... **£18.18.0**

CREDIT SALE TERMS, £4.15.0 Deposit and 9 monthly payments of £1.14.7. H.P. TERMS, £9.9.0 Deposit and 12 monthly payments of 17/6.

WHEN ORDERING PLEASE INCLUDE 7/6 to cover cost of Carriage and Insurance

THE NEW MULLARD "3-3"



A VERY HIGH QUALITY AMPLIFIER PROVIDING EXCELLENT REPRODUCTION AND HAVING AN ATTRACTIVE PERSPEX FRONT PANEL

Price - For complete kit of parts: £7.10.0 (plus 6/6 coverage and insurance).

Alternatively supplied **ASSEMBLED and FULLY TESTED: £8.19.6** (plus 6/6 coverage and insurance).

The complete specification is available for 1/6. Developed from the very popular 3-valve 3-watt Amplifier designed in the Mullard Laboratories. Our kit is complete to the Mullard specification, including supply of specified components, valves and a **PARMEKO OUTPUT TRANSFORMER.** We also include switched inputs for 78 and L.P. records, plus a radio position. Extra power to drive a Radio Tuning Unit is also available.

THE IDEAL AMPLIFIER FOR A SMALL HIGH QUALITY INSTALLATION

WE ALSO SUPPLY SEPARATELY—

(a) The 2-Stage (plus Rectifier) **AMPLIFIER** £4.2.6

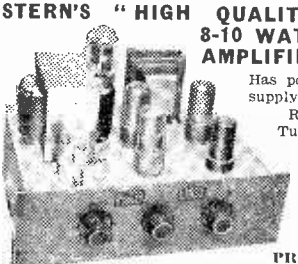
(b) The **PORTABLE CARRYING CASE** £3.17.6

(c) **P.M. SPEAKER** 18.9

Carriage and insurance, 4/- extra.

We also have a smaller **PORTABLE CASE Ideal for Record Players.** PRICE ONLY £3.3.0 (plus 3/- carr. & ins.).

STERN'S "HIGH QUALITY" 8-10 WATT AMPLIFIER



Has power supply for Radio Tuning Unit

PRICE OF COMPLETE KIT OF PARTS (Plus 5/- carr. & ins.) **£7.10.0**

SUPPLIED ASSEMBLED and READY FOR USE **£9.10.0**

Proved one of the most popular models yet offered to the HOME CONSTRUCTOR. Provides excellent reproduction up to 8 watts, employing 6V6's in push-pull, incorporating negative feedback. Provides for use of both 3 and 15 ohm speakers.

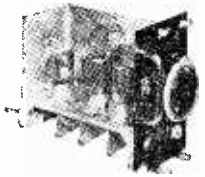
SPECIAL CASH ONLY OFFER !!

This very attractive **PORTABLE AMPLIFIER CASE** together with a good quality **GRAM AMPLIFIER** and a matched **P.M. SPEAKER.** ALL for ONLY **£8.7.6** (plus 7/6 carr. & ins.)

The Amplifier consists of a 2 Stage design incorporating 3 modern B.V.A. valves and has separate BASS and TREBLE CONTROLS. The Portable Case will also accommodate almost any make of Autochanger, and is attractively finished in Maroon and Grey colour Rexine.

CONVERTERS

Easily the most useful units released by the Ministry. Within minutes you can extend the frequency of any receiver to cover the following:—



R.F.26, 50-65 Mc/s., **20/-** each.
R.F.25, 40-50 Mc/s., **8/6** each.
R.F.24, 20-30 Mc/s., **12/6** each.
R.F.24, Shop soiled, **7/6** each
Complete with valves and circuit. 3/6 postage on each.

HIGH RESISTANCE HEADPHONES. 4,000 ohms. Brand new **11/6** each, P & P. 2/-.

WHEATSTONE BRIDGE. Consisting of four stud switches : 0-10 ohms, 0-100 ohms O-INF. Galvanometer centre zero F.S.D. 2.5 mA. Ranges easily extended. Housed in oak cabinet 16 x 7½ x 6in. Complete with instructions, **40/-**. P. & P. 4/ .

COLVERN WIRE WOUND POTENTIOMETERS. 25 watts 50k and 100k. Price **8/6** each.

INDICATOR UNIT SLC No. 5. Ideal for conversion into an Oscilloscope using a 139A or ACR 10 tube. Unit consists of 2-VR65, 1-VR66. various resistors. condensers and pots. Size 11 x 6 x 3in. Brand new, complete with modification circuit. **20/-**. P. & P. 3/- each.

500 MICROAMPS METER. 2in. circular calibrated 0-15 and 0-700 volts, resistance 500 ohms. **12/6**, P. & P 2/6.

No. 38 TRANSMITTER/RECEIVER/WALKIE TALKIE. Range approx. 5 miles. Covering 7.4-9 mc/s. Absolutely complete with junction box, headphones, microphones, webbing, haversack. Brand new, only **60/-**, carriage 7/6.

BENDIX RECEIVER MN26.C. Covering 150-1,500 kc/s in 3 bands. Valves used, 5-6K7, 2-6N7, 2-6J5, 1-6F6, 1-6L7. Complete with switching motor and dynamotor. This superb unit has been modified for 12 v. operation. With circuit. Only **80/-**, carr. 8/6.

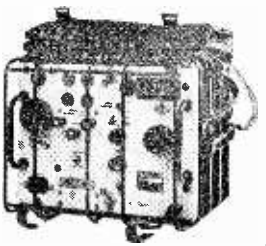
PYE 45 mc/s I.F. STRIPS. Complete with seven valves, 6-EF50, 1-VR92, 6 tunable I.F. transformers. **30/-**. post paid.

COMPLETE HEADPHONE AND MICROPHONE ASSEMBLY A *must* for every Constructor and "Ham," consists of moving coil, padded headphones and "press to talk" microphone. **10/-**, p. & p. 3/6.

MONITOR TYPE 28

Consists of VCR138, 6-SP61, 1-5U4, 1-VU120, 3-EA50. 1 m/a meter scaled 100-0-100 volts. Incorporates Y shift, X shift in u/secs., Focus, sync., Bias. Input to X plates switched X 20, X 5 and direct, requires only suitable power pack for use as oscilloscope. **60/-**, carr. 10-/.

R109 RECEIVERS



8 valves, 5-ARP12, 3-AR8 covering 1.8-8.5 mc/s on two frequency bands. Contains 6 v. Vibrator Pack and built-in 3½in. Goodmans speaker, operates from 6 v. battery, consumption 1½ amps. Housed in metal case 13 x 12 x 11 in. Designed for Mobile or Ground station. Operates with any normal aerial. Complete and tested, including circuit. Very good condition. Only **80/-**, carr. 7/6.

BATTERIES suitable for above giving 8-10 hours. FOUR 1.5 dry batteries in series. **5/-**, P. & P. 3/6.

SPECIAL VIBRATOR PACKS

12 VOLT input, 300 volts output at 150 mA. As a bridge rectifier will handle 450 volts RMS at 120 mA. Pack consists of 12 volt vibrator, 4 metal rectifiers, chokes and smoothing condensers. ONLY **30/-**, carriage 5/-. **6 VOLT** input, 230 v. output at 100 mA., complete 4-pin vibrator. OZ4 rectifier. Fully smoothed, **25/6** each, P. & P. 2/6.

DYNAMIC SOUND POWERED HEADPHONES

Type D.L.R. 5. 60 ohms. Individual earpieces can be used for room-to-room communication. No Batteries required—just connect up. Can also be used as miniature speakers. ONLY **7/6** pair, P. & P 2/6.

COMMUNICATION RECEIVER R.1155

This magnificent receiver covers 5 ranges : 75-200 Kc/s, 200-500 Kc/s, 600-1,500 Kc/s, 3-7.5 Mc/s, 7.5-18.5 Mc/s. Fully tested before despatch. Complete with circuit and instruction booklet. **£8.10.0**, carr. 10/-.

SPECIAL VALVE LIST

New Original Cartoned American Valves

2C26	3/6	6AG7	9/6	6X5GT	8/6	9004	1/9
2X2	2/6	6H6	2/6	807	6/-	9006	3/6
3B24	7/6	6SH7	6/-	830-B	4/-	12J5GT	6/-
5U4G	7/6	6SL7GT	7/-	955	1/9	446B	25/-
6AC7	5/-	6SN7GT	6/6	956	1/9	464A	25/-
6AG5	5/6	6V6GT	7/6				

All brand new and fully tested. Please add postage.

LUMINOUS MAGNETIC MARCHING COMPASS Pocket size. Brand new with instructions. ONLY **12/6**, P. & P. 1/-.

WESTINGHOUSE FENCIL RECTIFIER. Type J.50 output 500 v. at 5 mA. 5/- post paid.

MUIRHEAD VERNIER SLOW MOTION DRIVES. Scaled 0-180 def. Ratio 25 to 1. 3in. dia. **10/6**, p.p. 1/6.

R.T.-7/APN-1 ALTIMETER TRANSCEIVER. Brand new complete with 14 valves : 3-12SJ7, 4-12SH7, 2-12H6, 1-VR150, 2-9004, 2-955. Famous Wobbulator Unit, Dynamotor, Relays 3,500 ohms and 6,500 ohms. A.F. amplifier. Receiver section covers 400-450 mc/s. Transmitter sweeps 418 to 462 mc/s. Ideal for model control work, etc. With manual. Only **35/-**, carriage 10/-.

LEAD ACID ACCUMULATORS. 2 volts 16 A.H. Ideal for 6 volts and 12 volts supply. Brand new original cartons. Size 4in. x 7in. x 2in. **5/6** each, p.p. 2/6. 3 for **15/-**, p.p. 3/6. 6 for **27/6**, p.p. 5/-.

MAINS R.C.A. TRANSFORMERS. Input 110-240 v., output 345-0-345 at 150 mA. 6.4 v. at 4.5 amps. 5 v. at 2 amps. Brand new fully shrouded. Limited quantity. Write now. Only **35/-**, p.p. 3/-.

FERRANTI TRANSFORMERS. Input 225 volts, output 4 volts at 2 amps. or .5 amps. Potted type with ceramic bushes. Brand new, **7/6** each, P. & P. 1/-.

WESTON 1 Amp. H.F. METERS. 2in. circular. Brand new, **5/6**. P. & P. 1/-.

SIGNAL GENERATOR AND WAVEMETER. Type W.1649. Frequency of Signal generator : 140 to 240 Mc/s. Accuracy ±0.5 Mc/s. Accuracy ±0.2. Mc/s. Containing VR.135 and 4-VR91S meg. crystal. Retractable aerial. Power requirements : 6.3 volts and 120 volts. Unit housed in copper lined wooden case. Size 15½in. x 13in. x 14½in. **45/-**, plus 10/-.

0-25 AMPS. 2½in. ROUND FLUSH MOUNTING METERS. Ideal for battery chargers. New and boxed. **8/6**, post 1/6.

COMMAND RECEIVERS. 1.5-3 mc/s, fully valved, with circuit, **65/-**, P. & P. 3/6. 3-6 mc/s, fully valved, **35/-**. P. & P. 3/6.

PUSH BUTTON COIL PACKS. 465 Kc/s. I.F. Long, Medium and 2 Shortwaves. **8/6**. Post 1/6.

AMERICAN ROTARY CONVERTERS. With cooling Fan. Input 12 v. D.C. Output 250 v. at 90 mA. Completely suppressed. Brand new. **19/-** each, plus P. & P. 3/-.

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(Dept. "P") 32A, Coptic Street, London, W.C.I. *Phone : MUSeum 9607.*
Tottenham Court Road Underground. Fourth turning on the left down New Oxford Street.

FOR VALVES—
Guaranteed New and Boxed

0Z4	5/6	6U5	8/6	DK96	10/-	TP25	27 10
1A3	3/6	6U7G	8/6	DL96	10/-	U10	10 -
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1C2	11/6	6X4	7/6	EAC91	7/6	U26	15/-
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5Z4G	10/-	12BA6	9/-	EF55	10/-		
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6AC7	6 6	12C8	7/-	EF86	13'-		
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6AK5	6 6	12J5	4 6	EF92	8 6		
6AL5	6 6	12J7G	9 6	EL32	5 6		
6AM6	9 -	12K7	8 6	EL41	10/6		
6AQ5	7 6	12K8	13 6	EL42	11'-		
6AT6	8'6	12Q7	8'6	EL81	11/6		
6AU6	10 6	12SC7	2 6	EL84	10/6		
6B4	5 -	12SG7	7 6	EM34	10'-		
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6BJ6	9 -	12SL7	8/-	EY91	6'-		
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6D6	5'-	25L6GT	10'-	H30	5 -		
6F1	13 6	25Y5G	9 9	H12310	8 6		
6F6G	7'6	25Z4G	9 6	H32	12 6		
6F6M	7'6	25Z5	10 -	HN309	13 6		
6F13	14 -	25Z6GT	9 6	K10N	9 -		
6F33	5 6	30P5	12 6	KF35	8,6		
6F15	14 -	30FL1	12'6	KL132	8'6		
6G6G	4 6	35L6GT	9 6	KT2	5 -		
6H6	2 6	35W4	3 6	KT24	4 6		
6J5M	5 -	35Z4GT	8 -	KT33C	10/-		
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6J7G	6 -	50L6GT	8/6	KTZ41	6 -		
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6K8GT	9 6	77	7/6	PCF80	13 6		
6L6G	9 -	80	8,6	PCF82	12 6		
6L7	7 6	807	6 6	PCL83	14 6		
6L18	20 11	954	2 -	PCL85	14 6		
6N7	7 6	955	4 9	PEN44	15 -		
6P25	13 6	956	3 6	PEN25	5 -		
6Q7GT	9 -	9001	5/6	PEN46	7,-		
6SA7GT	8 -	9002	5/6	PEN220A	4 -		
6SC7	7 6	9003	5/6	PL81	15 -		
6SH7	6/-	9004	5,6	PL82	9'6		
6SJ7	8 6	9006	5'6	PL83	11'6		
6SK7	6,-	AC6/PEN	6/6	PP25	3 11		
6SL7	8'-			PX25	12'6		
6SN7	7 6	ATP4	3'6	QP21	7/6		
6SQ7	9 3	DAP96	10,-	SP220	3'11		
6U4GT	14 -	DF96	10/-	TH2	8 -		
6U5G	8,6	DH73M	9/-	TH30C	8'-		
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Aerialite Co-Axial Sockets ... ... 11½d. ea.
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Miniature I.F. Transformers 465 Kc/s ... ... 8'- pair
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Full range of carbon controls, Med. spindle length, all values ... ... 1/3 ea.
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New Miniature Models for use with Transistor Amplifiers, etc., etc., 8/1.75. Diameter 1¾in. Total depth 1in., 3 ohms Impedance, 2/6 9 ea. 8 2 x 3 Elliptical Speaker. Size 2 11/16in. x 1 27 32in. Depth 1 3/16in., 32/- ea.

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Marconi Dropper, resistance 1,000 ohms, 3 voltage taps 195/215, 216 235, 236 255... 1 - ea.

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4B.A. Terminals, Red and Black. Suitable for Battery Chargers, etc. ... ... 1 6 ea.

Studio "E" Kit. complete with Headphones, Battery, Valve, and all other parts to build this Popular Kit, 45/4.

A NEW HIGH FIDELITY AMPLIFIER

Type R.C.L. 2 Stage.
For use with a 3 ohm speaker, A.C. mains, 230-240 v., recommended for use with any record player. Control Knobs, Mains On/Off and Tone Volume.
Complete with 2 valves ready to operate, £3.19.6 each. Post 3 -.

NYLON DRIVE CORD. Non stretch, 6d. yd.

HEAD AND BREAST SETS

A pair of low resistance headphones 120 ohms resistance. A breast microphone with straps, etc. Packed in a strong wooden box, 10'6 ea. Post 3,-.

FOCUS UNIT

For 14in. or 17in. tubes, vernier adjustment by famous manufacturer. 15 - ea.

W.B. "STENTORIAN" HIGH FIDELITY UNITS

MODEL H.F. 1012
10in. Die-cast unit, incorporating 12,000 gauss magnet. Handling capacity, 10 watts. Frequency response, 30 c.p.s. —14,000 c.p.s. Base resonance, 55 c.p.s., £4.19.9.

MODELS H.F. 810 and H.F. 812

8in. unit incorporating 10,000 gauss magnet. Handling capacity, 5 watts. Frequency response 50 c.p.s.—12,000 c.p.s. Bass resonance, 65 c.p.s. Steel chassis, £3.2.0. Die-cast chassis (12,000 gauss), £4.3.6.

Attractive cabinets for 3 valve TRF Kit, complete with Chassis, dial, backplate, Dial Drum, Pointer, etc., etc., 27 6.

Complete Range of Metal Rectifiers. Compare the Prices. RM1, 4 6 ; RM2, 5/6 ; RM3, 7 6 ; RM4, 18 - ; RM5, 16/6, 14A97, 13 - ; 14A86, 13 6 ; 14A100, 15'-.

Isolation Transformers.—Mains Input NR20A. 2 volt, NR20B, 4 volt, NR200 6.3 v., all with 25% boost. All one price, 10 6 ea.

Full range of Osmor, Teletron, Wearite, Repanco Coils, Ferrite Rods, Coil Packs, etc., etc. See our catalogue for full details.

Selection of ½, ¼ and 1 watt resistors, all brand new, 12 6 per 100.
Maroon Twin Twisted flex, 6d. yd
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24 v. D.C. Bells, 4 6 ea.
Full wave rectifiers 12 v. 4 amps, 15 6 ea.

Pile wound chokes R.F., 1'6 ea.
Resistors T.S.L. ½ watt 10% Tolerance. Full range of Preferred Values, 6d. each. Also good selection of ½ watt 1% types 2 6 each. Order forms available on request.
Ceramic condensers by Top Manufacturers. Good selection in stock Price 9d. ea.

Aerialite Loft Aerials, 3 Element, 27'6 ; 5 Element, 37 6 ; Suitable for Channels 8, 9, 10.

We hold large stocks of Control Knobs, Brass Nuts and Bolts, Toggle switches, wavechange switches, tag boards and panels. All are listed in full detail in our current Catalogue. Send 1 - in stamps for your copy.

CYLDON "TELETUNER"

All types available, Stations of your choice. Fit this Converter and your troubles are over. £7.7.0 ea.

Aerials and Oscillator Coils (All Channels—all frequencies), 7 6 pair.

Also available from stock, complete range of spares.

Teletron Companion, complete kit of parts for this 3 Transistor Pocket Radio, Ferrite Rod, Case, etc., 89 6.

CONTROL KNOBS

Long knocked knobs for T.V. Receivers in walnut, black and cream, 1 - ea.

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Dubilier kits of condensers and chokes for Interference Suppression. 1 amp kits, 5/6 ; 2 amp kits, 6,- ; 3 amp kits, 6 6.

REVISED SECOND EDITION "POINT3 ON PICK UP3"

A Replacement Guide to pick up heads, cartridges, styli. Over 195 illustrations, 5 - ea.

Osmor Coils for Collaro Type Deck Transcriptor

QT6 Bias Filter coil, 7 6 ea.

QT7 Treble Boost coil in Mu Metal can, £1.7.6 ea.

QT9 Bias Osc. coil, 7 6 ea.

Osmor Coils for the Beginner's Short wave Receiver

Radio Constructor, Aug., 1957.
SW Q1 31 11 Mc/s, 6 - ea.
SW Q2 12 4.5 Mc/s, 6 - ea.

SCRATCHOFF

Removes scratches from Radio & T.V. Cabinets in Polythene Dispenser Tubes, 3 - ea.

MAINS TRANSFORMERS 3-WAY MOUNTING TYPE

M.T.1. Primary 200 220 240 v. Secondaries, 250-0-250 v. 80 mA. 0-6.3 v. 4 A. 0-4 v. 2 A., both tapped at 4 v., 21 9 each. Postage and Packing please add 2/- per transformer.

M.T.2. Primary 200 220 240 v. Secondaries 350-0-350 v. 80 mA. 0-6.3 v. 4 A. 0-5 v. 2 A., both tapped at 4 v., 21 9 each. Postage and Packing please add 2 - per transformer.

M.T.3. Primary 200 220 240 v. Secondary 30 v. 2 A. taps at 3 v., 4 v., 6 v. 8 v., 9 v., 10 v., 15 v., 18 v., 20 v., 24 v., 21 9 each. Postage and Packing please add 2/- per transformer.

DON'T BE CAUGHT LIKE THIS

CAR STARTER CHARGER KIT

All parts to build 6- and 12-volt charger which can be connected to a "flat" battery and will enable the car to be started instantly. Kit comprising the following.

Mains transformer	22/6
5-amp rectifier	17/6
Regulator Stud Switch	3/6
Resistance Wire	2/-
Resistance Former	2/6
Mains on/off Switch	2/6
0-5 amp. Moving Coil Meter	12/6
Construction Data	1/6

Or if bought all together price is 52/6, plus 3/6 post and packing.

Yours for £1.10.0 Down

and 8 monthly payments of £1 or cash price £8.10.0

The latest most up-to-date Record Player made by the famous B.S.R. company. Using Hi-Fi Crystal Pick Up and fitted with every modern device. Definitely a record changer which will give years of trouble-free music. Not surplus but the current model. Price £8/10/- or £1/10/- deposit and 8 monthly payments of £1, carriage and insurance 5/-.

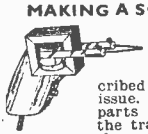
MINIATURE MOTOR

Size only 2¼in. long by 1¼in. diameter—American made—laminated poles and armature—intended for 28-volt D.C. but O.K. on lower D.C. voltages and A.C. mains, through step-down transformer—price 10/6, post, etc., 2/-.

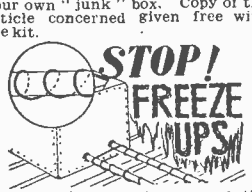
SUPPRESSOR CONDENSER

Stop your drill or other appliances interfering with your or your neighbours' radio or television. Simple instructions given. 2/6 each, 24/- dozen.

MAKING A SOLDER GUN



A 7-second solder gun of the type costing £3-14 was described in last month's issue. Only two essential parts are required—(a) the transformer and (b) the push switch. These we can supply at 13/6, plus 2/- post. The rest of the parts you will have in your own "junk" box. Copy of the article concerned given free with the kit.

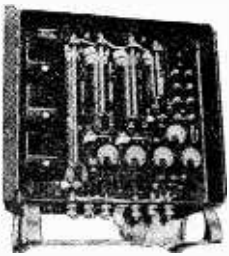


Wrap our heater cable around the pipes in your loft to prevent a freeze-up. 21 yards £1/1/- post free.

The "CRISPIAN" Portable Radio

A 4-valve truly portable battery set with very many good features as follows: Ferrite rod aerials, low consumption valves, superhet circuit with A.V.C. ready-built and aligned chassis if required, beautiful two tone cabinet covered with I.C.I. rexine and Tygan. Guaranteed results on long and medium waves anywhere. All parts, including speaker and cabinet are available separately or if all ordered together the price is £7/15/- complete, or 35/- down and 7 payments of £1/0/0, post and ins. 3/6, ready-built chassis 30/- extra. Instruction booklet free with parts or available separately, price 1/6.

CHARGING SWITCHBOARD



Offered at about one-twentieth of original cost. This is an ex-Government switchboard. It contains three reverse current relays, one voltmeter, one main ammeter, two secondary ammeters and three variable resistors for controlling circuits. These are original cases. Price £2/15/-. Carr. 10/-.

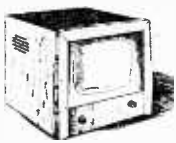
MULLARD AMPLIFIER "510"

A Quality Amplifier designed by Mullard. Power output exceeds 10 watts. Frequency response almost flat from 10 to 20,000 C.P.S. For use with the Acos "Hi G" and other good pick-ups. Made up and ready to work is £12.10.0 or £1.10.0 down and 8 payments of £1.10.0, plus 10/- carriage and insurance.

MULLARD PRE-AMPLIFIER

For extra gain and fidelity this unit gives ideal results. It is arranged to plug into the amplifier and has two switches to provide compensation for radio, microphone, L.P. and 78 records. Complete with valve made-up ready to work, £4. Post and insurance 3/6, or 10/- deposit and eight monthly payments of 10/-.

14in. T.V. CABINET



14in. T.V. cabinet of the latest styling made for one of our most famous firms—beautifully veneered and polished—limited quantity—19/6 each. Carriage and packing 3/6 extra.

INDICATOR No. 96

Contains many hundreds of very valuable spares including no less than 12 potentiometers. This indicator unit will take the VCR97 or the VCR517 and with relatively simple modifications can be turned into an Oscilloscope. Limited quantity offered at the extremely low price of 10/- each, carriage and packing 4/6 up to 250 miles, beyond this distance at cost.

All major components for making a tube tester and re-activator (described in December "Practical Television"). Available as a parcel price £3 plus 3/6 post and packing.

W.D. CIRCUIT DETAILS

Diagrams and other information extracted from official manuals. All 1/6 per copy, 12 for 15/-.

American Service Sheets	R. 109
A.1134	78 receiver
BC.348	76 receiver
BC.312	R28/ARC5
R.103A	R1116A
BC.342	RA-1B
RA-1B	AR88D
R-208	AN/APA-1
R-1155	78
R-1124A	76
R-1132A/R-1481	R.T.18
R-1147	CAY-46-AAM-
R-1224A	RADAR
R-1082	A.S.B.-3
R-1355	Indicator 62A
B.C.1206-A/B	Indicator A.&B.3
B-455-A (or-B)	Indicator 62
B-454-A (or-B)	Indicator 6K
B-453-A (or-B)	R.F. unit 24
Transmitter T1154	R.F. unit 26
Fifty-eight walkie talkie	R.F. unit 25
	R.F. unit 27
Frequency meter B.C. 221	Wireless set No. 19
	Demobbed valves

THERMOSTATS

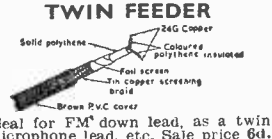
2¼in. x 1in. x 1¼in. high. Useful for the control of appliances such as convectors, gluepots, vulcanisers, hot plates, etc. Adjustable to operate over temperature range 50-550 deg. F., fitted with heavy silver contacts.

1¼ amp., 3/6; 5 amp., 8/6; 2 amp. QMB, 5/6; 15 amp. QMB, 15/-. 15 amp. wall mounting type, 19/6.

SAPPHIRE NEEDLES

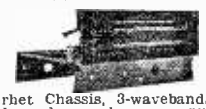
Unrepeatable bargain—new and perfect—two types available: miniature E.M.I. and Standard (trailer). Sale price 1/- each or 10/- doz.

TWIN FEEDER

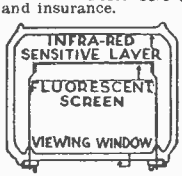


Ideal for FM down lead, as a twin microphone lead, etc. Sale price 6d. per yard. 80 ohm co-ax. low loss for Band III, 8d. per yard.

CHASSIS ASSEMBLY



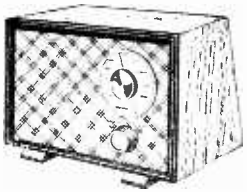
Superhet Chassis, 3-waveband, coloured scale, scale pan, pulleys, driving head, springs, drum, etc. Scale size 14¼in. x 3¼in. Chassis size 15in. x 15in. x 2in. Price 15/- plus 1/6 post. Note: We can supply cabinet for this. Price 39/6 plus 5/- carr. and insurance.



"SNIPER-SCOPE"

"Cats eye" used for seeing in the dark. Will work burglar alarms, counting circuits, smoke detectors and the hundred and one other devices as will the simpler type of photo cell. Price 5/- each. Post and ins. 1/-. Data will be supplied with cells if required.

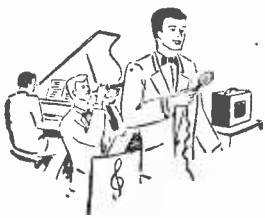
OUR 19/6 COLUMN



THE SKYSEARCHER

This is a 2-valve plus-metal receiver set useful as an educational set for beginners, also makes a fine second set for the bedroom, workshop, etc. All parts, less cabinet, chassis and speaker, **19 6**. Post and ins. 2 6. Data free with parts or available separately 1/6. **3-valve battery version also available at the same price.**

ALL-MAINS AMPLIFIER



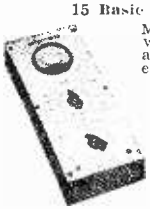
Powerful three-valve Mains amplifier ideal for dances, parties, etc. Complete less chassis, cabinet and speaker (available if required)—data 1 6 (free with parts). Price **19'6**, plus 2 6 post and insurance.

Simplex Transistor Kit

Makes ideal bedroom radio, uses one transistor and one crystal diode. Complete less case **19'6**, case 5 - extra post and ins. 1 6.

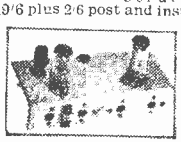
A.C./D.C. Multimeter Kit

15 Basic Ranges



Measures A.C./D.C. volts D.C. current and ohms. All the essential parts including metal case moving coil meter, selected resistors, wire for shunts, range selector switches, calibrated scale and full instructions

Price 19/6 plus 2/6 post and insurance.

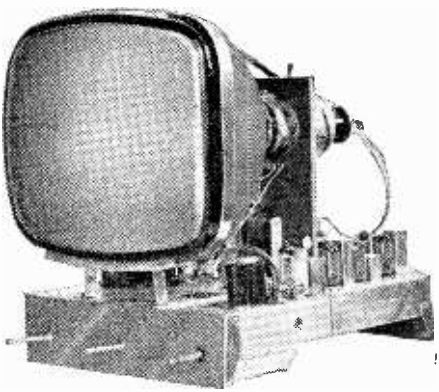


BAND III CONVERTER

Suitable Wales, London, Midlands, North, Scotland, etc. All the parts including 2 EF80 valves, coils, fine tuner, contrast control, condensers, and resistors. (Metal case available as an extra.) Price only **19 6**, plus 2/6 post and insurance. Data free with parts or available separately 1/6.

17" UNIT BUILT TV CHASSIS

Complete with tube and speaker, delivered to you for **£8** deposit and weekly payments of **25 -** for **35**, weeks or **£47** cash with order. Non-callers add 10 - carriage and insurance.



This is a most up-to-date Televisor

for home construction, can be completed in one evening (only 24 solder joints to make). When finished equal to any factory made set. Note these features :

★ No technical knowledge required.
★ 12 channel turret tuner.
★ All miniature valves and metal rect.
★ Ferrox coied e.h.t. scan coils.
★ Vision and sound interference suppression.

If required less tube and speaker price is **£29.10.0** or **£7** down and 25 weekly payments of **£1** : add 10 - carriage and insurance. **Constructional data and full information 3/6 post free.**

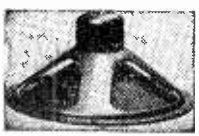
THIS MONTH'S SNIP

19 Range Testmeter

Can be yours for only 10/- deposit and 19 payments of 10/- weekly. Like all AVO meters it is a very fine instrument: it has a sensitivity of 10,000 ohms per volt and 19 most useful ranges as follows:—D.C. volts 0-1,000 (seven ranges), A.C. volts 0-1,000 (five ranges), D.C. Current 0-1 amp. (5 ranges), resistance 0-2 megs. (2 ranges), (complete with test leads). Immediate delivery. **Cash price £9.10.0—non-callers please add 3/6 post & ins.**

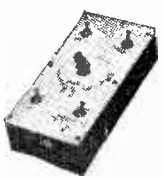
FREE GIFT.—All purchasers of the above item this month, will receive the M.M. Range Extender which adds : capacity 0.1 m.f. in two ranges —inductance 0-100 henrys and decible —20 to + 36

SPEAKER BARGAIN



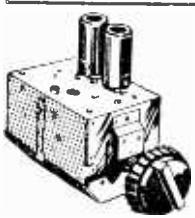
12in. Hi-fidelity loudspeaker. High flux. Permanent magnet type with standard 3 ohm speech coil. Will handle up to 12 watts. Brand new by famous maker. Price **32/6** plus 3'6 post and insurance.

TRANSISTOR TIMER



All the parts for making transistorised Enlarging or Process Timer with constructional details. **£2.10.0.**

NOW 2 MODELS Turret Tuner



Brand new stock, not surplus, with coils for Banu I and III complete with valves. Model 1 I.F. output 33 33 Mc/s. Series heaters. Model 2 I.F. output 16-19 Mc/s. Parallel heaters. With instructions and circuit diagram, **79/6**. With knobs 3/6 extra. post and insurance 2/6.

Guitar Amplifier operates directly from A.C. mains—high-fidelity.

3-valve 4/5 watt with frequency response better than 40-15,000 c.p.s. Control panel size 8in. x 2½in. comes fixed to chassis but is intended for independent mounting. Separate bass and treble controls giving fullest variation of cut and lift. Separate switch. absolutely no mains hum. Remarkable value at **£4 19 6.**

BEGINNER'S SUPERHET

All the components including metal chassis, valves, metal rectifier, coils, tuning condenser, etc., etc., required to build the " Beginner's Superhet " as described in the January issue, are available as a parcel. Price **£3** plus 3 - post and insurance.

ELECTRONIC PRECISION EQUIPMENT, LTD.

For Prompt attention post orders should be sent to our Eastbourne address marked Dept. 7.

42-46 Windmill Hill, Ruislip, Middx.
Phone : RUISLIP 5780
Half day, Wednesday.

66, Grove Rd., Eastbourne, Sussex.
Half day, Saturday.

29, Stroud Green Rd., Finsbury Park, N.4.
PHONE: ARCHway1049
Half day, Thursday.

266, London Road, Croydon.
Phone : CRO 6558.
Half day, Wednesday.

PRACTICAL WIRELESS

EVERY MONTH EDITOR : F. J. CAMM 26th YEAR OF ISSUE

VOL. XXXIV, No. 615, MARCH 1953

COMMENTS OF THE MONTH BY THE EDITOR

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CONTENTS :

The Editor will be pleased to consider articles of a practical nature. 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.*

STEREOPHONIC SOUND TESTS

EARLY in January the BBC, without any prior hint to the press, undertook some tests of stereophonic sound, involving simultaneous transmission and reception on different channels, and intended to give a realistic binaural effect. The experiment involved using two different receivers in the home to receive the transmissions on the two separate channels. The first experiment was radiated from Wrotham and the second on the Medium Wavelength from Brookmans Park. The two receivers have to be placed a few feet away from one another with the listener forming part of a triangle of which the two receivers are the base.

The results were surprisingly good. In its repeat performance, the sound section of the TV station at Crystal Palace was used, but this did not show any marked improvement. A strange effect is that the sound does not appear to come from either speaker. No statement has been made as to whether it is proposed eventually to radiate programmes on this system, which obviously will most benefit owners of V.H.F. receivers. It would seem that the use of two receivers would be a deterrent, until special receivers have been designed for the purpose. Stereophonic sound systems have, of course, been in use in connection with the cinema and P.A. for several years and with marked success.

"RADIO-CONTROLLED MODELS"

LARGE numbers of our readers are interested in the radio control of models, a hobby which has rapidly developed within the last 10 years and now has a controlling body—The International Radio-controlled Models Society.

They will be interested to know that we have recently published at 12s. 6d., by post 13s. 6d., "Radio-controlled Models," and this deals with almost every aspect of the subject, including the construction of receivers, control gear, transmitters, actuators, tuning control, auto switches, radio-controlled battleships, aircraft, etc. It contains 184 pages and 143 diagrams.

"THE PRACTICAL HOUSEHOLDER" EXHIBITION

"THE Practical Householder" Exhibition, organised by our companion journal, opens on Wednesday, February 19th, at the Empress Hall, Earls Court, London, S.W.6, and closes on Saturday, March 1st. The Exhibition is open from 11 a.m. to 9.30 p.m. Monday to Friday, and 10 a.m. to 10 p.m. on Saturdays. Price of admission is 2s. 6d.

We hope readers who visit the exhibition will call at our Stand No. 52. There will be daily demonstrations in the use of power tools, wood turning, paper hanging, use of paints, etc., and over 100 different manufacturers will exhibit a full range of their various products. We hope you will be able to spare the time to come.—F. J. C.

OUR NEXT ISSUE, DATED APRIL, WILL BE PUBLISHED ON MARCH 7th

Round the World of Wireless

By "QUESTOR"

Broadcast Receiving Licences

THE following statement shows the approximate number of Broadcast Receiving Licences in force at the end of November, 1957, in respect of wireless receiving stations situated within the various Postal Regions of England, Wales, Scotland and Northern Ireland. The numbers include Licences issued to blind persons without payment.

Region	*Total*
London Postal	1,094,406
Home Counties	1,108 780
Midland	827,705
North Eastern	1,082,489
North Western	804,073
South Western	692,970
Wales and Border Counties ...	432,203
Total England and Wales ...	6,042,626
Scotland	787,761
Northern Ireland	186,151
Grand Total	7,016,538

Audio Section at Earls Court

PLANS are in hand for broadening the scope of the National Radio Show when it is held at Earls Court, London, from August 27 to September 6, 1958.

At its monthly meeting recently the Exhibition Organising Committee of the R.I.C., under the chairmanship of Mr. F. W. Perks, discussed various new features including provision of a special audio section of the exhibition to cater for the increasing interest in high-fidelity sound reproduction.

This will involve the construction of more sound-proof demonstration rooms, large and small, to suit individual requirements.

"The popularity of sound demonstrations at the show in recent years has proved that there is a demand for more facilities of this kind." Mr. Perks told the Press, "but this is only one of several new plans which we shall be announcing after discussion with the various interests concerned."

Obituary

WE regret to report that Cecil Barker died on the 10th of December at his home. He had been ill for some years, fighting recurrent severe attacks of asthma and returning to his development work on natural sound reproduction whenever possible.

Cecil Barker was a musician, singer and acoustics engineer. He trained under Kennerly Rumford and sang with the d'Oyly Carte Opera Company for a while. In the 1930's he broadcast many times and began his work on loudspeakers, which led in 1936 to his patented dual drive. This was marketed under the Duode name by the Magnavox Company, and many will remember that unit.

In 1947 he started his own business with the Barker 148, and later revived the famous Duode mark under which a succession of his natural sound units found him many friends in all parts of the world.

Vice-Admiral Dorling

ON doctor's advice, but not with effect until October 31, 1958, Vice-Admiral J. W. S. Dorling, C.B., M.I.E.E., is to retire from his appointment as Director of the Radio Industry Council. He was the Council's first director, being appointed in 1946, immediately after the formation of the Council as the co-ordinating body of four associations in the industry.

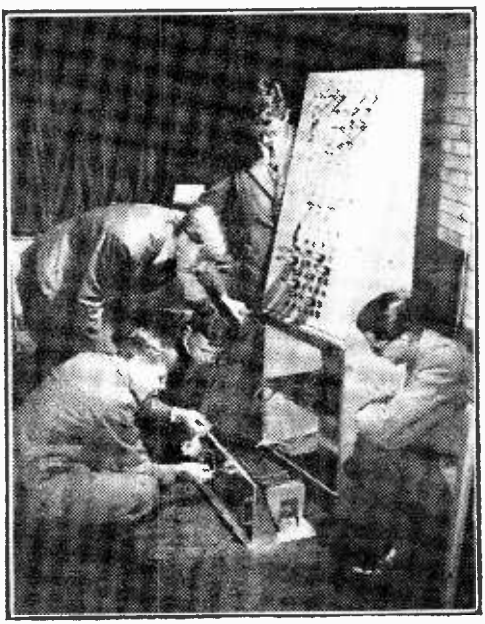
His resignation was regretfully accepted at a recent meeting of the Council. No successor has been appointed.

Admiral Dorling is present president of the Radio Industries Club. He made his first wireless set more than 50 years ago and had a distinguished career as a wireless officer in the Royal Navy in the first world war and after. His last command was the Royal Sovereign and after being Deputy-Controller of the Admiralty he went to the U.S.A. in 1941 as British Admiralty Supply Representative, taking over 813 U.S.-built ships on Lend-Lease.

New Radio Building for Budapest

WORK has restarted on new studios for the Hungarian Radio, adjoining the present building in Budapest. Begun in 1950, work was held up when it reached the first floor because of lack of funds.

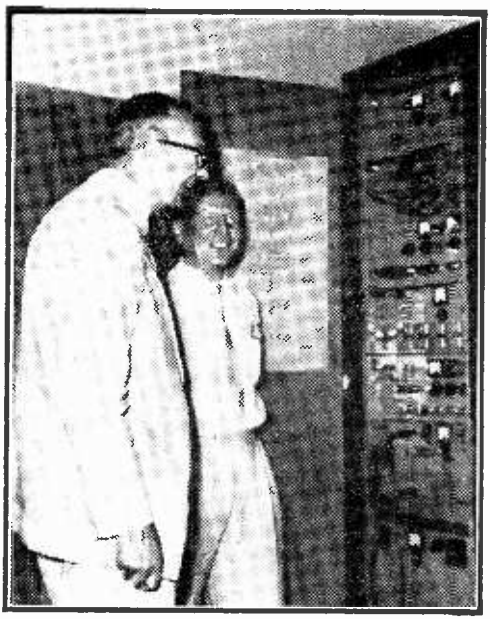
On the ground floor of the glass-fronted building—due to be completely finished by the end of this year—are eight studios. Two are medium sized and will be used for the transmission of light music and prose and the others are smaller news studios.



Sixth Form boys at St. Albans School are building a Computer. The machine is 5 ft. tall and is valued at £75.

On the second floor a studio for the transmission of plays will be built and will include a special sound effects department. There will be a "water room" where different water effects can be created and another room to reproduce the sound of footsteps on pavements, stairs, and different types of floor covering. There will also be an "echo room."

The structure of the building has now been completed and inside building work is going on.



During a recent visit to Nigeria, Sir Gordon Radley, Director General of the British Post Office, visited a number of sites of the extensive tele-communications scheme which is being constructed and maintained by Marconi's Wireless Telegraph Company for the Nigerian Posts and Telegraphs Department.

New Wenvoe Transmitters

THE BBC announces that, with the approval of the Postmaster General, additional transmitters are to be installed at Wenvoe, near Cardiff, to enable the station to broadcast the Third Programme and Network Three on VHF (very high frequency). A frequency of 96.8 Mc/s will be used with an effective radiated power of 120 kW. This will bring first-class reception of these programmes to a large number of listeners in South Wales and the West of England who have not hitherto been able to receive them satisfactorily.

The existing transmissions of the Welsh Home Service on 94.3 Mc/s, the West of England Home Service on 92.125 Mc/s and the Light Programme on 89.95 Mc/s will each continue on the full power of 120 kW as at present. It is hoped that the additional transmitters for the Third Programme will be ready in about a year's time. The temporary low-power transmitter at Bristol, which has carried the Third Programme on VHF since October 28, will then be closed down.

1957 Radio Record

NEW export records are assured for the British radio industry for 1957. Exports for November brought the total for the first eleven months of the year to over £39.7m., which is within £500,000 of the value, a record, for the whole of 1956, of just over £40.0m.

The forecast for the whole of 1957 is that the value of exports will approach £43½m., more than four times that for 1947, of £10.2m.

Exports of sound reproducing equipment (including record changers and players, electronic amplifiers, whole public address systems, etc.), were worth nearly £925,000 in November, the highest total since March, 1957. They brought the total for the first eleven months to nearly £9.0m., compared with £7.6m. for the whole of 1956.

The value of exports of components and test gear, over £9.0m., and of valves and tubes, over £3.6m., have also already exceeded those for the whole of 1956 (£8.7m. and £3.5m. respectively), and overseas sales of capital equipment (transmitters, communications equipment, navigational aids, etc.), now within reach of £15.0m. for the first eleven months, compares with £16½m. for the whole of 1956.

The B.I.R.E.

THE following meetings will take place during February, 1958:

London: London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, London, W.C.1. Wednesday, February 26th, at 6.30 p.m.—Decca: A Long-range Navigational Aid—C. Powell.

South Wales Section: Wednesday, February 26th, at 6.30 p.m, Glamorgan Technical College, Treforest. Industrial Television —R. Swinden. J. E. H. Brace, B.Sc.

South Midlands Section, Friday, February 28th, at 7 p.m. North Gloucestershire Technical College, Cheltenham. Some Advanced Application on Information Theory. — P. H. Blundell.

West Midlands Section: Wednesday, February 12th, at 7.15 p.m. Wolverhampton Technical College, Wulfruna St., Wolverhampton. Industrial Applications of Radio Isotopes—R. F. Armitage.

Siemens Lecture

A CENTENARY lecture—"Siemens Brothers, 1858-1958—100 Years of Electrical Engineering"—is to be given by Dr. J. N. Aldington, B.Sc., F.R.I.C., F.Inst.P., M.I.E.E., F.I.E.S., Chairman and Managing Director of Siemens Brothers, in the Central Hall, Westminster, at 6.30 p.m. on March 5th, 1958. Lord Chandos, Chairman of Associated Electrical Industries, Ltd., will be in the chair.

Dr. Aldington is principally known for his work on the development of electric lamps. For many years he was head of the Siemens Preston Lamp Research Laboratories which, under his direction, made a number of important contributions to the development of gas discharge lamps, ballast resistances, impulse valves, and kindred devices.

A Super-sensitive Transistor Receiver

A SINGLE-STAGE RECEIVER WITH NOVEL FEATURES

By C. Sinclair

THE majority of transistor receivers which have appeared in the press in the past have used crystal diodes for detection immediately after the first tuned circuit, the diode being followed by one or more stages of A.F. amplification. However, this type of receiver has little more sensitivity than a crystal set and is only really efficient with an external aerial of reasonable size. The reason for this is the crystal diode itself. The diode is non-linear in its rectifying ability, and below a certain signal level the efficiency is roughly proportional to the signal level. However, now that R.F. transistors are available at reasonable prices a really sensitive pocket receiver may be constructed without going to the complication and expense of a superhet.

LIST OF COMPONENTS

One 1 megohm variable resistance hearing-aid type.
One .001μF condenser 150 v.w.
One 500 pF trimmer.
One piece of ferrite 2in. x ⅜in. dia.
One white spot transistor.

As may be seen from the diagram (Fig. 1) the circuit is of rather an unusual nature and has been designed to obtain the highest possible efficiency from a single transistor. Although the circuit appears very simple (the number of components has been kept to a minimum), the actual way in which it operates is surprisingly complex so no attempt will be made to go into details.

Regeneration

The circuit is in fact a special form of regenerative detector in which oscillation automatically ceases when a station is accurately tuned in. All the components are readily available on the surplus market and the transistor used in the prototype was a white spot; this performed very reasonably.

Construction

Several coil systems were tried out but the best proved to be a Teletron FRM ferrite rod aerial cut down to a length of 2in. To do this remove the rubber grommet from one end of the ferrite. Now cut a groove on opposite sides of the rod and just about in the centre, using either a small file or a hacksaw. Then, holding one end of the rod in each hand, firmly snap it in two. The rubber grommet must now be replaced on the half of the ferrite which holds the coil. If you wish to wind your own ferrite rod aerial this can be done and the results are very little different if care is taken. Sixty turns of D.S.C. or D.C.C. wire, 34 gauge, should be close wound in three layers right at the centre of a 2in. piece of ferrite rod ⅜in. diameter.

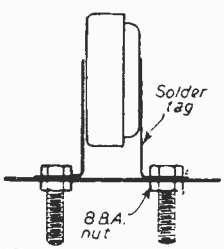


Fig. 2.—Details of the Battery Mount.

Tuning

If a really miniature receiver is required then a trimmer must be used. This should have a maximum value of 500 μμF, although any value above 250 μμF will have sufficient capacity to tune in the Home, Light and Luxembourg services, the Home being tuned when the value is approximately 200 μμF. If the existing screw is removed from the trimmer, one of the same gauge but greater length may be fitted, making it possible to sweat or bolt a suitable knob on. The battery used depends on the size to which you wish to keep the set, but if it is to be really small, a Mallory hearing aid cell, the RM250 should be used. This cell, which is obtainable from Boots the Chemists, is ideal as it has almost constant voltage with life enabling the station desired to be preset if necessary.

The 1 megohm potentiometer is of the type used in hearing aids, and several firms sell these as surplus for about 1s. If they are equipped with an on/off switch this may, of course, be used but if there is none the set can be switched off merely by disconnecting the head-phones. The transistor itself can either be wired into the circuit or inserted in a suitable holder.

Operation

When the set has been completed and inserted into a suitable non-metallic case it should be tested in the following way:—

Connect up an aerial of a few feet of insulated wire (a couple of yards will be sufficient in most areas), turn the volume control to maximum, and switch on by means of connecting up the headphones or hearing aid earpiece (4,000Ω optimum).

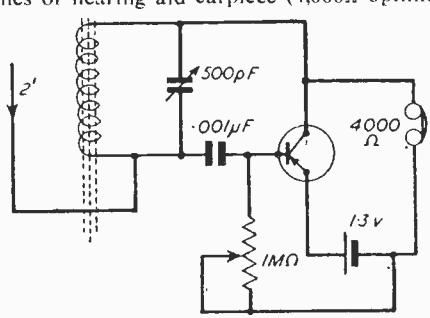
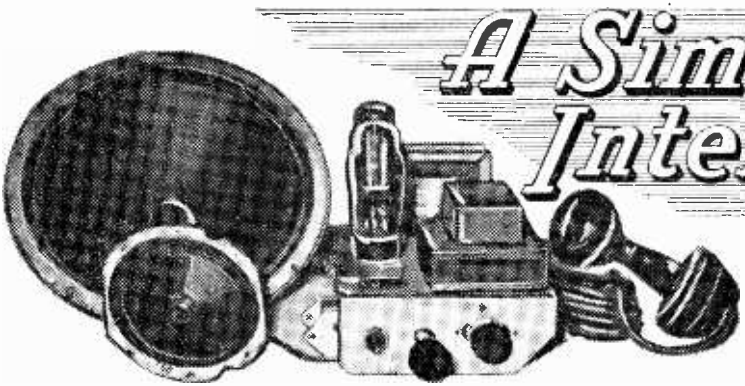


Fig. 1. Theoretical circuit.



A Simple Inter-Com.

By D. J. Russell

DETAILS OF A SIMPLE AND EFFECTIVE TWO-WAY LOUDSPEAKING TELEPHONE CIRCUIT

THERE must be many readers, especially those in business, who would welcome a discreet inter-com. set instead of the usual type which makes use of a loud-speaker at either end. Whilst the latter is excellent in certain circumstances, it can have a distinct disadvantage when one end is located, for instance, in a busy shop.

The salient advantage poin's of the inter-com. to be described can be briefly summed up as follows:—

(a) A conversation can be carried out between one person or more in a work-room to one person only at the other end, e.g., a floor manager.

(b) Work-room personnel cannot overhear normal floor conversation or vice versa, due to the limited range of the G.P.O. hand-set.

(c) Economical and simple in construction, by using one output valve to amplify speech from either end; one microphone transformer for both loud-speaker and calling system, and the absence of any extensive switching arrangements.

Circuit Details

The circuit will be divided into two halves for explanation purposes. The first half, which is quite conventional, is a two stage amplifier using V1 and V2, with a call system wired in.

Speech from the workshop is made into L.S.1 and fed into the grid of V1 via VR1. After further amplification by V3, speech is fed to the G.P.O. hand-set, marked in the diagram as A and B.

The calling signal from the workshop is effected by depressing switch 1 which cuts out

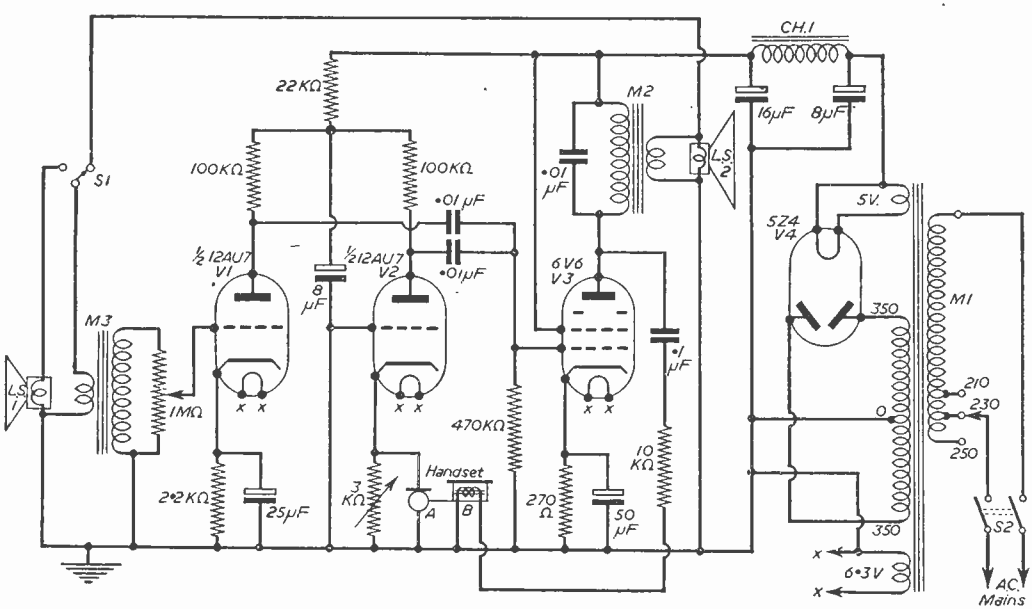


Fig. 1.—Theoretical circuit of the inter-com.

the speech coil of L.S.1 and brings in feed-back from the output transformer, M2. The signal again feeds to the hand-set via C7 and the limiting R7.

The second half utilises a grounded grid L.F. amplifier: V2 being the first valve and V3 the output. Speech from the floor manager end is fed in across the cathode resistor VR2. The cathode voltage energises and makes a low impedance input for the carbon mike "A." VR2 limits the voltage and acts as a gain control. No calling system is needed from the hand-set A and B as the normal voice is amplified to speaker volume in the workroom by L.S.2.

Construction

A four sided aluminium chassis 8in. × 6in. × 2in. gives ample space for mounting the components. From Figs. 2 and 3 the general lay-out of the parts can be seen. No special precautions are needed in making up this inter-com. set beyond taking care as to the positioning of the microphone transformer in order to keep hum level at a minimum and ensuring that Sw. 1 is of the "one make one break" type, otherwise feed-back will blow the cone of L.S.1.

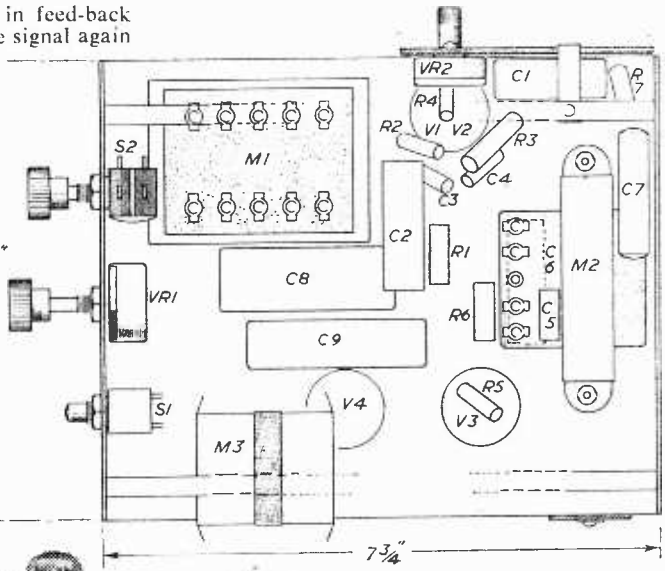
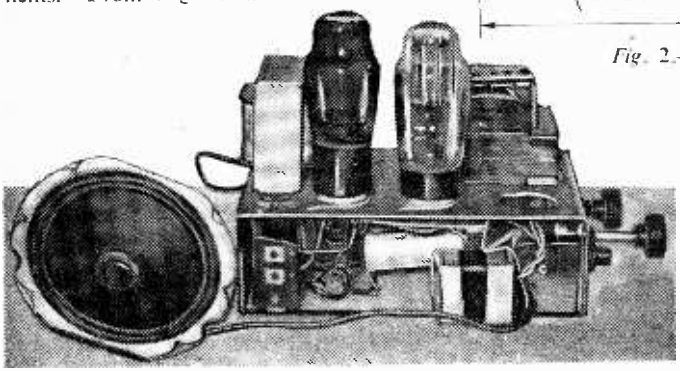


Fig. 2.—Layout of the main components.



Another view of the inter-com. set-up.

Conclusion

The set has been in use for several months and has given excellent results.

COMPONENTS LIST

RESISTORS	CAPACITORS
R1 22k	C1 25 μF/25 vwk.
R2 100k	C2 8 μF/450 vwk.
R3 100k	C3 .01 μF/450 vwk.
R4 2.2k	C4 .01 μF/450 vwk.
R5 470k	C5 .01 μF/450 vwk.
R6 270 ohms	C6 50 μF/25 vwk.
R7 10k	C7 .1 μF/450 vwk.
VR1 1MΩ	C8 16 μF/450 vwk.
VR2 3k pre-set	C9 8 μF/450 vwk.

VALVES	SWITCHES
V1 and V2, 12AU7	S1 Push button (one make one break).
V3 6V6G	S2 D.P. on/off.
V4 5Z4G	

TRANSFORMERS

M1 350-0-350 v. 70 mA. 6 v., 5 v.
M2 Output (8,000 load).
M3 Input 100-1.
CH1 L.F. choke, 40 H. 70 mA., 1.2 k.Ω
1 G.P.O. type hand set.

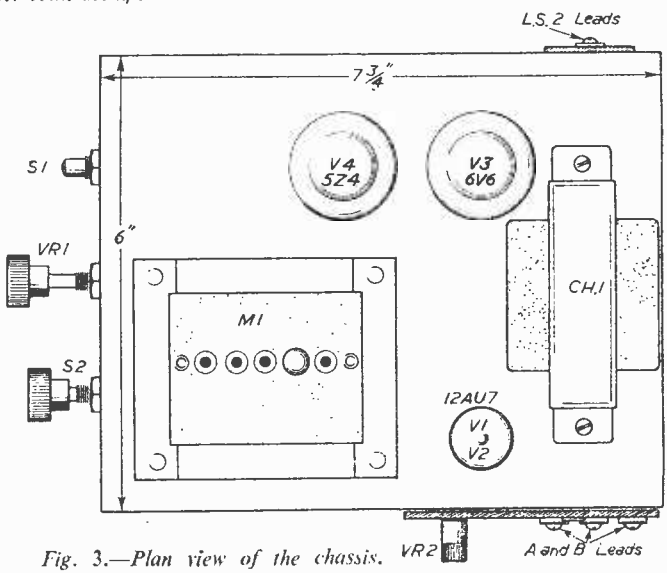


Fig. 3.—Plan view of the chassis.

Redetermination of the Standard Ampere

AN ACCOUNT OF RECENT TESTS OF THE STANDARD OF CURRENT

A RECENT experiment at the American National Bureau of Standards has shown that the standard ampere maintained by the Bureau has drifted no more than a few parts per million in the last 15 years. Such a small apparent change may well be due to slight errors in measurement, so that the standard ampere may actually have remained perfectly stable since its original evaluation in 1942.

Because of the importance of precise electrical measurements to modern science and industry, the Bureau maintains permanent primary standards of two basic electrical quantities, voltage and resistance. From these basic electrical standards, the Bureau has derived other standards for all electrical quantities in use today. One of these, of course, is electric current. Because current is transitory, the primary standard ampere cannot be kept in the form of a material object, such as the standard cells that maintain the volt or the standard resistors that maintain the ohm. Each time the standard ampere is required, it must be obtained anew from the stardard volt and the standard ohm by use of Ohm's law. However, a gradual change might sometimes occur in the standard cells or the standard resistors. One method of checking the stability of these standards is to compare the standard ampere derived from them with the "absolute" ampere, that is, the ampere obtained experimentally in terms of mechanical units of length, mass, and time.

In the present determination, R. L. Driscoll and R. D. Cutkosky, of the Bureau staff, measured the standard ampere in absolute amperes, using two different sets of apparatus. One was the current balance used in the 1942 evaluation; the other was a Pellat type electrodynamometer, which was introduced to reduce the possibility of systematic errors. The standard ampere was found to equal 1.000008 absolute amperes by the current balance method and 1.000013 absolute amperes by the Pellat instrument. The weighted mean of these two values is 1.000010 absolute amperes, but in this mean there is an uncertainty of 5 parts per million. If no accidental errors were made in either the original or the present evaluation and if all systematic errors remained fixed, then the value of the current yielded by the electrical standards of resistance and voltage has decreased by 6 parts per million. On the other hand, known sources of accidental error in the current balance determinations could easily account for the apparent drift.

The Current Balance

The ampere was evaluated with helical coils by determining the mechanical force between the two parts of the circuit through which the current flows. In the centre of two large, fixed, coils, a smaller coil is hung from the arm of a precision balance. All three coils carry the current to be measured, but the current in the fixed coils can be reversed. The electromagnetic force developed by the current in the coils tends to pull the movable coil downward for one direction of the current in the fixed coils but tends to lift it when this current is reversed. From the change in the force on the balance when the current is reversed and from the measured dimensions of the coils, the value of the current in absolute amperes can be computed. The uncertainty in this method arising from all known sources is estimated to be 6 parts per million.

The Electrodynamometer

The modified Pellat electrodynamometer consists essentially of a long stationary horizontal solenoid 28 cm. in diameter, a short solenoid 11.6 cm. in diameter, and a balance. The smaller coil, which is mounted on the balance beam, is inserted into the longer solenoid so that the coil axes are perpendicular. Current in the outer solenoid produces a magnetic field which is essentially constant at its centre. When the coils are connected in series an electromagnetic torque on the smaller solenoid is produced. The small coil therefore tends to tip. Since the balance-beam rests on a knife-edge, the tipping of the coil attached to the beam upsets the balance. The system is restored to equilibrium with a suitable counterweight. When the current in the stationary coil is reversed the coil tips the other way and equilibrium is restored by placing a mass on the end of the balance arm.

During this operation, the current was held constant at about 1.02 amperes, the value being determined by the standard cell and standard resistor. These standards were maintained at a constant temperature and compared from time to time with the Bureau's primary standards. The mass which counteracted the change in torque was adjusted by trial and later evaluated by comparison with known standards. A calibrated scale on the balance allowed for small corrections to the balancing mass. From the known value of the balance weight, the length of the balance arm, and the geometry of the windings, the value of the current was calculated.

The Bureau's electrodynamometer differs from Pellat's original in several ways. One such difference is its single-layer helical windings. The dimensions of the single-layer windings can be easily checked, whereas the uncertainty in the dimensions of the original balance introduced a source of error. The materials used in constructing the coils also differ from those used in the original. The stationary coil form and balance beam are of fused silica, the rotatable coil form is pyrex glass, and the winding is of oxygen-free copper wire. Special care was taken to insure low magnetic susceptibility in all parts. For example, aluminium alloys were used in the balance supports, and the brass and phosphor-bronze parts of the balance arrestment mechanism were tested for susceptibility.

A Switched "X" Amplifier for the 62A Oscilloscope

A MODIFICATION HINT WHICH NEEDS NO EXTRA PARTS

THE following notes should be read in conjunction with the articles which were published in the September and October, 1957, issues of this magazine describing the construction of an oscilloscope from the ex W. D. Indicator Unit 62A.

The purpose of this modification to the switching arrangements described in the original article is to enable the X amplifier to be automatically switched as a sync amplifier when the timebase is in operation.

The modification requires no extra components and thus involves no extra expense. The diagrams are really self-explanatory and, as can be seen, the modification merely requires that certain contacts of the X switch be inserted in the timebase circuit.

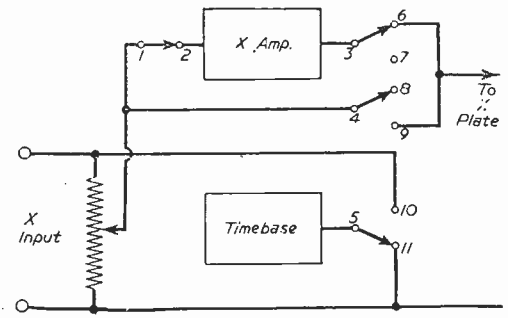


Fig. 1.—Original X switching circuit.

Modification

The timebase output is now connected permanently to the non-earthy end of the X sensitivity potentiometer. This connection can be simply made by unsoldering the appropriate leads from pins 5 and 10 of the X switch and soldering them together, insulating the naked wires from the chassis. Pin 11 is left earthed. Pins 5 and 10 are then connected in the timebase H.T. line as shown. Take care to see that this connection is made correctly for, if the two pins are accidentally reversed in the circuit, the H.T. will be shorted out when the X switch is put into the timebase position. This pair of contacts renders the timebase inoperative when the toggle is in the top two positions of its movement. This was found to be essential since the timebase was affecting the appearance of the trace due to the self-capacity of the X switch. The only other necessary alteration is to put two previously unused contacts (12 and 13) of the X switch into circuit as shown, and to take the moving contact of the sync potentiometer to Pin 7 of the switch.

It will be found that the modification is well worth while, since sync is made much more positive and is effective even for low-frequency sine waves.

For TV

Several constructors have written to ask if the oscilloscope is suitable for TV work. The oscilloscope is primarily designed for audio-frequency work, and is therefore not suitable for R.F. work in a TV set.

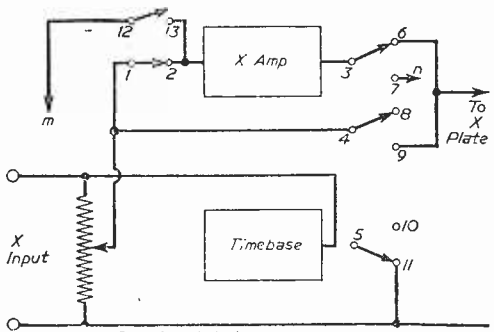


Fig. 2.—Modified switching diagram.

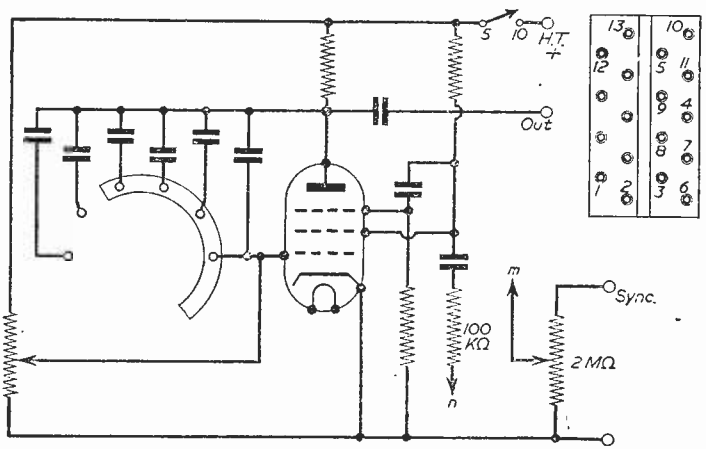


Fig. 3.—Modified timebase circuit.

Fig. 4.—(inset) Pin connections to the X switch.

Increasing T.R.F. Selectivity

HOW TO MODIFY OLDER TYPE STRAIGHT SETS

By F. G. Rayer

MANY T.R.F. receivers, even of comparatively simple type, have a high degree of sensitivity so that a good number of distant stations may be tuned in. The selectivity of tuning of such sets is, however, usually limited severely, and may be very poor with some circuits. The results of this are particularly noticeable during the hours of darkness, when many European transmitters may be received at excellent volume, but with interference from stations on adjacent channels. Some method of increasing the selectivity then becomes really worth-while, and in quite a number of cases this can be achieved without large scale alterations to the receiver.

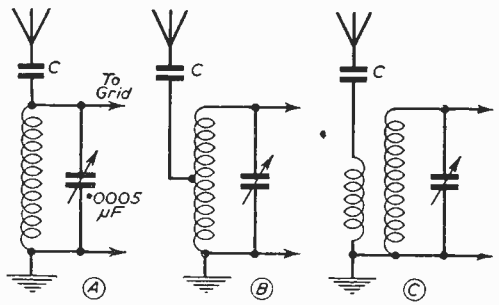


Fig. 1.—Alternative forms of aerial coupling.

The most commonly employed aerial circuits are shown in Fig. 1. That at "A" is not infrequently found in amateur designed receivers, and also appears in some simple A.C./D.C. T.R.F. receivers of low cost. The condenser C is usually about .0001μF. This circuit tunes quite flatly, and may almost always be abandoned with advantage. Its advantage lies in achieving good signal strength and in only requiring a very simple aerial coil. It should only be employed with *very short* aerials, and in receivers of comparatively low gain.

The method at "B" uses a tapped coil, and this reduces damping so that the coil can tune more sharply. That at "C" employs a separate primary, or "aerial coupling" winding, and is generally most satisfactory. In each case the value of the coupling or aerial condenser "C" may require to receive attention. In some A.C./D.C. sets the condenser is intended to keep mains voltages out of the aerial, and may be of large value (up to .1μF). In such instances it may be reduced in value, or have a second condenser of smaller capacity wired in series with it. A pre-set condenser is preferable, as its value can be adjusted. With the usual T.R.F. receiver sensitivity is adequate to permit of quite small values; e.g., a 50pF pre-set. As the value is reduced selectivity is increased, but volume falls off. A compromise is thus necessary.

If no primary is available on the aerial coil, about 40 turns of thin insulated wire (30 to 40 s.w.g.) is usually satisfactory for medium waves, with about 100 turns for long waves. This winding should be situated about ¼in. to ½in. from the tuned winding.

Intervalve Couplings

The method of coupling employed between R.F. and detector stages can similarly influence selectivity, and the methods most often seen are depicted in Fig. 2. That at "A" employs a choke and condenser C1. The latter may be about .0001 to .0003 μF, and may be reduced in value, or substituted by a pre-set condenser, to increase selectivity.

Transformer coupling, shown at "B," is often very satisfactory, if the coils are soundly designed. Tuned-anode coupling ("C" in Fig. 2) offers somewhat less selective results, but maximum volume. When selectivity is to be increased, choke or transformer couplings are preferable. The former allows of some control over selectivity, by adjustment of the coupling capacity, which is not possible with transformer coupling with standard coils.

A choke and condenser may also be used with a primary, as shown in Fig. 3, and forms one of the most selective single-coil intervalve circuits. Here, C1 is the aerial coupling condenser, and C2 the detector coil coupling condenser. By using low values, quite a high degree of selectivity can be achieved. The choke *must* be of good quality, intended for this application, and may require to be screened.

In T.R.F. receivers of this kind reaction is not often employed. This has the advantage of

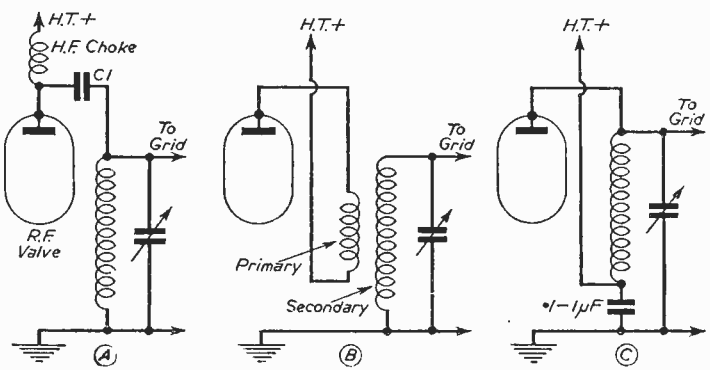


Fig. 2.—Common types of R.F. detector coupling.

simplicity of operation. But if maximum results are to be obtained, reaction should be introduced. It increases the selectivity of the detector circuit, and also compensates largely for the reduced signal strength arising from loose forms of coupling such as have been described. In battery-operated T.R.F. sets reaction is often found; but the higher gain of the main type of circuit has made it less frequent, here, and the possibility of employing it should not be overlooked. In general, it will improve the volume of weak stations quite noticeably. It should operate smoothly—if this is not so, detector voltages may be too high.

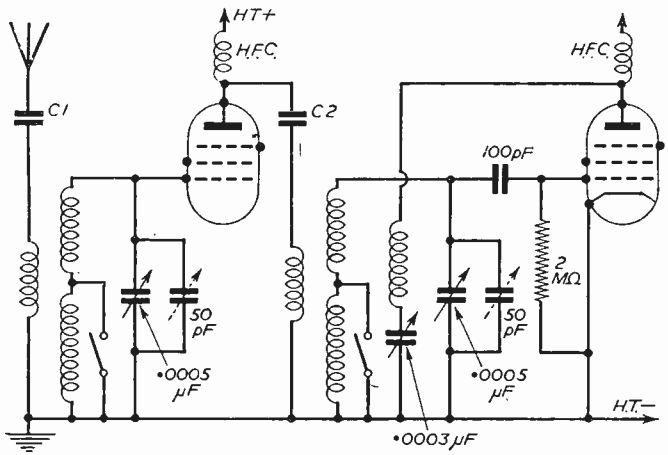


Fig. 3.—R.F. and detector circuit with reaction.

Additional Tuned Circuit

When circumstances permit, an additional tuned circuit will give a worth-while increase in selectivity. This may be used with a further R.F. stage as will be explained, or may be introduced without increasing the number of valves.

Fig. 4 (A) shows one method of employing a further coil—this should be of the same type as that already used in this stage, and may be for medium waves only, or for dual-range tuning. The coupling condenser must be of very low capacity, about 5 to 10 pF being usual. It may be made up by twisting together two insulated wires for about ½in. The value may subsequently be adjusted for best results by modifiying the length of twisting. A three-gang condenser will be required for tuning, assuming that the receiver has one R.F. stage.

Bottom-end coupling is shown at Fig. 4 (B), and gives similar results. Here, C requires to be of large value—about .005 to .05 μF. The resistor R may be of low value, 250 to 5,000 ohms being satisfactory. Its purpose is primarily to provide a D.C. path to the grid of the valve. With this form of coupling, it is possible to increase selectivity by increasing the value of C. (With the circuit at "A" in Fig. 4, selectivity is increased as the value of the coupling condenser is *reduced*.) It is also possible to omit the condenser, using a very low value for R—about 5 to 50 ohms.

In both circuits, the tuning coils are separated, so that no appreciable coupling arises between one tuned winding and the other. The aerial primary and tuned winding will, of course, be coupled together in the usual way.

Alignment

Accurate alignment is absolutely essential for best results and maximum sensitivity, and becomes increasingly important as the sharpness of tuning is increased. After *any* modification to any tuned circuit the circuits must be realigned or trimmed. If this is not done, the full benefit possible from such changes will not be achieved.

With simple air-cored coils a single trimmer is usually employed with each coil. This should be adjusted for maximum volume at a point fairly low in the medium-wave band (e.g., about 230 to 250 metres). An insulated tool should be used. If maximum results from some "difficult" station are particularly desired, the receiver may be trimmed for highest sensitivity at this point.

If individual coils are used for medium waves and long waves, then each band may be trimmed separately. With dual-range coils, however, trimming is best undertaken on the medium-wave band, as explained.

If the coils have adjustable dust cores, these should be adjusted for maximum volume at a fairly high wavelength—say 450 to 500 metres, in the case of those tuning medium waves. A fully insulated tool must be used, as the inductance of the coils would be modified by introducing a metal blade into the former.

In old receivers, a fully-variable R.F. trimmer, panel operated, may be present. This is not usually required with present-day receivers, but is worth considering if the coils do not gang exactly over each waveband.

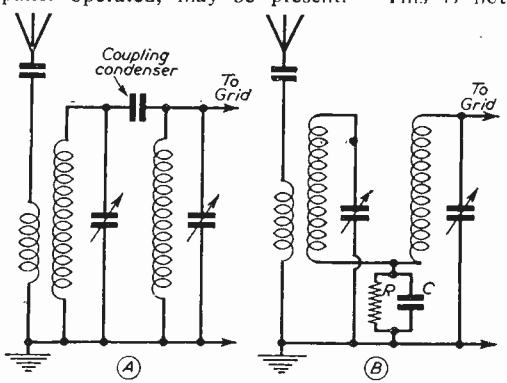


Fig. 4.—Band-pass couplings.

Wavetraps

Where difficulties arise from some powerful local station, a great improvement is possible if

a wavetrap is added. This is, in its simplest and most general form, a tuned circuit which can be adjusted to the wavelength of the undesired station. The signal strength of this station, at the receiver, is thereby much reduced.

Two such traps are shown in Fig. 5. For medium waves, any medium wave coil is suitable, tuned by a variable or pre-set condenser. In order that the trap may tune more sharply, a small condenser may be added in series with the

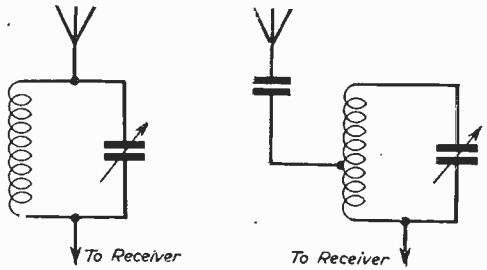


Fig. 5.—Wavetraps for station elimination.

aerial lead-in, or the lead-in taken to a tapping on the trap winding, as shown. With coils having a dust-core, a fixed condenser may be used instead of the variable component, and the circuit brought to resonance by adjustment of the core. The value of the fixed condenser must be chosen with the wavelength of the undesired station in mind.

For such traps to be effective, leads should be quite short. The trap coil may be screened, or kept from coupling with the receiver aerial coil by a suitable layout. A further condenser of fairly low value may be introduced in the wire from trap to aerial socket of the receiver.

To adjust, the troublesome station should be tuned in on the receiver, and the wavetrap then adjusted until the volume is at minimum. Complete elimination of the station will not usually be possible, but its volume will be greatly reduced so that other stations of adjacent wavelength are not interfered with to such a large extent.

Wavechange Switching

When the tuned circuits are modified, care should be taken that no H.T. or other shorts are introduced. Some coils have a primary winding which does not require switching for band changing. Others, however, require both primary and secondary switching, and this is shown in Fig. 6. Here, section 1 switches the aerial primary, and section 4 the detector tuned winding. Both these are at earth potential. This is not so, however, with section 2, because of the bias circuit, while section 3 is at H.T. potential.

With coils of this kind, incorrect switch connections usually become evident by results being unsatisfactory on one waveband. For example, if the switch used for the R.F. tuned winding were taken to earth, the V.M. volume control would not operate on medium waves. With section 3, a H.T. short would arise when the switch was set for medium-wave reception, unless the correct circuit, as shown, were employed.

Additional R.F. Stage

As there will almost always be sufficient power available for an extra valve of the R.F. type, the addition of a further R.F. stage can be attractive and useful. Three tuned circuits can thus be used without the loss of sensitivity always associated with a band-pass circuit with loose coupling.

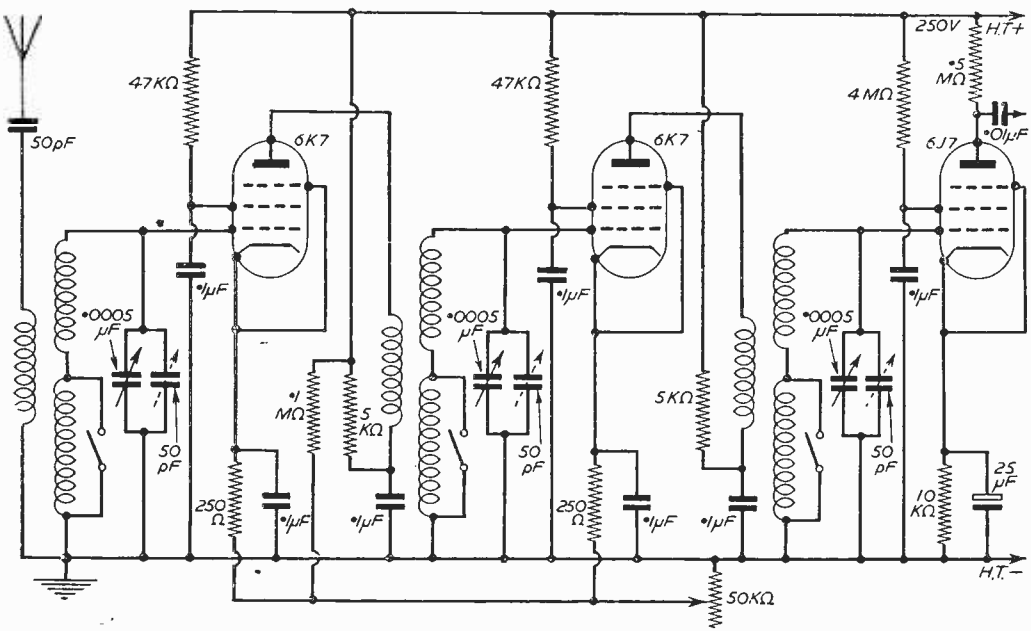


Fig. 7.—Complete R.F. and detector stages.

A typical 2-R.F. and detector circuit is shown in Fig. 7, and can provide a high degree of sensitivity, with very useful selectivity. It is, of course, not essential that the valve types given be employed, but these are shown for guidance.

The R.F. anode circuits are decoupled to avoid instability, and this is usually desirable. With such a circuit, adequate screening and a sound layout

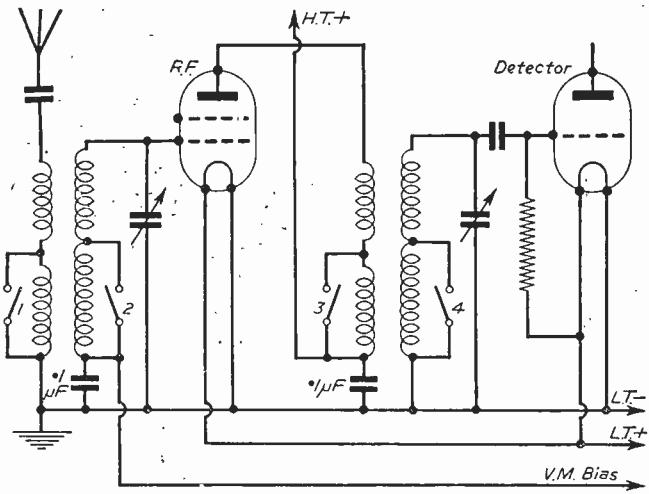


Fig. 6.—Isolation of coil switching.

are essential, or uncontrollable oscillation will arise. It will usually be necessary to fit the coils in separate screening cans. All wiring should also be short and direct. If the valves are of clear glass, screening cans for them will generally prove essential. If the receiver goes into oscillation when the volume control is advanced towards maximum, or when trimming is attempted, this indicates that some form of stray coupling is arising.

Other forms of inter-stage coupling, such as illustrated in Fig. 2, may be employed. It is generally best to avoid tuned-anode coupling, however, as with 2 R.F. stages it may prove almost impossible to maintain stability, unless gain is reduced. Separate coils for medium and long waves, or coils with switched primaries, may be used, but all wavechange switching will be a potential cause of instability, and this must be kept in mind. Any carelessness in this direction will lead to oscillation, due to the presence of three tuned circuits, with associated gang condenser and other wiring, all operating on the same frequency.

More than three tuned circuits are seldom seen in T.R.F. design, but 4-gang condensers are obtainable, and permit of a band-pass coupling being used. This may be placed between the R.F. stages, or between 2nd R.F. and detector. With such a circuit the limit of selectivity reasonably possible with a T.R.F. receiver is approached. In some cases it may be desirable to provide for medium waves only, and the troubles associated with wavechange switching will then be avoided.

"Unit" Coils

In some respects the use of separate coils for each waveband has advantages, and the method of switching these will be seen from Fig. 8. Each coil may have its own trimmer, so that each band can be adjusted separately. Coils of this kind are available with adjustable dust-cores, and are very suitable because of their efficiency and small size. Cores and trimmers should be dealt with as already explained, each band being treated individually.

With this form of switching, the leads, etc., associated with one tuned circuit must be kept separate from those in other tuned circuits. As aerial and R.F. anode switching is now employed, more trouble from interaction is likely than when using dual-range coils, or single-range coils in a single waveband set. As an aid in this direction it is best to use a rotary switch with a separate wafer for each tuned circuit, and a long spindle. Wiring may then be kept segregated—a most important point if such coils and switching are employed in a received with two R.F. stages.

Finally, bias, screen-grid and other power-supply wiring will usually require no modification, so can be left unchanged. The circuits shown may be used in both battery and mains receivers.

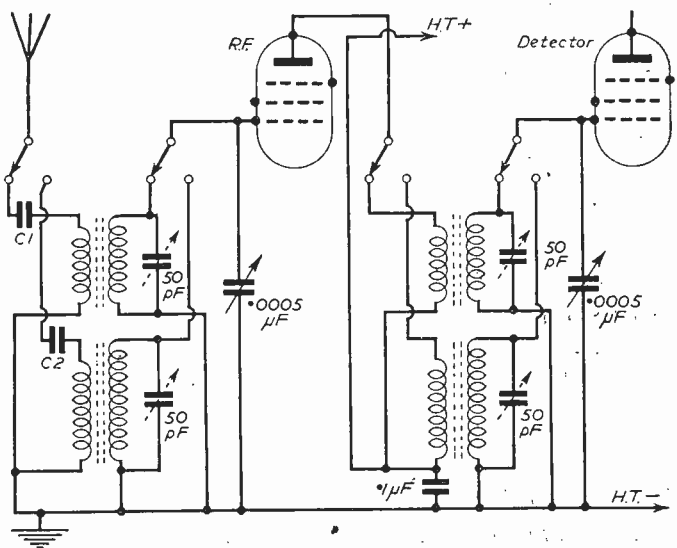


Fig. 8.—Switching for "unit" coils.

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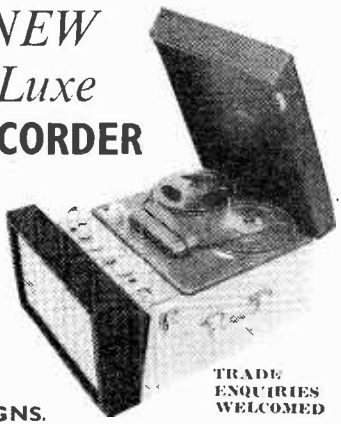

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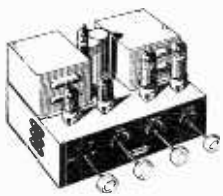

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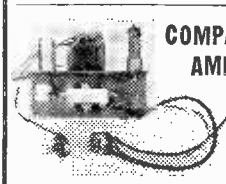

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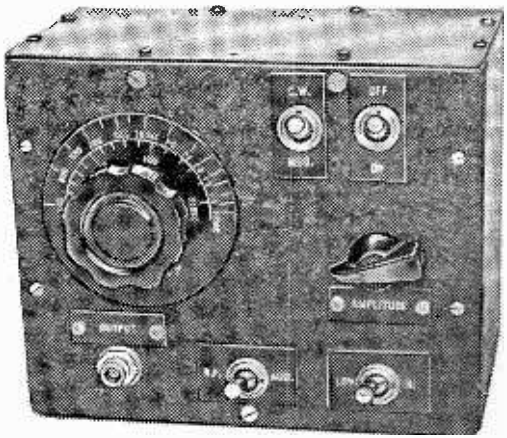
A TRANSISTORISED SIGNAL GENERATOR

ALIGN RECEIVERS AND LOCATE TUNING SETTINGS WITH THIS INSTRUMENT

By P. C. Kemp



THE generator described here has the advantage of being completely portable and, since it facilitates the using of transistors, consumes negligible power.

The frequency coverage of the generator is from 400 Kc/s to 1,700 Kc/s in two ranges. Range 1, 400-550 Kc/s; range 2, 550-1,700 Kc/s. Range 1 is primarily used for I.F. alignment. The carrier can be modulated by an audio frequency of 400 c/s to a depth of 30 per cent. Another facility offered is a 400 c/s output, this being provided by the modulating oscillator.

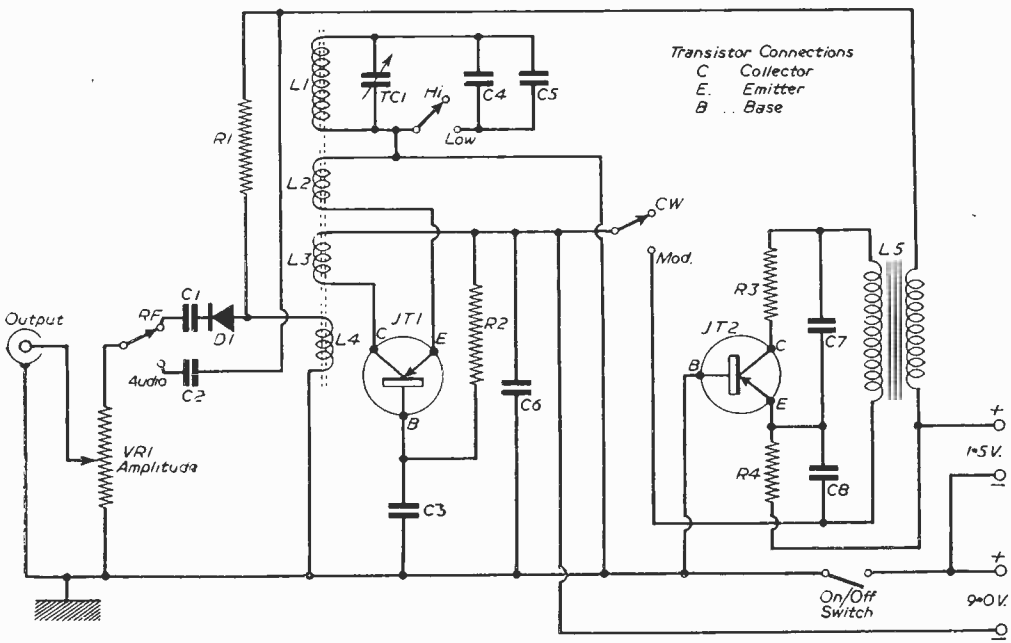
An OC71 Mullard transistor is used in the audio frequency oscillator and an OC45 Mullard transistor in the R.F. oscillator. An OC72 transistor of high current gain and high frequency cut-off can be used in the R.F. oscillator circuit with success, although the carrier output is reduced at the higher frequencies.

Modulation of the carrier is carried out by using a crystal diode, the GEX34 point contact diode, which is biassed in the forward direction, the audio modulating signal varying the bias, hence providing modulation.

Power is supplied by two batteries, one of 9 volts and the other of 1.5 volts. The author used mercury cells which have long life but are very expensive. Recommended cells are the D21 1.5-volt cell and the PP3 9-volt cell. These are manufactured by Ever Ready. The experimenter may wish to use other types of cell, and this is quite acceptable provided the correct voltages are used.

Coil Details

Two coils are required. The R.F. coil is wound on a 1½in. length of Ferrite rod of ¼in.



Theoretical circuit of the instrument described in this article.

diameter and the audio oscillator coil on a ½in. stack of Stalloy laminations as a transformer. The Ferrite rod used in this instance was part of a rod aerial from a portable receiver.

R.F. Coil

The winding of this coil is rather critical. the actual numbers of turns of the collector and emitter windings are preferably found by experiment as the optimum number of turns depends on the transistor characteristics and at present moment transistor variations are widespread and not uncommon.

The author found that the numbers of turns for his particular transistor were as follow and should act as a good guide.

1. Collector winding, 20 turns of 20 strand 47 s.w.g. cotton covered Litz wire.
2. Emitter winding, 3 turns of 20 strand 47 s.w.g. cotton covered Litz wire.
3. Tuning winding, 48 turns of 20 strand 47 s.w.g. cotton covered Litz wire.
4. Coupling winding. 2 turns of 20 strand 47 s.w.g. cotton covered Litz wire.

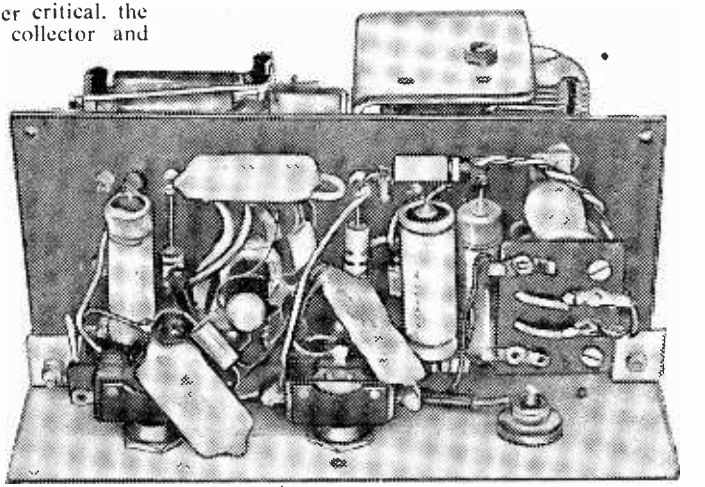
It is advisable to wind the collector winding nearest the rod. the emitter winding next and the tuning winding on the top, the windings being in layers of ½in. width. The coupling winding is wound beside the main winding.

If the experimenter finds the R.F. circuit will not oscillate he should reverse the connections of either the collector or emitter winding. Care should be exercised when cleaning the cotton and enamel from the Litz wire.

Frequency	Wavelength
400 Kc/s	750 metres
450 Kc/s	668 metres
500 Kc/s	600 metres
550 Kc/s	545 metres
600 Kc/s	500 metres
650 Kc/s	460 metres
700 Kc/s	430 metres
750 Kc/s	400 metres
800 Kc/s	375 metres
900 Kc/s	355 metres
950 Kc/s	333 metres
1,000 Kc/s	300 metres
1,200 Kc/s	280 metres
1,400 Kc/s	214 metres
1,600 Kc/s	188 metres
1,700 Kc/s	177 metres

A.F. Coil Winding Details

The A.F. coil was wound on a ½in. stack of M.E.A. type 21 Stalloy laminations, the former being made from cardboard. If this type of lamination is not available to the experimenter the author suggests using the laminations from the output transformer of a small portable receiver. The former can be used also. Number of turns required: primary. 1,000 turns of 38 s.w.g. enamel copper; secondary. 230 turns of 30 s.w.g. enamel copper wire. Before winding secondary cover the primary with two turns of .002in. paper. The complete winding is covered with 2¼ turns of .01in. thick bitumised cloth and wax dipped.



View of the interior of the signal generator.

Constructional Details

The circuit may be incorporated in a 20 s.w.g. aluminium box of dimensions 6½in. × 5in. × 3½in., depending on the size of the tuning condenser and the batteries. A metal box is recommended as it reduces radiation from the oscillator. The main circuitry is mounted on ⅛in. thick S.R.B.P. board of 6in. × 3in., connections being made via eyelets. The R.F. oscillator circuit must be mounted near the tuning condenser where possible and if a long lead to the output terminal is needed it is advisable to use co-axial cable to

(*Continued on page* 68)

LIST OF COMPONENTS

C. No.	Value	Type	R. No.	Value	Type		Misc.	
C1	330 pF	Silver Mica	R1	8.2 K Ω	Carbon	L1	Tuning	R.F. Oscillator Coil
C2	0.1 μF	Paper	R2	680 K Ω	Carbon	L2	Emitter	
C3	470 pF	Silver Mica	R3	15 K Ω	Carbon	L3	Collector	
C4	470 pF	Silver Mica	R4	10 K Ω	Carbon	L4	Coupling	
C5	47 pF	Silver Mica	VR1	500 Ω	W.W. or Carbon, Variable	L5	A.F.	Oscillator Coil
C6	0.1 μF	Paper				TR1	OC45	Transistor
C7	0.1 μF	Paper				TR2	OC71	Transistor
C8	0.1 μF	Paper				D1	GEX34	Diode
TC1	15-525 pF	Variable						

TRANSMITTING TOPICS

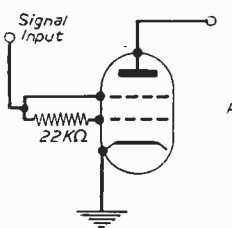
FURTHER MODULATION ASPECTS

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

PREVIOUSLY it has been pointed out that matching of the modulator valves to the load presented to the P.A. stage is of great importance. Thus, unless the load value is correct, the full rated audio power will not be generated at the rated audio drive to the modulator grids. As previously explained, if the load presented to the modulator tubes is too high, then maximum power cannot be obtained, and overdriving in an attempt to gain more audio power will result in severe clipping of waveforms in the modulator. Conversely, a modulator presented with too low a value of load impedance will require more drive to give the required audio power output, and may draw excessive peak currents.

While, therefore, a certain tolerance is possible on load values, it is preferable to err on the side of too low rather than too high load values of impedance. The "possibility" of gaining increased power output by using a low load value and providing an increased grid drive is, however, not so attractive as it appears. The grid drive power requirements rise steeply, and the peak anode current taken by the modulators also increases. Either of these factors may result in drastically diminished valve life, and are not to be countenanced except when only a small change is made from the accepted ratings of the valve. For example, operation with a load value of some 10 to 20 per cent. lower than the rated figure may be quite acceptable, although the grid drive power may have to be nearly doubled to obtain the benefit of this deviation.

Readers are interested, however, in the operation of modulator valves at voltages "intermediate" between rated values. Thus, for example, a well-known handbook only quotes the full "all-out" values for modulator tubes. The familiar 807 rating and load values are given for the absolute maximum power output of 120 watts of audio at 750 volts on the anodes of the modulator. This immediately poses the question of what load values and power output are indicated for operation at lower H.T. values. The British amateur, for example, is interested in 75 watts output in order to modulate his 150 watt maximum P.A. input. For reasons of economy, however, he is interested in gaining this power output with as economical a power supply as possible. Conventional books may confuse him here, for under some conditions (i.e., as a Class A amplifier), the performance of a valve falls off as the $2\frac{1}{4}$ power of the applied voltage. Even apart from this, it would seem that a valve would fall off as the square law of applied anode voltage.



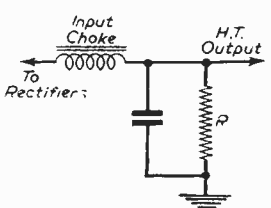


Fig. 1 (Left).—Zero-bias triode connection of the 807. Fig. 2 (Right).—Choke input circuit with bleeder resistor.

However, as it happens, the situation is simpler with Class AB2 or Class B valves. Thus with tetrodes such as the 807, the power output falls off almost directly as the anode voltage falls. This presupposes, however, that the screen voltage is kept at the rated 300 volts. Thus for the 807 giving 120 watts of audio at 750 volts, we can expect 60 watts of audio at 350 volts H.T. A more exact calculation based upon valve curves indicates a power output of 51.4 watts, so that if we allow a little extra for inefficiency at lowered anode voltages, we may calculate the power output on simple proportion. Moreover, it is always wise with modulators to allow a little power in hand, so by being pessimistic, by ten per cent. or so for small changes in anode voltage, and doubling this allowance for drastic changes (as for halving the H.T. voltage) one is sure of being on the safe side.

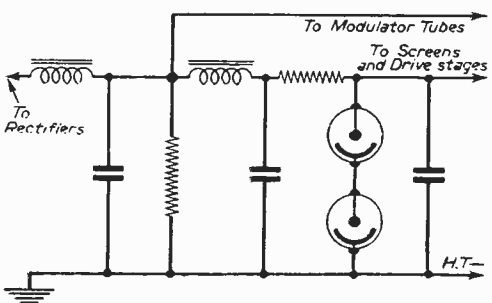


Fig. 3.—The push-pull modulator valves may be fed directly after the input choke of a choke input power supply. The screen and driver H.T. line should have further smoothing and be stabilised by neon stabilisers, as shown.

As an example, for 75 watts from a pair of 807s we would by straight proportion need a voltage of 469 volts, so that 500, or better still, 550 volts would be chosen as the operating voltage. A more accurate calculation based upon

the valve characteristic curves gives 490 volts as the anode potential providing 75 watts of audio. Furthermore, the "safety" figure of 550 volts anode voltage gives a generous 85 watts of audio, which is well on the safe side. Thus, simple estimates made upon a direct falling off of audio power with anode volts will give quite accurate figures, and if a reasonable allowance is made, will indicate in any given case whether full modulation might be obtained. Remember, of course, that whatever the anode voltage, the screen voltage is maintained at 300 volts. The value of this "estimate" is that it indicates, for example, that a 100-watt P.A. stage may be modulated by a pair of 807s at 350 volts anode potential, so that a quite unpretentious power supply using the high current highly efficient receiving type of rectifiers might well supersede 5R4GYs or the faithful 5U4Gs in the power supply.

Notice that the above description implies that the modulator tubes still draw their rated peak current despite the lowered anode voltages. In fact, with the usual driver stage, there is not any difficulty over this. The only point is to budget in the power supply for the rated D.C. input of 250 mA. when the modulator is delivering full rated power. Economically minded readers may no doubt reason that by using the 100μF or larger sizes in receiving type electrolytics for smoothing, and with the largest permissible electrolytics as reservoir condensers, the power pack voltage may be nicely held up by using a 350-volt pack of standard receiving design, so that an economical transmitter with a comfortable 100 watts P.A. input may be modulated. This might obviate the design questions of running the full input by enabling a sizeable economy on the modulator and power supply.

Load Impedance

The question of load impedance has been skipped over so far, and this question also arises when operating at other than the rated modulator voltages. Precisely the same principles apply, however, and for the above argument on power ratings to hold, the load impedance should also be reduced proportionately to the anode voltage. Thus, ideally, halving the anode voltage requires that the modulators be now matched into a load one half of that required at the full anode voltage. Here again, to be on the safe side, assume a load some 10 per cent. less than the value calculated by proportion.

The above arguments represent the simplest method for the amateur, as by operating in this way—i.e., with the load impedance reduced proportionally to the anode voltage reduction, the greatest power output is obtained, providing that the power pack regulation permits of the full peak 240/250 mA. required for full output. Providing the power pack maintains the rated voltage, this is assured.

One further possibility, in the interests of voltage regulation, is to retain the higher voltage and reduce the current swing. That is to say, the modulator tubes are not driven so hard, so that the reduced power output is obtained by reducing the current swing. If the modulator load value is unaltered, however, the reduction is not great, and the disadvantage is that we are running the modulators at a higher voltage than is necessary. However, if the load value is increased, it is then possible to reduce the peak anode current appreciably if reduced power output is needed. Thus by doubling the load impedance, the power output is approximately halved as also is the peak current. Under some circumstances this might be preferred as a means of obtaining better power pack regulation.

Swinging Choke Input

The Class B zero-bias connection of 807s (Fig. 1) offers a problem in power pack regulation, as the resting current in the zero-bias triode connection is only some 10 to 15 mA. The current demands on peaks rise to a steady 240 mA input for full output, so that power pack regulation is severely tested. The swinging choke input circuit is the standard method of obtaining good power regulation (Fig. 2). It is necessary to use a bleeder resistor if a swinging choke is used, in order that the zero signal current should not be less than the rated figure for the choke. Even if an ordinary choke is used, a bleeder passing some 25 mA or so is useful in restricting surges. The smoothing capacitor should be large, and 16 μF is a popular choice. Where the power pack is able to supply the total current required, it is possible to run the driver stage as well from the power supply. However, this needs a power pack capable of some 300 to 350 mA output under peak conditions for both Class AB2 and Class B modulators. To do this successfully requires extensive use of electrolytic condensers in the driver stages if trouble is to be avoided on modulation peaks. Also it is necessary to switch on the driver stage filaments before the main power supply, so that the drivers will draw current at all times, and drop enough voltage through the dropping resistor to prevent the electrolytics being "blown." The writer provides the screen and drive stages of his Class AB2 modulator in this way from the modulator supply, but all transmitter filaments are switched on before power is applied. This has so far obviated blowing the many electrolytics decoupling the

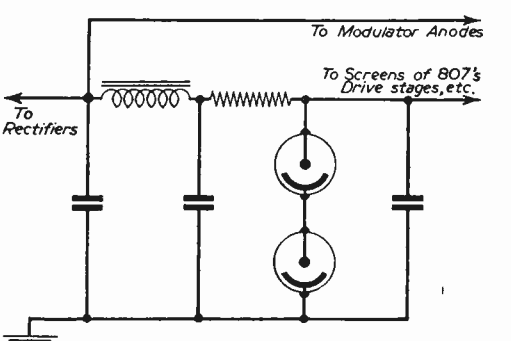


Fig. 4.—Push-pull modulator valves may be fed directly from the input capacitor of the main power supply.

driver and speech amplifier stages. However, as in this case the stabiliser valves for the screen supply draw current through the main dropping resistor (Fig. 3), this prevents the driver supply ever exceeding 300 volts. Moreover, where a zero-bias connected modulator is used, no stabiliser is used as there is no screen supply. It would be worth while fitting stabilisers for the purposes of restricting any possible voltage surge on the

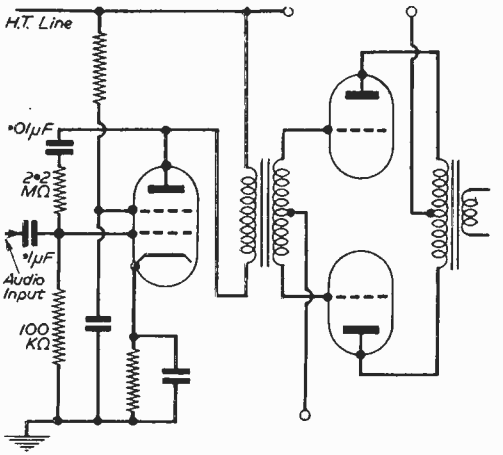


Fig. 5.—A simple and effective way to add negative feedback to the driver stage of a modulator. This helps in reducing distortion on audio peaks.

driver stage H.T. line, and thus protecting any bypass electrolytics that may be used.

Condenser Input

A further expedient now very popular is to use condenser input, and to take the modulator supply voltage directly from the input condenser of the power supply (Fig. 4). This is claimed to equal or exceed the conventional choke input method for regulation. Without entering into any arguments on this score, it has the merit of simplicity, and provides a higher H.T. line voltage than the choke input filter. It should be explained that hum is not a problem with this system. If a large condenser at 16 μF or more is employed, then the quiescent ripple is a few per cent. However, this is cancelled out in the push-pull modulator stage, and no hum is discernible on the transmission. Having tried the system the writer agrees that with a given power transformer one does gain extra audio power by changing from a choke input to this system. This is mainly because of the higher voltage obtained from the condenser input circuit. Also a further slight gain is obtained as the drop in the choke is eliminated on peaks. Even with large chokes a 10 or 20 volt drop occurs under peak current conditions with tetrode modulators in Class B and Class AB2.

A point of some interest about the zero-bias Class B operation of 807s is that the grids being at zero potential, grid current flows throughout virtually the whole signal cycle, as one grid or other is driven positive throughout any signal cycle. This feature of zero-bias operation means that the modulator grids present a fairly constant load to the driver stage under all conditions. This is an advantage compared with Class AB2 and biased Class B type stages, where the grid impedance changes sharply at the point where grid current starts to flow. Furthermore, the impedance of the grids of a zero-bias connected pair of 807s is moderately high, so that driving is not very difficult. No undue alarm need be felt at the grid drive requirement of approximately 560 volts "peak-to-peak" grid swing needed by zero-bias 807s as this merely means that the peak signal per grid is half this, that is 280 volts peak, which again is a swing of 200 volts R.M.S. In fact a 6L6 driver stage is adequate to swing the 807s. The quoted figure for the grid-to-grid impedance of a pair of zero-bias 807s is 7,100 ohms. The diagram illustrates what this means, as one has merely to calculate the driver transformer to match a load of 7,100 ohms across the whole secondary to the primary. Thus, as a simple example, a drive valve requiring 3,550 ohms load would require by the square root rule a ratio of 1 : 1.4 step-up to match it to a pair of 807 grids rated at 7,100 ohms grid-to-grid impedance. This would approximate to a single 6L6 driver stage, and indicates that a single 6L6 with 300 volts H.T. should be adequate to drive a pair of zero-bias 807s.

(To be continued)

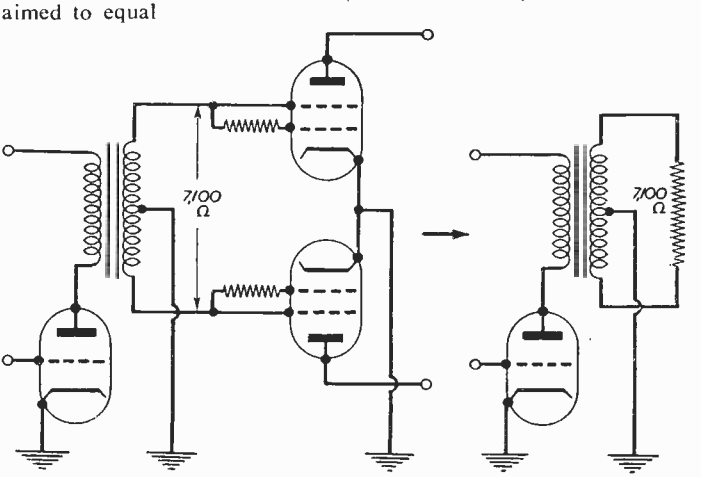


Fig. 6.—The "grid-to-grid" impedance of zero-bias connected 807s is 7,100 ohms. This means that the effect is that of a 7,100 ohm load connected across the whole of the driver transformer secondary. The driver transformer, therefore, should match the driver valve to an impedance of 7,100 ohms across the transformer.

On Your Wavelength

BY THERMION

Muggeridge and the BBC

I EXPECTED a heavy correspondence on the paragraph concerning Muggeridge and his ill-timed article on the monarchy. Most of the correspondence has been favourable and a small amount the reverse. Nothing in any of the latter, however, has caused me to have second thoughts on the matter. Some of the letters are extremely critical, not only of Muggeridge, but of the BBC, in wishing to give even wider publicity to his views.

Pronunciation

THE old rule "An before A, E, I, O and U" will shortly have to be amended to omit the O, if some check is not put upon the BBC to prevent it interfering with the English language and our standard methods of pronunciation as laid down in the dictionary. Even the Prime Minister has caught the disease. In a recent speech he referred to "Furrin" affairs. As a reader remarked in a recent issue, I do hope the BBC does not have to deal with the subject of bombers!

Catering at Earls Court

MY good friend, the secretary of the Radio Industry Council, thinks that my strictures on the catering arrangements at Earls Court during last year's Radio Show a shade harsh, although he agrees that there was some justification for them. In justification he tells me that immediately before the 1957 Radio Show began the previous Earls Court catering management was replaced by another firm of contractors who, considering that they had to take over at a few days notice, "carried out the catering at the Radio Show so satisfactorily that the number of really serious criticisms received by the organisers regarding the catering arrangements was negligible." He tells me that the new contractor was well aware that what he was able to do this year fell a good way below the ideal which the organisers hope to achieve. The organisers believe that the catering arrangements for this year's exhibition will show a really significant improvement over what we have hitherto experienced. The main objective will be to introduce more in the way of popular meals at inexpensive prices and the new contractor has a number of plans for achieving this. At the same time it must be borne in mind that the special problems connected with catering for only a certain number of weeks in the year in a building such as Earls Court are quite different from the problems which face the average West End caterer. He can remain open 52 weeks in the year. The solution to these problems always tends to militate against low prices and it cannot be expected that an exhibition service can be run economically in direct competition with outside catering. I agree with all this, but, whatever the prices fixed, surely they should be standardised? At different bars there were different prices for drinks, and at one bar the prices varied from hour to hour. I know that there are difficulties, but the organisers have a duty to protect the public from exploitation. An evening meal, as I have said, is part of the show. People cannot leave the exhibition and go elsewhere for a meal without having to pay for readmission. To many radio enthusiasts the show is an evening out, and the catering should be such as to send them home with a happy feeling.

More About Midgets

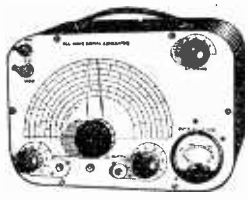
IN view of the easy availability of midget components, transistors and printed circuits, I am astonished that more manufacturers have not yet produced a tiny pocket radio which can be used on the odd occasion when you are away from home, perhaps in a train or on a picnic, or at a football match and wish to listen to a play or some particular item of news. I know that there are many problems yet to be solved and that the production of a battery power pack having a reasonable life is only a possibility of the future, in spite of the developments in America of really midget batteries, one smaller than a sixpenny piece capable of running a watch for a year. The battery has always been the bugbear. It is large and cumbersome, as well as weighty in comparison with the receiver proper, but in America they have solved the problem. Large numbers of really small receivers are on the market. They are not cheap, but they sell in very large quantities and I believe that they would do so over here, where only a few manufacturers are supplying them. The midget American receivers on sale are good, but there is difficulty with spares. How many of my readers, I wonder, would be interested if this journal sponsored such a design, making use of a printed circuit?

At the recent Turin Motor Show a new pocket portable with six transistors was exhibited, this clipping on to the car's instrument panel. It will function from the car's battery, or from the domestic mains. It receives medium waves only.

The smallest portable radio so far produced on a commercial scale is a Japanese set, as far as is known. This is a medium-wave set with six transistors, approximately the size of a sardine tin. It is said to work for 100 hours on a dry battery smaller than a match-box.

I am certain that if manufacturers showed more interest in the market, sales of receivers would improve, although I am glad to note that over one million sets were sold in the first eleven months of 1957, an improvement of nearly 120,000 over the figures for the whole of 1956.

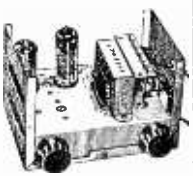
SIGNAL GENERATOR



25/- deposit plus P. & P. 5/- and 4 monthly payments of 21/6. Cash £4/19/6 plus P. & P. 5/-.
Coverage 120 kc/s, 84 Mc/s. Metal case 10in. x 6¼in. x 4¼in. Size of scale, 6¼in. x 3¼in. 2 valves and rectifier. A.C. mains 230-250 v. Internal modulation of 400 c.p.s. to a depth of 30 per cent., modulated or unmodulated R.F. output continuous variable 100 milli-volts. C.W. and mod. switch, variable A.F. output and moving coil output meter. Grey hammer finished case and white panel. Accuracy plus or minus 2%.

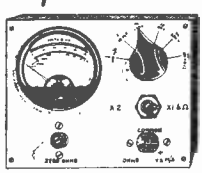
CONVERT TO I.T.A. FOR ONLY 25/- deposit plus P. & P. 5/- and 4 monthly payments of £1/5/6. Cash £5/17/- plus P. & P. 5/-.

ANY T.V. (except Philips) WITHIN 35 MILES OF I.T.A. TRANSMITTER. ALL CHANNELS NO ALTERATIONS TO SET.



Complete with built-in power supply. 200-250 v. A.C. mains. Crackle finish case 5¼in. long, 3¼in. wide, 4¼in. high, incorporating gain control and band switch. Illus. with cover removed. Complete installation comprises "Converter," Wolsey 3-element I.T.A. outside or loft aerial, 36ft. I.T.A. lead, two plugs. (Wolsey 4-element 5/- extra.)
"CONVERTER" only £3/19/6 plus P. & P. 2/6.

AC/DC POCKET MULTI-METER KIT



Comprising 2in. moving coil meter scale calibrated in A.C./D.C. volts, ohms and milli-amps. Voltage range AC/DC 0-10, 0-100 and 0-500, Milliamps 0-10, 0-100. Ohms range 0-10,000. Front panel, range switch, wire-wound pot (for ohms zero setting) two toggle switches, resistors and meter rectifier. In grey hammer finish case.

19/6 Plus P. & P. 1/3.

Point to point wiring diagram 1/- free with kit.

4 VALVE ALL-DRY SUPERHET PORTABLE KIT

incorporating Ferrite rod aerial
Medium and long waves. In grey leatherette. Size 9in. x 7in. x 6in. Valve line-up: 1T4, 1R5, 1S5, 3V4. Complete kit of parts (less batteries).

£5.19.6 Plus Post & Packing 3/6.

COMPLETELY BUILT PORTABLE AMPLIFIER

approx. size 6¾in. x 2¼in., incorporating 2 valves, contact-cooled metal rectifier, bass and treble lift controls and double wound mains transformer 230-250 v. **39/6** Plus P. & P. 3/6
5" **P.M. SPEAKER & O.P. TRANSFORMER,** if purchased with the above, **18/6.** Plus P. & P. 1/6.

COLLARO 4-SPEED AUTOMATIC CHANGER

Model 456 (suitable for use with above amplifier), A.C. mains, 200-250 v., turnover crystal head. Brand new, fully guaranteed.
£8.19.6 Plus P. & P. 5/-. or 25/- deposit, plus P. & P. 5/-, and 7 monthly payments of £1-5-0.

T.R.F. KIT in PLASTIC CABINET

3 valve plus metal rectifier. A.C. mains 200-250 v. Medium and Long waves. In pastel blue or brown. Valve line-up: 2 VR65s and VT52. Size 15¼in. long by 9in. high by 7in. deep.
£3.19.6 P. & P. 7/6.

Point to point wiring diagram 1/6. Free with kit.

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(Carriage 20/- England and Wales, rest of U.K. extra).

S.A.E. for Illustrated Leaflet.

COLLINS TCS TRANSMITTERS. Special offer of these famous American Transmitters. Frequency Range 1.5-12.0 Mc's in 3 bands. Employs 7 valves, 2 of 1625 in P.A. Stage, 1625 buffer and 1625 modulator stage, 3 of 12A6 in Oscillator stage. Radio Telephone or Radio Telegraph. Provision for VFO or Crystal Control 4 Crystal positions. Has Plate and Aerial Current meters. IN BRAND NEW CONDITION. ONLY **£12.10.0** (carriage, etc., 15/-).

WIRELESS SET NO. 19MK. II.—The famous Army Tank Transmitter-Receiver, incorporates "A" Set (TX/RX covering 2.0-8.0 Mc/s, i.e., 37.5-150 metres). "B" Set (VHF, TX/RX covering 230-240 Mc/s, i.e., 1.2-1.3 metres) and intercommunication Amplifier. Complete with 15 valves as follows: 6 of 6K7G, 2 of 6K8G, 2 of 6V6G, and 1 ea. 6B8G, 6H6, E1148, EF50, 807 and booklet giving circuits, notes, etc. Size 17¾in. x 8¼in. x 12¼in. Magnificently made by famous American firms. IN BRAND NEW CONDITION. ONLY 65/- (carriage, etc., 10/-).

12 VOLT POWER UNIT for the above available, 25/- (carriage, etc. 5/-).

6 v. VIBRATOR PACKS. Output approx. 130 v. at 30 mA., fully filtered and smoothed. Complete. ONLY 12/6.

R1155 SUPER SLOW-MOTION TUNING ASSEMBLY. As used on all late model 1155s. Easily fitted to "A" sets, etc. ONLY 12/6.

EHT TRANSFORMERS. 5.5 kV. (Rect.) with 2 v. 1 a., 7/6. 7 kV. (Rect.) with 2 v. 1 a., 89/6. 2.5 kV (Rect.) with 2-0-2 v. 1.1 a., 2-0-2 v. 2 a. (for VCR97 tube, etc.), 42/6 (postage 2/- per trans.).

INSULATION TESTERS (MEGGERS). Read up to 20 megs. at 500 volts pressure. Overhauled and in perfect order. ONLY £8.10.0.

POCKET VOLTMETERS.—Read 0-15 volts and 0-300 volts A.C. or D.C. BRAND NEW AND UNUSED. ONLY 18/6.

CRYSTALS. British Standard 2-pin 500 kc/s. 15/-. Miniature 200 kc/s and 465 kc/s 10/- each.

ROLA 6½in. P.M. SPEAKER. Mounted in grey crackled metal cabinet 9in. x 9in. x 4¼in., with volume control. Ideal for use with receiver, or as extension. BRAND NEW. ONLY 27/6. (Post 2/6).

12 VOLTS 1 AMP. BATTERY CHARGER. Very robust ex-Admiralty. In grey crackled metal case size 6in. x 6in. x 4½in. BRAND NEW. ONLY 35/-. (Post 2/6).

MAINS ISOLATING TRANSFORMER. Manufactured by Vortexion. Fully shrouded. Will provide true 1 : 1 ratio from nominal 230 v. Primary. Rated at 100 watts. BRAND NEW. ONLY 22/6. (Post 2/6).

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Constructing a Direct-coupled A.C./D.C. Amplifier

A USEFUL TWO-VALVE UNIVERSAL AMPLIFIER

By J. S. Kendall

THE universal amplifier in many cases has the advantage of lower cost as well as giving the constructor on D.C. mains a chance. This circuit to be described was developed in the laboratory of Kendall and Mousley Ltd., following the great demand for such a circuit by the home constructor. The basic circuit is simple, and the tone control follows the general lines of the Mullard tone control, but values have been altered to give a different range of action, especially in the bass register. The idea of the circuit is for the construction of a high quality—or at least reasonably high quality—circuit for a portable gramophone. This reduces chassis size as well as speaker size, so the type of speaker chosen was the Elac eliptical, whilst the Garrard T.A. player with a pair of Acos heads can well complete a portable gramophone. The case has been left for the individual constructor to design for himself.

The chassis is a Kendall and Mousley 5in. × 6in. × 2¼in., and can be obtained ready punched and drilled with the various holes. However, for those who wish to make their own, the front has three ⅜in. holes for the volume control spindles; both ends are drilled ⅜in. for jacks or grommets. Jacks were used in the prototype as they give a greater flexibility in testing, on the other hand there is nothing to beat the soldered joint for input and output. It is also cheaper. A further hole of ⅜in. diameter is drilled in the rear of the chassis to take the mains lead. There is nothing to prevent this lead being taken out at any other place in the chassis. The top is drilled for three valves. The valve on the left is the output and takes a B8A holder. The centre for the H.F. pentode is a B9A with skirt and can, whilst the right-hand holder is a normal B9A, but can, of course, have a skirt and can for retaining the valve if required. This screening of the rectifier valve is not to be recommended, as the reduced cooling will most certainly cause the valve to overheat. The centres of the valve holders should be 1¾in. back from the front of the chassis. The line for the mounting of the output transformer and the electrolytic is 1¾in. behind this again. The chassis should be mounted so that the spindles are in the air, thus allowing the heat to rise. This would not be the case if the chassis were mounted flat, with the spindles at the side.

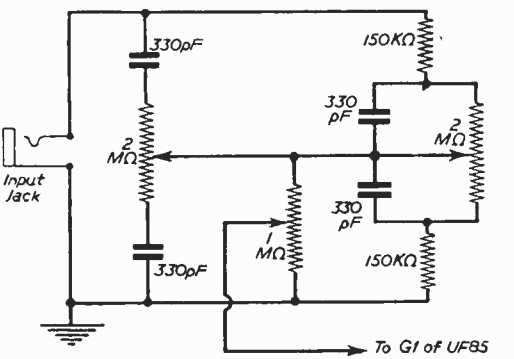


Fig. 2.—Circuit of the tone control arrangement.

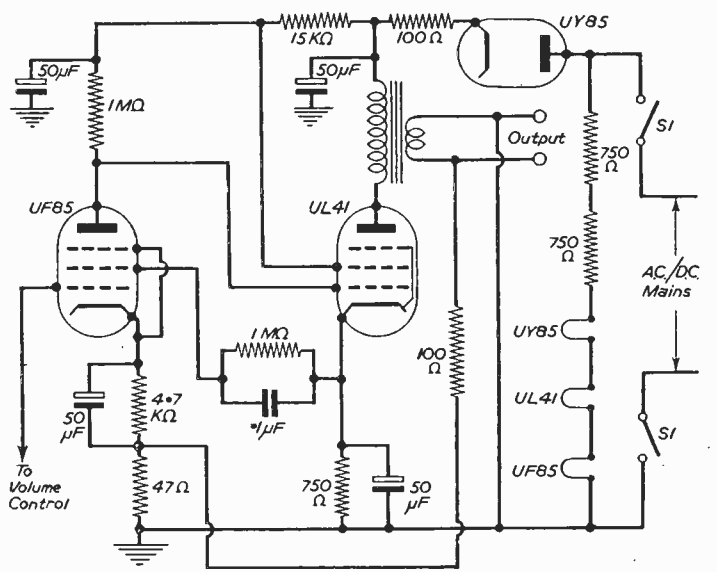


Fig. 1.—The complete circuit of this universal amplifier.

Construction

Having made or obtained the chassis, the valve holders should next be bolted in place, followed by the output transformer and the electrolytic. The three potentiometers can be mounted last. As stated previously, jacks were used in the original, but tag strips can be used and the input and output leads soldered. Three three-way tag strips are used in the construction and these are fixed to the fixing bolts of valve holders and the output trans-

former. The component layout of holders and tag strips is shown in Fig. 3.

The layout will, of course, depend on the constructor ; rarely do two people construct a circuit in the same manner. The basic circuit is shown in Fig. 1. The mains is taken to the amplifier via a twin-pole switch mounted on the volume control. This is not essential, but is only advisable from a safety angle. With a single-pole switch, there is always the chance of getting a shock with the switch in the "off" position. The anode of the rectifier valve is taken direct to the "live" pole of the switch, the surge limiter is placed in the cathode circuit of the valve. The smoothing is effected with the aid of a double 50 μF 350 volt electrolytic capacitor. A Hunts component with a single hole fixing is the best here. The use of a 15K resistor at 50 cycles is far superior to the use of a 20 H choke, as it has a high impedance. Also, the feeding of the ripple from the reservoir capacitor has the effect of allowing a small amount of hum from the output. The hum, on the other hand, fed to the screen is amplified and fed antiphase to the output. The result, if a careful balance is struck, is that hum in the output just doesn't exist. In this amplifier this has been done.

The driver stage is a UF85, direct coupled to the UL41 output valve. This means that the UF85 is run under low anode volt and screen conditions, thus the gain is very high. The EL41, in order to be directly coupled, has to run with its cathode at a higher voltage than the anode of the UF85. This is done in this case by the aid of a 750 Ω resistor shunted by a 50 μF 50 volt electrolytic. The screen of the UF85 is fed from the cathode of the UL41. This has the effect of applying negative feedback and reducing distortion as well as stabilising the conditions of the circuit. The stabilising effect is that as the cathode voltage of the UL41 rises, the screen voltage is raised, thus raising the anode current of the UF85. The increased current causes an increase in the voltage drop across the 1M anode load, and thus the grid voltage is dropped on the UL41, reducing the cathode voltage. The circuit is thus self-compensating over a large range of mains variation.

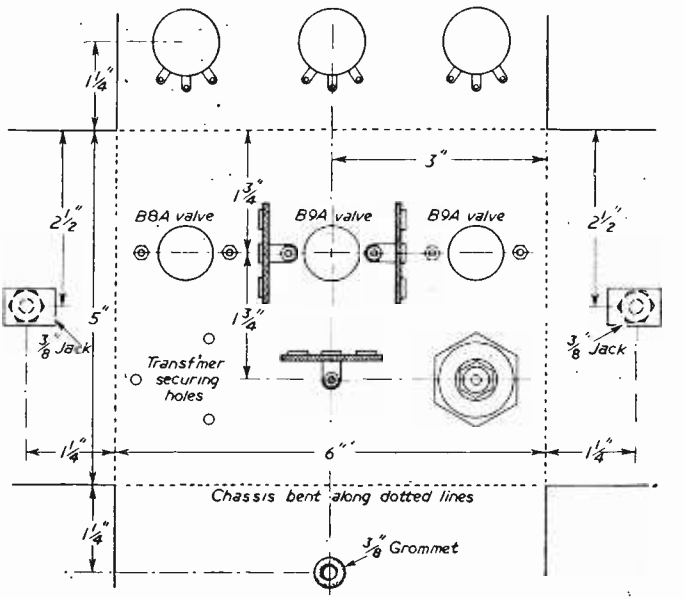


Fig. 3.—Chassis details and layout.

LIST OF COMPONENTS

One Mullard UF85
One Mullard UL41
One Mullard UY85
One McMurdo B8A holder
One McMurdo B9A holder
One McMurdo Skirted B9A holder with screen

RESISTORS

Three 750 Ω 7 W wire-wound
Two 150 K Type R resistors
One 15 K Type X resistor
Two 1 M Type T resistors
One 4.7 K Type T resistor
One 47 Ω Type T resistor
Two 100 Ω Type T resistors
(All "Lab" Components)

CAPACITORS

One 50-50 μF 350 volt Type KN418A Hunts
One 50 μF 12 volt Hunts
One 50 μF 50 volt Hunts
One 0.1 μF 150 volt Hunts

Four 330 pF Ceramicaps "Lab"
Two 2 MΩ volume controls L/S "Lab"
One 1 MΩ volume control with double-pole switch
One Elstone MR/T output transformer
Three three-way tag strips } Kendall & Mousley Ltd.
One chassis 6in. x 5in. x 2½in. }
Wire, nuts, bolts }

Tone Control

The tone control circuit is shown in Fig. 2. The circuit will give a top lift or top cut. The "bass" circuit is designed to work from a higher frequency than the Mullard circuit. The 330 pF condensers do not bypass the low frequencies as would be the case if higher values of capacitors were used. The range of frequencies "cut or lifted" would be lower, and a larger speaker and output transformer would be required to handle them.

If the circuit is required for real "high fidelity" reproduction the Elstone MR/7 can be used, but a larger chassis will have to be used in this case. The values of the bass control capacitors can then be raised, that at the earthy end of the bass potentiometer to 3,500 pF, and 680 pF for the one on the live side of the control. The treble control capacitors can be left as they are.

A Two-Valve Portable Radiogram

UTILISING ONLY TWO VALVES, THIS PORTABLE RADIO WILL ALSO FORM A USEFUL RECORD REPRODUCER

By M. L. Michaelis

THIS apparatus consists of a small radio amplifier complete in a cabinet only six by eight inches, with the record player built as a separate unit which is attachable to the radio amplifier by only a single cable. The radio amplifier may be used by itself, forming a very handy portable radio for the bedroom, etc., with excellent sensitivity on a small picture-rail aerial. The radio amplifier and record player unit are both designed to operate from 200 to 250 volts A.C. mains, the radio amplifier consuming about 15 watts and the record player motor about 5 watts.

A standard mains output valve of the beam tetrode type is used, capable of up to three watts speech power under the operating conditions. Although this is far more than is required by the size of the loudspeaker used, it is a decided advantage, from the point of view of tone quality, over the various R.F.-Pentode adaptations so often used in the output stages of simple receivers.

The loudspeaker used is a 5in. P.M. type, which should be carefully selected at time of purchase

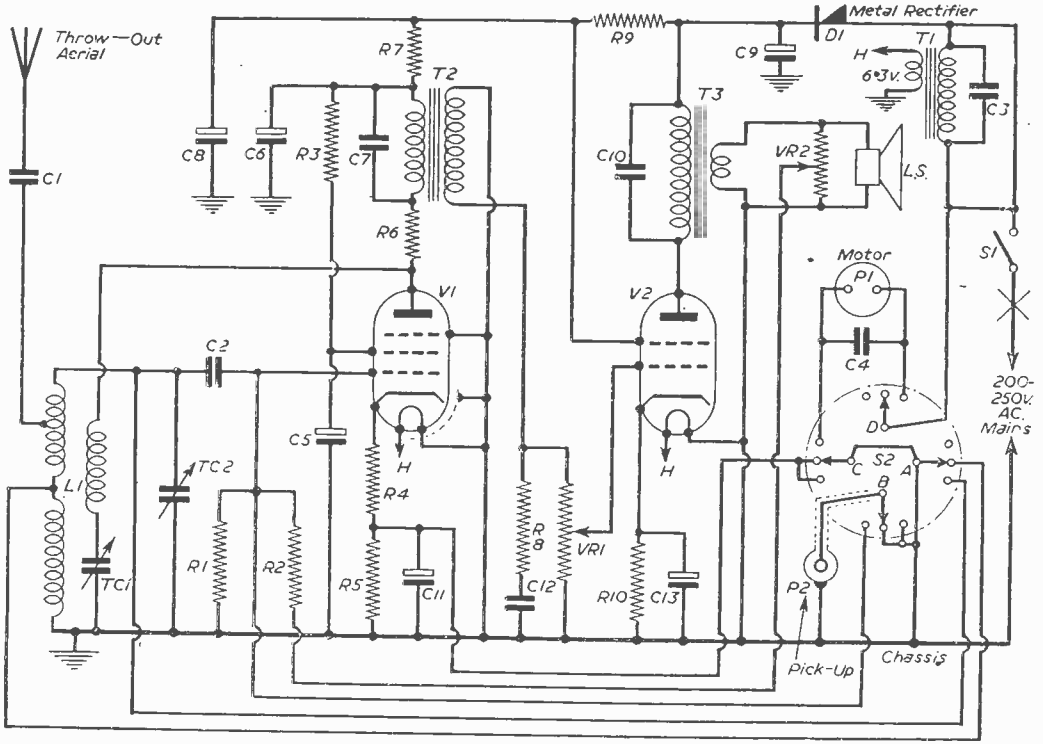


Fig. 1.—The circuit of the portable radiogram.

for freedom of cone movement. In spite of the use of such a small speaker, the quality of reproduction is very good, and it may be claimed that

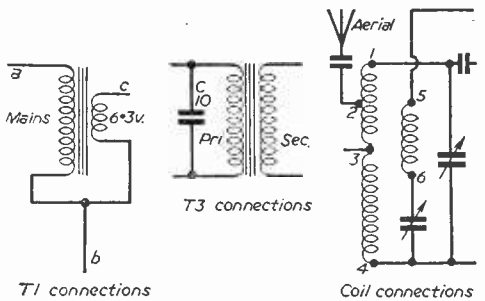
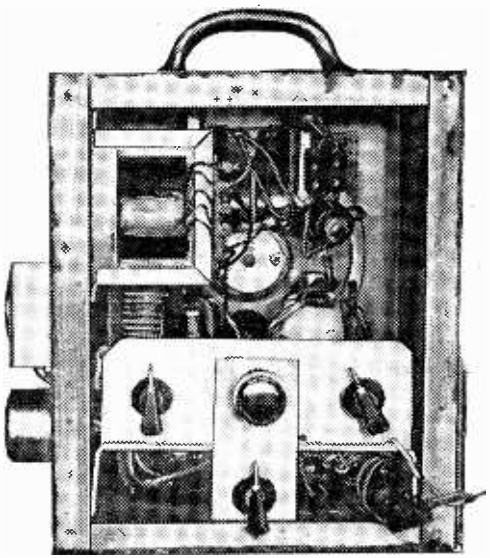


Fig. 3.—Details of transformer and coil connections.

this circuit, whilst maintaining the simplicity and sensitivity of this type of set, gives a tone quality and volume superior to most others of the two-valve type. This can be attributed to a number of special circuit features introduced, which will next be mentioned briefly.

Perhaps the most important novel features lie in the negative feedback arrangements adopted. In two respects these will at once be seen to go directly contrary to accepted custom, namely, that two transformers are included in the loop and that the volume control is included inside the loop. Far from leading to an impossible situation, these measures provide distinct advantages once the problems to which they give rise have been solved. The purpose of using transformer coupling between the detector and output valves is to preserve good sensitivity in spite of the use of negative feedback. This results in the necessity of having two transformers within the loop, giving large phase shift changes from the low to the high end of the audio frequency range, which would cause instability before a useful degree of negative feedback could be applied, if steps were not taken to prevent this. Accordingly, it is seen



View of the interior of the set.

that T2 has been loaded with R8, C12, C7. The reason for the second departure from custom,

LIST OF COMPONENTS (FOR FIGS. 1 AND 2).

C1 : 100 pF mica.
C2 : 200 pF mica.
C3, C4 : 0.1 μF 1,000 v.
C5, C6, C8 : 8 μF 350 v. wkg. electrolytic.
C7, C14 : 1,000 pF 350 v. paper.
C9 : 16 μF 450 v. wkg. electrolytic.
C10 : 2,000 pF 350 v. paper.
C11, C13 : 25 μF 25 v. electrolytic.
C12 : 0.01 μF 350 v. paper.
TC1 : 300 pF solid dielectric small variable condenser (Reaction control).
TC2 : 500 pF solid dielectric small variable condenser (Tuning control).

SWITCHES
S1 : On/off (see VR1).
S2 : Yaxley 4-pole, 3-way, 1 bank (Wavechange).

TRANSFORMERS
T1 : Filament transformer, 200/250 v., 6.3 v. 2 A.
T2 : "Radiospares" miniature intervalve transformer. Ratio 5:1.
T3 : Output transformer, 50:1, 4 w.

GRAMOPHONE UNIT
The circuits are designed for the ACOS-HiG HGP54 unit taking SK1 and SK2 sapphires.

CARBON RESISTORS : ½ watt ratings throughout :—
R1 : 1 MΩ.
R2, R3 : 250 KΩ.
R4 : 30 ohms.
R5 : 680 ohms ± 5%
R6 : 33 KΩ.
R7, R8 : 22 KΩ.
R9 : 4700 ohms.
R10 : 220 ohms ± 5%
R11 : 470 KΩ.
Tolerances ±20% unless otherwise stated.

POTENTIOMETERS
VR1 : 250 KΩ log. carbon track with S.P. switch 250 v. 3A (S1) (Volume and on/off).
VR2 : 100 ohms linear wirewound miniature preset (Negative feedback adjust.).
VR3 : 100 KΩ log. carbon track (Gramophone volume).
VR4 : 250 KΩ log. carbon track (Gramophone tone).

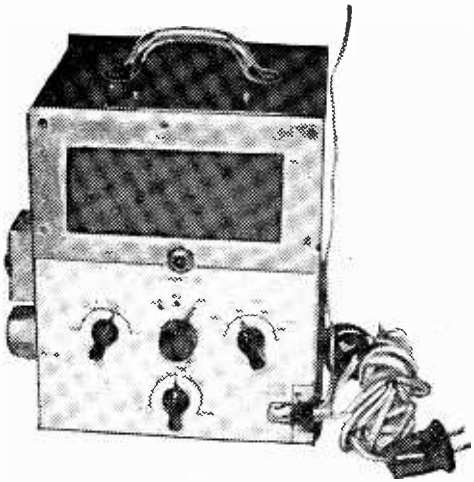
VALVES
V1 : Type SP61, Base Mazda Octal.
V2 : Type 6V6GTG, Base Int. Octal.
D1 : Metal rectifier, high voltage rating 350 v. 50 mA.

COIL
Any M L coil with reaction winding (e.g. 'PEPANCO').

PLUGS AND SOCKETS
P1 : 200/250 v. 2 amp. 2-pin plug and socket.
P2 : Coaxial plug and socket (TV aerial type).
P3 : Mains plug, preferably of the modern fused type. Fuse at 1 amp. If plug not fused, insert 1 amp. fuse at X in Fig. 1.

SPEAKER
Goodmans 5in. P.M., 2-3Ω.

namely the inclusion of the volume control within the loop, is that it was found by experiment to give the desired results of smooth control of volume coupled with maximum negative feed-



Front view of the receiver.

back at maximum volume. Other circuits of this type of radio have often used increasing negative feedback to reduce volume, so that maximum negative feedback is in use at minimum volume where distortion is least and therefore negative feedback least called for !

Although certain advantages are realised by this, the author has for some time questioned the advisability of praising it too highly. Surely it is also worth considering the merits of doing exactly the opposite, i.e., arranging for the maximum negative feedback to be operative at full volume where it is most needed to cancel distortion. It was on this basis that experiments were conducted in the development of the present circuit, with very pleasing results. It was at first intended to have the negative feedback operative only on the gramophone function, by taking R2 to a suitable contact on S2 instead of direct to V1 grid: but further experiment showed that the application of negative feedback gives a remarkable improvement also on the radio function, when V1 is functioning as a leaky grid detector. The effect was found to be one of transforming what was a reasonable and average performance into a reproduction with a surprising measure of true bass (as distinct from muffled roar) at the same time as a sibilantly crisp and clear presence of even the highest frequencies. Since the tone was found to be equally pleasant on speech and music, after fixed correction by C10, no variable tone

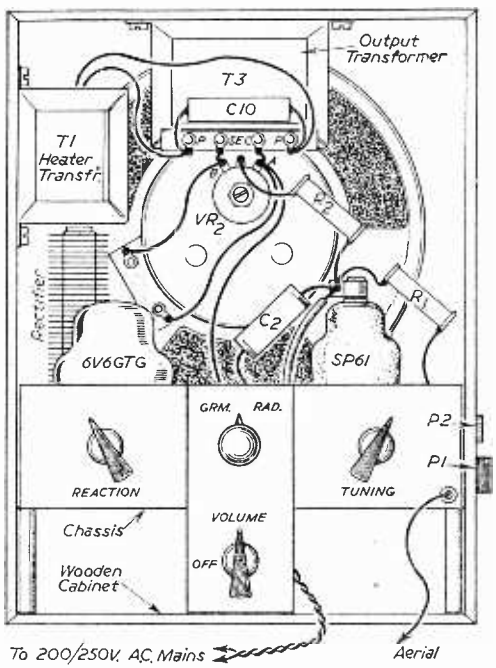


Fig. 5.—General rear view with cabinet open.

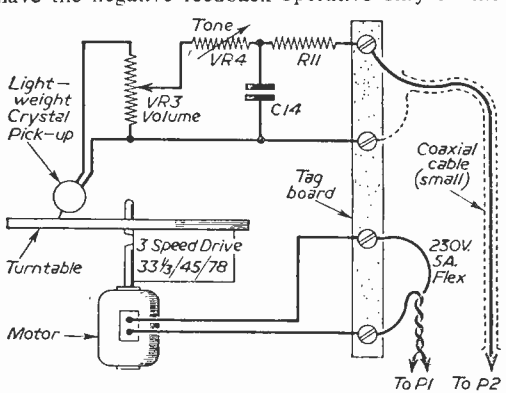


Fig. 2.—Theoretical circuit of the record player deck.

control was deemed necessary on the radio-amplifier. A variable tone control is used on the record player only, for the purpose of compensating for the various recording characteristics of commercial records, and to enable treble-cut to be used for reducing needle hiss on poor or old records. No prejudicial effects at all were found with regard to the function of V1 as a leaky-grid detector when negative feedback was applied.

It must be emphasised again that success depends also in quite large measure on the selection of a really good 5-inch loudspeaker. The cone should be felt *carefully* at the centre, and only if considerable movement is freely and easily possible is the item satisfactory.

The cathode circuit of V1 merits some mention next. Here R4 is a small resistor permanently in circuit, giving a small degree of bias and sub-

sidiary negative feedback to smoothen reaction on the radio function. An extra bias resistor, R5, is switched into circuit on the gramophone function only, to bring V1 to the correct operating point as Class A amplifier. Experiments were tried to leave R5 unbypassed also, but although this had some beneficial effect on gramophone, it led to troublesome instability on radio due to the switch leads. This indicated the essential necessity of C11.

The rest of V1 circuit is more or less conventional. The only other point of possible interest is R3. Here a high value (250K) is best for good sensitivity of V1 as a detector, but a rather lower value might be better for Class A amplifier operation. A suggestion to interested readers is to free one section of S2 by taking live mains direct to C4 and P1, and then use this section to switch a 100K half-watt resistor in parallel with R3 on gramophone function only.

The output stage, V2, is conventional. As already stated, no advantage in price or effectiveness was found in trying to adapt an R.F. Pentode here. Early experiments with an SP61 also in this position, with a view of interchangeability of V1 and V2, proved a failure due to unsatisfactory maximum undistorted volume, and so a conventional 6V6 was therefore soon adopted. This

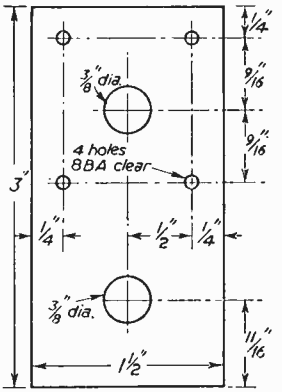


Fig. 4 (a).—Details of volume control panel.

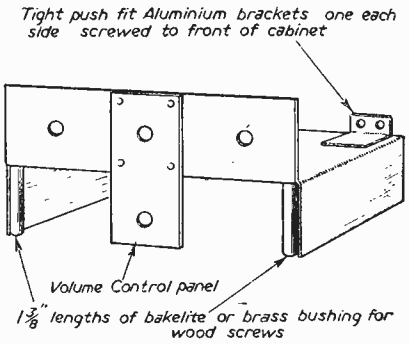


Fig. 4 (b).—Diagram of complete chassis assembly.

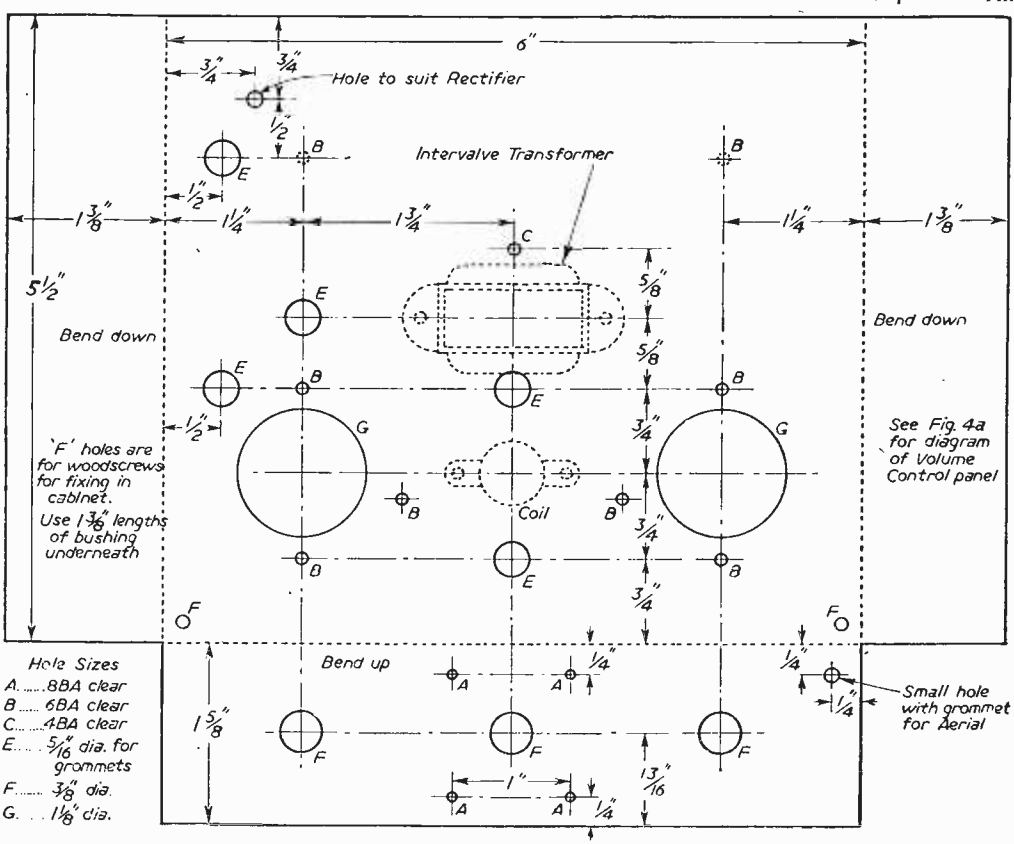


Fig. 4.—Chassis drilling and cutting data.

valve is still obtainable on the surplus market for a few shillings. The 6V6, however, takes a high anode current, and this presented problems with the wattage rating of R9. Accordingly, the anode circuit was fed direct from the reservoir condenser C9, this being permissible without introduction of appreciable hum, because there is no amplification following the anode. This relieved R9 of the heavy anode current of V2, enabling this resistor to be kept to a small rating. But from the screen to the anode of V2 there is significant gain, therefore the screen could not be fed from the reservoir condenser without causing severe hum. For this reason V2 screen is still fed through R9.

The Gramophone Side

Changeover from radio to gramophone is performed in the multifunction switch S2, which also performs waveband selection. Mains to the gramophone motor is automatically switched off on the radio function positions, and the tuned circuit is short-circuited on the gramophone function so that radio-breakthrough is positively prevented. C4 is essential to prevent excessive sparking at S2 when the motor is switched on and off. C3 is to prevent modulation hum. Both these condensers must be of high quality, as they have to take the full mains pressure across them continuously.

The record player is designed to use a crystal pickup giving a very high output, i.e., about a volt on standard 78 r.p.m. records, and about half a volt on microgroove records of 45 and 33⅓ r.p.m. This is far more than is required to load the radio-amplifier fully, and therefore VR3 is included as a volume control in the record player. It is advisable on gramophone, to operate the radio with its own volume control at maximum, so as to be using maximum negative feedback, and control the volume then by means of VR3. VR4 and C14 form a variable tone control for compensating various recording characteristics and filtering needle scratch. R11 is necessary to isolate C14 from the negative feedback circuit at V1 grid, and thus prevent interference with the frequency characteristic of the feedback network. The unavoidable attenuation of about 60 per cent. which R11 gives is easily affordable because of the high output of the crystal pickup.

Constructional Hints

Figs. 1 and 2 give theoretical circuits, Fig. 3 the coil connections, Fig. 4 chassis drilling details, Figs. 5 and 6 detailed wiring diagrams. On pages 40 and 41 will be seen pictures of appearance of the radio amplifier. Little difficulty should be experienced in construction if these diagrams are followed carefully.

Keep all leads as short as possible; those shown longer than necessary in the diagrams have been so represented only for clarity. Layout of the few electrical components in the record player is not critical, so long as the very minimum necessary of non-earth leads are run unscreened, and all such unscreened leads are run as far away as possible from the mains leads to the motor. Also, do not forget to bond the metal cases of the controls to the earth lead. The mains flex to the motor and the audio coaxial cable, however, may be run in a single insulated lead, with the two plugs fitting P1 and P2 on the end. This gives the neat appearance of a single-cable connection between the radio and record player.

(To be continued)

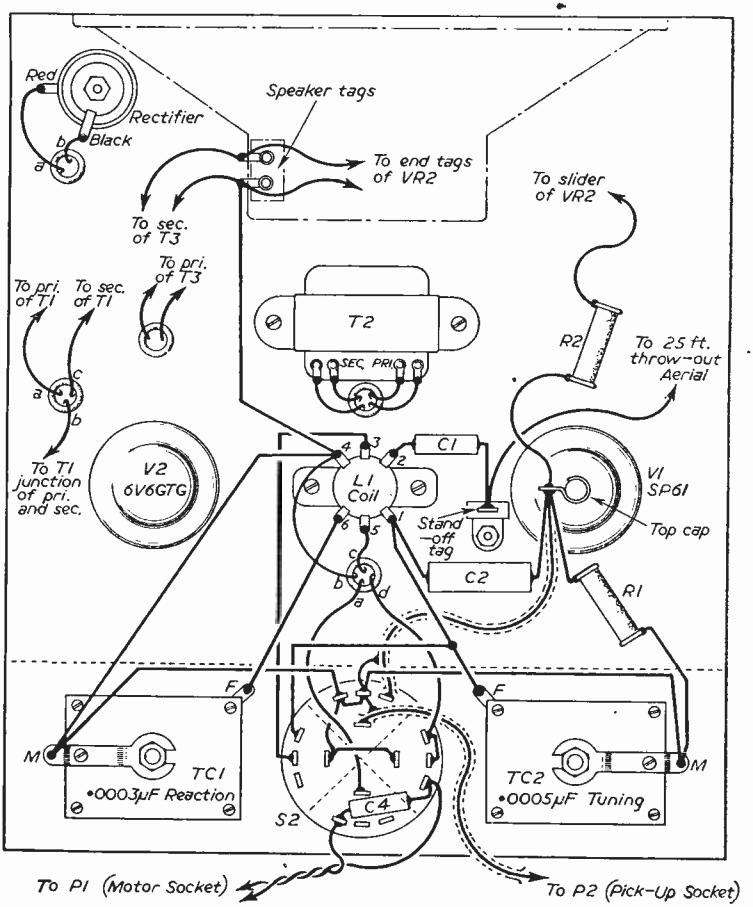
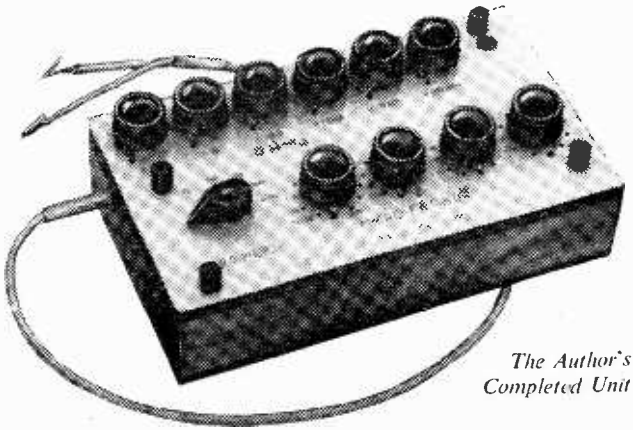


Fig. 6.—Above chassis wiring details.

An R.C. Substitution Box

AN ACCESSORY FOR THE EXPERIMENTER'S BENCH AND FOR THE SERVICEMAN

• By F. Quelon, B.Sc.



The Author's Completed Unit

A RESISTANCE-capacitance substitution box is easily made and soon repays the time and effort of making it in time saved and increased fault-finding efficiency. As a matter of fact, during the few months since I completed the box here described it has been, next to the multimeter, the most frequently used instrument on my bench.

The following are some of the possible uses of the R.C.S. box:

(a) The straightforward substitution of a suspected faulty component.

(b) Finding the best value of resistance or capacitance in cases where the original value is not known.

(c) Where it is expedient to depart from the published design, as is sometimes the case with old sets, the best value of resistor or capacitor is conveniently found.

(d) When some visible defect in a TV picture is suspected to be due to a leaky capacitor, an artificial leak can be connected across the suspected capacitor, and if increasing this leak (reducing the resistance) does not accentuate the defect, it can be concluded that leakage of that particular capacitor is not the cause of the trouble. With the clip leads still in place, the box can be switched to the nominal capacitance. In this way a capacitor can sometimes be completely checked without making any disconnection.

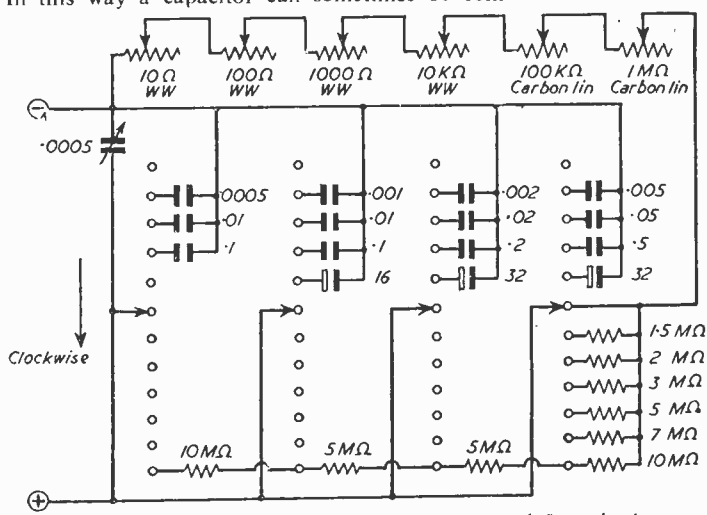
(e) Service manuals often give voltage readings ascertained with a voltmeter having a certain ohms per volt resistance. If only a valve voltmeter is available, it is a simple matter to shunt it with the appropriate resistance, using the box.

(f) It is sometimes useful to know the lowest L.T. voltage with which the oscillator of a battery set will function. This is easily found by connecting the box in series with the L.T. battery and increasing the resistance until the set cuts out.

(g) In experimental work (as opposed to servicing existing apparatus) the box can be invaluable.

Limitations

Due to stray capacitance and inductance effects, the use of the box at frequencies in excess of a few tens of kc/s becomes unreliable. Whether it can be of use or not at such frequencies will depend on circumstances



The Circuit. 4 Yaxley 12-way switches are used for selection.

Specification

Resistance—any value from zero to 1 megohm, then in steps to 31 megohms.

Capacitance—any value from a few pico-farads to 0.999 microfarads, and 16, 32, 64 and 80 microfarads.

Resistance and capacitance in parallel for most of the above values.

Construction

The accompanying photograph shows the general layout of the box, which measures 8¼in. × 5in. × 3in. overall, and is made from ¼in. plywood. The top panel is faced with white formica, on which the figures of capacitance and resistance have been scratched and coloured black and red.

TRANSISTORS in Practice

4.—FURTHER NOTES ON THE DETECTOR STAGE

By R. Hindle

(*Continued from page* 884 *February issue*)

THE variable, R2, determines the voltage from which the biasing current is derived, but R3 serves the purpose of limiting the bias as well as preventing the bias source from loading the input signal.

The transistor used must be capable of amplifying at the operating frequency, of course, so one with a suitable α cutoff frequency must be chosen. Suitable transistors are now available, but it has to be remembered that the cutoff for a common emitter circuit is lower than for the same transistor in a common base circuit. One with a cutoff quoted at 3 Mc/s at least is preferred for the present work.

Practical Application

The circuit of Fig. 27 is complete as shown. The difficulty, from the point of view of a design offered for home construction and which, therefore, must work when built by others and not only as a prototype, is due to the spread in transistor characteristics already referred to many times. If the feedback coupling is excessively tight the reaction potentiometer loses control, but before this stage is reached reaction will operate, but there is backlash on the control that makes it difficult to adjust for optimum results. For the benefit of those who have not had experience with the equivalent valve circuits this means that as the control is advanced the set bursts into oscillation, to stop which the control has to be backed off considerably further than the point initiating the oscillation, with the result that stopping the oscillation has taken place at a relatively insensitive feedback level. Consequently, the aim is to reduce the inductive feedback until the reaction control operates smoothly, sliding into oscillation gently after a build-up of signal, and oscillation stopping with only a slight backing off of the control.

If the constructor wants to experiment with a coil he could wind one covering the medium waveband, tapping at a third of the turns from the earthy end. The feedback coil could well be about a third of the main winding, closely coupled and capable of being adjusted, either in position or by the removal of turns. One possibility would be to use the coil specified previously for use with the crystal detector circuit. Over the winding a layer of drawing paper can be wrapped and gummed so that it forms a close-fitting cylinder that will slide over the main coil. The feedback winding could go on top of this. Now, when the circuit is put into operation and if it is found to be overcoupled, winding can be stripped off until smooth control is obtained. The windings can be anchored with a touch of coil cement, and if this is used sparingly there will be no difficulty in releasing the wire to strip off some turns. If when first connected it is found that oscillation cannot be induced it is likely that the feedback coil is connected the wrong way round and the connections should be reversed.

The Osmor people are winding a coil to the specification of the writer for this receiver. The use of this recommended, particularly as this same coil will be used in the next stage also, and the present design has been developed around this coil. The windings have been set so that the transistor does not have to be an exceptionally good specimen to be satisfactory in this circuit. The following transistors have all been used in this receiver:

Goltop V6/R4. Nominal cutoff frequency 5.5 Mc/s.

Ediswan XA101. Nominal cutoff frequency 5 Mc/s.

Ediswan XA102. Nominal cutoff frequency 8 Mc/s.

The manufacturing spread may result in the constructor having a transistor that, even with the special coil, oscillates too freely to give satis-

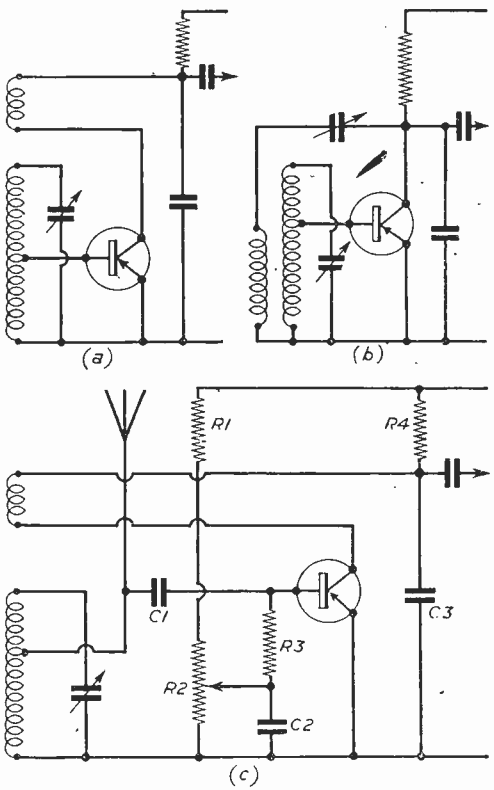


Fig. 27.—Regeneration circuits.

factory control and naturally he will not wish to strip off windings from a commercial coil, but he has still another trick up his sleeve. If he introduces a resistor into the emitter lead of the transistor (which, of course, must not have a bypass capacitor) this will introduce negative feedback which will partially cancel out the positive feedback via the coil. Try first a 100 ohms component and if this is inadequate increase it in steps up to about 500 ohms until the desired result is obtained.

It was found, in practice, that all the transistor specimens tested gave an optimum detector efficiently at a collector current of around 400 μA. This will be a guide to set up his transistor circuits with a meter, but it is not really necessary to check this current and, of course, it does not follow that all transistors will be identical in this respect.

Construction

For the sake of completeness, Fig. 28 gives the complete circuit for the regeneration detector, followed by the two-stage audio amplifier. The amplifier stages are as previously described constructionally, and if the steps in construction previously given have been followed it will be necessary now only to wire in the regenerative stage. In Fig. 28 the audio components are the same as given previously and the same component numbers are repeated.

The third valve-holder mounted on the chassis in the earlier stages of construction is used for the transistor. The coil is mounted on the rear face of the chassis alongside the twin socket nearer to the tuning capacitor. The input capacitor to the amplifier, previously connected to one pin of the socket, is now disconnected and this socket strip is used for aerial and earth. Fig. 29 gives the wiring for the regenerative stage. R11 (shown in Fig. 28) is not included—the emitter should first be wired to earth as shown and later, if necessary to ease off the coupling, a resistor can be interposed.

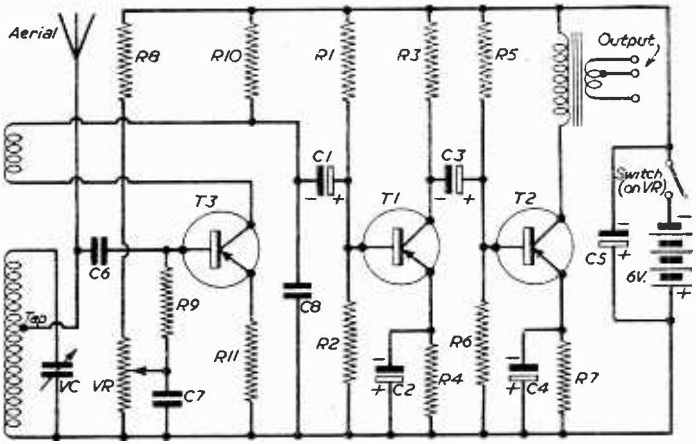


Fig. 28.—The complete circuit. R11 may not be needed (see text).

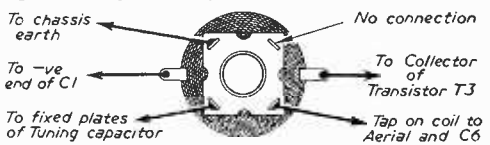


Fig. 29—Details of coil connections.

It was pointed out previously that one cannot be too dogmatic about connecting the electrolytic capacitors coupling stages with the positive lead to base and, in fact, it was found that C1 of the amplifier had to have its negative lead to the base of T1 because the signal input was assumed to have no DC component. That is changed now that T3 is feeding T1. Not only is C1 disconnected from the two socket strip, but also it is reversed, so that its positive lead is now towards the base of T1.

The receiver as it stands is still a low output type, of course. Putting the detector stage in front does nothing to increase the capacity of the last transistor to deliver power. The sensitivity of the circuit is quite startling, however, from an R.F. point of view.

(To be continued)

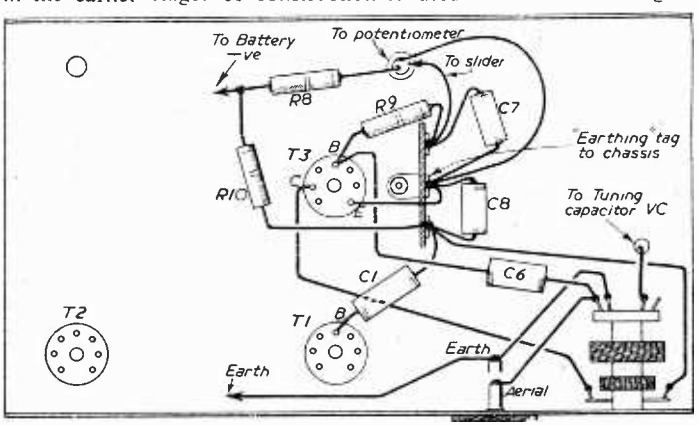
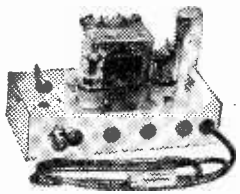


Fig. 29a.—Wiring diagram.

COMPONENTS LIST

(For Audio Section see Fig. 15)

C6— 500 pF (Dubilier).
C7— 10 μF 6 v. (Daly H2 5,1).
C8—.01 μF (Dubilier).
R8— 100 KΩ
R9— 10 KΩ ½-watt (Dubilier).
R10—4.7 KΩ
R11—See Text.
V.C. is half of two-gang capacitor already mounted.
V.R. is 20 KΩ wirewound potentiometer, with single-pole switch referred to in Fig. 15.



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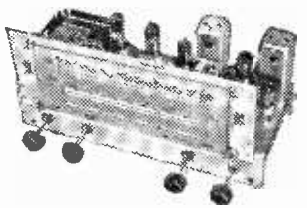

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6K7	6/8	EABC80	9/6	EM85	11/6	PY81	9/6
6K8	8/6	EB91	6/6	EL41	10/6	PY82	8/6
6Q7	8/6	EBC41	10/6	EL84	11/6	PY83	10/6
6SN7	8/6	ECC83	9/6	EY51	10/6	U22	8/6
6V6	7/6	ECC84	12/6	EZ40	8/6	U25	11/6
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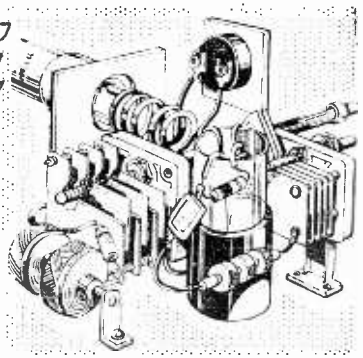


SLOW-MOTION DRIVES AND THE R1155

By A. W. Mann

THE recent release by the Air Ministry of the Model R1155L designed for use by the air/sea rescue branch of the R.A.F. brings within the reach of short-wave listeners a very good general purpose receiver. The ranges covered are 200-500 kc/s. 600-1,500 kc/s. 1.5-3 Mc/s. 3-7.5 Mc/s and 7.5-18.5 kc/s.

Various Models

It is not generally known that eight different models of the original R1155 receiver were produced. These are R1155A, B, C, D, E, F, L and M. The I.F. in all instances is 560 kc/s.

Model C, now obsolete, incorporated certain modifications which enabled H.F. direction finding to be carried out in conjunction with a suitable loop aerial.

While many listeners use the R1155 type sets as headphone receivers, the general trend is to add a power output stage where loudspeaker reception is desired.

It may be of interest to mention that for 40 metres and 80 metres European amateur phone reception, replacing the headphones with a M.C. speaker will provide in most cases signals of sufficient strength, with a very good signal-to-noise ratio, providing of course that the I.F. and signal frequency circuits are accurately aligned. For general all round loudspeaker reception, however, a power output stage is recommended.

Slow-motion Drive Mechanisms

The original slow-motion drive as fitted to the R1155 range of receivers apart from models L and N is officially known as the Type 13.

The outer knob provides direct drive to the gang condenser, and the inner knob a slow-motion drive with a ratio of 100 to 1 for fine tuning. This drive mechanism with a little careful attention and constant use can be made to work smoothly.

The Air Ministry has now released the so-called N type drive which is available from one advertiser at 10s. 6d., which, by the way, must be considerably below production cost.

This drive mechanism is officially designated as Type 35, and incorporates a precision cut gearing arrangement in order to achieve a satisfactory step-down ratio for fine tuning.

There is no direct drive. The inner knob has a ratio of 4.5 to 1 and the outer knob provides a fine tuning ratio of 89 to 1.

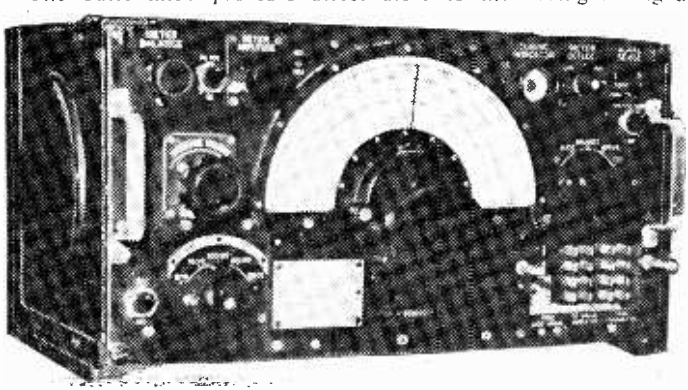
The reduction gearing is fitted inside a die casting, the inner knob being fluted and the outer one serrated as is common practice.

Now choice of tuning drive ratio is a serious problem so far as the short-wave enthusiast is concerned, especially in the case of non-bandspread receivers.

A 100 to 1 ratio is ideal providing that it is smooth in operation and fitted with a tuning knob of suitable shape and reasonable size.

In this case we are discussing two drive mechanisms, each of which offer certain advantages. It would appear a disadvantage to choose a drive ratio of 80 to 1 against the extra 20 to 1 further step down provided by the original model. Much good DX has been achieved by listeners using tuning dials with as low as 10 to 1 ratio.

The author having fitted three of the new type to his R1155 receivers found that while a smooth drive was obtainable it could be further improved.



The R1155 ex-R.A.F. receiver.

Extra Smooth Operation

Before going further it should be appreciated that the Type 35 drive is a splendid example of British precision workmanship. Designed for tuning a receiver fitted in aircraft, it is smooth in operation but not equal to fly-wheel drive fitted to modern commercially produced communication type receivers.

It can, however, be adjusted so that for extra smoothness in

operation it will compare most favourably with the best drive mechanisms with which we are familiar.

Correct Procedure

In order to achieve the desired results there is no need to remove the drive unit from the receiver. First remove the black wax covering the heads of the three screws holding the slow-motion knob in position. Follow by removing the three screws, and withdraw the slow-motion tuning knob.

This will expose the reduction gearing and two metal guides which fit inside the slow-motion tuning knob. It may be that on examination the inside of the tuning knob shows a very slight irregularity in the moulding.

The tip of one or both horizontal guides touching this at some part of the travel will cause a slight amount of friction denoted by a momentary snatch at one point.

In order to remove it care should be exercised in bending the tips of the metal guides. In the case of the top guide press the tips very slightly and carefully downwards. Follow by pressing the tips of the bottom guides upwards.

As the gear case is open the opportunity to apply a little light lubricating oil with a matchstick to the gears should not be missed and will safeguard against wear due to dryness in the future.

Do not use ordinary machine oil or heavy oil. Gunlock or similar light oil is recommended and will safeguard against clogging the gears.

The slow-motion knob can now be replaced and screwed in position. Test the drive by spinning the slow-motion knob with the index finger. If the foregoing instructions have been carefully followed the drive will be sufficiently smooth to spin the gang condenser with ease and a smoothness which we associate with the more expensive spin wheel drives.

Why Modify?

It may be that some readers wonder why it should be necessary to adjust the newer type drive mechanism. This is a matter of personal choice. The Type 35 drive mechanism as supplied new and unused, in fact unopened, is very smooth in operation and will meet the requirements of the average DX enthusiast. The conditions under which short-wave receivers are used in aircraft, and the tuning procedure, are totally different from that of ground station listening and tuning.

For example, an aircraft receiver may be used under bumpy conditions and subject to vibration, consequently a drive and condenser assembly which is too free in operation under such conditions might prove difficult to keep on a desired frequency. Secondly, traffic working is carried out on definite frequencies. The DX enthusiast spends in many instances long periods tuning over different bands. This being so the smoother the tuning drive the better. The Type 35 drive can be adjusted with ease to suit the individual.

Removing the Type 13 Drive

It is quite possible that some R1155 owners have contemplated purchasing one of the Type 35 drives but do not feel like undertaking the task of removing the old one. If the dial cover plate is removed, however, it will be found that the job is a straightforward one.

Care is necessary, however, when removing the small bolts which hold the dial cover plate in place, and a screwdriver which is in good condition is most desirable.

While the dial cover plate is off any dust which has collected should be removed. When the small bolts are to be replaced a little soap applied to the threads will remove the possibility of stripping them or breakage.

In the R1155 series of receivers the drive mechanism or unit does not fit directly on to the tuning condenser shaft. A metal clamp fitted with an eccentric pin is used. If the slow-motion driving head is examined it will be noticed that it incorporates a spring grip. When fitting the driving head to the condenser it is necessary to force the spring grip to one side so that the eccentric pin can be fitted in the hole which is disclosed when the spring grip is moved.

Incidentally this is the only snag likely to be encountered, and requires a little patience. First, the receiver panel should be in the usual vertical position in the interests of seeing what one is doing.

We have the new driving head fitted to the dial cover plate and the new brass distance pieces screwed on the appropriate bolts. If the spring grip at the back of the driving head is forced to one side it will be possible to slip the eccentric pin in position.

This pin should be fully engaged by pressing the driving head forward and incidentally locating the dial plate in its correct position so that it may be screwed in place without difficulty.

The author would stress that while the foregoing instructions might imply in the minds of some readers the possibility of unforeseen complications developing, that is not the case. As the advertisers state, this form of drive is easily fitted. It is not, however, a five minutes' job and requires patience. A useful hint is to make notes relative to the sequence followed in removing the original driving head and reverse the process in fitting the new one.

So far as the author is concerned, one of the principle advantages of the Type 35 drive mechanisms is that they can be adjusted so far as smoothness of operation is concerned, to individual requirements.

Old timers will recall the days when slow-motion drives of various types were fitted with a tuning knob much too small for the purpose even with a comparatively high ratio reduction. Tuning, if bandspread facilities were not available, was tricky and long sessions at the dials cramped the fingers.

Comparatively large tuning knobs have the same effect if the drive is at all stiff. Tastes differ, some, and the writer amongst them, prefer a drive which is of ball bearing silkiness. Others feel more confident when a slight friction effect is in evidence. Those facts as they affect the individual should be borne in mind when adjusting the tips of the guides. Whatever the preference a little careful adjustment should produce the desired results.

Making a Start

INSTRUCTIONS ON HOW TO BECOME AN AMATEUR TRANSMITTER

By "Old Timer"

(*Concluded from page 862 February issue*)

IN the circuit of Fig. 1 "almost any" includes 6L6, 6V6, 6AG7, 6AQ5, 6BW6, QVO3, EF50, KT66, 6K6, 5763, 807, 6F6—indeed almost any small pentrode or tetrode, and many small triodes as well. Naturally the circuit must be limited to the ten watt or less input level, depending upon the crystal used. With some very well-shielded types of valves, it may indeed be very difficult to obtain oscillation. In such a case, the addition of 1pF of capacity between grid and anode will ensure oscillation. Thus one pointer is given on the fact that even a "simple" circuit may need a little "know-how" before it operates satisfactorily. In addition, the anode circuit tuning, with its effect upon output, or, indeed, in stopping

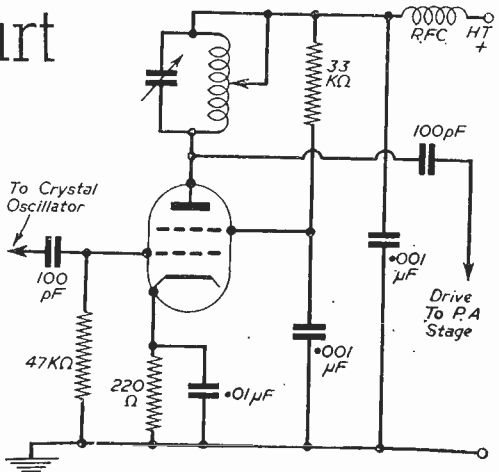


Fig. 10.—A simple buffer/multiplier stage enables the crystal oscillator P.A. stage rig to operate on two or three bands. A 6AG7 or QVO 3-7 may be used as the buffer/multiplier valve.

rapidly. Particularly that, unless tuned for slightly less than maximum output, it will not pick up on pressing the key. It will also reveal that a crystal oscillator will give a chirpy note if pressed to give too much output. With a few minutes experiment, plus the above warnings, anyone can provide ample output plus a rock-steady signal from a keyed crystal oscillator. However, it is not unknown for beginners to struggle for a long while to produce a note that is not chirpy, owing to their having religiously tuned for maximum output. Incidentally, a glance at the DX news column of QST will reveal that crystal-controlled operation on the DX bands is still known in these days of V.F.O.s.

To assist in loading up, some form of aerial

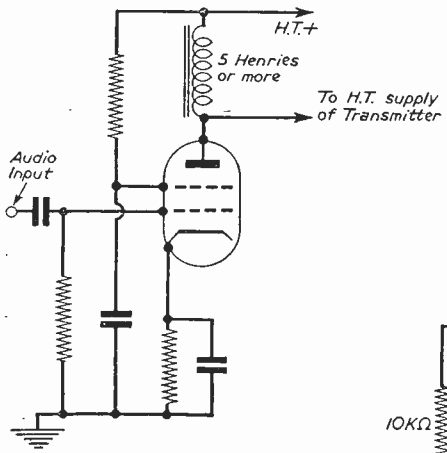


Fig. 8.—A simple Heising modulator for providing phone with simple rigs of low power. With a 6L6, inputs up to twenty watts may be modulated, while a smaller valve such as a 6V6, 6AQ5, 6BW6 enables a top-band rig to be modulated at up to 10 watts input.

oscillation if tuned to too low a frequency, will provide further "know-how." Furthermore, when coupled to an aerial and tuned for maximum output, further know-how will be acquired

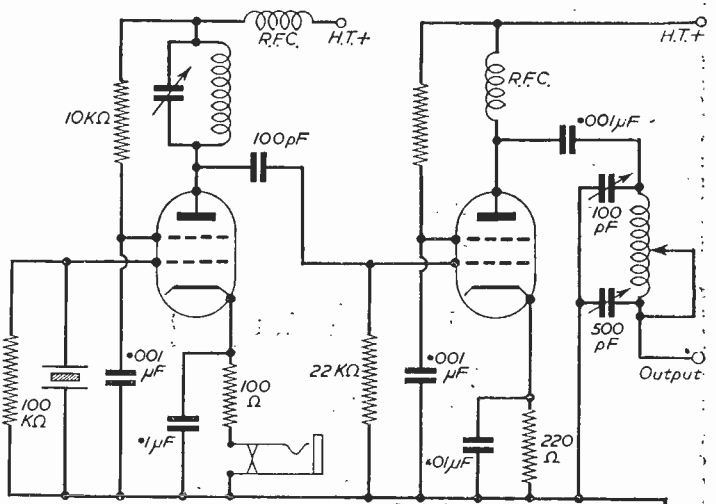


Fig. 9.—The simple crystal oscillator will drive a P.A. stage thus enabling quite high power to be easily attained.

network is to be used, despite the fact that even a simple crystal oscillator could be worked directly into an aerial, or at any rate link coupled. Fig. 2 gives the bare essentials of a tuning network. These may be coupled in many ways to feed many forms of aerial, as the accompanying diagrams show. Indeed, as Fig. 11 shows, the components, plus a load resistance, may be used as an artificial aerial for load and tuning tests without inflicting signals on the ether and the amateur bands. Indeed, if any old surplus quartz crystal is available, an oscillator of this type may be tuned up for experience on an artificial aerial.

Telephony

The "simple rig" may, of course, be modulated for telephony working by any suitable modulator, including the Heising modulator of Fig. 8, using a 6V6 for QRP, and a 6L6 for "QRO" operation. This at any rate enables an old L.F. choke to be used to give phone, without need for expensive modulation transformers. For R.A.E.N. and topband operating, many stations use similar rigs in addition to their main rig used on the other bands. However, such a simple crystal oscillator rig may be used to drive a stage operating up to at least 50 watts or so. Nowadays, to be in the fashion, a Pi tank rig might as well be used for the P.A., as shown in Fig. 9. If the beginner is using such simple rigs as a means of getting on the air, or of gaining familiarity with handling R.F. gear, there is no reason at all to use an expensive ceramic bandswitch . . . just use a crocodile clip and tap in. That way you will be able to select the optimum tap at any rate, and the experience will be of value when "setting up" the inductance taps on the main rig Pi tank circuit. Also, if the loading capacitor is too small, a mica fixed condenser can be clipped in when necessary. The cost, therefore, of running some 50 watts or so with such a simple rig is not necessarily high, particularly if the circuits are made up by raiding the junk box. Naturally new or presentable equipment need not be used on "practice" or standby lashups. However, with a little ingenuity in building and housing such simple items of gear, presentable looking units may be made, even if the veriest junk may be incorporated. Furthermore, the efficiency is not necessarily less because surplus components are used, and indeed a "simple" rig may be made that is a valuable stand-by and "second station" for permanent use in the shack and on expeditions and field-days.

Thus the "one-band" crystal operation may be rapidly expanded by inserting a buffer/multiplier stage, as in Fig. 10. This enables, say, a 7 Mc/s crystal to be used for P.A. output on three bands. This immediately expands the usefulness and general utility of the "simple rig," while V.F.O. operation may be added as well. If a V.F.O. is constructed, the crystal oscillator stage may be used as a buffer/multiplier, by removing the crystal, and applying V.F.O. output to the grid of the valve previously used as a crystal oscillator. If in addition the rig has already incorporated a buffer/multiplier after the erstwhile crystal oscillator, the beginner has now arrived painlessly at a V.F.O./Multipliers/Pi Tank multiband rig, and obtained also a great deal of fun and experience in so doing.

Some Snags

Human nature being what it is, we must warn

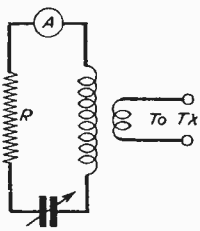


Fig. 11.—The components of the aerial tuning unit may be combined with a resistor to give an "artificial aerial" for non-radiating tests of transmitter performance. For the load resistor a 12 watt 500 ohm wire wound resistor may be used. Values of R between 50 ohms and 1,000 ohms or so might be used, depending upon the calibration of the R.F. ammeter (A). The wattage rating may be increased for higher powered transmitters.

the unwary beginner that there are two serious snags. The first is that having become familiar with operating his simple rig, he will always be comparing unfavourably his full dress all-band rig in gleaming cabinet with his first love. Secondly, having got to the stage of enjoying QSO's, even if local topband natters on a simple rig, he may find that operating becomes so fascinating that he never seems to find time for getting along with building the "big rig." These snags apart, the second string "simple rig" idea has everything to recommend it, particularly as a very simple low-power top-band rig may even be powered off the receiver power pack. If this is done, one tip is to remove the receiver power stage and use phones for reception to enable the extra load to be met. In fact, some economical amateurs utilise the output valve of the receiver as the oscillator or even PA stage of the "simple rig."

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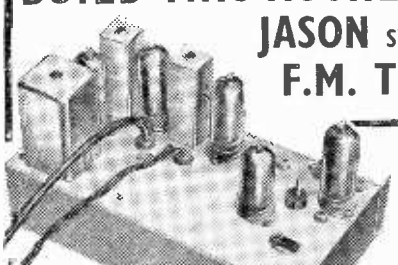

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EAC91	10/-	EY81	10 -	PY83	8/6	Z719	8.6	10C2	18 6
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EB41	10/6	EY91	9 -	R10	22/-	1C2	11/9	10LD11	
EB91	5/9	EZ35	8/6	R19	19/-	1F3	8/6		14/9
EBC41	9/3	EZ40	8/-	SP41	3/6	1R5	9/-	10P13	23/6
EBF80	9/6	EZ41	10 6	SP61	3.6	1T4	8/-	12AH8	10/-
EBF89	9/6	EZ80	8 -	TD04	18.6	5U4G	8/6	12AT6	8/9
EBL21	21/-	EZ81	8 -	TP22	12/6	5Y3GT	8/6	12AT7	8.9
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EC91	8/9	FC2	14/6	U16	11/-	6A8GT	10/-	12AX7	9/-
ECC33	8/6	FC13	14/6	U25	13/6	6AL5	5,9	12BA6	8/9
ECC40	17/6	FC13C	19,6	U78	8/-	6AM6	9/-	12BE6	9/3
ECC81	8 6	GZ32	11/6	U142	8/6	6AN5	5/-	12BH7	10/-
ECC82	9/-	H30	4/9	U145	8/6	6AQ5	7/6	12J7G/GT	
ECC83	9/-	H63	10 -	U147	9/9	6AT6	8/3		10/-
ECC84	10/-	HBC90	8 -	U153	9/6	6B8	4/-	12K7GT	
ECC85	10/6	HL92	11/6	U403	9/6	6BA6	8/6		10/6
ECF80	12/6	HL133D		U404	9/6	6BE6	8/3	12K8GT	
ECF82	12 6		11/6	U801	27/6	6BJ6	7/6		12/3
ECH21	21/-	HY90	7 6	UABC80		6BR7	12/-	12Q7	8/6
ECH35	12/6	KBC32	10 -		10/-	6BW6	8/6	12Q7GT	8/6
ECH42	9/6	KT33C	12 6	UAF42	10 -	6BW7	9/6	11H7	8/-
ECH81	9/6	KT66	16.6	UBC41	8/6	6BX6	8/6	15D1	20 -
ECL80	10 -	LZ319	12/6	UBF89	9/6	6CD6G	27/-	20P2	21/-
ECL82	13 6	ML4	12,6	UCH42	10 -	6D2	5/9	20L1	19 6
EF9	21/-	MKT4(5)		UCH81	10/6	6F1	19/6	30F5	12/8
EF22	16/-	(or 7)	21/-	UCL83	21 -	6F12	8/6	35W4	7/8
EF37A	10 3	MsP4	15 -	UF41	9 -	6F13	18/6	35Z4GT	8/6
EF40	15 -	MU14	10 -	UF89	10 -	6J5G	6 6	50L6GT	
EF41	9 6	N37	18/3	UL41	9.6	6J7GT	10 -		10/-

Quotation given for any types not listed. Obsolete and old types a speciality, send for lists.

A Microphone Pre-amplifier

A SINGLE VALVE UNIT FOR USE WITH A MOVING-COIL MICROPHONE

By R. Hindle

HIGH-FIDELITY amplifiers previously described in this magazine, and those obtainable ready made, generally require a fairly large audio input, probably of the order of half a volt or higher, which is reasonable enough if fed from a radio unit with a diode detector because such a detector should be operated at a high level of signal for the minimum of distortion, though if tone controls are to be used some additional amplification will probably be needed. Many devices, however, are quite inadequate to load such an amplifier unaided and the moving-coil type of pickup and microphone are in this category. The present unit was devised as a pre-amplifier feeding a high-quality amplifier and taking its input from a moving-coil microphone.

The type of microphone under consideration might well give no more than 1 mV of signal at a low impedance. A transformer will be required to match the microphone into the pre-amplifier and this will have a step-up ratio so that the voltage presented to the valve of the amplifier will be higher, but a gain of 100 appears to be a reasonable aim in the present case and that was the design aim for this unit, such gain to be, of course, independent of the transformer step-up.

In the amplifier series of articles published some time ago a design was given for obtaining such a gain in two stages using a double-triode valve but, in fact, it can be obtained in a single stage using a pentode and because the input signal is so small this type of valve is quite suitable. A very important consideration for this purpose is the question of noise generation, for this must be very low compared with the small input from the microphone or else it will be objectionable when amplified along with the required speech, and one has to be very careful in choosing a pentode for this reason, because the pentode is somewhat prone to noise generation. Besides the straightforward noise generation in the valve there is microphony and hum injection to contend with and these factors vary according to the valve used. The Brimar 6BR7 is particularly suitable and is chosen for this design.

COMPONENT LIST FOR FIG. 1

T—Input transformer in mumetal case (Belclere EM1-50-01-Z)
V—6BR7 (Brimar)
R1—1.5 MΩ ½ watt high stability } (Dubilier type
R2—220 KΩ ½ watt high stability } R425)
R3—2.2 KΩ ½ watt carbon
R4—1 MΩ ½ watt carbon
R5—22 KΩ ½ watt carbon } (Dubilier type BT)
R6—22 KΩ ½ watt carbon
VR—50 ohms potentiometer wirewound (if required —see text) (Dubilier type A2/A)
C1—4 μF 350 volt electrolytic (Dubilier type *BR435)
C2—100 μF 12 volt electrolytic (Dubilier type BR1001)
C3—.1 μF 250 volt paper (Dubilier type 410)
C4, C5—16-16 μF 350 volt electrolytic (Dubilier type CT161635, with mounting clip)

Power Supply

A power supply of 250 volts is assumed and the valve makers supply curves for the 6BR7 as audio amplifier using such a supply from which it is seen that a gain of 108 times is obtained using an anode load of 220 KΩ, which satisfies the design aim in this case. The circuit is given in Fig. 1, from which it will be seen that a screen resistor of 1.5 MΩ and a cathode resistor of 2.2 KΩ is used. Some 30 volts of output signal can then be obtained for a distortion of 5 per cent. This sounds rather poor for a high-fidelity proposition, but in fact in the present case there is negligible distortion because nothing like the 30 volts of signal is required; in fact, as we have seen, we have budgeted for only about a half volt of output and the characteristic over this range is nearly straight.

The microphone transformer is built into the pre-amplifier as shown, and this is a miniature contained in a mumetal screen. This is a point that is prone to hum pickup and the use of the specified transformer is to be recommended as being particularly good in this respect. Of course it is no use using such a component and then throwing away all the advantages by connecting it with long unscreened leads and it will be seen

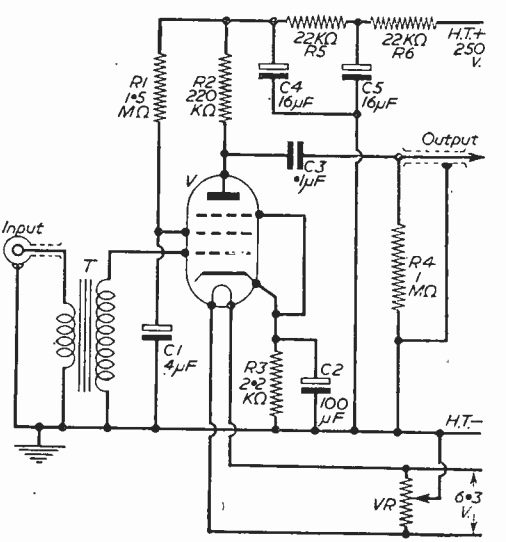

Fig. 1.—The theoretical circuit. VR may be on the main amplifier—(see text).

from the wiring diagram, Fig. 4, that the transformer is brought up as near to the valve base as possible so that the connecting wires are short and they are, in fact, unscreened.

The circuit will be seen to be quite orthodox in principle. A two-stage filter is used in the H.T. feed line because, of course, this stage is

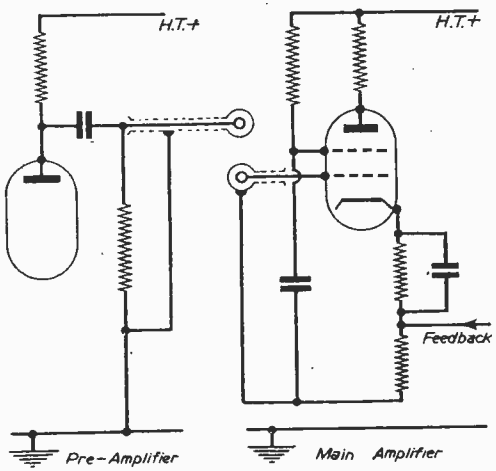

Fig. 2.—Preferred method of feeding signal to mains amplifier.

very sensitive to all the ills that can travel via the power supply and a 100 μF electrolytic is used across the cathode bias resistor. It will be noticed that a 1 MΩ resistor appears across the output. This is intended to be the grid return resistor of the first valve of the main amplifier and if there is one already built into that position in the main amplifier it should be removed, unless, of course, that amplifier is to be used at times without the pre-amplifier, in which case it had better be left, but preferably it should not be less than 1 MΩ.

When connecting the pre-amplifier to the main amplifier it is preferable not to earth the screen of the connecting cable (which is a piece of television coaxial lead-in) to the chassis. The input coaxial socket on the main amplifier can conveniently be mounted on a piece of Paxolin board with a soldering tag underneath one of the holding-down bolts. This tag is then used as the return earthing point for all components associated with the first main amplifier stage. The circuit will then appear as shown in Fig. 2.

Method of Use

This amplifier was intended for use near to the main amplifier and with a comparatively short run to the microphone; in fact it was for use by a dance band combination where the whole outfit was kept quite compact. Consequently, the power required for this pre-amplifier was picked up from the main amplifier. The requirements are quite modest and are not likely to overload any amplifier power pack. The heater takes .15 amp at 6.3 volts and less than a milliamp of H.T. is drawn at 250 volts. If the microphone is to be any considerable distance from the main amplifier it will be better to put the pre-amplifier by the microphone and in this case a separate little power pack should be constructed to feed it. This can be quite modest,

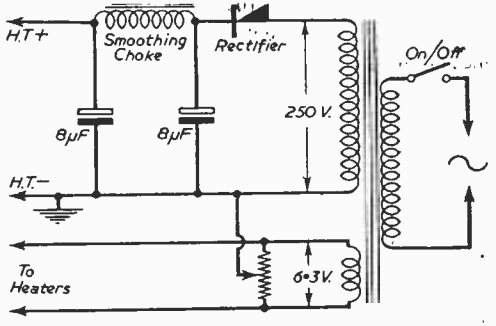

Fig. 3.—The power supply.

using a small metal rectifier and a transformer with a single H.T. winding giving 250 volts and a 6.3 volt heater winding as shown in Fig. 3.

(*Continued on page 63*)

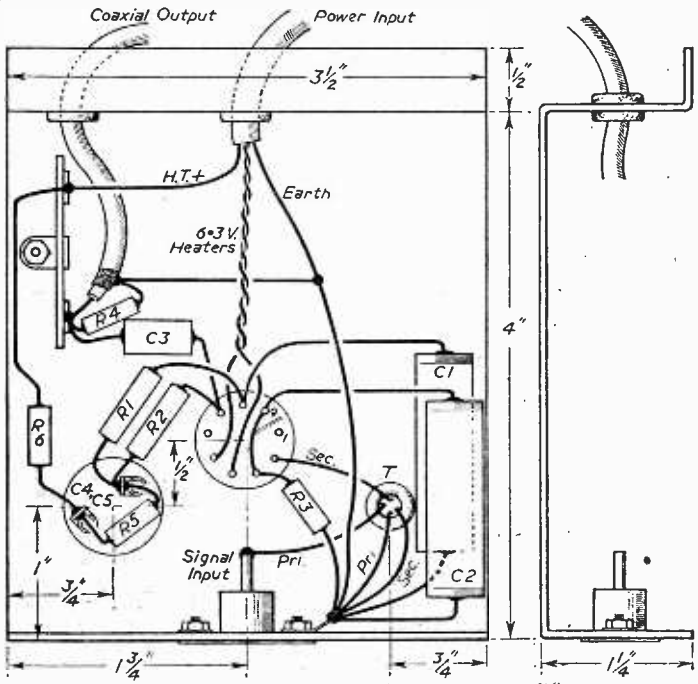

Fig. 4.—Wiring details for the pre-amplifier.

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The method of connecting the heater of the pre-amplifier will depend on the source of power. If this is taken from the main amplifier it may be that one side of that amplifier's heaters will be earthed and it is fairly certain that to change that will be difficult so it will be as well to connect one side of the pre-amplifier heater also to earth. It is preferable, however, for both sides of the heater to be floating, with a centre-tap to earth by means of a "humdinger" potentiometer. This method is shown in Fig. 1 because the amplifier with which the unit was to work had already this method of connection. The idea is, of course, that any residual hum can be cancelled out by adjustment of this control. In practice complete cancellation cannot be effected by this means because of spurious phase-shifts and so it is essential to take every precaution to avoid hum introduction in the pre-amplifier, but what slight hum is unavoidable can be reduced by adjusting the humdinger.

Floating Heater

It follows, of course, that if a special power pack is constructed the floating heater method will be adopted and this is given in Fig. 3. If more convenient, the actual potentiometer could be fitted to the pre-amplifier instead of to the power pack. In either case, two interconnecting heater leads will be required in addition to the earth and H.T. + lead; the earth to the potentiometer is made on whichever chassis it is mounted.

Fig. 4 gives the wiring for the chassis. It will be seen that the heater leads of the interconnecting cable go directly to the heater pins on the valve holder, and these connections should be made first. These are shown as floating, as explained above, so do not forget to link one to earth if the power supply to be used requires that mode of connection.

Earthing

Note that all earth leads on the pre-amplifier are taken to one point, actually to a soldering tag on the input coaxial socket; if the heater has to be earthed this could go to the chassis, but no other lead should be so connected. A soldering tag strip is used to anchor the output coaxial lead and the H.T. + input, but the earth tag of this strip is not used for connections. After the heater connections wire in the input transformer, cutting down the leads to the minimum required for the connection. The remaining connections can be made in any order, but preferably leaving the comparatively bulky electrolytic capacitors until the last.

Both input and output leads must be screened. Coaxial cable as specified is ideal for the link between the pre-amplifier and the main amplifier, and if it is necessary to provide the lead from the microphone to the pre-amplifier the same material could be used.

Should the run between microphone with pre-amplifier and the main amplifier be considerable it may be preferable to introduce a cathode-follower in the output circuit.

News from the Clubs

NORTHAMPTON SHORT-WAVE RADIO CLUB (G3GWB)
Hon. Sec.: S. F. Berridge (G3ITW), 20, Ethel Street, Northampton.

A SERIES of lectures from the R.S.G.B. Recorded Lecture Library has been arranged; those so far heard have been "Receivers," by R. H. Hammans (G2IG), on December 6th, and "Transmitter Design and T.V.I.," by N. Shires (G3BTM), on January 3rd. The next two in the present series are scheduled for February 7th and March 7th and the respective subjects will be "Aerials," by F. Charman, M.B.E. (G6CJ), and "Amateur Radio in the Antarctic," by Roth Jones (VK3BG). A film show has been arranged to take place on February 28th: it will consist mainly of films of technical interest connected with radio, but it is hoped to include films on other subjects as well. Details as to programmes, times and place of showing may be obtained from the hon. secretary at the above address.

PLYMOUTH RADIO CLUB
Hon. Sec.: Cyril Teale (G3JYB), 3, Berrow Park Road, Peverell, Plymouth.

THE club continues to meet each Tuesday at the Virginia House Settlement, St. Andrews, Plymouth, at 7.30 p.m.

MIDLAND AMATEUR RADIO SOCIETY
Hon. Sec.: P. G. Turton, 2, Holloway Head, Birmingham, 1.

MORSE classes are held every Thursday at The British Red Cross Society (Birmingham County Branch), 16, Highfield Road, Edgbaston, Birmingham, 15, at 7.30 p.m., by H. B. Bligh (G3HBB). All welcome.

North Midland Mobile Rally to be held at Trentham Gardens (between Stoke and Stafford), on Sunday, April 20th, car park for 120, accommodation for everyone.

G. R. M. Meeting at The Digbeth Institute, Birmingham, 5. Tickets: approximately 7/-, including meal. April 27th.

Club meetings 3rd Tuesday at The Midland Institute, 7.30 p.m.

RAVENSBOURNE AMATEUR RADIO CLUB
Hon. Sec.: J. Wilshaw, 4, Station Road, Bromley, Kent.

MEETINGS are held Wednesday, 8 p.m., at Durham Hill School, Downham. Recent addition to the club station, G3HEV, is a BC348 receiver. On Tuesday evenings a beginners' basic radio class is held—all welcomed. Morse lessons held.

BURY RADIO SOCIETY
Hon. Sec.: L. Robinson, 56, Avondale Avenue, Bury, Lancs.

THE society holds its meetings at the George Hotel, Kay Gardens, Bury, at 8 p.m., on the second Tuesday of each month, and all radio amateurs and short-wave listeners are always welcome. On February 11th Mr. J. E. Hodgkins (G3EJF) will talk about "Elements of Radio Astronomy."

On Tuesday, March 11th, there will be a talk on "T.V.I. Prevention," by Mr. G. Openshaw (G2BTO).

TORBAY AMATEUR RADIO SOCIETY
Hon. Sec.: Geo. Western (G3LFL), 118, Salisbury Avenue, Barton, Torquay.

AT a recent meeting held at the Y.M.C.A., Torquay, unanimous approval was expressed when Arthur Hook (G3CMT), signified his willingness to act as experimental manager. The Annual Dinner and Social is on Saturday, February 22nd, at 7.30 p.m. Tickets for this event are priced 10/6 (ten shillings and sixpence), and can be obtained from the Social Committee Chairman, John Olway, 9, Hoyles Road, Paignton, and the secretary.

READING AMATEUR RADIO CLUB
Hon Sec.: G3IKA, 12, Chiltern Bank, Peppard.

AN invitation is extended to readers and all who are interested in Ham Radio to attend the following meetings of the above club:

February 22nd, 7.30 p.m., Broad Street H.Q. S. Woodward, Esq., A.M.I.Mech.E., will give a talk on selsyns and desyns, which will interest those Hams with beams.

March 29th, 7.30 p.m., Broad Street H.Q. Lt.-Col. Bower will give a talk on his experiences using VU, VS1, etc., call signs, which should be very interesting to those D.X. Hunters.

This club has been in existence for some months now, and the aim is to get together those Hams and SWLs in the district who are keen to meet and help each other in the true Ham spirit.

It is hoped shortly to start Morse classes for those interested in obtaining their tickets, and if sufficient members are keen this will be followed by technical instruction up to C. and G. standard.

The address of the club's headquarters is being changed, and those who do not know of the new address should contact the above temporary officer who will be only too pleased to help.

Programme Pointers

Our Critic, Maurice Reeve, Reviews Some Recent Programmes

"WELL" is a one syllable word listed both as a noun and an adjective. Among its many definitions as the former are "a rise of water from the earth," "a spring," "a cavity," etc. etc. Within the latter category are "good in condition," "fortunate," "comfortable," and others. "To issue forth" is to use it as an intransitive verb, whilst "in a proper manner," "rightly," "favourably" or "thoroughly" are adverbal usages. And so on and so on.

What am I getting at? Just this. When shall we ever hear an interview which doesn't begin with that tiresome little word "well"? A Cabinet Minister returns from a foreign mission and answers "our reporter" at London Airport with, "Well, I think my visit to Paris . . ." A famous centre forward says, "Well, it was a fine game . . ." a Trades Union leader replies, "Well, I think the Government . . ." A film or TV star, "Well, I'm thrilled to be in London . . ." a Grand National Winner, "Well, I always knew Dobbin would win. . . ." Well, well, well! A spring. To issue forth. Who knows? Perhaps they are justified, after all!

Audrey Russell presented an enlivening, entertaining and informative programme styled "American Spoken Here." It might well make the forerunner of a series. It was based on "impressions made with the help of a tape recorder in Washington, Philadelphia and New York," and contained many interviews with representative American men and women and observations on things seen there. What a country! What a people!

Master Pianist

Artur Rubinstein must be very nearly, if not, the last pianist who is both a giant of yesterday and to-day. With the B.B.C. Symphony Orchestra in two concertos—Schumann and Saint-Saens—he showed, both in virtuosity and poetic insight—that the "new school" has nothing to show excelling the masters of yesterday, especially in the latter department. They were memorable performances.

George Gissing was a novelist of little account in his own day—a day of giants—and of even less to-day. Certainly to the present writer. But the admirably presented centenary "Portrait" showed us to be the poorer for our neglect. It was compiled and narrated by Anthony Curtis. But I didn't like the "voices" of H. G. Wells (Chas. Leno), Morley Roberts (P. Woodthorpe), or Gissing himself (Martin Starkie).

Comedy and Plays

That famous comedy of Aristophanes, "Lysistrata," in which, during the Peloponnesian war, Athens defeated Sparta by the horrible to think of, and never since repeated, ruse of women segregating themselves from their men, was given a rollicking performance. Googie Withers was enchanting as the conspiratress in chief.

James Bridie's murder thriller, "Dr. Angelus," is popular with amateur dramatic societies and is good entertainment. It doesn't seem to convey any reality or psychological implications. Whether such a scoundrelly doctor—or, for that matter, such a nit-wit as his young English assistant—was ever found with a plate and the usual qualifications on his gate is extremely doubtful.

The Glasgow Citizens Theatre Company put it on with great realism. One noticed a few hesitances in Duncan Macrae's performance of Dr. Angelus, who first poisons his mother-in-law and then his wife (as well as seducing the maid by way of light relief, one presumes); otherwise it was ghoulish and evil enough. Fulton Mackay, as his assistant—who is foolish enough to sign both death certificates against all the evidence—had, I presume the unusual experience for a Scotsman of turning himself into a North country Sassenach. Others in the cast were Edith McArthur, Jessie Morton, Joan Scott, Edward Waddy (very good), Michael O'Halloran and James Nairn. Producer, James Crampsey.

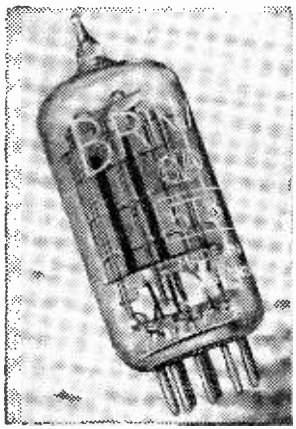
Documentary

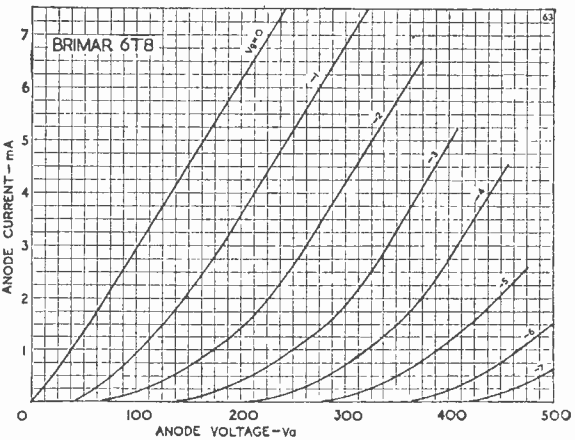
"The Latest Witness" was an absorbing documentary, styled "a spontaneous conversation" between Dr. Ernst Hanfstaengl, Alan Bullock, Peter Fleming and Lindley Fraser. The subject: Dr. Hanfstaengl's recent book, "Hitler, The Missing Years." (The doctor was a friend and confidant of the corporal in his early years and up to his assumption of real power.)

Although speaking very elementary English, some of the doctor's epigrams were so funny that one cannot help wondering as to the degree of spontaneity the programme actually achieved. I cannot refrain from quoting two. Of girls—"they looked at him as if he were the Unfinished Symphony" (he certainly was the unfinished general, thank Heaven). And of Wagner's music —"it had an effect on him like a brassiere: it gave him uplift." These are remarkable linguistic coinages from someone who sounds as though he might frequently be at a loss for the *mot juste* if hard pressed. However, it was a diverting and rewarding forty-five minutes.

BRIMAR 6T8

The Brimar 6T8 is a triple-diode triode in which one diode has a separate cathode. The triode section has a high amplification factor making the valve suitable for use in AM/FM receivers in the demodulation and first stage audio circuits. The diodes may be used in series shunt limiter circuits, for example, in the audio sections of television and communications receivers, followed again by the triode, section for A.F. amplification.





Near Equivalents
EABC80 DH719
6AK8

Typical Triode Operating Characteristics as an R.C. coupled amplifier.

Anode Supply Voltage	250	250 volts
Anode Load Resistor	0.25	0.25 megohm
Grid Resistor	1.0	10 megohms
Cathode Bias Resistor	3	0 kilohms
Peak Output Voltage	43	40 volts
Stage Gain (for 24 V peak to peak output) ...	42	42
Distortion (for 24 V peak to peak output) ...	1	5%

Keep this for further reference or write to the Publicity Department for a data sheet.

Standard Telephones and Cables Limited **FOOTSCRAY, SIDCUP, KENT** **Footscray 3333**

SEE THESE FINE BARGAINS AT *The Walk-around Shop*

ELECTRIC TIME SWITCH

Beautifully made, clockwork mechanism automatically wound by 6 volt Solenoid. The time switch can be set for any period between 30 minutes and 44 days. This robust unit is housed in strong Bakelite case, 4in. in diameter. ... ... *post paid* **12s. 6d.**

NEW TANNOY SPEAKERS

External 8 watt unit 7½ ohm impedance complete with matching transformer. ... ... *plus 3/6 packing and carriage.* **£1 . 0 . 0**

CRYSTAL MICROPHONE INSERTS

Suitable for connection directly into pick-up sockets of Radio or Gramophone Amplifier. No transformer required. Very sensitive. Guaranteed. ... ... *each, post paid.* **4s. 6d.**

F.M. RECEIVER ARR.3.

Frequency : 60 Mc/s. Requires only a simple conversion to B.B.C. F.M. Transmissions.
Valve Line Up : 1st RF 12SG7. 2nd RF 12SG7. Mixer 12SG7. Osc. 12SG7. 1st IF Amp. 12SG7. 2nd IF Amp. 12SG7. Limiter 12SG7. Det. 12H6. 1st AF Amp. 12SQ7. O/P 12A6. 2 12SH7's AFC. Magic Eye 12USG. ... ... *plus 7/6 carriage.* **£6 . 0 . 0**

MARCHING COMPASS

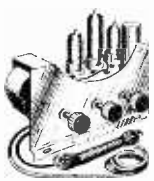
3in. x 2½in. x ⅞in. Ideal for scouts, hikers, etc. ... *plus 1/- postage and packing.* **12s. 6d.**

WALKIE-TALKIE TRANSMITTER/RECEIVER TYPE 38

Frequency 7.4 to 9 Mc/s, valves with four VP23's and one ATP4. Brand new and complete, with two pairs of earphones, two throat microphones, whip aerial, junction box and canvas satchel. ... ... *plus 5/- postage and packing* **£3 . 5 . 0**

PROOPS BROS. LTD. *When ordering, please quote Dept. 'P.'*
52, Tottenham Court Road, London, W.1. *LAN 0141*
Shop hours : 9-6 p.m., Thursday, 9-1 p.m. **Open all day Saturday**

3-4 WATT GRAM AMPLIFIER

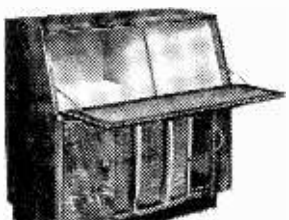


A three-valve quality amplifier designed to satisfy the more discriminating record enthusiast. Three controls give a very wide variation of tone. Fully isolated chassis. Output matched for 2-3 ohms. Valves ECC83, EL84, EZ80. Size approx. 6¾ in. x 5 in. x 2½ in.

PRICE 79/6 PLUS 2/6 POSTAGE

SUPERIOR BUREAU

PRICE 16½ GNS. PLUS 25/- CARR.



In richly figured walnut veneer, internal panels in polished sycamore. Uncut control panel (16in. long x 10¾in. high) alongside which is an uncut base-board (15¼in. long x 13¼in. back to front). Inside front lid is panelled in beige leatherette. In the lower part of the cabinet are two storage cupboards (13½ in. high, 7½ in. wide, 16½ in. deep). Overall dimensions 33 in. high, 34 in. long, 16½ in. deep.

LARGE SELECTION OF CABINETS

SUPERIOR RADIO SUPPLIES
37, HILLSIDE, STONEBRIDGE, N.W.10.
PHONE : ELGAR 3644.

Open to Discussion

The Editor does not necessarily agree with opinions expressed by his correspondents

Wavebands of P.C.R. Set

SIR,—In reply to inquiry by your reader, Mr. W. E. Rigg, Northern Rhodesia (January issue). The P.C.R. sets were made in two models. P.C.R.2, covering wavebands 13-49 metres, 200-600 metres and 800-2,100 metres and P.C.R.3 covering 12-41 metres, 41-120 metres and 200-560 metres. Valve line up: EF59 R.F. stage; X61 freq.-changer; EF39 1st L.F. stage; EF39 2nd L.F. stage; EBC33 det. and L.F. amp.; 6V6g output.

A separate power pack is required, with a 12-volt filament supply, as the valves are linked in pairs series-parallel. This can easily be converted to 6.3 operation, but is hardly worth the trouble, as 12-volt filament transformers are obtainable. I have two of these P.C.R. sets in use, made by the Invicta Radio Co., and have received signals from Newfoundland, Canada, most districts of the U.S.A., including W.6's, Panama, Bahamas and West Indies, South America, Persian Gulf, all Mediterranean countries, Johannesburg, Cape Town, Rhodesia on the 15 and 20 metres ham bands, all at full L.S. strength. The 13, 16, 19, 25, 31 and 41 bring in world-wide stations like the local; in fact you would have a job to beat this set for general all-round short-wave work.—J. A. LAWTON (Southport).

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 commercial or 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.

Peculiar Faults

SIR,—Some time ago you reported one or two peculiar faults which had been experienced by readers, and I should like to add to these with one of my own experiences. It does serve as a reminder that you cannot be too sure, and even the most careful tests may not reveal a fault. I must say that when cases such as that to be described occur in commercial sets, I do feel pity for the poor service engineer. A set which I was using suddenly developed the peculiarity of crackling, for no apparent reason, at odd times. Sometimes it went for days on end without any trouble, then it would start crackling. I listened carefully and it was not due to any microphonic trouble, so I decided I would have to have it down. I removed it from the cabinet, went over all the wiring, and there were no bad joints or loose connections, so I blew out all the dust and replaced it. Everything was all right for about two days, then a fit of crackling again. I stuck it for a week or so, then removed all the valves, carefully cleaned each pin with emery-cloth but still the crackling went on. I next took out the set and carefully cleaned the switches with special cleaner bought for the occasion, and still it crackled. The reason was discovered quite by accident. I was listening to a programme, and the wife got up to answer the door and as she walked across the room the crackling started, only to cease when she had gone out. Eventually I found that the power point on the floor into which the set was plugged was the cause of the trouble. The switch was of the surface mounting type with small brass tubular pieces inside, through which the mains lead was passed and then held in place by a small setscrew. The tubular piece was attached to a strip of brass which made contact with the forked piece into which the switch blade locked. The small tubular piece had come away from the brass strip. The mains wire held it in place, but vibration resulted in it making and breaking, hence the crackle. Apparently passing traffic was sufficient to produce vibration and cause the crackling. A new switch cured the trouble. H. G. WATTS (N.W.).

A C.R.L. Bridge

SIR.—Many readers may be wondering why Mr. J. Hillman's C.R.L. Bridge (January issue) fails to work.

It can soon be put right by moving resistors and condensers around.

I suggest the following:

R1—4.7 KΩ	R16—10 Meg Ω precision
R2—47KΩ	R17—1KΩ
R3—1KΩ	
R4—100KΩ	C1—8μF 350v.w.
R5—10Ω	C2—.001μF
R6—10KΩ	C3—.001 μF
R7—2 Meg Ω	C4—.1μF
R8—1 Meg Ω	C5—.1μF
R9—1 Meg Ω	C6—8μF 350v.w.
R10—7.5 K 10 W	C7—100pF pre.
R12—10Ω precision	C8—.001μF pre.
R13—100Ω precision	C9—.01μF pre.
R14—10KΩ precision	C10—.1μF
R15—1 Meg Ω	C11—1μF

One other small point: he states that to use a 6J5 instead of one half of 6SN7 is inconvenient *due to its top cap grid.* All 6J5s that I have used are single ended (all base connections). The bridge was completed in quite a short time, and is very good. The valves used in mine—6SN7,

6J5 and a UU6 (4v. rectifier).—B. E. C. LAVENDER (G3KAQ) (Emsworth).

P.W. Organ—Correspondent Wanted

SIR,—I am a regular reader of P.W. and I have been building radio sets since the early twenties. I have now built the Mullard 20-watt quality amplifier, and I am interested in building an electronic organ for myself. I have your blue print for the monophonic organ, but I would like to get in touch with someone who has built a polyphonic one. I see references from time to time in P.W. to various parts and improvements, but only the names of correspondents are given. I should like to get in touch with someone who has built the P.W. organ who would be prepared to pass on any hints.—D. J. JONES (Pwllheli).

Restrictive Practices

SIR,—I was most interested in the Editor's comments in the February issue, and should like to ask one or two pertinent questions of manufacturers. Valves are repeatedly advertised in your pages at below cost. I have bought many from time to time, and although some have been proprietary makes and boxed, I have also had from time to time unboxed (or plain boxed) valves, on which the type number is engraved in a different way from standard valves, and no maker's name appears. They are obviously brand new, and are on a parallel with the "non-ring" lamps as they are called which can be obtained from the popular stores. I have been told that they are standard valves and lamps made by one of the big manufacturers, but sold outside a contract by the "ring."—H. PENN (Edgware).

Tag Boards

SIR,—I should like to ask readers how they have found the use of tag strips and tag boards in their general application. I always wire components direct between the parts of a circuit, in the case of valveholders actually mounting condensers and resistors direct on the valveholder tags. It always seems to me to be wrong in principle to mount all components on one board and then use long leads to hook them up. Am I alone in this idea?—T. R. YOUALL (Wembley).

Fault Finding—a Hint

SIR,—I should like to pass on a hint to other readers who are interested in fault finding and may fall into the same trap as I did. I have in my den a number of various lengths of flexible lead, with crocodile clips at each end. I use these a lot in experimental work, and recently was experiencing very bad hum on an experimental layout, which took up a lot of room on the bench. In trying to locate the source of the hum I clipped on a longish lead to an earth point and clipped the other end on various parts of the circuit, hoping by this means to find where the hum was entering the circuit. I got right back to the beginning of the circuit without stopping the hum, and realised that there was something wrong with my diagnosis. I did eventually stop the hum about one-third of the way through the circuit, but with a 5in. lead used in the same way. The long lead was picking up as much hum as the circuit being checked, and it was not until I used a short earth from one point in the circuit that the hum stopped and the cause was thus traced. Moral, don't use long leads!—G. PRENTICE (Exeter).

Beginners' Constructional Course

SIR,—I should like to extend my appreciation of the recent series of articles under the above title. I started and built each one and have read in conjunction with it the beginners series when recently published and which I now have in book form. I should now very much like to go a stage further and start on valves, and should like to suggest that it would be very useful if you could arrange to publish a series on the same lines but dealing with valves. I am sure this would appeal to many readers, and it could be made so that it was not too elementary.—J. RINGELY (Finchley, N.).

[*Arrangements have been made to publish a series of articles on the lines mentioned, and we hope to publish the first of these in next month's issue.*—ED.]

A TRANSISTORISED SIGNAL GENERATOR

(*Continued from page* 30)

reduce capacity effects. The R.F. oscillator coil is mounted vertically, a hole of just under ½in. diameter being drilled in the board and the Ferrite rod forced through. The leads from the coil to various components should be as short as possible.

The general layout apart from the points mentioned depends on the experimenter. Note: Care must be exercised when soldering the transistor into place as too much heat will damage the germanium.

Testing and Calibrating

Before switching on care must be exercised to ensure the correct polarity of the batteries. Damage to the transistors will result if incorrect. Current drain from the 9-volt battery is of the order of 2 to 3 mA and that of the 1.5-volt battery is 0.5 to 1 mA with both transistors switched on.

If no standard signal generator is available to the experimenter calibration can be carried out using a broadcast receiver set to medium wave.

The output of the generator is connected to the aerial and earth terminals of the receiver. Switch on and set "C/W/MOD" switch to "MOD." thus modulating the carrier. If the generator tuning is now rotated a 400 c/s note will be heard on the receiver. Set receiver tuning to 300 metres (1 Mc/s), set generator "HI-LOW" switch to "HI" and rotate tuning slowly until the 400 c/s note is heard. There may be several 400 c/s notes at different settings of the dial, tune for maximum audio output and mark dial 1 Mc/s. Set receiver to 600 metres and tune for maximum sound, "HI-LOW" to "LOW," this will give calibration at 500 Kc/s. The table on p. 30 will give direct conversion from wavelength to frequency. The generator should be calibrated at each of these points.

News from the Trade

K.B. PLASTIC COVER

A NEAT transparent plastic cover for the K.B. "Rhapsody" portable radio is now being supplied with each new set leaving the Footscray, Kent, factory.

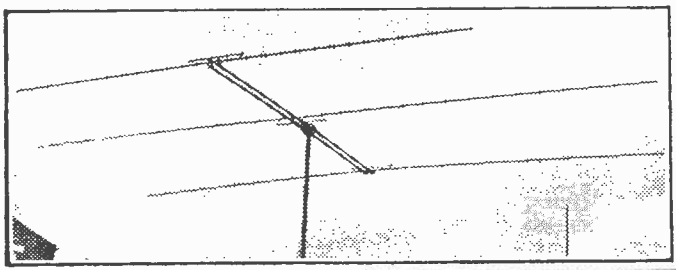
The cover is being introduced not only for protection after purchase, but also to guard the highly polished injection moulded cabinet during factory assembly and delivery to dealers.

A K.B. official said this week that although the covers could not be supplied free to dealers for issue with existing stocks, they would be available as a separate item for sale to present "Rhapsody" owners. — Kolster-Brandes Ltd., Cray Works, Footscray, Sidcup, Kent.

NEW THREE-IN-ONE BEAM AERIAL

AMATEUR radio enthusiasts have long worked to perfect the quality of their signal transmission and reception. A beam aerial for home-assembly was recently introduced by the Panda Radio Company of Rochdale, Lancashire.

Known as the "Globemaster Minibeam," this new piece of apparatus, which was designed to provide high-gain directional antennae for the three amateur wavebands, was invented by Capt. G. A. Bird. It employs a simple lightweight array or aerials which, together with a unique method of feed, permits of transmission on three wavebands—10, 15 and 20 metres—eliminating the necessity of tuning or switching. The array is easily erected and requires no elaborate supporting tower and does away with the need for complex arrays. A single feed line to the transmitter is used on all three bands and no adjustment to the aerial is required when changing from band to band. The performance on each band is equal in every way to that of a comparable single band beam.



The benefits of the ordinary beam aerial are well known—its ability to concentrate a signal in the required direction, to give similar gain on reception and to reject signals from an unwanted quarter—but its drawback is that a separate aerial is required for each waveband used. The physical size of the beam aerial is determined by the wavelength required, and to the transmitting amateur concerned with 10, 15 and 20 metres this often results in cumbersome structures, difficult to rotate, and weighing as much as 500lb. for the more complex arrays.

In order to overcome structural problems created by a wide range of climatic conditions in various parts of the world, high-tensile aluminium alloys supplied by Northern Aluminium Company Limited were specified for the "Globemaster Minibeam." Noral 51SWP tubing is used for the boom and elements and Noral 350W for the clamps. A complete array weighs only 35lb., and the manufacturers claim that it can withstand the worst weather conditions.

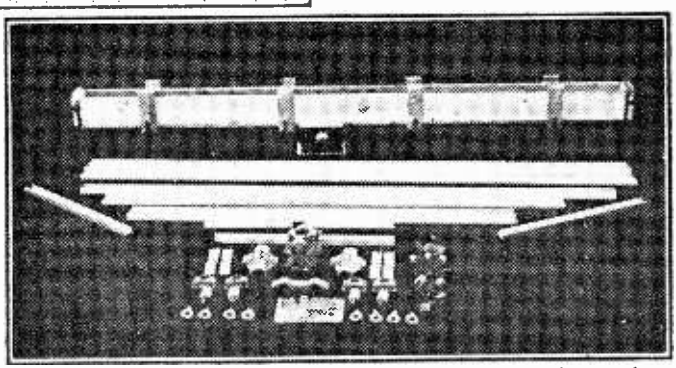
The gain on 10 metres is 9.5db., on 15 metres 7.5db., and on 20 metres 4.5db., over a simple dipole. Expressed as power, this is equivalent to a power gain of 9 on 10 metres, 5.6 on 15 metres and 2.8 on 20 metres. The front to back ratio is 20-30db. To the transmitting amateur in this country, restricted to an input of 150 watts, the use of the beam gives an equivalent power of 1,350 watts on 10 metres, 840 watts on 15 metres and 420 watts on 20 metres if only a simple dipole is used.

NEW MINIATURE BEAM POWER VALVE

THE 6973 is a beam power tube of the 9-pin miniature type designed for use as an output tube in high-fidelity audio equipment.

The 6973 features linear operation over a wide range of power, higher power sensitivity, and high stability. These features in addition to low heater power (6.3 volts at 450 milliamperes) permit the design of compact, relatively low-cost audio equipment where high output voltage with low harmonic distortion is a primary consideration.

For example, in push-pull class AB1 audio, two 6973s operating at a plate voltage of 350 volts, grid No. 2 voltage of 280 volts, and fixed grid No. 1 voltage of −22 volts, can



The complete set of parts for constructing the aerial shown above This is the "Globemaster Minibeam."

deliver a maximum-signal power output of 20 watts with a total harmonic distortion of only 1.5 per cent.

Design features of this valve include double base-pin connections for both grid No. 1 and grid No. 2 to provide cool operation of these grids and thus to minimise grid emission. Furthermore, cool operation of both grids permits use of relatively high values of grid-circuit resistance to reduce driving power.

During manufacture, close controls for dynamic zero-bias plate current, plate-current cutoff, grid No. 2 current, and grid emission ensure dependable performance of the 6973 in high-fidelity audio equipment.—R.C.A. Gt. Britain Ltd., Lincoln Way, Windmill Road, Sunbury-on-Thames, Middlesex.

TRANSISTOR TRANSFORMERS

THE great interest shown in the various uses of transistors during recent months has resulted in a demand for suitable transformers for incorporation in factory-built and home constructed equipment.

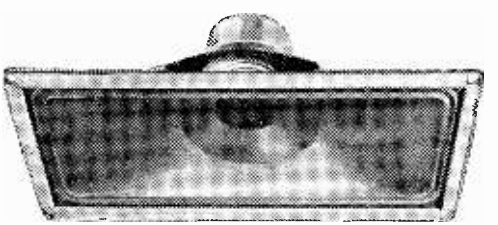
For nearly 35 years Messrs. H. W. Forrest have designed and manufactured transformers for the radio, electrical and television industry and have now produced a complete range of transformers from 200 mW to 20 W rating.

These cover all the popular transistor types at present obtainable and further designs will be added from time to time.—H. W. Forrest (Transformers) Ltd., Shirley, Solihull, Warwickshire.

NEW RECTANGULAR SPEAKER

IN instances where television, radio and gramophone cabinet space is severely restricted it has been considered good practice to employ an elliptical loudspeaker. This arrangement has been generally satisfactory, but the fullest use has not been made of the loudspeaker panel area.

To meet this requirement The Plessey Co., Ltd., has now introduced a new 9in × 4in. rectangular-shaped loudspeaker, which provides considerably improved high efficiency and firm low-frequency performance. Moreover, it has extremely good power handling ability.



The new Plessey 9 x 4 in. rectangular loudspeaker, which is ideal for use in table gramophones, car radios, table television sets and A.M./F.M. receivers.

It can be supplied with alternative cones made from different qualities of materials to give a varied high note response to suit customers' specific requirements. The standard cone has a smooth extended high note characteristic.

This speaker is ideal for use in table gramophones, car radios, table television sets and A.M./F.M. receivers, for which quality of reproduction above average is desired. The ¾in. voice coil can be supplied with any of the Plessey ¾in. range of magnets from 7,000 to 12,000 gauss.—The Plessey Co., Ltd., Ilford, Essex.

JACKSON BROS. (LONDON) LTD.

THERE have been certain alterations to some of the J. & B. range of products. These are as follows:

Dilecon Condensers: capacities from .0001 to .0005, price now 4s. 6d.; .00075, price now 5s.

Jackson Bros. range of ball drives are now available with a flange for use for scale or pointer mounting. Part No. 4511/F.

The S.L.16 Drive, Cat. No. 5191, will in future be supplied complete with escutcheon and glass 6¼in. × 1⅝in. opening, 7¼in. × 2⅜in. overall. The escutcheon will be provided in Florentine bronze finish. Retail price 13s. each, complete.

The Jackson Type OPC 2 gang condenser, Cat. No. 5250/2/PC, has the following specification: Stator terminals and earthing tags for frame and rotor are formed to provide resilient plug in mounting, for use in printed circuit technique. Provides instantaneous and accurate location which retains the component firmly until soldering is completed, no tags or wires to bend or clench. Resilient stator tags make it possible to unsolder and remove if necessary. Trimmers are provided as standard (2-25 pF). Specification otherwise same as for "O" gang.—Jackson Bros. (London), Ltd., Kingsway, Waddon, Surrey.

CLIP-ON CABLE MARKERS

THE most recent addition to Creators range of identification systems is the "Clip Marker." This, as its name implies, is a plastic moulding which is designed to clip on to a cable. It is provided with interchangeable paper or plastic shields which can be supplied either pre-printed or blank so that the user can write or print his own code on to them. The standard clip marker can be used anywhere along the length of a cable but an alternative design is available which can be pushed on to the end of a cable. This type also acts as a binding sleeve.

Both types of marker are available in a wide range of colours and sizes. Cables can thus be colour coded by this means as well.

The two types of clip marker have been designed to overcome some of the disadvantages of the more usual type of identification sleeve, which are that a wiring system cannot be coded *in situ* and that once it has been coded that coding cannot be changed without dismantling the whole layout.—Creators Ltd., Plansel Works, Sheerwater, Woking, Surrey.

RECEIVERS & COMPONENTS

TELEVISIONS, 12in. 5 channel, **£14;** 14in., **£18;** 17in., **£27;** Faulty Sets from **£2.** WILKINSON'S, 146, Goldhawk Rd., W.12. (SHE 4379.) Callers only.

MIDDLESBROUGH. Largest stocks on N.-East coast. Radio, TV components, FM Kits, Gram. Cabinets, Tape Decks, Leak Amplifiers, Valves, etc. Callers only. PALMERS, 106, Newport Road. (Phone: 3096.)

MAKING YOUR OWN? Telescopes, Enlargers, Projectors, or in fact, anything using lenses. Then get our booklets "How to use Ex-Gov. Lenses & Prisms," price **2/6** ea. Comprehensive lists of optical, radio and scientific equipment free for s.a.e. H. W. ENGLISH, Rayleigh Rd., Hutton, Brentwood, Essex.

TELEVISIONS NEEDING ATTENTION. 9in.-10in. models, **£4/10/-** each. 12in. models, **£6/6/-** each. 15in. models and Philips Projection models **£11/10/-** each; immediate despatch, carriage paid. BARKERS, 325, Brockley Road, S.E.4. (TID 6752.)

NEW SHOP IN LEEDS, 1. We are stocking Spares for Radios and T.V.s. New and Surplus Valves. Bring this ad. for free valve testing this month. We have plenty of reduced Aerials and Converters in stock for callers only. T.V. SPARES, 41, Call Lane, Leeds. 1.

"OSMOR NEWS" Components lists for "P.W." "Consul Car Radio." "P.W." "The Chorister" and "R. Constructor" "Beginner's S. Wave 1 Valver" on request. OSMOR, 418, Brighton Rd., S. Croydon. (CRO 5148.)

HI-FI TEST TAPE. Check your recorder with the B.R. Test Tape Frequency response check, 50-10,000 cycles; transit and quality test 600ft. reel recorded at 7½ or 3¾ in. per sec.; **20/-,** post free. BISPHAM RADIO LTD., 153, Red Bank Rd., Blackpool.

UNREPEATABLE OFFER.—12in., 5 Channel T.V., **£15;** 14in., **£22,** good working order. C. EDWARDS, 1070, Harrow Rd., London, N.W.10. (Phone: LADbroke 1734.)

TELEVISIONS, 9in. models, **£7/10/-,** 12in. models, **£13/10/-,** 12in. 5-channel models, **£19/10/-** each; all working, carriage paid. Send for list. TOMLINS, 127, Brockley Rise, Forest Hill, S.E.23. (FOR 5497.)

RATES: 5/6 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.

TAPESPONDING. Exchange tape recorded messages home/overseas. Details EWART, 87, Terrace, Torquay.

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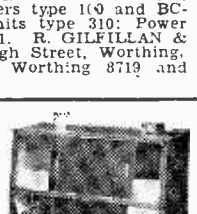

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AMATEUR WIRELESS AND WIRELESS MAGAZINE

STRAIGHT SETS

Battery Operated

One-valve : 2/6

B.B.C. Special One-valver AW387*

Mains Operated

Two-valve : 2/6 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 : 2/6 each

S.W. One-valver for American AW429*

Two-valve : 2/6 each

Ultra-short Battery Two (SG, det Pen) WM402*

Four-valve : 3/6 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 : 3/6

Standard Four-valve A.C. Short-waver (SG, D, RC, Trans) WM391*

MISCELLANEOUS

Enthusiast's Power Amplifier (10 Watts) (3/6) WM387*
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De Luxe Concert A.C. Electrogram (2/6) ... WM403*

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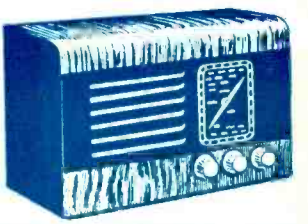

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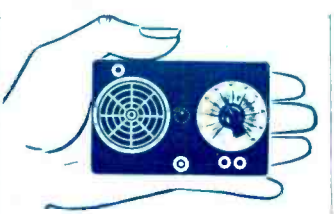

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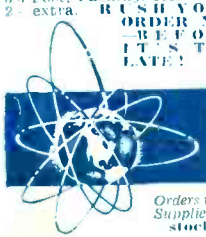

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