A HI-FI A.M. RECEIVER

PRACTICAL WIRELESS

1/3

JUNE 1958
EDITOR: F. J. CAMM

CONTENTS

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'MICROMITE'

DRY ELECTROLYTIC CONDENSERS

These small but high quality electrolytics have proved so popular that the range has been greatly extended. The use of high-gain etched foil electrodes keeps size and weight down, making the condensers suitable for suspension wiring. Conservatively rated; long shelf life ensured; green plastic insulating sleeving prevents short-circuits.

Capacity in µF.	Peak Wkg. Volts	Surge Volts	Dimns. in Ins.		Type No.	List Price Each
			Length	Diam.		
50	12	15	1 5/8	13/32	CE87B	2/9
25	50	60	1 11/16	15/32	CE88DE	3/-
1	350	400	1 5/8	3/8	CE86L	2/6
8	350	400	1 13/16	17/32	CE99LE	3/3
16	350	400	2 7/16	13/32	CE91LE	4/-
32	350	400	2 [illegible]/16	1 1/16	CE93LE	6/-
4	450	550	1 13/16	17/32	CE99PE	3/3
8	450	550	1 13/16	13/16	CE90PE	3/6
16	450	550	1 13/16	1 1/16	CE92PE	5/-
32	450	550	2 13/16	1 1/16	CE94PE	7/6

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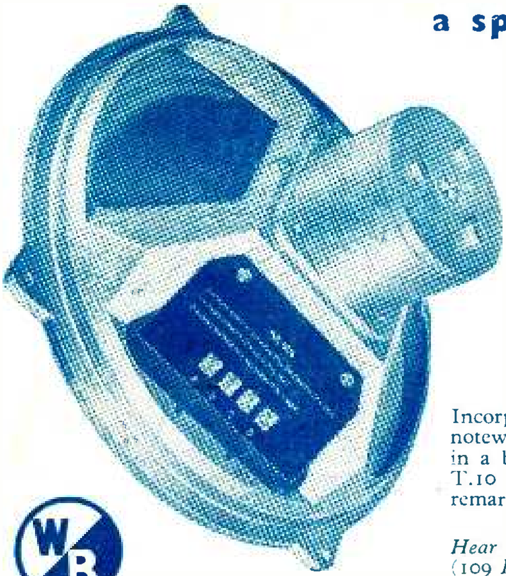

Stentorian H.F.1016

- ★ 10″ Die Cast Chassis ★ 16,000 gauss magnet
- ★ 10 watts handling capacity
- ★ Patented Stentorian Cambric Cone
- ★ Universal Impedance Speech Coil (instantaneous matching at 3, 7·5 and 15 ohms.)
- ★ 30-15,000 c.p.s. frequency response
- ★ 35 c.p.s. bass resonance

Incorporates a very powerful magnet assembly and is noteworthy for its brilliant transient response when mounted in a bass reflex cabinet. May also be used with Stentorian T.10 Tweeter Unit as an outstanding two-speaker system at remarkably low cost.

£8 (inc. P.T.)

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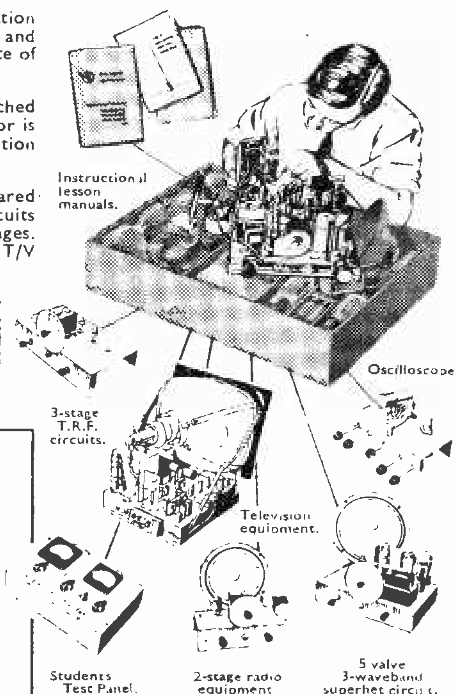

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IC107

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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.

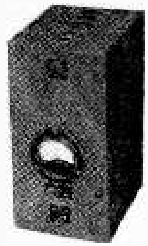
6 v. or 12 v. 1 amp......	22 9
6 v. 2 amps.	25 9
6 v. or 12 v. 2 amps......	31 6
6 v. or 12 v. 4 amps...........	53 9

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 **49/9** Carr. 3 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. 1 6. **75/-** Credit Terms: Deposit 30 - and 4 monthly payments, 13 -.

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

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

TOP SHROUDED DROP THROUGH

250-0-250 v. 70 mA. 6.3 v. 2 a. 5 v. 2 a.	16 9
350-0-350 v. 80 mA. 6.3 v. 2 a. 5 v. 2 a.	18 9
250-0-250 v. 100 mA 6.3 v. 4 a. 5 v. 3 a.	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
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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. A.F. 7 6.

VOLUME CONTROLS with long (¼in. 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.

EX-GOVT. SMOOTHING CHOKES

250 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

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; 0-9-15 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 3Ω ...	4 9
10,000Ω 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 watt, 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 c/s. 375-0-375 v. 150 mA. 6.3 v. 4 a. C.T. 6.3 v. 1 a. Fully shrouded, 22 9. 325-0-325 v. 100 mA. 6.3 v. 2.5 a. 5 v. 2 a. Drop through type, 18/9. Postage on either type 2 9.

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

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 cost £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. 10-0-100-230-220-240 v. to 5-0-75-115-135 v. or REVERSE. 80-100 watts. Only 12 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.

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)

1R5	7/9	6J5	5 9	ECC91	4 9
1T4	7 9	6J6	4.9	EF80	7 9
1S5	7 9	6V6G	7.9	EB91	4 9
3S4	8 9	6X4	6.9	EF91	8 9
5Y3G	8/9	6X5GT	8.9	EL32	3 9
5U4G	8 9	6L6G	11 9	KT44	8 9
5Z4G	9 9	807	7 9	KT61	9 9
6K7G	5 9	12A6	7 9	EZ90	6 9
6SJ7GT	6/9	15D2	4 9	EL84	10·6
6SLGT	8/9	35Z4GT	8 9	FW4/500	9 9
6SN7GT	8/9	MH4	4.9	SP61	2 9
6AT6	7 9	ECC83	9 9		

SPECIAL OFFERS: Electrolytics. 32-32-32 mfd. 250 v. Dubilier small cans, 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. ¼in. 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. 90 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 c/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 2¼ x 1½in. Spindle 1¼in. long, ⅛in. diam. Brand New, 9 9.

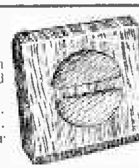
HEADPHONES. Brand new. Low resistance. Only 6 9 pr.

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.
6½in. 2-3 ohms, 29 11.
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;

ELECTROLYTICS (current production) NOT EX-GOVT.

Tubular Types		Can Types	
8 μF 450 v. ...	1 9	16 mfd. 450 v.	1/11
8 mfd. 500 v.	2 6	16 μF 450 v. ...	2 9
16 μF 350 v. ...	2 3	32 μF 350 v. ...	2 11
16 μF 450 v.	2/9	32 mfd. 450 v.	4.9
16 μF 500 v.	3 9	100 mfd. 450 v.	4.9
32 μF 350 v. ..	3 9	8-8 μF 450 v....	2·9
25 μF 25 v.	1 8	8-16 μF 450 v.	3 11
50 μF 12 v. ..	1 3	16-16 μF 450 v.	4 11
50 mfd. 25 v. ...	1/6	32-32 μF 350 v.	4·9
50 μF 50 v. ...	1/9	32-32 μF 450 v.	5/9
100 mfd. 12 v.	1 9	100-100 mfd. 350v	5·9
100 mfd. 25 v.	2/3	100-200 mfd. 275 v. ...	6 9
1,500 mfd. 6 v.	1 6		
3,000 mfd. 6 v.	3/9		

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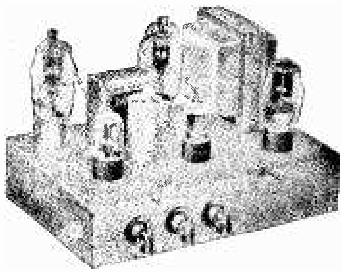
R.S.C. A8 ULTRA LINEAR 12 WATT AMPLIFIER

High-Fidelity Push-Pull Amplifier with "Built-in" Tone Control. Pre-amp stages, high sensitivity, includes 5 valves (807 outputs). High Quality sectionally wound output transformer specially designed for Ultra Linear operation, and reliable small condensers of current manufacture. INDIVIDUAL CONTROLS FOR BASS AND TREBLE "Lift" and "Cut". Frequency response ± 3db., 30-30,000 c/s. Six negative feed back loops. Hum level 71 db. down. ONLY 70 millivolts INPUT required for FULL OUTPUT. Suitable for use with all makes and types of pick-ups and practically all microphones. Comparable with the very best designs. For STANDARD or LONG - PLAYING RECORDS. For MUSICAL INSTRUMENTS such as STRING BASS, GUITARS, etc. OUTPUT SOCKET with plug provides 300 v. 20 mA. and 6.3 v. 1.5 a. For supply of a RADIO FEEDER UNIT. Size approx. 12-9-7in. For A.C. mains 200-230-250 v. 50 c/cs. Outputs for 3 and 15 ohm speakers. Kit is complete to last nut. Chassis is fully punched. Full instructions and point-to-point wiring diagrams supplied. Unapproachable value at £7 15 - or factory built 45 - extra. Carriage 10 -.

£7-15-0



If required louvred metal cover with 2 carrying handles can be supplied for 18 9. Additional input socket with associate Vol. control so that two different inputs such as Gram and 'Mike' or Tape and Radio can be mixed, can be provided for 13 - extra. Guaranteed 12 months.

TERMS on assembled two input model **DEPOSIT** 25 6 and nine monthly payments 25 6.

HIGH-FIDELITY MICROPHONES and **SPEAKERS** in stock. Keen cash prices or credit terms if supplied with amplifier.

R.S.C. 30 WATT ULTRA LINEAR HIGH-FIDELITY AMPLIFIER A10

A highly sensitive Push-Pull high output unit with self-contained Pre-amp. Tone Control Stages. Certified performance figures compare equally with most expensive amplifiers available. Hum level 70 db. down. Frequency response ± 3 db. 30-30,000 c/s. A specially designed sectionally wound ultra linear output transformer is used with 807 output valves. All components are chosen for reliability. Six valves are used, EF86, EF86, ECC83, 807, 807, GZ33. Separate Bass and Treble Controls are provided. Minimum input required for full output is only 12 millivolts so that **ANY KIND OF MICROPHONE OR PICK-UP IS SUITABLE.** The unit is designed for **CLUBS, SCHOOLS, THEATRES, DANCE HALLS or OUTDOOR FUNCTIONS,** etc. For use with Electronic **ORGAN, GUITAR, STRING BASS,** etc. For standard or long-playing records. **OUTPUT SOCKET PROVIDES** L.T. and H.T. for a **RADIO FEEDER UNIT.** An extra input with associated vol. control is provided so that two separate inputs such as Gram and 'Mike' can be mixed. Amplifier operates on 200-250 v. 50 c/s. A.C. Mains and has output for 3 and 15 ohm speakers. Complete kit of parts with fully punched chassis and point-to-point wiring diagrams and instructions. If required cover as for A8 can be supplied for 18 9. The amplifier can be supplied, factory built with 12 months' guarantee, for £13.13.0. **TERMS: DEPOSIT** 36 - and 9 monthly payments of 31 -.

£10-19-6 Carr. 10 -

COLLARO RC54 3-SPEED AUTO-CHANGERS with Studio pick-up. Brand new. For 110 v. 50 c.p.s. A.C. mains. Price with 110 v. to 200-250 v. Auto Trans. only 7 Gns. Carr. 5 6.

COLLARO CONQUEST 4-SPEED AUTO-CHANGERS with high fidelity Studio Pick-up. Latest model. Brand new. Cartoned. For 200-250 v. 50 c/s. A.C. mains. Our price £8 19 6. Carr. 5 6. Credit Terms: Deposit 3 gns. and 6 monthly payments of 21 6.

COLLARO 4-SPEED SINGLE PLAYER with separate pick-up, as fitted RC457. For 200-250 v. A.C. mains. £4.12.6. Post 3 9.

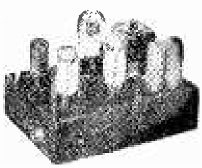
LG3 MINIATURE 2-3 WATT GRAM AMPLIFIER. For use with above or any other single or auto-change units. Output for 2-3 ohm speaker. For 200-250 v. 50 c.p.s. A.C. mains. Overall size 6½ x 3½ x 2½in. Controls: Vol. and Tone with switch. Guaranteed 12 months. Only 55 9.

SUPERHET FEEDER UNIT. Design of a high quality Radio Tuner Unit especially suitable for use with any of our Amplifiers. Delayed A.V.C. employed. The W.Ch. Sw. incorporates Gram position. Controls are Tuning, W.Ch. and Vol. Only 250 v. 15 mA. H.T. and L.T. of 6.3 v. 1 amp. required from amplifier. Size of unit approx. 9-6-7in. high. Simple alignment procedure. Point-to-point wiring diagrams, instruction and priced parts list with illustration, 2 6. Total building cost, £4 15 -. For descriptive leaflet send S.A.E.

LINEAR L45 MINIATURE 4 5 WATT QUALITY AMPLIFIER. Suitable for use with Collaro, B.S.R. or any other record-playing unit, and most microphones. Negative feed-back 12 db. Separate Bass and Treble Controls. For A.C. mains input of 200-250 v. 50 c/cs. Output for 2/3 ohm speaker. Three miniature Mullard valves used. Size of unit only 6-5-5in. high. Output for 2 3 ohm speaker. Guaranteed for 12 months. Only £5 19 6. Send S.A.E. for illustrated leaflet. Credit Terms. Deposit 22 6 and 5 monthly payments of 22 6.

LINEAR 'DIATONIC' 10-14 WATT HIGH FIDELITY PUSH-PULL ULTRA LINEAR AMPLIFIER. For 200-230-250 v. 50 c/cs. A.C. mains. Valve line-up ECC83, ECC83, EL84, EL84, EZ81 miniature Mullard. The unit has self-contained Pre-amplifier Tone Control stage, and separate Bass and Treble Controls. Independent 'Mike' and Gram input sockets are provided. Size is only 9-7-6in. Output Matchings for 3 and 15 ohm speakers. Only 12 GNS.: or Deposit 26 9 plus 10 - carr. and 9 monthly payments of 26 9. Send S.A.E. for leaflet.

R.S.C. 4-5 WATT A5 HIGH-GAIN AMPLIFIER



A highly-sensitive 4-valve quality amplifier for the home, small club, etc. Only 50 millivolts input is required for full output so that it is suitable for use with the latest high-fidelity pick-up heads, in addition to all other types of pick-ups and practically all 'mikes'. Separate Bass and Treble Controls are provided. These give full long-playing record equalisation. Hum level is negligible being 71 db. down. 15 db. of negative feedback is used. H.T. of 300 v. 25 mA. and L.T. of 6.3 v. 1.5 a. is available for the supply of a Radio Feeder Unit, or Tape-Deck pre-amplifier. For A.C. mains input of 200-230-250 v. 50 c/cs. Output for 2-3 ohms speaker. Chassis is not alive. Kit is complete in every detail and includes fully punched chassis (with baseplate) with Blue hammer finish and point-to-point wiring diagrams and instructions. Exceptional value at only £4 15 -, or assembled ready for use 25 - extra, plus 3 6 carr.: or Deposit 22 6 and 5 monthly payments of 22 6 for assembled unit.

LINEAR LT45 HIGH QUALITY TAPE DECK AMPLIFIER. With "built in" power pack and output stage. For Tape Decks with High or Low Impedance, Playback and Erase Heads, such as Lane, Truvox, Aspden, Collaro, Brenell, etc. For A.C. Mains 200-250 v. 50 c/cs. Linear frequency response of ± 3 db., 50-11,000 c/cs. Negative feed-back equalisation. Illustrated leaflet 6d. **Ready for Use, ONLY 12 GNS.** Carr. 7 6

SENSATIONAL OFFER

STAAR GALAXY 4-SPEED MIXER AUTO-CHANGER. A precision manufactured unit with a motor which virtually eliminates "wow" and rumble. Playing Desk size 11½ x 10in. Depth below baseboard 2in. Above 5in. Fitted pick-up with dual sapphire tipped stylus. For 200-250 v. A.C. mains. A once in a lifetime opportunity. Only **£3-19-6** Brand new cartoned. Carr. 3 9

R.C.A. 20 WATT RE-ENTRANT SPEAKERS, 15 ohms or 600 ohms matching. For Outdoor work. Only 8 GNS.

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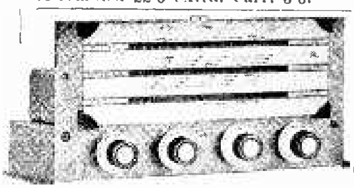

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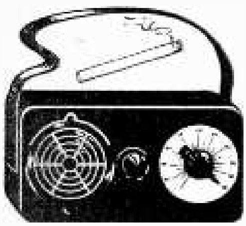

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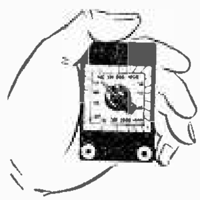

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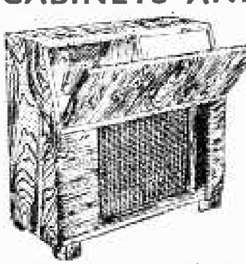

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3D6	5/-	6E5	12/6	6X5GT	6/6	12SQ7	8/6	1203	7/-	DL94	9/-	EF80	8/-	KT44	15/-	QVO4/7	15/-	VP4(7)	15/-
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3Q5GT	9/6	6F6GT	8/-	6Z5	12/6	12Y4	10/6	5763	12/6	DLS10	10/6	EF86	17/6	KTW61	8/-	SD6	12/7	VP41	7/6
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5Z3	12/6	6H6G	3/-	7V7	8/6	25Z5	10/6	AC/P4	8/-	EB91	6/6	EL91	5/-	MHL4	7/6	U22	8/-	X61	12/6
5Z4G	10/6	6H6M	3/6	7Y4	8/-	25Z4G	10/-	AC/VP1	15/-	EBC33	7/6	EM34	10/-	MHLD6	12/6	U31	10/-	X63	10/-
5Z4GT	12/6	6J5G	5/-	8D2	3/6	25Z6G	10/-	AL60	10/-	EBC41	10/-	EM80	10/6	ML4	12/6	U43	10/6	X65	12/6
6A8	10/-	6J5GTG	5/6	8D3	7/6	28D7	7/-	AP4	7/6	EBF80	10/-	EM81	10/6	ML6	6/6	U45	10/6	X66	12/6
6AB7	8/-	6J5GTM	6/-	9D2	4/-	30	7/6	ATP4	5/-	EBF89	9/6	EY51		MU14	10/-	U50	5/-	XD(1.5)	6/6
6AB8	14/-	6J6	5/6	10C1	15/-	30C1	10/-	AZ31	12/6	EC52	5/6	(Small)	10/6	OA10	12/6	U52	8/6	XFW10	6/6
6AC7	6/6	6J7G	6/-	10F1	19/6	30F5	8/-	BL63	7/6	EC54	6/-	EY51		OA70	5/-	U76	7/6	XFY12	6/6
6AG5	6/6	6J7GT	10/6	10F9	11/6	30FL1	12/6	CK505	6/6	EC70	12/6	(Large)	12/6	OA71	5/-	U78	7/-	XH(1.5)	6/6
6AJ8	9/-	6K6GT	8/-	10F18	12/6	30L1	9/-	CK506	6/6	ECC31	15/-	EY86	17/6	OC72	30/-	U107	11/10	XSG(1.5)	6/6
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6AL5	6/6	6K7GT	6/-	10LD11	16/9	30P16	10/-	CV63	10/6	ECC33	8/6	EZ40	8/-	P215	10/6	U404	10/6	Z63	10/6
6AM5	5/-	6K8G	8/-	10P13	17/6	30PL1	19/6	CV85	12/6	ECC35	8/6			PABC80	15/-	UABC80		Z66	20/-
6AM6	7/6	6K8GT/G		11E3	15/-	31	7/6	CV271	10/6	ECC81	8/-	EZ41	10/6	PCC84	9/-		10/6	Z77	7/6
6AQ5	8/6		11/-	12A6	6/6	33A/158M		CV428	30/-	ECC82	7/6	EZ80	9/6	PCC85	12/6	UAF42	10/6	Z719	8/-
6AT6	8/6	6L6G	9/6	12AH7	8/-		30/-	D1	3/-	ECC83	9/-	EZ81	10/-	PCF80	10/-	UB41	12/7	Z729	17/6

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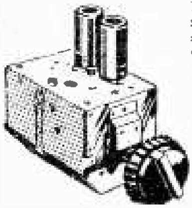

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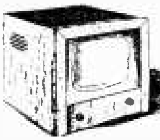
14in. T.V. Cabinet



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Ranges: D.C. volts 0-5, 0-50, 0-100, 0-500, 0-1,000. A.C. volts 0-5, 0-50, 0-100, 0-500, 0-1,000. D.C. milliamps 0-5, 0-100, 0-500. Ohms 0-50,000 with internal batteries. 0-500,000 with external batteries. Measures A.C. D.C. volts, D.C. current and ohms. All the essential parts including metal case, 2in. 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.

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9-pole, 3-way	2/-
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4-pole, 5-way	2/6
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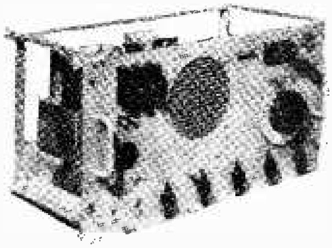
1-pole, 7-way	2/6
1-pole, 12-way	2/6
6-position shorting switch	2/-
Double-pole mains switch for attaching to Yaxley switches	1/6

Discount of 10% allowed where a dozen of one type ordered. Special quotes 144 or over.

Short Wave Communications Receiver R.208. ONLY £6.19.6.



This is a super short-wave receiver covering 5 - 30 metres (10-60 mc/s). Uses 6 valves. Has R.F. stage, 2 I.F. stages B.F.O., etc. Muirhead instrument drive, two internal power packs, mains and battery vibrator pack. Complete with own P.M. speaker. Provision for phones and speaker muting. Complete in metal transit case; size approx. 24 x 18 x 12in.; weight 70lb. Suitable A.C. mains 100-250 and 6 volt battery. In perfect condition, practically unused. Tested before despatch and guaranteed. Handbook free with each. Price £6.19.6, carriage and insurance 15/-, or 10/- (plus 15/- carriage and insurance) deposit and 14 weekly payments of 10/-.

Geiger Counter

As described in "Practical Wireless" April issue. All the parts including the 20th Century tube type G24 and other specified valves and components but not the chassis or case. £5.7.6. plus 3/6 post and ins.

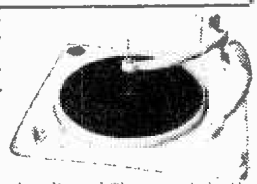
T.V. Pattern Generator

All the parts for the unit described in the April issue of "Practical Television," including valves and other parts but not the chassis or case 45/-, plus 3/6 post and ins.

Response Curve Generator

All the parts to make the unit described in the April issue of "Practical Television," including valves and other parts but not the chassis or case, 5/- plus 2/6 post and ins.

Yours for 10/- down and 17 weekly payments of 10/- 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 10/- deposit and 17 weekly payments of 10/-, carriage and insurance 5/-.

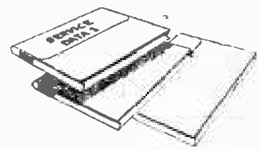
PUBLIC ADDRESS SNIP

Parmeko 12 watt output transformer, primary 4,000 ohms centre tapped, secondary 100 ohms (thus suitable for 6-15 ohm speakers wired in series). Really massive transformer, weighs approx. 8 lb. Offered at a ridiculously low price of 17/6, plus 3/6 carriage and ins.

The "CRISPIAN" Portable Radio

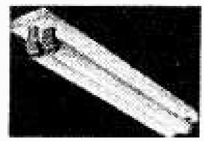
A 4-valve truly portable battery set with very many good features as follows: Ferrite rod aerials, low consumption valves, superhet circuit with A.V.C. ready-built and aligned chassis if required, beautiful two tone cabinet covered with I.C.I. rexine and Tygan. Guaranteed results on long and medium waves anywhere. All parts, including speaker and cabinet are available separately or if all ordered together the price is £7 15/- complete, or 10/- down and 16 weekly payments of 10/-, post and insurance 5/-. Instruction book free with parts or available separately price 1/6.

T.V. Service Sheets



100 sheets covering the most popular post-war Televisors by leading makers—Cossor, Ekco, Ferguson, Pye, etc., etc. Give circuit diagram component valves, I.F. frequencies etc., £1 post free.

Fluorescent Lights

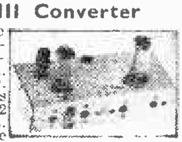


These are complete fluorescent lighting fittings. Built-in ballast and starters—stove enamelled white and ready to work. Ideal for the kitchen over the work-bench and in similar locations.
Single 40. 4ft. 3in. long, uses a 40-watt tube.
Twin 20. Uses 2 20-watt standard tubes.
Price for either type 39/6, with tubes. Carriage and ins. up to 150 miles 5/6, up to 250 miles 7/6.

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 ins.

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.

Ex-Government Valves

Many types in stock. Here are some of the more popular ones:

1LD5	3/6	6N7	7/8	1625	10/6
1T4	7/6	6Q7	9/6	DDT4	8/6
2X2	4/9	6SA7	8/-	DDT13	8/6
3A4	7/-	6SJ7	8/6	DH73	9/6
5U4	8/-	6SK7	6/-	DL74	9/6
5Z4	9/6	6SL7	8/-	EF50	5/6
6AC7	6/6	6V6	9/6	EF80	8/6
6B8	4/-	7A7	9/6	EL50	10/6
6C4	6/6	7V7	9/6	H63	6/6
6C6	6/6	7Y4	8/6	HL4G	6/6
6D6	6/6	12SK7	6/-	HL13	9/6
6F6	7/6	25Y5	10/-	HL1320	9/6
6F8	9/6	25Z4	9/6	KT72	9/6
6G6G	4/6	25Z6	10/6	KTW61	4/6
6H6	2/6	41	9/6	KTW73	9/6
6J5	5/-	42	8/-	KTZ41	9/6
6J7	6/-	43	10/-	PEN428	10/6
6K6	7/-	75	12/6		
6K7	7/6	77	8/6	U12	8/6
6K8	9/6	78	8/6	U71	9/6
6L6	9/-	84	8/6	U74	9/6
		954	3/6		

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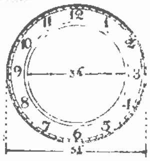
CLOCK CASE

Also suitable for barometer or other instrument. Nicely polished. Price 4 6, post and packing 1 6.

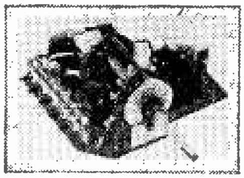
Clock numerals to suit these cases etched on metal, 2 6.

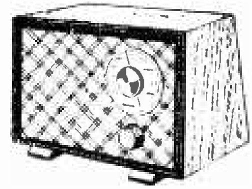
Post 9d. if ordered separately.



Coil Pack Snip

Covers the Medium waveband 200-550 metres and two short wavebands 35-120 metres and 13-42 metres, for 465 kc/s I.F. Extremely well made supplied complete with diagram of connections. Only 9 8, plus 1 6 post and insurance.





The Skysearcher

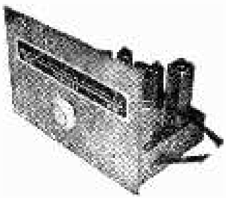
This is a 2-valve plus-metal receiver set useful as an educational set for beginners, also makes a fine second set for the bedroom, workshop, etc. All parts, less cabinet, chassis and speaker, 19/6. Post and ins., 2/6. Data free with parts or available separately 1/6. 3-valve battery version also available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

Power Transformer

400 v. 3-phase to 230 v. single-phase, 20 kVA oil filled. Original cost probably around £100. In perfect working order, £25 each, ex. Eastbourne.

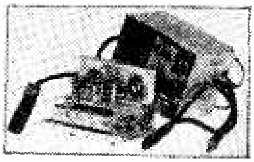
Ditto, but smaller and not oil filled, 3 kVA., £12.

F.M. Tuner



This is a high fidelity unit which although moderately priced has a performance equal to the highest priced. Its stability is very good and extremely good results have been received with the simplest of aerials as far away as Eastbourne. The unit is made up ready to work and has its own power supply for A.C. mains. Demonstration at all our branches. Price 12 gns. or 10 - down and 26 weekly payments of 10 -. Post plus insurance 5 -.

This Month's Snip



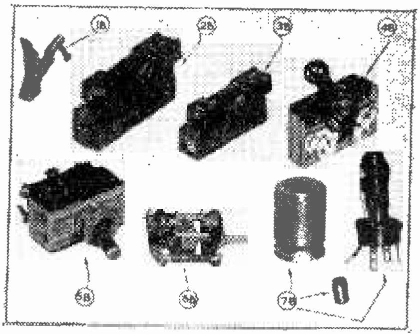
Breakdown unit contains: miniature relay, push-pull input transformer, push-pull output transformer valveholders, condensers, resistors, useful bakelite enclosed hand switch which can also be used as foot switch if mounted on base, all in really useful aluminium case with easily removable lid. Size approx. 5½in. x 4½in. x 3½in. Case is ideal for building Pattern Generator or similar instrument. Special snip price this month 8 6, plus 1 6 post and insurance.

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.

You can build our TV in one evening

There are only 24 solder joints to make—suitable 14in. or 17in. tube, cost £29 10/-. We will gladly send full constructional details and circuit diagram on receipt of 3 6 which will be credited in full if you buy the kit.



1b. Crocodile clip for metering, etc. Has sharp point for piercing insulation without spoiling it. 8d. each or 7 - per dozen.

2b. 15 amp slydlok panel mounting fuse and fuse carrier. 2 6.

3b. 5 amp slydlok panel mounting base and fuse carrier. 2/-.

4b. Double pole 15 amp toggle switch, ex. equipment but unused. 1 9.

5b. 5 amp double pole change-over toggle switch (DP DT), ex. equipment but unused, 2 6.

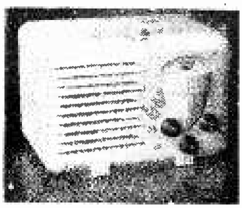
6b. Air spaced trimmer 30 pF long ¼in. spindle. 2 3 each or 24 - per dozen.

7b. ¾in. coil former with dust core and can, 4 6 per dozen sets.

Complete Walkie-Talkie for £1

This 38 Walkie-Talkie Radio Transmitter has a range of approx. 5 miles. Just right for search parties, fire brigades, etc. Operates on dry batteries. Complete with five valves and in metal case. Size approx. 9" x 6" x 3½". Unused but not tested or guaranteed £1 only, plus 2/6 post and insurance.

Mains-Mini



Uses high-efficiency coils, covers long and medium wave bands and fits into the neat white or brown bakelite cabinet—limited quantity only. All the parts, including cabinet, valves, in fact, everything, £4 10 0, plus 3 6 post. Constructional data, free with the parts, or available separately 1/6.

Super Sensitive (2,000 O.P.V.) Multimeter Kit

17 ranges including D.C. volts to 1,000 volts, A.C. to 1,000 volts, D.C. milliamps to 500, ohms to 2 meg., capacity and inductance. All the essential parts including metal case, selected resistors, wire for shunts, selected switches, calibrated scale and instructions. 32 6, plus 2 6 post and insurance.

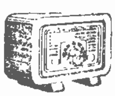
Variable Rheostat

This is a heavy duty slider resistor rated at 25 amps., but easily capable of twice this load. Basic resistance is .4 ohms, but by the removal of one wire this becomes .8 ohms, alternatively it can be rewired to suit individual requirements. Adjustment is by rotating a bakelite knob which couples to a heavy duty slider, ideal for dimmer circuit. Price 8 3, post and insurance 3 6.

500 Microamp Flush Mounting Moving Coil Meter 2in.

Brand New Ex-Ministry, 17 6, plus 1 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.

ELECTRONIC PRECISION EQUIPMENT, LTD

Post orders are dealt with from Eastbourne, so for prompt attention please post your orders to 66, Grove Road, Eastbourne, marked Department 7.

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

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

29, Stroud Green Rd., Finsbury Park, N.4. PHONE: ARChway 1049 Half day, Thursday.

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

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MAXI-Q REGD.

COIL PACKS

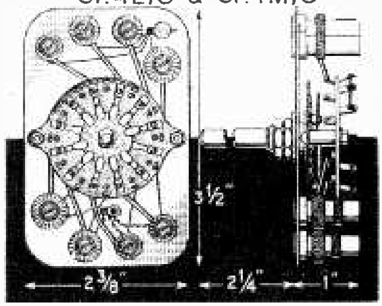
CP.3 370pF and CP.3/500pF. These 3 waveband Coil Packs are available for use with either 370pF or 500pF tuning condensers. The coverages are: Long Wave 800-2,000 metres, Med. Wave 200-550 metres, Short Wave 16-50 metres. Designed for use with "MAXI-Q" glass scale type S2. Retail price of each unit: 32/- plus 12/9 P.T.—total 44/9.

CP.3 G. As above but with Gram position, suitable for use with 500pF tuning condenser: 39/- plus 15/7 P.T.—total 54/7.

CP.3 F. This Coil Pack is for use with a 500pF tuning condenser and covers the standard Long, Med. and Short wavebands with the addition of the band 50/160 metres. This covers the Trawler band, Aeronautical and the 80 and 160 metre Amateur bands: 49/- plus 19/7 P.T.—total 68/7.

CP.3F/G. As CP.3/F but with Gram position: 57/- plus 22/9 P.T.—total 79/9.

CP.4L/G & CP.4M/G



CP.4/L and CP.4/M. These compact 4-station Coil Packs are available for either 1 Long Wave and 3 Medium Wave stations (CP.4/L) or 4 Medium Wave stations (CP.4/M). They are fully wired and require only four connections for use with any standard frequency changer valve: 25/- plus 10/- P.T.—total 35/-.

CP.4L/G and CP.4M/G. As CP.4/L and CP.4/M but with provision for Gram position: 31/- plus 12/5 P.T.—total 43/5.

See Technical Bulletin DTB.9 for details of all Coil Packs, 1/6

GENERAL CATALOGUE covering technical information on full range of components 1/- post free.

DENCO (CLACTON) LTD. (Dept. P.W.), 357/9 Old Road, Clacton-on-Sea, Essex

STOP PRESS.—TREBLE LIFT INDUCTOR FOR THE MULLARD TYPE "C" TAPE AMPLIFIER. Wound in ferroxcube pot core assembly. Price: 22/6 each.

Trading Terms for direct postal orders. C.W.O. plus appropriate postal charges. Please send S.A.E. with all enquiries.

EXCLUSIVE OFFER—

low voltage, halogen quenched

GEIGER—MUELLER TUBES at 55/- each.

A large contract purchase from famous manufacturer enables us to make an exclusive offer of these highly sensitive gamma counters. Straight from production, individually tested and fully guaranteed.

SPECIFICATION

- Effective length : 11.8 cm. Standard British 4-pin base.
- Background count : 90/min.
- Plateau : Minimum length 80 V. Slope 5% per 100 V.
- Working potential : 400-450 V.
- Current : 0.001 μA to 1 μA at 100 to 6,000 c/min.
- Response : exceeds 30,000 c/m.
- Dead time : 100 μsec. at 6,000 c/m. Rise time : 5 to 10 μsec. at 6,000 c/m.
- Temperature range : −55 C. to + 60 C.
- Gamma efficiency : 1%. ● Stainless iron electrode.

COME TO PROOPS' *for special component bargains such as transformers, rectifiers, relays, solenoids and valves and an endless variety of surplus equipment at keenest prices.*

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EXPRESS ELECTRONICS

ROSEDENE LABORATORIES
KINGSWOOD WAY, SELSDON, SURREY

VALVES *NEW, TESTED AND GUARANTEED*

1AC6	8/6	6BW6	7/6	12K7GT	8/-	EB91	6/9	KT33C	9/6
1C1	7/6	6BW7	8/-	12K8GT	12/6	EBC41	10/-	N17	7/6
1C2	8/6	6CH6	7/-	12Q7GT	8/-	EBF80	9/6	N18	7/6
1C3	9/-	6C10	9/-	16A5	9/-	ECC35	7/6	N19	7/6
1F1	8/6	6D1	1/6	25L6GT	8/6	ECC81	8/6	PCC84	9/-
1F3	7/6	6D2	6/9	25Z4G	8/6	ECC82	7/6	PCF80	10/6
1FD1	8/6	6F12	6/-	35L6GT	9/-	ECC83	8/6	PCF82	10/6
1FD9	7/6	6F15	9/-	35W4	8/6	ECC84	10/6	PL82	9/-
1P1	9/-	6J5G	5/6	35Z4GT	8/-	ECF80	10/6	PY81	8/6
1P10	7/6	6J5GT	6/6	5763	13/6	ECF82	10/6	PZ30	17/6
1P11	7/6	6K7G	5/6	D77	6/9	ECH42	10/-	U52	8/-
1R5	7/6	6K8GT	9/6	DAF91	7/6	ECH81	8/-	U76	8/-
1T4	7/6	6L6G	10/6	DAF96	9/-	EF37A	9/-	U78	7/-
1S5	7/6	6Q7GT	8/6	DF91	7/6	EF39	5/-	UBC41	8/6
1U5	7/-	6SL7GT	7/6	DF96	8/6	EF41	9/-	UCH42	10/-
3Q4	7/6	6SN7GT	8/-	DH76	8/-	EF80	8/6	UF41	8/6
3S4	7/6	6V6G	7/6	DH77	7/6	EF91	6/-	UL41	10/-
3V4	7/6	6V6GT	7/6	DH142	8/6	EF92	5/6	UY41	7/6
5U4G	8/6	6X4	7/-	DH150	10/-	EL37	19/6	W76	8/-
5Z4G	9/6	6X5GT	7/6	DK91	7/6	EL38	20/-	W142	8/6
6AL5	6/9	8D3	6/-	DK92	8/6	EL41	10/-	X17	7/6
6AM6	6/-	12AH9	10/6	DK96	9/-	EY51	12/6	X18	8/6
6AT6	7/6	12AT6	8/6	DL92	7/6	EZ35	7/6	X142	8/6
6BA6	7/6	12AT7	8/6	DL96	9/-	EZ40	8/-	X150	10/-
6BE6	8/-	12AU7	7/6	EA50	1/6	EZ80	8/-	Z77	6/-
6BR7	10/6	12AX7	8/-	FABC80	8/6	EZ81	8/-	ZD17	7/6

MATCHED PAIRS

EL84 23/-, 6V6G and GT 17/-, 6BW6 13/- per pair.
Push Pull O.P. Transformers for above 3-15 ohm 14/6.

SETS OF VALVES

DK91, DF91, DAF91, DL92 or DL94 .... 27/6
1R5, 1T4, 1S5, 3S4 or 3V4 .... 27/6
6K8, 6K7, 6Q7, 6V6, 5Z4G 35/-
12K8, 12K7, 12Q7, 35L6, 35Z4 .... 35/-

Postage and packing, 6d. Over £1 post free. C.O.D. 2/6

PREMIER RADIO COMPANY

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207 EDGWARE RD., LONDON, W.2 & 23 TOTTENHAM COURT RD., LONDON, W.1

The "Petite" PORTABLE

A completely new design with the **all star** features from the firm with 45 years of experience in the supply of designs for the home constructor.

MAY BE BUILT FOR

£7·7·0

Plus p. & p. 3/-.

Batteries Extra. H.T. 10/- (type B126) or equivalent. L.T. 1/6 (type AD35) or equivalent.

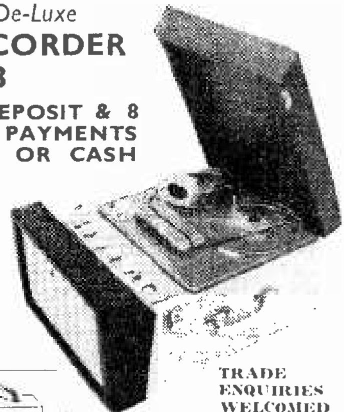
★ Size only 8in. x 8in. x 4½in. ★ Instruction Book 1/6.

The New De-Luxe TAPE RECORDER TR3

for £6. 5. 0. DEPOSIT & 8 MONTHLY PAYMENTS OF £5.17.11 OR CASH 45 GNS.

Plus 21/- post & pkg.

Case finished in Red and Cream with gilt styling and fittings. Size 18½in. x 15in. x 9in. for A.C. Mains 200/250 v. 50 cycles.



TRADE ENQUIRIES WELCOMED

Build this New TAPE RECORDER KIT

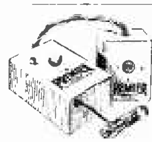
for only

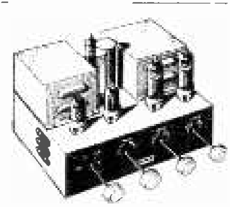
£38.15.0

This Kit comprises:
- 2-speed lane Mk. VI Deck £18/10/-
- Premier Tape Amplifier complete with separate plug-in-type power pack £14/-/-
- 7 x 4 Elliptical Speaker £1/1/6
- De-luxe Cabinet with gilt fittings and detachable lid £4 19/6
- Reel of Scotch Boy 1,200ft. Tape and empty Spool £1 11/6
- Latest Type ASCOS microphone £2/15/-

All the above sections can be purchased separately.

PREMIER BATTERY ELIMINATOR, housed in two containers which are exactly the same size as AD35 and B126 Batteries. Kit 37/6 plus 2/- p. & p.





8 WATT AMPLIFIER

This design includes 5 miniature valves of the latest types, an ultralinear output transformer suitable for Speakers of 3 and 15 ohms and a very attractive Perspex front panel with gold lettering, complete set of parts.

Postage & packing 5/- extra. **£8·8·0**

or **£10.19.6** built and tested. Send 1/6 for Booklet.

BUILD THE 1-VALVE BATTERY RECEIVER

As shown on B.B.C. T.V. This receiver contains a DAF96 valve and a pair of 4,000 ohm headphones, and is powered by a combined 67½ and 1½ volt battery. Price complete with headphones but less battery 45/-. Send for free diagram.

PUT IT TOGETHER YOURSELF

AND SAVE POUNDS

TOTAL COST ONLY **£9.19.6**

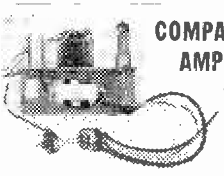
Plus 5/- packing & postage.

Each Unit may be purchased separately as follows:—
- Amplifier Cabinet in maroon and fawn (size 13¾ x 11 x 6½in.) £2/10/-
- 1 Valve Amplifier £2/19/6
- 7 x 4in. Elliptical Speaker £1/1/6
- B.S.R. TU8 Turntable and Pickup £3/19/6

This can also be supplied complete with the **Latest Collaro 4-speed Junior Turntable and Pickup** for only £4 12 6 plus 5/- packing and postage.

If any of the individual items are purchased kindly add the postage as follows: Cabinet 3/-, Amplifier and Speaker 3/-, Turntable 2/6.

2-Volt 16 Ah bakelite-cased ACCUMULATOR by Oldham, Dagenite, Exide. New and unused, unspillable. 7¼ x 4 x 2. Price 6/6, plus 1/6 p. & p.



COMPACT GRAM AMPLIFIER

Complete ready to connect to any type of Pick-up and Speaker (3 ohms). A.C. Mains 200/250 v. Volume and tone control on 9" extended leads. 1 valve. Overall size 7" long x 6" wide x 3½" high.

Plus packing and postage 2/6. **£2·19·6**

3-Band Superhet Receiver may be built for £7/19/6 plus pkg. & carr 3/-.

4-WATT AMPLIFIER

MAY BE BUILT FOR **£4.10.0** Plus 2/6 Pkg. & Carr.

Instruction Book 1/- post free.

A steel case is now available, complete with engraved panel, for 15/6 extra. The amplifier may be supplied complete for £5.5.0 plus pkg. and post 3/6, or fitted in case at £6 plus pkg. and post 3/6.

Why not make the best!

MULLARD AMPLIFIER KIT

Now supplied with ultralinear output transformer.

All the components for Model 510, plus pre-amplifier, on one chassis (total six valves), chassis gold hammer finished. May be purchased for **£12.12.0** plus pkg. and post 7/6. This version complete and tested **£15.15.0.** Or pre-amplifier and tone control in a separate unit **£14.14.0.** plus pkg. and post 7/6.

SPECIAL REDUCTION 2-BAND T.R.F. RECEIVER

MAY BE BUILT FOR **£5.10.0** Plus 3/- Pk. & Post.

These two receivers use the latest type circuitry and are fitted into attractive cabinets 12in. x 6½in. x 5¼in. in either walnut or ivory bakelite or wood. Individual instruction books 1/- each. Post free.

ADDRESS ALL MAIL ORDER ENQUIRIES TO: (Dept. P.W.) 207 EDGWARE RD., LONDON, W.2

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Stern's "fidelity" TAPE RECORDERS

THEY INCORPORATE . . .
- Choice of the latest COLLARO or TRUVOX Tape Decks
- The model HF TR2 "fidelity" AMPLIFIER
- ROLA CELESTION 10 x 6in. P.M. Speaker
- 1,200ft. reel EMI Tape
- ACOS Crystal Microphone

THIS POPULAR RECORDER IS OFFERED INCORPORATING EITHER . . .

★ The Latest COLLARO TRANSCRIPTOR DECK or
★ THE NEW TRUVOX MK IV DECK

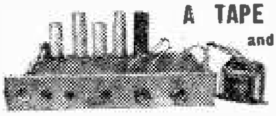
- You WON'T BUY better value
- Truly "Hi-Fi" RECORDINGS are obtainable
- Call in and HEAR THEM or send S.A.E. for ILLUSTRATED LEAFLET.

PRICE INCORPORATING COLLARO DECK **£49.10.0**
CREDIT SALE. Deposit £12.8.0 and 9 Monthly Payments of £4.10.8.
H.P. TERMS. Deposit £24.15.0 and 12 Monthly Payments of £2.5.11.

PRICE WITH TRUVOX DECK INCORPORATING REV. COUNTER **£52.10.0**
CREDIT SALE. Deposit £13.2.6 and 9 Monthly Payments of £4.16.3.
H.P. TERMS. Deposit £26.5.0 and 12 Monthly Payments of £2.8.8.

(Plus £1.10.0 carriage & insurance of which £1 is refunded on return of Packing Case.)

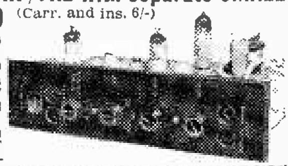
A TAPE PRE-AMPLIFIER and ERASE UNIT



STERN'S MODEL HF/TR1—A completely assembled Pre-amplifier with own Power Supply. Can be supplied correctly matched for use with Truvox or Collaro Decks and incorporates Recording Level Indicator and Monitoring facilities. Please send S.A.E. with any enquiry. PRICE **£11.10.0** (Plus 5/- carr. and ins.)

SPECIAL REDUCTION WHEN PURCHASED WITH DECK.

"fidelity" TAPE AMPLIFIER HF/TR2 with Separate SMALL POWER SUPPLY UNIT £16.0.0 (Carr. and ins. 6/-)



H.P. TERMS: Desposit £8 and 9 months of £1.
CREDIT TERMS: Deposit £4 and 9 monthly payments of £1.9.4. When ordering please advise make of deck in use. Send S.A.E. for full details.
HOME CONSTRUCTORS. We can supply a COMPLETE KIT OF PARTS to build this TAPE AMPLIFIER for £12 (plus 5/- carr. and ins.). The Assembly Manual, Practical Diagrams, etc., are available for 2/6.

(Can be supplied to correctly operate with Collaro & Truvox Decks.)

HOME CONSTRUCTORS

BUILD YOUR OWN RECORDER . . . *We offer*

(a) The HF TR2 AMPLIFIER and POWER UNIT, both assembled, with the TRUVOX MK. IV TAPE DECK	£38.10.0
ALTERNATIVELY the Amplifier and P/Unit as a KIT OF PARTS	£35. 0 .0
(b) The HF/TR2 AMPLIFIER and POWER UNIT, both assembled, with the TRUVOX TAPE DECK incorporating PRECISION REV. COUNTER	£41.10.0
ALTERNATIVELY the Amplifier and P/Unit as a KIT OF PARTS	£38. 0 .0
(c) The HF/TR2 AMPLIFIER and POWER UNIT, both assembled, with the COLLARO TRANSCRIPTOR	£35. 0 .0
ALTERNATIVELY the Amplifier and P/Unit as a KIT OF PARTS	£31.10.0

plus 12/6 carriage and insurance.

TO COMPLETE THE RECORDER . . . *We offer*

The Portable Carrying Case . . . Acos Crystal Mike . . . Rola 10in. x 6in. P.M. SPEAKER . . . 1,200ft. Plastic Tape. ALL FOR **£9.0.0** (Plus 7/6 carr. & ins.)

WE MAKE SPECIALLY REDUCED PRICES FOR COMBINED ORDERS

ADD TAPE TO YOUR EXISTING AMPLIFIER . . . *WE OFFER YOU*

(a) The Model HF/TRIP TAPE PRE-AMPLIFIER together with the TRUVOX MK IV TAPE DECK..................	£35. 0 .0
(b) ALTERNATIVELY as in (a) above but Truvox Deck incorporating PRECISION REV. COUNTER..................	£38. 0 .0
(c) The model HF/TRIP TAPE PRE-AMPLIFIER together with the COLLARO TRANSCRIPTOR Tape Deck......	£31.10.0

PLEASE INCLUDE 12/6 to cover cost of carriage and insurance

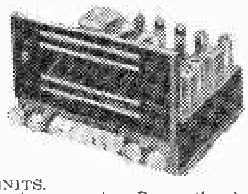
HIRE PURCHASE and CREDIT SALE TERMS are available on all equipment (excluding Kits of Parts). Send S.A.E. for details.

NOTE.—The Collaro Transcriptor is in short supply and there may be a delay in delivery. We will however book an order.

The Deck switches of the Transcriptor have to be "wired-up." We will complete this wiring, for use with either the HF TR2 or the HF TRIP, for an extra charge of £1.

A Selection of RADIOGRAM CHASSIS enabling "MODERNISATION" of that OLD RADIOGRAM

ALL ARE THE LATEST AM/FM DESIGN

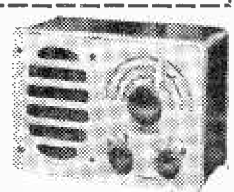


- The Dulci Model H.3 £20.17.0
- The Dulci Model H.4 £24.6.6
- The Dulci Model H4/PP £29.3.10
- The ARMSTRONG PB 409 £29.8.0
- The ARMSTRONG AF 105 £37.0.0

We also have the latest FM or combined AM/FM RADIO TUNING UNITS.
- THE Dulci FM Tuner incorporating Power Supply £17.10.3
- The Dulci AM FM Tuning Unit having own Power Supply incorporated £20.17.0
- The TSL FM Tuner incorporating Power Supply £18.18.0

The above are just a few examples—we have others. Send S.A.E. for full data on any chassis. Credit Sale and H.P. Terms are available.

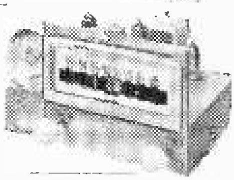
"FRUSTRATED EXPORT ORDER"



The Cossor Model 527. X 4-Valve "All dry" Battery Transportable. Offered for **£6.15.0** Plus 5/- carr. & ins.

Consists of a 4-valve Superhet Receiver covering, Medium Waveband 197-575 metres, and two Short Wavebands 13.6 to 136 metres. The new low consumption valves are incorporated and the whole is accommodated in an attractive robustly made case. Battery required is 90 volts and 1.4 volts (price 19/6) and is external to case.

STERN'S "F.M." TUNING UNIT



A 5-valve Tuner incorporating the latest Mullard Permeability Tuning Heart and a "Magic Eye" Tuning Indicator.

PRICE ASSEMBLED READY FOR USE **£14.10.0** (Plus 7/6 carriage and insurance.)

TERMS: (a) Hire Purchase: Deposit £7.5.0 and 9 monthly payments of 18/4. (b) Credit: Deposit £3.12.6 and 9 monthly payments of £1.6.7.

HOME CONSTRUCTORS—You can build this unit for £10.10.0. Full Assembly Instructions are available for 1/6.

HOME CONSTRUCTORS—BUILD YOUR OWN "Hi-Fi" LOUDSPEAKER SYSTEM

WITH W-B's WELL-KNOWN RANGE OF READY-TO-ASSEMBLE CABINETS. ALL ARE BEAUTIFULLY MADE AND FINISHED AND VERY EASILY ASSEMBLED. ONLY A SCREWDRIVER IS REQUIRED. THEY ARE PACKED FLAT IN CARTONS AND COMPLETE WITH SCREWS.

SEND S.A.E. FOR LEAFLET.

STERN RADIO LIMITED (Dept. P.W.)

PLEASE SEND S.A.E. WITH ALL

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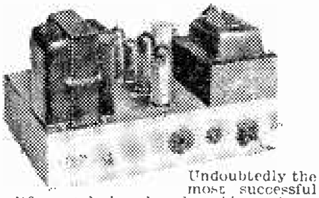
1958 NEW LOOK MULLARD DESIGNS FOR THE "Hi-Fi" ENTHUSIAST

The VERY POPULAR MULLARD "5-10" MAIN AMPLIFIER



Undoubtedly the most successful amplifier yet designed, and used in conjunction with the new Mullard Pre-Amplifier, an undistorted power output of up to 10 watts is obtained. Thoroughly recommended to the "Hi-Fi" enthusiast who contemplates a very high quality home installation. In addition the versatility of the equipment makes it quite suitable for use in small halls, etc. We supply complete to MULLARD'S Specification with specified valves and components and including the latest PARMEKO Ultra-linear Output Transformer and the PARMEKO Mains Transformer which has power available to drive Radio Tuning Unit.

COMPLETE KIT OF PARTS **£10.0.0**

Alternatively, we supply ASSEMBLED and TESTED **£11.10.0**

(Carriage & Insurance 5/- extra.)

This "5-10" with the latest PARTRIDGE ULTRA-LINEAR OUTPUT TRANSFORMER for **£1.6.0** extra

MULLARD'S NEW 2-STAGE PRE-AMPLIFIER - TONE CONTROL UNIT

A completely new design employing Two EF86 valves, and in particular designed to operate with the Mullard range of Power Amplifiers, but also perfectly suitable for other makes, etc.

Briefly it incorporates:

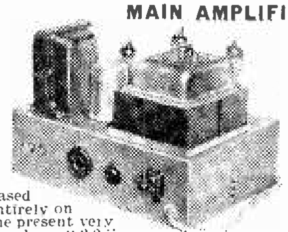
- Equalisation for the latest R.I.A.A. characteristics.
- Input for variable reluctance.
- Magnetic Pick-Ups.
- Input for Crystal Pick-Ups.
- Input for Tape replay.
  - (a) Direct from High Impedance Tape Head.
  - (b) From a Tape Amplifier or Pre-Amplifier.
- Sensitive Microphone Channel.
- Wide range Bass and TREBLE Controls.
- Attractive Perspex front control panel.
- Our Kit is strictly to MULLARD'S SPECIFICATION.

COMPLETE KIT OF PARTS **£6.0.0**

Alternatively, we supply ASSEMBLED and TESTED **£8.0.0**

(Carriage & Insurance 5/- extra.)

THE NEW MULLARD "3-3" MAIN AMPLIFIER



Based entirely on the present very popular "3-3" model and designed to operate in conjunction with the new 2-stage PRE-AMPLIFIER (shown left) thus providing all the facilities associated with the more expensive "Hi-Fi" Equipment. We recommend it as the IDEAL HOME INSTALLATION where very high quality is desired at the lower volume level (up to 3 watts). We supply completely to MULLARD'S SPECIFICATION including the latest PARMEKO Output Transformer, specified Valves and Components. Has power available to drive a Radio Tuning Unit.

COMPLETE KIT OF PARTS **£7.0.0**

Alternatively, we supply ASSEMBLED and TESTED **£8.0.0**

(Carriage & Insurance 5/- extra.)

NOTE Only NEW HIGH GRADE Components and MULLARD VALVES are supplied with these Kits—We do NOT use "Surplus or Cheap" components.

Please enclose S.A.E. if ILLUSTRATED and DESCRIPTIVE LEAFLETS are required; alternatively, the COMPLETE ASSEMBLY MANUALS, containing component Price Lists and Practical Drawings, etc., are available at 1/6 each.

SPECIAL PRICE REDUCTIONS . . .

(a) The COMPLETE KIT OF PARTS to build both the "3-3" MAIN AMPLIFIER and the 2-STAGE PRE-AMPLIFIER-CONTROL UNIT **£12.10.0**

(b) The COMPLETE KIT OF PARTS to build the "5-10" MAIN AMPLIFIER and the 2-STAGE PRE-AMPLIFIER-CONTROL UNIT **£15.15.0**

PRICES FOR THE "5-10" ARE SUBJECT TO £1.6.0 EXTRA IF THE PARTRIDGE TRANSFORMER IS REQUIRED.

(a) The "3-3" and the 2-STAGE PRE-AMPLIFIER both ASSEMBLED and TESTED **£15.0.0**

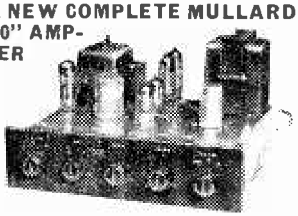
CREDIT: DEPOSIT £3.15.0 & 9 Monthly Payments of £1.7.6
H.P.: DEPOSIT £7.10.0 & 9 Monthly Payments of 19/-.

(b) The "5-10" and the 2-STAGE PRE-AMPLIFIER both ASSEMBLED and TESTED **£18.18.0**

CREDIT: DEPOSIT £4.15.0 & 9 Monthly Payments of £1.14.7
H.P.: DEPOSIT £9.9.0 & 12 Monthly Payments of 17/6

When ordering include an extra 7/6 to cover Carriage and Insurance

THE NEW COMPLETE MULLARD "5-10" AMPLIFIER



Designed for a simple domestic installation with Genuine High Quality reproduction up to a maximum of 10 watts. Separate BASS and TREBLE Controls are incorporated with switched inputs for 78 and L.P. Records plus Radio Tuning Unit.

We incorporate SPECIFIED COMPONENTS and NEW MULLARD VALVES. We also give the purchaser the choice of two of the best ULTRA-LINEAR OUTPUT TRANSFORMERS made—first the latest by PARMEKO, LTD., and also the latest by PARTRIDGE (£1.6.0 extra). We also supply the PARMEKO MAINS TRANSFORMER, and this has extra power available to supply a Radio Tuning Unit.

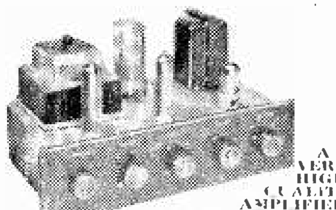
The Control Unit can easily be detached from the Amplifier Chassis for use in a remote position.

COMPLETE KIT OF PARTS (PARMEKO Transformer) **£11.0.0**

Alternatively, we supply ASSEMBLED AND TESTED **£13.10.0**

Credit Sale. Dep. £3.7.6 and 9 Monthly Payments of £1.4.11. H.P. Terms. Dep. £6.15.0 and 8 Monthly Payments of 19/3. Send S.A.E. for ILLUSTRATED LEAFLET or 1/6 for the COMPLETE ASSEMBLY MANUAL.

THE NEW COMPLETE MULLARD "3-3"



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

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 MULLARD'S 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

RECORD PLAYERS

The Very Latest Models are in Stock.
MANY AT REDUCED PRICES!!!
TRANSCRIPTION UNITS — AUTO-CHANGERS, SINGLE RECORD PLAYERS

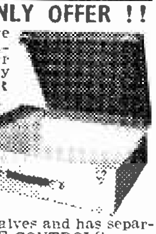
Send S.A.E. for ILLUSTRATED STOCK LIST

A FEW CASH BARGAINS

- The latest BSR MONARCH 4 SPEED "MIXER" AUTO-CHANGER Entirely complete with Crystal Pick Up **£7.19.6**
- The latest COLLARO 4 SPEED "MIXER" AUTO-CHANGER — Complete with the Studio "O" Pick Up **£7.19.6**
  (Also available with the low gain Studio "P" Pick Up for £8.15.0.)
- The latest COLLARO 4 SPEED SINGLE RECORD PLAYER complete with Studio "O" Pick Up **£6.19.6**
- The COLLARO "JUNIOR" 4 SPEED SINGLE RECORD PLAYER, complete with separate Crystal Pick Up **£4.10.0**
  (This high output Crystal Pick Up is available separately for £1.12.6.)

Carriage and Insurance on above Units 5/- ex.

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 Rexine.

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.

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

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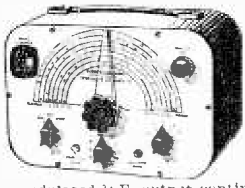
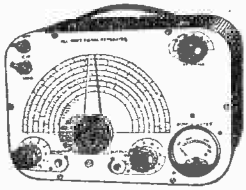


25/- deposit and 6 monthly payments of 21/6. Cash £6.19.6. Post and Packing 5/- extra.

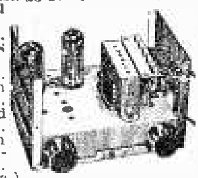
Coverage 100 Kc/s-100 Mc/s on fundamentals and 100 Mc/s to 200 Mc/s on harmonics. Metal case 10in. x 6½in. x 5¼in., grey hammer finish. Incorporating three miniature valves and Metal Rectifier. A.C. Mains 200/250 v. Internal Modulation of 400 c.p.s. to a depth of 30%; Modulated or unmodulated R.F. output continuously variable 100 millivolts. C.W. and mod. switch, variable A.F. output. Incorporating magic eye as output indicator. Accuracy plus or minus 2%.



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 6½in. x 4½in. Size of scale, 6½in. x 3½in. 2 valves and rectifier. A.C. mains 230-250 v. Internal modulation of 400 c.p.s. to a depth of 30%, modulated or unmodulated R.F., output continuous variable 100 millivolts. 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%.

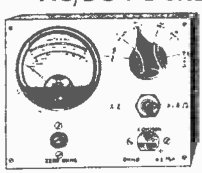
CONVERT TO I.T.A. FOR ONLY 25/- deposit plus P. & P. 5/- and 4 monthly payments of £1/5/6. Cash £5/17/- plus P. & P. 5/-. **ANY T.V. (except Philips Bristol area or Valley Area, Wales) WITHIN 35 MILES OF I.T.A. TRANSMITTER. ALL CHANNELS NO ALTERATIONS TO SET.**



Complete with built-in power supply. 200-250 v. A.C. mains. Crackle finish case 5½in. long, 3½in. wide, 4½in. 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 5-element 10/- 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 AC/DC volts, ohms and milliamps. Voltage range AC/DC 0-50, 0-100, 0-250, 0-500. Milliamps 0-10, 0-100. Ohms range 0-10,000. Front panel, range switch, wire-wound pot. (for ohms zero setting), toggle switch, resistor and rectifier. In grey hammer finish case.

19/6 Plus P. & P. 1/6. Built and tested 7/6 extra.

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.

PORTABLE AMPLIFIER

Size 6½in. long, 5in. high, 2½in. deep. Will suit any type of crystal pick-up. Output approx. 2 watts. Incorporating ECC83 double triode, Cossor 142BT output pentode and contact-cooled rectifier. Fully isolated mains transformer for 230/250 AC mains. Base, treble, and volume controls. **49/6** Plus P. & P. 3/6

5in. SPEAKER with O.P. TRANSFORMER purchased with the above, 18/6, plus P. & P. 1/6.

COLLARO MIXER 4-SPEED AUTOMATIC CHANGER

Model 457 Type "O" Pick-up. Size 12in. x 13½in. Minimum clearance above baseboard 5in., below 2½in., 10 records. A.C. mains. 200-250 v., turnover crystal head. Brand new, fully guaranteed (suitable for use with the above amplifier).

£8.19.6 Plus P. & P. 5/-, or 25/- deposit, plus P. & P. 5/-, and 7 monthly payments of £1/5/0.

RADIO & T.V. COMPONENTS (Acton) LTD.
23 HIGH STREET, ACTON, LONDON, W.3

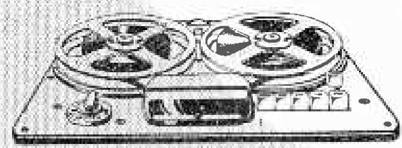
All enquiries S.A.E. Goods not dispatched outside U.K.

The new
MOTEK-K9
✱ **TAPE DECK**

This superlative all British Deck with **three speed control** knob is designed to allow easy fitment and simplicity of operation. The many outstanding features place this Deck in a class alone.

Details on request
Patents pending

List **21** *gns*



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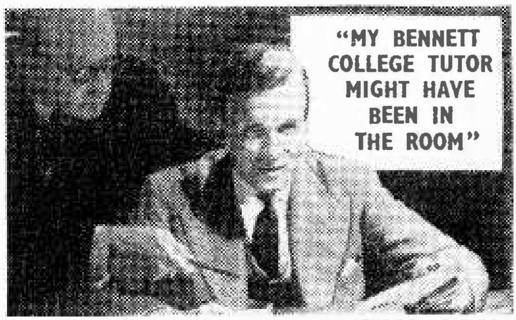

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Surveying	and many others

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ATP4	3/6
AZ31	17/5
CBL31	24/4
CCH35	24/4
CL33	20/2
CY31	17/5
DAF96	10/6
DF96	10/6
DK96	10/6
DL96	10/6
DM70	8/6
EA50	1/6
EABC80	10/-
EAC91	7/6
EAF42	10/6
EB34	2/-
EB41	9/6
EBC33	7/6
EBC41	10/6
EBF80	10/6
EBF89	18/1
EBL21	24/4
EBL31	24/4
EC91	7/6
ECC40	12/6
ECC84	10/3
ECC85	9/6
ECF80	13/6
ECF82	12/6
ECH21	24/4
ECH35	10/6
ECH42	10/6
ECH81	9/-
ECL80	13/6
ECL82	12/6
EF22	8/6
EF36	6/-
EF37A	12/-
EF39	6/6
EF40	13/6
EF41	9/9
EF42	14/-
EF50	4/-
EF55	10/-
EF80	9/6
EF85	9/-
EF86	13/6
EF89	10/-
EK32	8/6
EL32	5/6
EL33	20/2
EL38	27/10
EL41	10/6
EL42	12/-
EL84	10/6
FM34	10/6
EM80	10/6
EM81	11/6
EY51	13/6
EY86	17/6
EZ40	9/-
EZ41	10/-
EZ80	8/9
EZ81	11/10
EZ90	8/-
E1148	2/-
FW4/500	10/-
GZ32	12/-

H30	5/-
HL23DD	8/6
K40N	9/-
KF35	8/6
KK32	23/-
KLL32	8/6
KT24	5/-
KT33C	10/-
KT36	27/10
KT55	13/6
KT66	15/-
KTW61	8/-
KTW63	7/6
KTZ41	8/6
ME91	7/6
MH4	7/6
MH41	7/9
N37	18/1
N78	12/6
OZ4	5/6
P61	3/6
PCC84	10/-
PCF80	13/6
PCF82	12/6
PCL82	14/6
PCL83	14/6
PL38	27/10
PL81	16/-
PL82	9/6
PL83	11/6
PX25	12/6
PY80	9/-
PY81	10/-
PY82	8/6
PY83	10/-
PZ30	20/11
PEN4DD	27/10
PEN25	5/-
PEN44	27/10
PEN45	27/10
PEN46	7/-
PEN220A	4/-
PENA4	15/-
QP21	7/6
R16	27/10
R19	13/6
SP41	3/-
SP61	3/-
SP220	3/11
T41	24/4
TH2	9/-
TP25	27/10
U10	10/6
U14(DW4/500)	8/6
U22	8/-
U37	27/10
U45	15/-
U329	14/6
U403	17/5
U404	11/10
U801	31/4
UABC80	10/6
UAF42	10/6
UB41	9/6
UBC41	10/-
UBF80	9/6
UCC84	20/11

UCF80	23/-
UCH42	10/6
UCH81	11/6
UCL82	23/-
UCL83	25/9
UF41	10/6
UF85	10/6
UF89	10/6
UL41	10/6
UL44	27/10
UL46	24/4
UL84	11/6
UU6	20/11
UU8	27/10
UU9	8/6
UY41	8/6
UY85	10/-
VP2B	8/-
VP23	6/6
VP41	8/6
VR105/30	6/6
VR116	4/-
VR150/30	9/-
VU120A	3/6
VU39 (MU12/14)	8/9
VU111	2/6
W77	8/6
W729	13/6
X65	12/6
X78	22/3
X79	11/6
Y63	9/-
Z309	9/6
Z359	9/6
Z759	9/6
1A3	3/6
1A5GT	6/-
1A7	12/6
1C2	11/6
1C5GT	12/6
1D6	12/6
1H5GT	10/6
1L4	6/6
1LD5	3/6
1N5	10/6
1R5	8/-
1S4	10/6
1S5	7/6
1T4	7/6
1U5	7/6
2C26	1/6
2X2	4/6
3A4	7/-
3D6	5/-
3Q4	9/-
3Q5GT	9/6
3S4	8/-
3V4	9/-
4D1	3/-
5R4GY	9/6
5U4G	8/-
5Y3G	8/-
5Y3GT	8/-
5Z4G	10/-
6A7	13/-
6A8G	10/-
6AC7	6/6
6AG5	5/6

6AK6	6/6
6AL5	6/6
6AM6	9/-
6AQ5	7/6
6AT6	8/6
6AU6	10/6
6B4	5/-
6B8G	4/-
6BA6	7/6
6BE6	8/-
6BG6G	24/4
6BH6	16/-
6BJ6	9/-
6BR7	11/6
6BW6	8/6
6BW7	10/-
6C4	7/-
6C5GT	6/6
6C6	5/-
6C8G	5/-
6CD6G	31/4
6CH6	7/6
6D6	5/-
6F1	13/6
6F6G	7/6
6F6M	7/6
6F13	14/-
6F15	14/-
6G6G	4/6
6H6	2/6
6H6GT	2/6
6J5GT	5/6
6J5M	6/6
6J6	6/-
6J7G	6/6
6J7M	9/-
6K6GT	7/-
6K7G	5/-
6K7GT	7/-
6K7M	6/9
6K8G	8/6
6K8GT	10/-
6K25	20/11
6L6G	9/-
6L7	7/6
6N7	7/6
6P28	27/10
6Q7GT	9/-
6SA7GT	8/-
6SG7	7/6
6SH7	6/-
6SJ7	8/6
6SK7	6/-
6SL7GT	8/-
6SN7GT	7/6
6SQ7	9/3
6U4GT	14/-
6U5/6G5	8/6
6U5G	8/6
6U7G	8/6
6V6G	7/-
6V6GT	7/-
6V6M	8/6
6X4	7/6

6X5G	7/-
6X5GT	7/-
6/30L2	12/6
7B7	8/6
7C5	8/-
7C6	8/-
7H7	9/-
7Q7	9/-
7S7	9/6
7Y4	8/6
8D2	2/9
9D2	3/6
10F1	27/10
12A6	6/6
12AH8	11/6
12AT6	10/6
12AT7	9/-
12AU6	10/6
12AU7	7/6
12AX7	8/6
12BA6	9/-
12BE6	10/-
12BH7	11/6
12C8GT	8/-
12H6GT	3/-
12J5GT	4/6
12J7GT	10/6
12K7GT	8/6
12K8GT	13/6
12Q7GT	8/6
12SC7	1/6
12SG7	7/6
12SH7	5/6
12SJ7	8/-
12SK7	6/-
12SL7	8/-
12SN7GT	17/6
12SQ7	8/6
14S7	14/6
15D2	7/9
19BG6G	24/4
20D1	16/-
20F2	27/10
20P1	27/10
20P3	20/11
20P5	20/11
25A6G	11/6
25L6GT	10/-
25Y5	9/9
25Y5G	9/9
25Z4	9/6
25Z5	10/-
25Z6	10/-
30F5	12/6
30FL1	12/6
30P4	21/7
30P12	12/6
30PL1	12/6
35L6GT	9/6
35W4	8/6
35Z4GT	8/-

35Z5GT	9/-
42	8/-
50C5	11/6
50CD6G	31/4
50L6GT	8/6
75	11/6
77	7/6
80	8/6
142BT	3/6
185BT	34/9

210DDT	4/6
210VPT	3/6
807	6/6
954	2/-
955	4/9
956	3/6
9001	5/6
9002	5/6
9003	5/6
9004	5/6
9006	5/6

MAINS TRANSFORMERS

3 Way Mounting Type.

MT1
Primary: 200-220-240 v. Secondaries: 250-0-250 v. 80 m/A 0-6.3 v. 4 amp., 0-4 v. 2 amp. Both tapped at 4 v. **21/9** each.

MT2
Primary: 200-220-240 v. Secondaries: 350-0-350 v. 80 m/A 0-6.3 v. 4 amp., 0.5 v. 2 amp. Both tapped at 4 v. **21/9** each.

MT3
Primary: 200-220-240 v. Secondary 30 v. 2 amps. 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.

CHASSIS

Aluminium Undrilled with Reinforced Corners. Available in the following sizes:—

	ea.
6in. x 4in. x 2½in. ...	4/6
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10in. x 7in. x 2½in. ...	7/3
12in. x 3in. x 2½in. ...	5/9
12in. x 5in. x 2½in. ...	6/9
12in. x 8in. x 2½in ...	8/6
14in. x 3in. x 2½in. ...	6/-
14in. x 9in. x 2½in ...	12/-
16in. x 6in. x 2½in. ...	8/6
16in. x 10in. x 2½in. ...	14/-

All are four-sided—ideal for radio receivers—amplifiers—power packs, etc.

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Universal speech coils.

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SPECIAL PURCHASE 8in. P.M. Speaker Units with Output Transformer removed from equipment, 11/6 each.

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Make	Type	Size	Price
Plessey	Square	3in.	19/6 each
Lectrona, Plessey	Round	5in.	17/6 each
Goodmans, Plessey	Round	6½in.	18/6 each
Goodmans, R. & A.	Round	8in.	19/6 each
Plessey, R. & A., Elac	Round	10in.	25/6 each
Elac	Elliptical	7in. x 4in.	19/6 each
Elac	Elliptical	10in. x 6in.	25/6 each

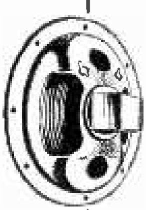
All the above are PM units with 2 to 3 ohms speech coils.

RTC 12in. heavy duty 20 watts model 15 ohms Speech Coil £5 5 0

6½in. Mains Energised Speaker 17 6

8in. Mains Energised Speaker £1 1 0

All have field coils of approx. 600 ohms.



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LEEDS 7**

TERMS: Cash with order or C.O.D. Postage and Package charges extra, as follows: Orders value 10/- add 1/-; 20/- add 1/6; 40/- add 2/-; £5 add 3/- unless otherwise stated. Minimum C.O.D. fee and postage 3/-. All single valves postage 6d. Personal Shoppers Monday-Friday 9 a.m. to 5 p.m. Saturday 10 a.m. to 1 p.m.

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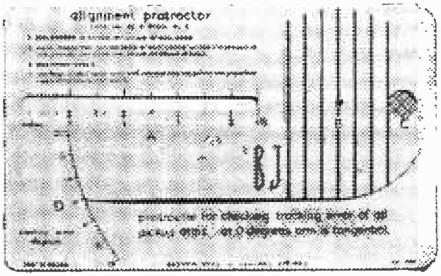

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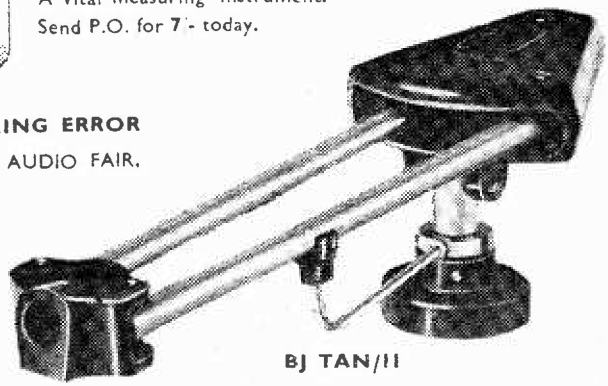

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BJ TAN/II ARM	...	£3.3.0
P.T.	...	£1.5.3
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THE
MULTIMINOR

A new pocket-size instrument for the Radio and T.V. constructor.

This splendid new AVO Instrument has been developed to meet a definite demand for a sturdy pocket-size multi-range test meter at a modest price, suitable for use on modern electronic apparatus as well as for radio and television receivers, motor vehicles, and all kinds of domestic appliances and workshop equipment.

Readings are obtainable quickly and easily on a very open scale, and range selection is by means of a robust clearly marked rotary switch of the characteristic AvoMeter type. Measurements of A.C. and D.C. Voltage, D.C. Current, and Resistance are made by means of only two connection sockets.

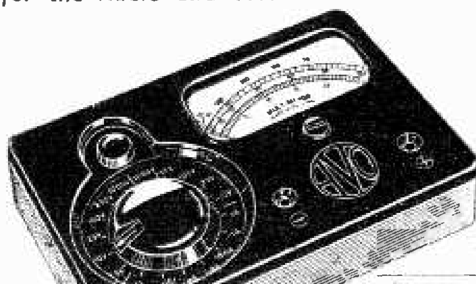
19 RANGES

D.C. Voltage	A.C. Voltage	D.C. Current	Resistance
0—100mV.	0—10 V.	0—100μA	0—20,000 Ω
0—2.5V.	0—25 V.	0—1mA	0—2M Ω
0—10 V.	0—100 V.	0—10mA	
0—25 V.	0—250 V.	0—100mA	
0—100 V.	0—1,000 V.	0—1 A	
0—250 V.			
0—1,000 V.			

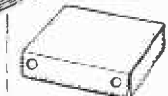
List Price:

£9/10s.

complete with Test Leads and Clips.



Pocket size: 5⅝ x 3⅜ x 1⅝ ins.
Weight: 1 lb. approx.



Leather Case if required 32/6

Sensitivity:
10,000 Ω/V on D.C. voltage ranges.
1,000 „ „ A.C. „ „

Accuracy:
3% of full scale value on D.C.
4% „ „ „ „ „ A.C.

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PRACTICAL WIRELESS

EVERY MONTH
VOL. XXXIV, No. 618, JUNE 1958

EDITOR : F. J. CAMM

26th YEAR OF ISSUE

COMMENTS OF THE MONTH BY THE EDITOR

Editorial and Advertisement Offices :
PRACTICAL WIRELESS
George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.

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Phone : Temple Bar 4363.
Telegrams : Newnes, Rand, London.
Registered at the G.P.O. for transmission by Canadian Magazine Post.

SUBSCRIPTION RATES

including postage for one year

Inland - - - 19s. per annum.
Abroad - - 17s. 6d. per annum.
Canada - - - 16s. per annum.

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.*

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MIDGETS

OUR recent editorial comments on the need for a really midget battery-operated personal receiver, light in weight, and easily carried in the pocket, has brought forth a large amount of correspondence and suggestions, and readers will be glad to know that we are now experimenting with a circuit which we feel will meet most of the conditions which have been named. It is obvious that high quality of reproduction cannot be expected, nor can the reader expect to receive a large number of stations. Such a receiver must essentially operate only on the medium-waveband and from low-voltage batteries. One or two readers have submitted tiny receivers which they have made themselves and we shall be describing one of these in an early issue. In the meantime, we shall still be glad to receive details of midget receivers which have actually been built and we should prefer constructors to send the receiver to us for test. We shall, of course, pay for all articles describing such receivers accepted for publication. One of the difficulties at present is to find suitable sources of components, and it would seem that some of these will have to be made.

ANOTHER "P.W." EVENING ?

EVER since we organised that P.W. evening at Caxton Hall last year there has been immense demand from readers for a repetition of it with, of course, a different programme. We should be glad, therefore, if readers who would be interested in attending will drop us a card signifying their intentions.

THE RADIO SHOW

THIS year's Radio Show takes place at Earls Court from August 27th to September 6th. We can report up to the moment of going to press that there is no indication of any startling developments and the mixture it would seem will be as before. It is good that there should not be too frequent changes in design. The motor trade tried the sales dodge of putting each year's model out of date at the end of the current year. This was always irritating to the purchasers. The trade has now adopted a more sensible plan of producing new models by series numbers and not designating them by the year of introduction. The radio trade in its earlier years followed this system, but found that it did not work. The public did not too readily take to the idea of scrapping a £50 radio set because the latest model had a different design of loudspeaker grille or a different tuning dial. New models every two or three years are tolerable. This year's show, therefore, may show price changes and, as usual, different designs of cabinet. The public will go to the Radio Show not only to see the manufacturers' products, but also the sideshows put on by the Services, the BBC and other associations. The Radio Show is a fascinating event for this reason alone. There will be improved catering arrangements and innovations to add to the comfort of the visitor. —F. J. C.

Our next issue, dated July, will be published on June 6th.

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Round the World of Wireless

By "QUESTOR"

Broadcast Receiving Licences

THE following statement shows the approximate number of Broadcast Receiving Licences in force at the end of February, 1958, in respect of 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	1,047,961
Home Counties	1,056,672
Midland	781,325
North Eastern	1,016,681
North Western	758,308
South Western	654,548
Wales and Border Counties...	406,725
Total England and Wales ...	5,722,220
Scotland	759,319
Northern Ireland	180,774
Grand Total	6,662,313

During February the number of combined television and sound licences throughout Great Britain and Northern Ireland increased by 96,476, bringing the total to 7,994,723. Sound only licences total 6,662,313 including 330,238 for sets fitted in cars.

Transistors in Explorer

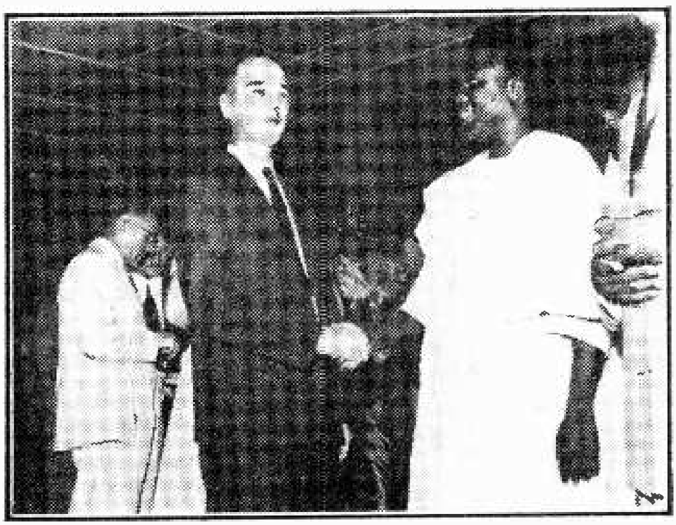
COSMIC ray, meteorite and temperature information now relayed to earth from the globe-girdling Explorer satellite is being gathered with the help of many tiny silicon transistors made by Raytheon Manufacturing Company.

Extremely rugged and reliable, the pea-sized Raytheon transistors are in the satellite's telemetering circuit that sends coded data to receiving stations on earth.

The transistors, Type 2N328, developed under Army Signal Corps contract, are the PNP design, made by the Raytheon-perfected fusion alloy process. This process permits a mechanically stronger assembly, allowing the transistor to withstand higher shock and vibration stress, both in the launching and orbit.

Other advantages for satellite use, in addition to the many inherent advantages of silicon transistors, are the 2N328's high electrical efficiency and ability to withstand sudden surges of voltage.

The silicon devices work well at temperatures ranging from minus 50 to plus 150 degs. Centigrade, or much higher than germanium. Likewise, silicon performs more uniformly at the predicted temperatures for which the satellite equipment was designed.



Mr. D. P. Young, Chief Installation Engineer, Marconi's, is seen receiving the congratulations of the Minister, Chief Akintola on the successful opening of the network referred to on the opposite page.

Retirement

THE retirement is announced of Mr. W. H. Grinsted, O.B.E., F.C.G.I., M.I.E.E., Director of Engineering of Siemens Edison Swan Ltd.

Mr. Grinsted, O.B.E., etc., who has retired from Ediswan as reported here.

Mr. Grinsted was born at Slinfold, Sussex. He received his education at Collyers School, Horsham and at the Central Technical College (now Imperial College) London, where he held the Clothworkers scholarship and won the Siemens Medal (awarded to the third year student heading the list in Electrical Engineering).

R.E.C.M.F.'s New Chairman

AT a meeting of the Council in London, Mr. K. G. Smith (N.S.F. Ltd.) was elected chairman of the Radio and Electronic Component Manufacturers' Federation in succession to Mr. Richard Arbib. Mr. Hector V. Slade (Garrard Engineering and Manufacturing Co. Ltd.) was elected vice-chairman.

Mr. K. G. Smith is technical and sales director of N.S.F. Ltd..

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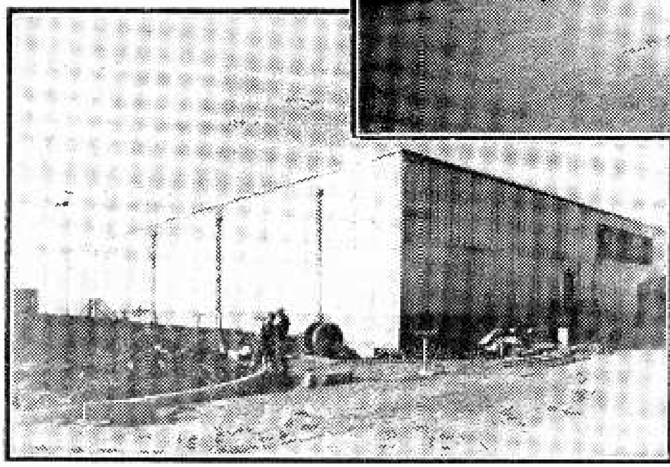
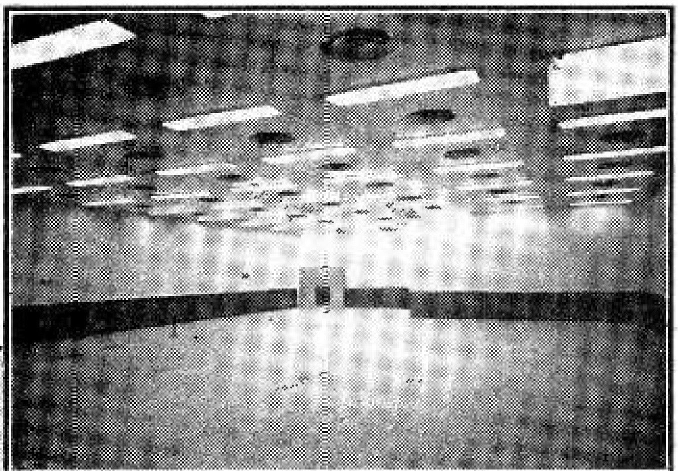
whose factories are at Keighley, Yorkshire and Liverpool. He is a native of South Africa but has lived in this country for over 30 years.

He is also a director of the Motor and Electronics Corporation, Ltd., of British Centralab, Ltd.





Outside and inside views of the £300,000 factory at Swindon, which is to be devoted to the production of transistors. It has no windows, is dustproof and fully air-conditioned. It is owned by Semi Conductors, Ltd.

Linear Accelerator at Cheshire Hospital

A FOUR million electron-volt gantry mounted Linear Accelerator designed for super voltage X-ray treatment of deep-seated tumours has been installed in the new Radiotherapeutic Unit of the Clatterbridge General Hospital, Bebington, Cheshire.

The inaugural ceremony, performed by Lord Cohen of Birkenhead, took place on March 28th under the auspices of the Liverpool Regional Hospital Board.

The installation of this equipment represents a further stage in the programme for the provision of Linear Accelerators for deep therapy treatment at suitable hospital centres in Great Britain. Newcastle-upon-Tyne General Hospital was the first to be equipped under the programme. Other centres where Linear Accelerators have been installed are in Edinburgh, London and Manchester.

New Records for Radio Exports

EXPORTS of two items of radio equipment reached their highest monthly levels in February it is announced by the Radio Industry Council. These were sound reproducing equipment, where the value in one month topped £1m. for the first time, and valves and tubes, where the value was £426,000. These figures compare with values of £793,000 for sound reproducing equipment in February, 1957, and of £350,000 for valves and tubes in February, 1957.

The provisional value of exports of all items of radio equipment in February was £3.65m. This was slightly below the figure, £3.7m. for February, 1957 (but may exceed it when the full returns are known).

The total for the first two months of the year is now over £7.4m. compared with £6.9m. for the first two months of 1957, which was a record year.

World's Biggest Radio Multi-channel Link

THE largest radio telecommunications system of its type in the world was inaugurated recently in Nigeria by the Nigerian Minister of Communications and Aviation, Chief the Honourable S. L. Akintola, M.H.R. Marconi's Wireless Telegraph Company have been responsible for the construction of the whole system, which is capable of providing an ultimate capacity of over 50,000 channel miles. Marconi V.H.F. multi-channel equipment has been used at all the 14 terminal and 25 repeater stations.

With the completion of this scheme internal communications in Nigeria have made a significant advance. It is now possible to telephone from Lagos to many provincial towns whose local services have not previously been connected into a national network. The important centres now linked by first class trunk services include Lagos, Ibadan, Benin, Onitsha, Enugu and Kaduna.

Radios to Seven Countries

HUNGARY is to export a total of 14,000 radio sets to Cyprus, Yugoslavia, South Africa, Sweden, Czechoslovakia, Greece and Roumania this year from the Telephone Electrical Goods Factory, Budapest.

And railway safety equipment worth £600,000 will be exported to Czechoslovakia, and Yugoslavia, reports the newspaper *Népakarat*.

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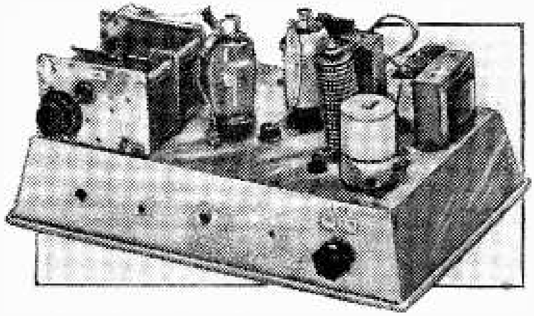
A Beginner's CONSTRUCTIONAL COURSE-III



A NEW SERIES WRITTEN ESPECIALLY FOR THE AMATEUR By E. V. King

3.—CONVERTING THE 2-VALVER INTO A 3-VALVE SET

WHERE the lead from C14 goes through the grommet scrape it clean and solder on R10 which is then earthed to chassis (Fig. 16). Solder on a few feet of lighting flex for the speaker. Fix C16 across the primary of the speaker transformer, i.e. the tags already going to anode and H.T.

Checking the Circuit

Again pencil out the theoretical circuit. Ink it in as each part is checked. Especially check the value of R9, beginners make many mistakes with the colour code. Then carry out a visual "round the clock" valve base check as follows: 1 to earth. 2 to earth via R9 and C11. 3 to TR2 and C16. 4 to pin 7. 5 to earth. 6 to earth. 7 to pin 7 V2, TR2 and pin 4 V3. 8 to pin 8 V2.

Testing the Detector With an Output Stage

The detector stage should not have been disturbed and should of course still be working. Connect everything up, note the mains is in the right way round and switch on. Note that both filaments light up. If not check the mains supply and filament circuits. Attach a good aerial (50ft. will give good volume at this stage) to the positions on the PA2 already detailed. In Fig. 22 these places are "Y" or "Red" of the PHF2 coil near V2. If the aerial is short it is best attached directly to the red tag of the coil via a small 500 pF safety condenser.

Your receiver will now receive the local stations at good speaker volume. There should only be a minimum of hum from the speaker and speech and music should be undistorted and clear.

If you do not get reception proceed as follows. Unplug V3 leaving all wiring in place. Attach headphones as already detailed and verify that the detector stage is working. If not then you must have disturbed the detector stage wiring or shorted the H.T. supply to earth. If the detector stage is working replace V3, remove the top cap clip and touch the top cap with a finger. Loud 50 cycle hum should be heard from the speaker. if not then the output stage is faulty. Check the valves by interchange into the detector stage (using phones). If the valves are all right thoroughly check all V3 wiring and the value of components.

If the directions have been carefully followed no troubles will arise. A student of 15 built one of these receivers from these instructions and only made one error which he quickly put right. His error, for some reason or other, was to short out R11 with a direct loop of wire between C12 and C13. The result, of course, was a terrific hum even when all top caps were in place!

Do not proceed to the next stage until your two valver is working perfectly as regards clarity and lowness of hum. There are some notes on hum at the end of this series.

Adding an H.F. Stage

If we fit an amplifier to increase the aerial signal then we shall get much more volume from the output stage. This volume is, of course limited, or distortion will occur on local stations. So the amplifier fitted must have a variable amplification factor. If the amplifier fitted is

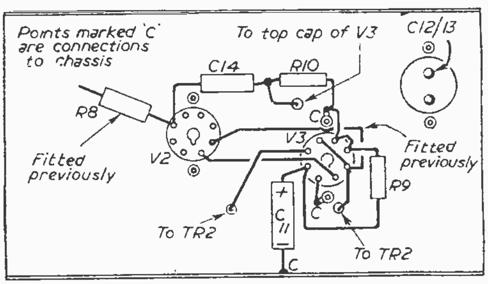


Fig. 16.—New wiring added when fitting V3 (view of underside of chassis).

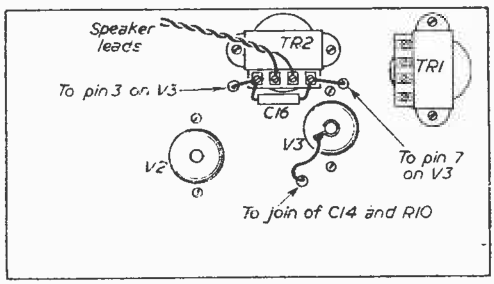


Fig. 17.—Additional wiring when V3 is fitted (top view of chassis).

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tuned like the detector stage we shall have much increased selectivity. Stations near together on the dial will be separated with ease and distant ones received well provided fading troubles are not too bad (these are atmospheric in origin).

Preliminary Alterations to the Detector Stage

Fix another coil, a Wearite PHF2 this time, in the position shown in Fig. 19. Make sure the red tag is facing the top cap of V2 as shown. Now remove the end of C7 which is attached to the red tag of PA2 and attach it instead to the red tag of the PHF2 just added. Shorten the leads if necessary. Earth tag X of PHF2 and earth tag Z. Any suitable tag may be attached to chassis for this purpose. Take a short lead

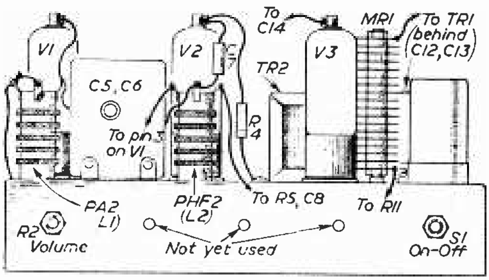

Fig. 20.—Side view of the receiver with this month's modifications.

from the red tag of this coil to the other gang (C6), that is the gang nearest the front of the receiver, making sure that the lead goes to the fixed vanes and not the moving ones.

Now try out the detector and output stage as before. It should work as before when the aerial is placed on the red tag of the new PHF2 coil. It should work, but with much reduced volume, in position on tag Y. This is in order. Do not proceed until the set is working with this new coil added. Any troubles which occur must of course be due to the tuned circuit of coil and condenser and nothing else, for nothing else has been disturbed.

Wiring the H.F. Stage (Underneath)

Refer to Fig. 20 and fix the volume control in the correct position. Fix another Mazda

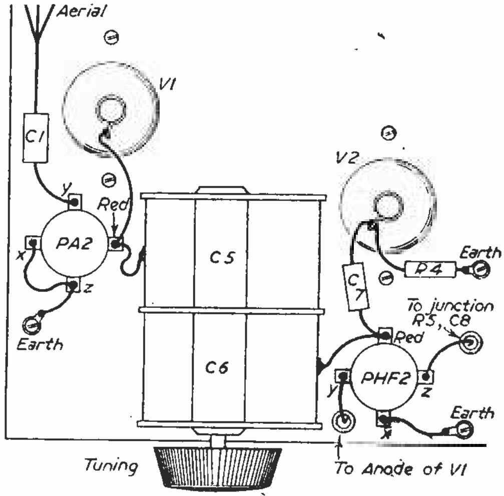

Fig. 19.—Top view of H.F. and detector stages.

Octal base for V1 in the same relative position as V2 and V3 (Figs. 1 and 21).

The theoretical circuit is given in Fig. 18, compare it with the diagram of the complete three-valver in Fig. 22. The under view of the practical layout is given in Fig. 21 and the top view in Fig. 19. The front elevation of Fig. 20 may also help the reader with the wiring.

Here is a suggested plan to follow. Take pin 8 of V1 to pin 8 V2. Take pin 7 on V1 to pin 7 on V2. This valve is then supplied with H.T. and L.T. Earth pin 1 to nearby tag. Earth pins 5 and 6 to the other tag. Suspend R1 in air between pin 2 and any earth (i.e. pin 6 would do). Fix C3 likewise. Take pin 3 to the Y tag of the PHF2 (detector stage). Remove the earth lead on the Z tag and instead take Z to C8 (other half of double 8-8 μF). Join C8 to pin 7 on V1 via R5. The H.T. supply is now decoupled. Take pin 4 to slider (centre tag) of the volume control and from there to earth (any suitable tag is fitted) via C2. One of the side tags of the volume control is earthed, the other is connected to junction R5 and C8 via R3 (more about this value later). Earth junction of R3 and volume control via C4 (this could be omitted in most cases without any effect). Check this with pencil and paper, and "round the clock"

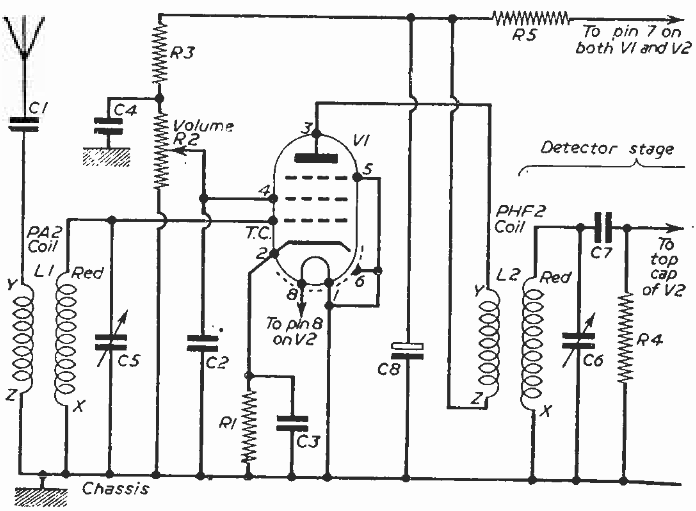

Fig. 18.—Theoretical circuit of H.F. stage.

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again as follows: 1 to earth. 2 to earth via R1 and C3. 3 to Y of PHF2. 4 to R2 and C2. 5 to earth. 6 to earth. 7 to pin 7 V2. 8 to pin 8 V2. Now check for sure that your component values are correct.

Wiring the H.F. Stage (On Top)

The PA2 is now used. This should already have tags Z and X to chassis, and the red to the fixed vanes of the nearby gang C5. Make sure these leads are still attached. Now take a lead direct to the top cap connector of the new valve V1. The H.F. stage is now complete.

LIST OF COMPONENTS FOR OUTPUT STAGE (Fig. 15)

- C11—25μF 25v.w.
- C14—.01μF
- C16—.01μF
- R9—330 ohms
- R10—470k ohms
- Tr2—Standard speaker transformer
- V3—SP41 61

Testing the Complete Receiver

Fix up all leads making sure mains is in correctly. Observe that all valves light up. If not verify if the valve is faulty by changing them round, or if the filament circuit is faulty check the circuit Tr1. and pins 1 and 8 on each holder. Advance R2 and signals should be heard. A long aerial is not required. Advance R2 fully, if the set starts to oscillate this is in order. Do not leave it doing so, retard R2 until the oscillations clear (if there were any) and tune the gang condenser. Stations should be heard though probably with interference for the time being.

Trimming the Receiver

Have a look at the gang condensers and find the small auxiliary condensers which are called trimmers. A small screwdriver will be required to adjust these. Do them up tight and then undo

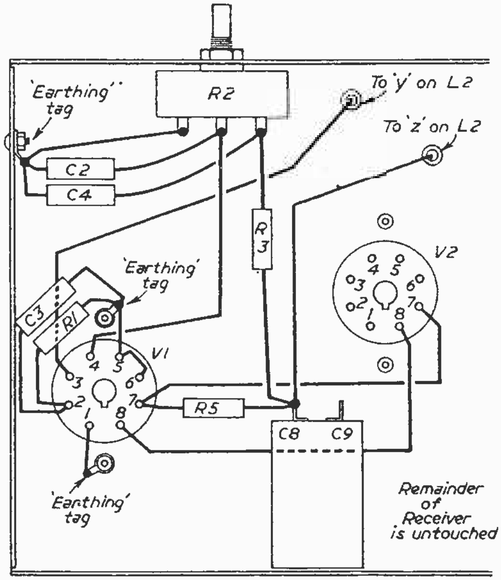

Fig. 21.—View of the underside wiring added to complete H.F. stage.

them both two complete turns. Now open the vanes and find a weakish station (i.e., Luxembourg, if you are not too near the south coast). Use R2 control as necessary, but do not let the receiver oscillate: if it does reduce setting of R2 slightly. Now adjust carefully the two trimmers

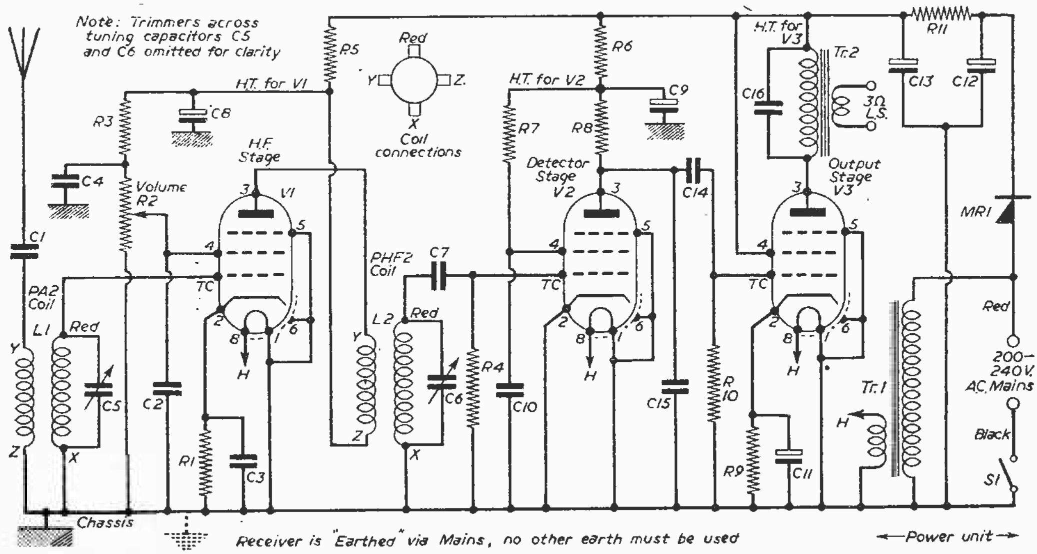

Fig. 22.—The theoretical circuit with this month's additions.

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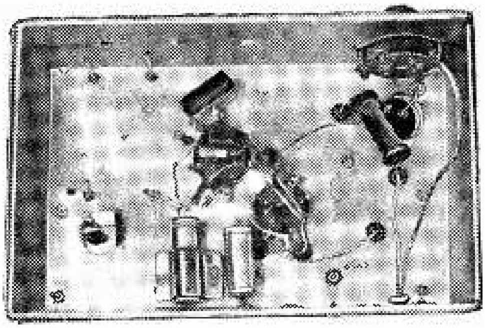

A view of the underside of chassis.

one at a time to receive your weak station at maximum volume. If the radio oscillates as you do this retard R2. With care you will get the station loudest at a certain setting of each trimmer and if each screw is moved the slightest either way the signal should be fainter. If this condition is not obtained you must experiment with one trimmer done up more than the other in the first instance.

All trimming is best done on the aerial it is intended to use with the receiver as the setting of the trimmer on C5 is affected by the capacity of the aerial. The author would like to repeat again that when finished the trimming should be such that a weak station on the high frequency end of the tuning is *peaked* with *each* trimmer.

(To be continued)

LIST OF PARTS

Here is a complete list of parts, with alternatives and their function in the circuit.

C1—500 pF mica aerial series condenser fitted to safeguard someone fitting the aerial if the receiver were connected to mains the wrong way round. Incidentally, it will also save PA2 burning out if the aerial hit the gutter, etc., under similar conditions.

C2—.01 μF paper, 350 volts working. This is a screen decoupling condenser.

C3—.01 μF 350 v. bias condenser.

C4—.01 μF 350 v. decoupling condenser (optional, see text).

C5 and C6—Twin gang 500 pF, each gang fitted with trimmers. Slow-motion drive an advantage. A three-gang may be used with the middle gang not used (one prototype will be seen in the photographs to have a three-gang in use). Insulated knob with sunken grub screws required. These condensers tune the two coil secondaries to the frequency required.

C7—100 or 120 pF mica or ceramic. This is the grid condenser which stops a charge on the grid of V2 leaking instantaneously to earth via PHF2.

C8 and C9—A double 8-8 μF electrolytic condenser. Any value will do which is greater than 8, i.e., a 32-32 μF will be just as good. The working voltage must be at least 250 v. and for safety order 350 v. condensers.

C8 decouples with R5 the H.T. for V1, and C9 decouples with R6 the H.T. supply for V2.

C10—.1 μF paper 350 v. working, screen decoupling for V2.

C11—25 μF (between 12 and 50 is suitable), 25 v. electrolytic condenser. Do not use one with a higher voltage rating. This keeps the bias on V3 grid steady no matter what current is passing across R9.

C12 and C13—Another double electrolytic, 16-16 μF or larger, say, 32-32 μF, 450 v. working. Do not use a lower working voltage than 350 v. C12 is the reservoir condenser for MR1 and C13 is the smoothing condenser working with R11.

C14—.01 μF mica or ceramic or Sprague type, 600 v. working. This couples the output from V2 anode to the grid of V3. It must be good or H.T. will get to the grid and ruin V3. Slight leakage would put a wrong bias on V3 grid and cause distortion.

C15—100 pF mica or ceramic. This gives a H.F. by-pass to earth with practically no path for audio currents. It also helps with modulation hum troubles.

C16—.01 μF paper 450 v. working. A top cut capacitor for toning down the high note response of pentodes. It also helps to cut out medium wave heterodyne whistles during the evenings.

(All resistors are ¼ watt unless stated otherwise.)

R1—1,000 ohms (brown, black, red). This gives a bias on V1 grid. Bias varies with position of R2 as the current through the resistor thus varies.

R2—1 megohm potentiometer. This is a true potentiometer between H.T. plus and minus. The voltage (and hence the amplification of the valve) on V1 screen grid is thus controlled by the slider.

R3—220 k. (red, red, yellow), a resistor to stop the grid of V1 connected to R2 slider from becoming too positive. The value given is satisfactory, for greater sensitivity adjust as described later.

R4—1 megohm (brown, black, green). Grid leak to allow the charge on the control grid of V2 to leak slowly to earth, otherwise the valve would cut off.

R5—10 k. (brown, black, orange). Decoupling resistor for V1, works in conjunction with C8.

R6—10 k. Decoupling resistor for V2, works with C9.

R7—1 megohm. Screen H.T. dropper for V2 to get a suitable voltage on V2 grid for leaky grid detection.

R8—470 k. (yellow, violet, yellow). Anode load for V2. The detected signal is developed across this resistor.

R9—330 ohms (orange, orange, brown). Bias resistor for V3. This gives a voltage drop when the valve draws current, thus producing a negative bias for V3 grid (via R10).

R10—470 k. (yellow, violet, yellow). Grid leak to give the proper bias to control grid of V3 and to stop it acquiring a charge.

R11—3,000 ohms (5,000 ohms would do). 3 watts or larger wattage. This is the smoothing resistor in the H.T. circuit and works in partnership with C12 13. Large resistors are not usually coded, but if so it is orange, black, red.

L1—Wearite PA2 aerial coupling coil and tuned grid coil for V1.

L2—Wearite PHF2 anode coupling coil and tuned detector coil for V2.

V1—SP41/SP61 (that is VR65a/VR65 ex-government) H.F. amplifier.

V2—Ditto. Leaky grid detector.

V3—Ditto. L.F. output stage.

Three bases for the above valves. Mazda Octal. Three top caps to suit.

TR1—Filament transformer, 4 v. 3 A. or 6 v. 2 A. (see text) from A.C. mains. Standard speaker transformer will do under some conditions.

TR2—Standard speaker transformer or multi-ratio type (R.C.S.). This provides an anode load for V3 and matches the valve to the speaker.

MR1—Metal rectifier. Any type supplying 30 mA or more and rated at 240 v. input will do. This rectifies the A.C. input to pulsating D.C., which is received by C12 (H.T.48 is a suitable type).

S1—Mains on/off switch. Toggle type not suitable. Rotary type with insulated knob is required. One pole one way will do, or two pole one way can be used (see text).

CHASSIS—See text.

MAINS LEADS—Two core coloured cable with three pin plug, if possible.

AERIAL—50 ft. or more for one-valver, 20 ft. or less for ordinary reception with 3 valves.

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New Radio Components

DETAILS OF SOME OF THE EXHIBITS SEEN AT THIS YEAR'S R.E.C.M.F. SHOW

MANY of the new radio components which were exhibited at the Radio and Electronic Component Show at Grosvenor House and Park Lane House, London, were smaller, more robust and able to withstand higher temperatures than ever before.

The trend to miniaturise components continues, particularly for those to be used with the very small transistors now being manufactured, and also in connection with printed circuitry.

Components for use in guided weapons need to be sub-miniature, of extreme ruggedness and able to operate in high temperatures. Some of the new transformers and chokes are suitable for working in temperatures up to 200 deg. C. and even 250 deg. C. and there is an exploratory design suitable for 500 deg. C.

Certain components have also been designed to withstand the strong vibration and enormous acceleration due to high "G" values in guided missiles.

Improvements are to be found in even the more stereotyped components such as wafer switches and small relays, both sealed and unsealed.

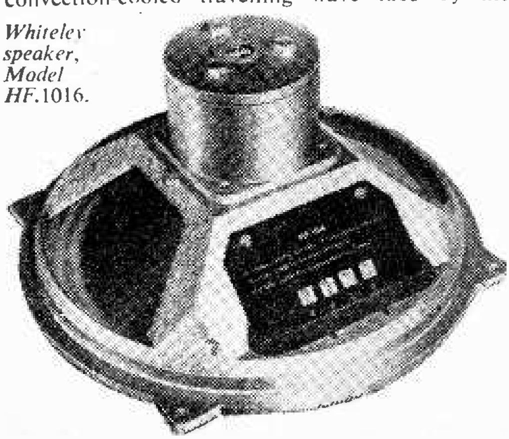
Developments in ferrites and dust iron cores include the introduction of new materials with new properties, especially for memory devices for computers.

Made for the first time in this country are sintered glass preforms for glass-to-metal seals in hermetically sealed components. These are cheaper, less laborious to use and available with closer tolerances than the glass tubing they replace.

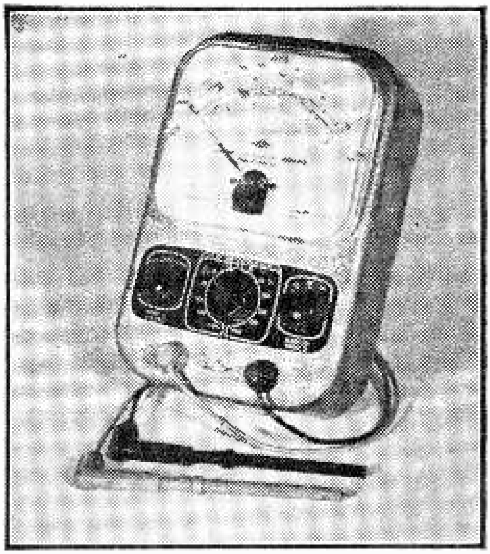
It would not be possible to deal with everything shown at the exhibition, so we pick out here a few of the more interesting items from the point of view of the constructor.

Travelling Wave Tube

The T.W.S.1, shown on page 271 is a convection-cooled travelling wave tube by the



*Whiteley speaker, Model HF.*1016.



The New Series 100 *Test Set by Pullin.*

M.O. Valve Co., intended for use in the 1,500 to 3,000 Mc/s frequency range, and suitable for most broad-band amplifier and variable attenuator requirements. The tube is conservatively rated, and an output of 38w can be obtained with a power gain of 26 db.

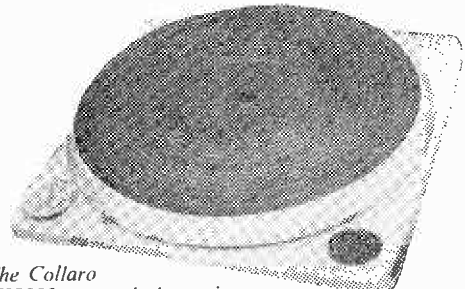
Series 100 Test Set

The Pullen (Measuring Instruments Ltd.) test set shown above has been redesigned and has the following features:

(i) A new type diakon plastic cover is fitted to the meter, which gives a very wide angle of vision, and good illumination on the dial surface.

(ii) An increased scale length is possible due to the use of the new cover, and re-arrangement of scales, giving an extra long ohms scale.

(iii) The test set is fitted with a stand which makes it possible to use an instrument in a horizontal, vertical or an inclined position. This, it



The Collaro 4TR200 transcription unit.

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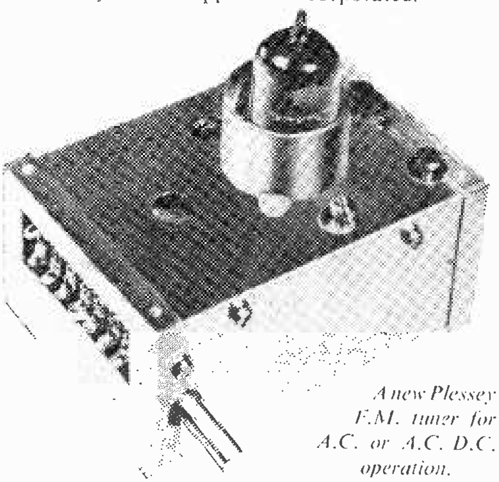
will be appreciated, facilitates reading the instrument under difficult lighting conditions. The case has been re-styled in aluminium alloy and a finger recess for carrying is fitted instead of the protruding handle previously used.

(iv) The case is finished grey hammer enamel and an adjustable support is incorporated.



A new Plessey F.M. tuner for A.C. or A.C. D.C. operation.

(v) The meter has a 3¼in. mean scale length, rectangular pattern with knife edge pointer, 3 ohm scale and a sensitivity of 100 microamps for full scale deflection.

(vi.) The test leads have been improved and they are fitted with retractable probes and a swivelling mechanism which enables the leads to be used in any position without risk of damage.

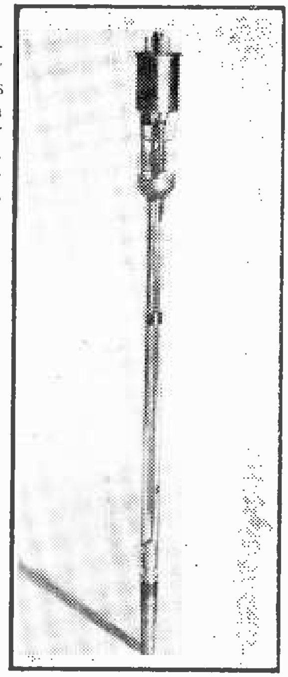
(vii) A special printed circuit has been designed for the majority of the wiring, which gives a much more rugged construction, facilitates service, and enables all components to be accessible when the back cover is removed.

Whiteley V.H.F./F.M. tuner.

Whiteley Electrical

Amongst the well-known Whiteley (W.B.) apparatus were the 10in. High Fidelity Loudspeaker (Type HF.1016), incorporating powerful 16,000 gauss magnet, cambric cone and tapped speech coil, handling capacity 10 watts, frequency response 30-15,000 c.p.s., retail price £8 including tax.

Also there was a new model F.M. tuner with a circuit of advanced design. An important feature is the use of printed circuit techniques to ensure maximum electricity stability together with rigid mechanical structure thus ensuring freedom from drift. It is designed to receive frequency modulation signals in the band of 88-108 Mc/s and is therefore suitable for use in most parts of the world.



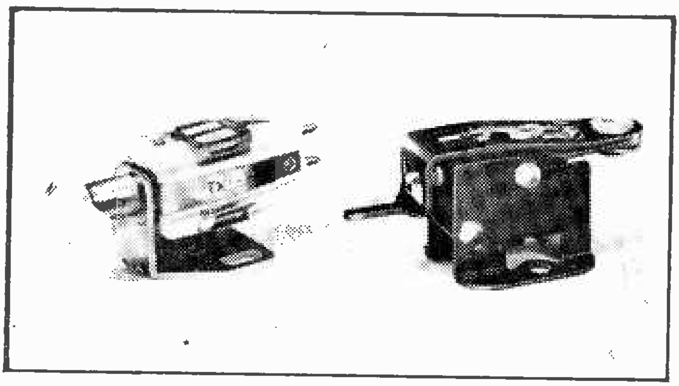
The Travelling Wave Tube by M.O. Valve Co.

Plessey F.M. Tuner

Another tuner was shown by the Plessey company. This is for A.C. and A.C./D.C. operation, using a double triode valve as R.F. amplifier and mixer-oscillator. The frequency coverage of this unit is 87 to 101 Mc/s.

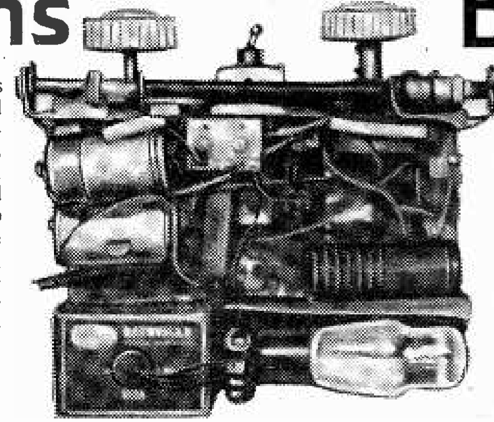
Collaro Products

Collaro Ltd. presented their new improved Tape Transcriptor Mark IV, which incorporates several modifications to the previous design. Among the new features are the interconnected micro switch and fly-wheel brake. By means of these improvements both motors will be switched off and the fly-wheel instantaneously stopped when the "stop" button is operated. Any one of the six smaller knobs will then start the machine in either direction without subjecting the motors to excessive loading.



Collaro's TX.88 and a ceramic pick-up.

A Mains — Battery Portable



An A.C./D.C. Set With Stabilised Power Supply Enabling it to be Plugged in Anywhere Without Adjustment Where 200-250 Volt Mains Exist. Also Containing Automatic Switch-over from Mains to Battery if the Power is Cut Off.

By G. Keating

THIS receiver was designed to be used by anyone, anywhere, at any time. It is a four-valve superhet using economy valves and readily obtainable cheap batteries. For the above reasons the set was built around an Ever-Ready B.126 90 volt H.T. battery and the popular 1289 4½ volt pocket-lamp battery (7½ volt L.T. batteries are notoriously expensive). The valves used are DK96, frequency changer; DF96, intermediate frequency amplifier; DAF96, detector, A.V.C. and A.F. amplifier; DL96, output pentode; a contact cooled metal rectifier is used for the mains supply together with a VR105/30 voltage stabiliser. Since the main circuit details are reasonably conventional, and therefore the power supply and switching are of more interest the receiver will be dealt with theoretically in two sections, although full practical details will be given.

The power supply section will be dealt with first and the circuit is given on page 274.

Power Supply

The power from the mains is rectified by MR. C8A being the reservoir condenser, R11 the dropper resistor, C88 and the VR105/30 smoothing and stabilising the output at 105 volts. Current from this supply flows through R9, the filament dropping resistor, and A/3, a 500Ω surplus relay, finally returning through a Brimistor type CZ10 and the filament chain if the set is switched on. The CZ10 is included to absorb the filament current, 25 mA, when the set is switched off, the voltage across it then being about 15 volts. With the set running, the voltage across it drops to 9.05 volts, and at this voltage it only passes about 2 mA. The current flowing through A/3 causes it to operate switching A1, 2 and 3 to the mains position. Pin 7 of the DL96 receives the mains supply of 9.05 volts which flows right through to pin 1 of the DK96 and the chassis. From there if S2 (part of the on/off switch) is closed it flows through R6, which provides part of the grid bias for the output valve, and back to the mains. About 1.1 volts is developed across R6 since the H.T. and L.T. currents flow through it on the mains position; also about 5½ volts are dropped across R4 and the first three valves, thus about 6½ volts bias is present for the output valve. The H.T. supply on mains is fed through A2 and R8 which drops the voltage to about 85 volts on the H.T. rail. When the mains is switched off or disconnected, the relay A3 is de-energised and A1, 2 and 3 change to battery, connecting pin 7 of the DL96 to chassis and earthing the negative L.T. battery tag through A3 and supplying the H.T. rail with voltage from the H.T. battery. The L.T. current now flows through S1 and is split, one half feeding R4 and the DL96, and the other half feeding the remaining valves in exactly the same way that the mains supply did. Only the output valve changes its working condition in that all the bias is now produced by R6, R13 and R7 carrying the H.T. current. R3 is used to by-pass the cathode current of the DL96 on mains supply, since the anode and screen currents must flow out of the filament and would, unless by-passed, overload the other valves. Similarly R5 by-passes the current from the DF96. The DAF96 cathode current is only about 0.1 mA and may safely be neglected. R2 by-passes the cathode current of the first section of the DL96 and the current through R1 on mains. On battery R1 and R2 are in parallel and by-pass the cathode current of the second section which, it will be remembered, comes *first* on battery operation, because the current flow through the filament of this valve is reversed. As a result of these resistors the voltage is maintained at 1.3 volts per section on mains operation and is no greater than 1.5 volts per section on battery which is the operating conditions recommended by the manufacturers. The stabilised power supply ensures that the operating voltages are always correct whenever the set is operated from A.C./D.C. mains between 200 and 250 volts. If the supply voltage is below 200 volts at peak demand times then the stabiliser may flicker on and off, in which case R11 should be reduced in value to, say, 2 KΩ (a 15k 1w resistor connected in parallel, will achieve this temporarily). This can also be used when the rectifier falls in efficiency after very prolonged use. The relay deserves special mention, it is of 500Ω resistance and it closes at about 12 mA, so the 25 mA filament current is more than sufficient for reliable

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operation. The original had a two-pole change-over switch only fitted, so a bolt was mounted on the chassis in such a position that the armature just made contact with it when the relay was de-energised. As the mounting bracket was already insulated from the frame a wire from the frame to the negative terminal of the L.T. battery provided contact A3. Of course, if a relay with a three-pole change-over switch was obtained, this modification would not be necessary. Any relay will do providing it will operate firmly and reliably on 25 mA. The value of R9 should be altered so that R9 and the relay A/3 total 3.4 KΩ resistance.

The Circuit

The remainder of the set will now be described and Fig. 2 gives the circuit diagram of this part. It should be noticed that most of the components already detailed in the power supply section will be omitted from Fig. 2 for simplicity. Consequently it is wiser to wire in all components in Fig. 1 first, before wiring in the additional ones in Fig. 2. The signal is picked up by a dual wave Ferrite rod aerial tuned by C9A and applied to G3 of V1. The oscillator section of this valve is a conventional series fed, grid tuned circuit with separate coils for medium and and long waves.

It will be observed that both the oscillator coupling windings are in series with the medium-wave section nearest to G2, the oscillator anode.

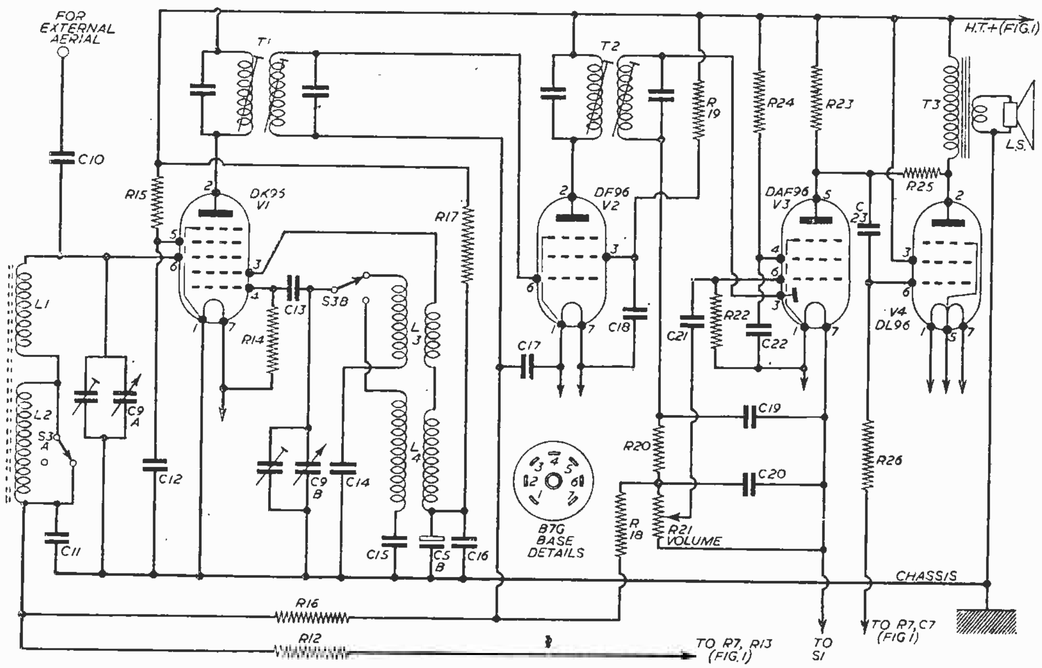

Fig. 2.—The receiver circuit. The mains section is shown on page 274.

COMPONENTS FOR FIGURE 2

- * C5A—50 μF 150 v. } in the same can
- C5B—50 μF 150 v. }
- C9A } 500 pF twin gang midget
- C9B } with trimmers (2½ x 1½ x 2in.)
- C10—5 pF silver mica or ceramic
- C11—0.1 μF 150 v.
- C12—0.1 μF 150 v.
- C13—100 pF silver mica
- C14—470 pF silver mica
- C15—150 pF silver mica
- C16—0.1 μF 150 v.
- C17—0.1 μF 150 v.
- C18—0.1 μF 150 v.
- C19—100 pF ceramic
- C20—100 pF ceramic
- C21—10,000 pF ceramic
- C22—0.1 μF 150 v
- C23—10,000 pF ceramic
- R12—10 MΩ
- *R13—100 Ω
- R14—27 KΩ
- R15—100 KΩ
- R16—10 MΩ
- R17—27 KΩ
- R18—10 MΩ
- R19—39 KΩ
- R20—47 KΩ
- R21—2 MΩ volume control (with double pole switch)*
- R22—10 MΩ
- R23—2.2 MΩ
- R24—10 MΩ
- R25—15 MΩ
- R26—10 MΩ
- T1 and T2—Pair slug tuned midget IFTs, 13/16 x 13/16 x 2in. maximum.
- T3—Radiospares miniature output transformer
- L1 } Dual wave Ferrite rod aerial (Teletron used in
- L2 } original but any should do). 8 x 5/16in.
- L3—Osmor QO8
- L4—Osmor QO9
- S3A } D.P. D.T. toggle switch
- S3B }
- L.S.—3 Ω loudspeaker (original was 5in. Celestion but a 7 x 4in. elliptical would suit). A high flux density type is strongly recommended.

* See Fig. 1.

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Because of this the coils should not be mounted too close together as mutual coupling will make adjustment of one coil core affect the other. With the layouts given, however, the coils are virtually completely independent of each other. C14 and C15 are the medium and long wave padding condensers: these particularly must be silver mica. It is desirable that all the condensers marked in to the I.F. amplifier V2 and then through T2 to the detector, V3. It is rectified by the diode section and the audio voltage, having been freed from I.F. voltages by the filter R20, C19 and C20, is developed across the volume control R21. A 2 MΩ component was used in the original but 1 MΩ would be quite satisfactory if easier to obtain. The audio voltage is taken from

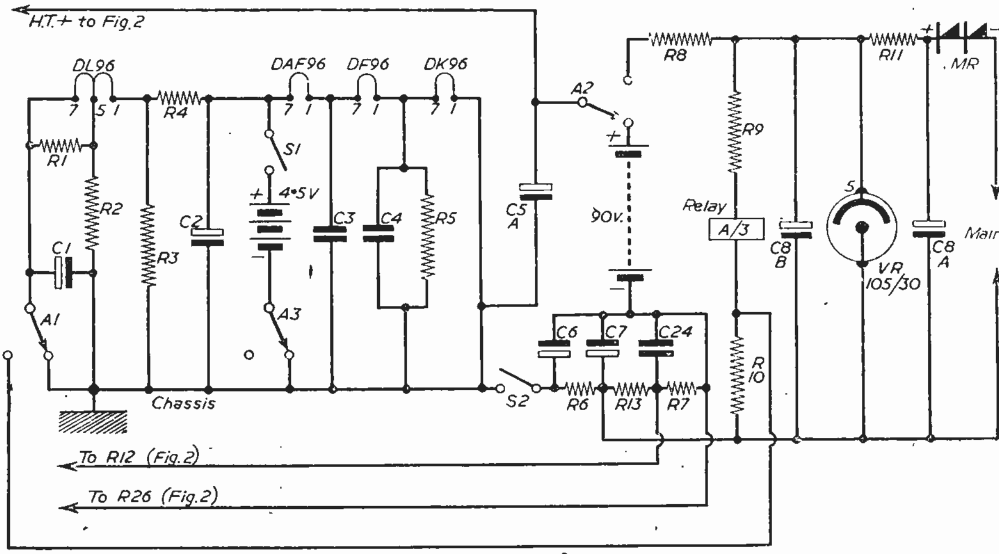

Fig. 1.—The power supply circuit.

the components list should be silver mica also. The reason for this is that ceramic condensers have a fairly large negative temperature coefficient, and since the set gets fairly warm when used from the mains these will cause serious and prolonged tuning drift. You have been warned! Moulded mica condensers are mostly unsatisfactory, solely because of their size. To continue with the circuit; the signal is now fed through T1 the first I.F. transformer at 465 kc/s, the slider of R21 and fed through C21 to G1, the signal grid of V3. R22 is the grid leak, and R23 the anode load. From the anode of V3 the signal is fed through C23 to the output valve V4. The output transformer matches to a 3Ω speaker and R25 provides sufficient negative feedback to reduce the distortion produced in the output valve. The tone has been found to be quite good although the high Q coils, which give excellent selectivity, naturally reduce the

COMPONENTS FOR FIGURE 1

R1—680 Ω
R2—2.2 KΩ
R3—2.7 KΩ
R4—56 Ω
R5—680 Ω
R6—33 Ω
R7—560 Ω
R8—2.2 KΩ
†R9—2.5 KΩ 5 w. wire wound + 390Ω ½ w.
R10—CZ10 Brimistor
R11—2.5 KΩ 10 w. wire wound
R13—100 Ω
C1—25 μF 25 v. (BEC, CE200)
C2—25 μF 25 v. (BEC, CE200)
C3—0.1 μF 150 v.
C4—0.1 μF 150 v.
C5A—50 μF 150 v. } in the same can
***C5B—50 μF 150 v. }**
C6—25 μF 25 v. (BEC, CE200)
C7—25 μF 25 v. (BEC, CE200)
C8A—8 μF 275 v. { in the same can
CB8—8 μF 275 v. }
C24—0.1 μF 150 v.
S1 and S2 ganged with volume control (R21)*
A/3 500 Ω relay (see text)
MR Electrix contact cooled 250 v. 85 mA half wave metal rectifier
† Two resistors in series
*** See Fig. 2.**

SUNDRY COMPONENTS

4 B7G valve holders
Octal valveholder
1 J.B. cord drive, standard type No. 4,690
1 J.B. dial drum, 2¼in., No. 4,030
1 cord tensioning spring, No. 4,587
2 tool clips
1 plug to suit B.126, 3 pin
Various nuts and bolts (mostly 6 B.A.)
2 knobs to taste (original were A713 1⅜in. white, engraved "Vol/On-Off" and "Tuning")
1 sheet of aluminium, 8 x 13in. for main chassis
Miscellaneous pieces for screens, mounting brackets, etc.
Wire, solder, nylon drive cord, small pulley

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treble response. As some people may prefer a further reduction in treble (what is usually called a mellow tone). it will not be amiss to show how this can be achieved. R25 the negative feedback resistor is omitted and a fixed condenser is wired across the primary of the output transformer. Another 10.000 pF ceramic will probably be found suitable. although the value may be varied to suit individual taste. Since the bass response can be surprisingly good for this type of set. a 5in. loudspeaker of good quality is recommended. A high flux density speaker has the supreme advantage of giving more volume from the limited output power. and is strongly recommended. Cheap and midget speakers will be found disappointing from the point of view of both tone and volume. The A.V.C. system is a little unusual in that it consists of a potentiometer network between the positive filament pin of V3. and a negative bias point of approximately −1.2 volts to chassis. Three 10 MΩ resistors R18. R16 and R12 divide the majority of the standing voltage of 5.1 volts into three equal parts (the volume control divides a little but the amount is small). Thus at the junction of R12 and R16 the potential is about +0.5 volts to chassis and at the junction of R16 and R18 the potential is about +2.1 volts. These points are thus at about the same voltage as the middle of the filaments of V1 and V2 respectively and are thus suitable for the A.V.C. feed. Owing to this potentiometer, only one-third of the control bias is applied to V1 and only two-thirds to V2. Another useful feature is that about 1 volt delay exists owing to the biases being about mid filament potential and not negative filament potential. This stops weak signals decreasing the gain and improves sensitivity. A.V.C. is provided to stop strong signals from overloading the set if an auxiliary outside aerial is used. and to minimise variations in volume. caused by the marked directive properties of a Ferrite rod aerial. when the set is being carried as a portable. The negative bias point referred to earlier is obtained from the bias supply for the output valve and is arranged to be the same on both battery and mains. (On mains it is the full mains bias. on battery it is just part of the full bias.)

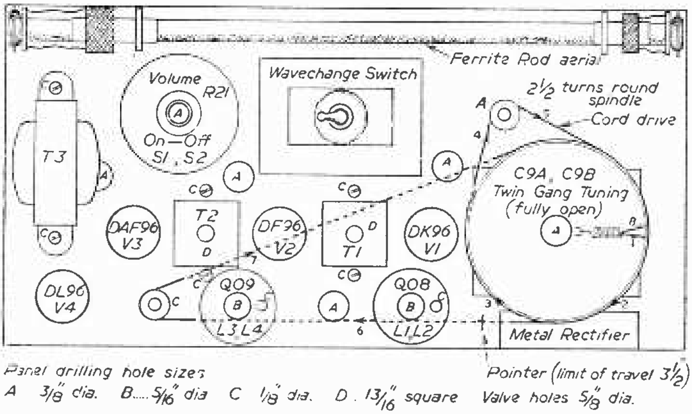


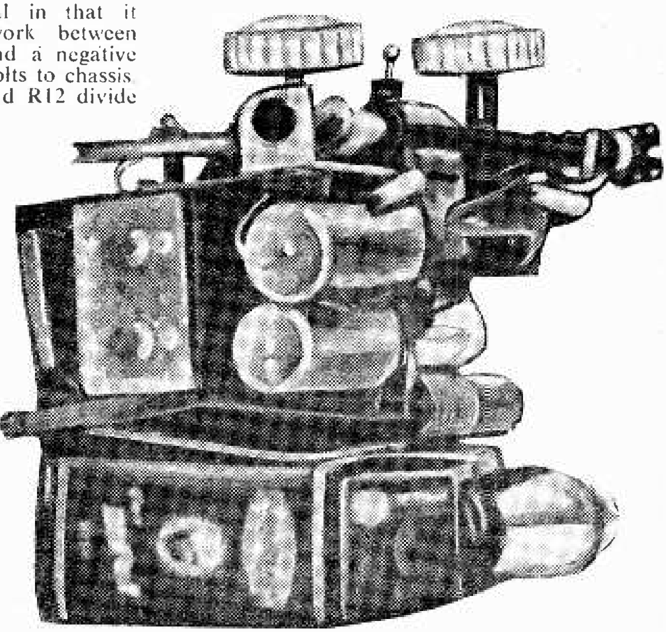
Fig. 3.—Plan layout of the portable.

Constructional Details

As every theoretical detail has been exhaustively dealt with the practical layout and dimensions will now be given. Despite all the refinements incorporated. it is remarkably compact: the measurements of the chassis being 8in. × 6in. × 5in.. which includes both batteries and a 5in. loudspeaker: in fact everything except the cabinet and knobs. The chassis is made from sheet aluminium. as ready-made chassis are costly. and the wrong shape. The front panel forms the basis of the set and carries almost all of the components. Slow-motion tuning and a dial are included.

No detailed layout diagram can be given owing to the extremely compact wiring. but the layout of all the larger components such as valves. tuning condensers. transformers. and controls will be given.

(To be continued)



A general view of the set.

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On Your Wavelength

BY THERMION

"Arrangements"

HAVE you ever noticed the high proportion of "arrangements" pumped into the ether by ersatz musicians today? A composer writes a piece of music and immediately someone wishes to "arrange" it, so that it sounds nothing like what the composer intended. Some of those who do the arranging are not genuine musicians and could not compose music. Music should be played as the composer wrote it. So many of these quack musicians batten on like limpets and barnacles to other people's work. The arrangement usually consists of a complete mutilation of the score so that the original theme is unrecognisable. Liszt was one of the pioneers of the arranging racket. He arranged a large number of other people's compositions. This is a form of musical piracy. If so-called musicians feel they are able to arrange, let them compose and arrange their own music.

The Voice of America

THE VOICE OF AMERICA HAM SHOW is heard weekly on Tuesdays at 4 p.m. Eastern Standard Time (2100 G.M.T.) and is directed to audiences behind the Iron Curtain. It is a 12-minute segment of the regular English language 30-minute programme called "Report from America" which is broadcast daily. As readers know, The Voice of America Programmes in Russian and other Iron Curtain languages are severely jammed, but broadcasts in English are free from jamming. Since English is the second language of a substantial part of the audience which The Voice of America is trying to reach, these broadcasts are regarded by the American authorities as extremely important. The commentator for Voice of America is Bill Leonard.

Three Exhibitions in One Week

IN April, no less than three comparatively small exhibitions were held on one week—the Radio Components Show, the London Audio Fair, and the Instruments, Electronics and Automation Exhibition. None of the industries which these three exhibitions represent is large enough to promote an exhibition on a national scale, with the possible exception of the last which held its show at the Olympia. The Radio Components Show was held in two parts at Grosvenor House and Park Lane House, London, and the London Audio Fair at the Waldorf Hotel. I still think that these exhibitions should be held under the same roof as the National Radio Exhibition at Earls Court. Each of the three industries represented are only component parts of a major industry. I know that they are more or less trade shows, but that is no reason why the public should not be permitted to examine the exhibits.

Luxembourg and Religion

I OBSERVE that the perfervid tub thumping, religious programmes are still being injected into the ether for five nights a week on 208 metres between the hours of 11 p.m. and midnight. There are usually four programmes of a quarter an hour every evening, and in all of them we are told what miserable sinners we are, backed up by lashings of miscellaneous and unrelated quotations from the Bible. All of these programmes emanate from America, where religion has become big business. They do not teach it—they sell it. The thinly-veiled appeals for sacrificial letters from listeners must bring in a large amount of money. You are offered free copies of periodicals and booklets. One such periodical is before me now. In it is a column on how to make your will. It includes the line "to the . . . . . organisation" just to make quite sure that you do not forget them when you die. There is a religious mania in America, and there are blatant advertisements in the newspapers. One religious quack advertises "For one dollar you will receive a guaranteed blessing within 48 hours." Steps are, I am glad to note, being taken to investigate some of these religious organisations, many of which are run by people who have had no religious training. Unfortunately, under the American constitution laid down by Abraham Lincoln, no law can be made which restricts religion in any way. Of course, Radio Luxembourg is a commercial station and the money of a religious organisation is as good as anybody else's. I recommend you to listen to some of these broadcasts and see if you agree with me. They do not ring true.

In America anyone can set himself up as an evangelist and millions of unthinking people may regard him as a trained parson. Some of these people are undoubtedly just making a business of it, and it seems a pity that they are aided in their efforts by being permitted to purchase programme time. Fortunately, it could not happen over here, but the ether knows no boundaries and large numbers of people do listen in to these foreign broadcasts. It is a thousand pities that our own Archbishop of Canterbury should have lent support to this form of insincere hot-gospelling and, in view of the exposures of this religious quackery which have taken place in the American papers, I hope he is wiser now.

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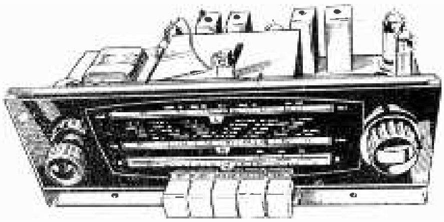

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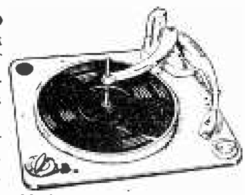

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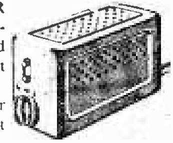

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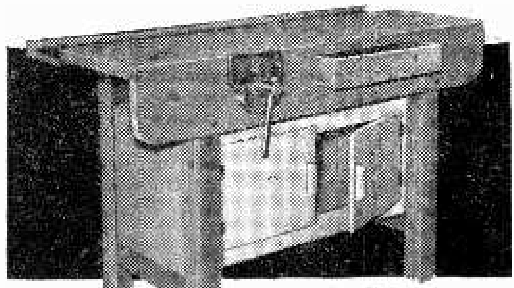

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TRANSISTORS in Practice

7.—AUDIO OUTPUT STAGES

By R. Hindle

(*Continued from page 197, May issue*)

THE receiver so far described will provide only low power output and the addition of an extra transistor in front of the circuit does not add to the power that the last transistor is capable of giving. The next development will be a power stage so that a speaker can be driven.

It will be realised that the variable resistor can no longer provide reaction because the secondary winding is no longer connected. It still has the effect of adjusting the working point of the detector transistor and it should be adjusted for best signal.

The neutralising winding of the inter-transistor coil must be connected the right way round or else instead of reducing the effective back coupling it will increase it. If the circuit is unstable, therefore, it could be that the coil connections are reversed and the first thing to try is the changing over of the two leads going to the neutralising winding. It may be found with some transistors that the amount of feedback without neutralising capacitor is insufficient to cause instability. Should this be so, the neutralising capacitor could be omitted and the winding once more connected for reaction, to give somewhat more gain. These are experiments that can be tried but it is suggested that in the first place the chassis should be made to work with the circuit as specified.

A series of batteries has been developed especially for transistor operation. The rather untidy hook-up used in the early stages of the development of this design has now given way to one of these neat and compact sources of power. Press-stud connectors are used for connecting to this battery, which is an Ever Ready type PP1, and as the studs are of different types it is impossible to reverse the connections. The type quoted is only 2½in. × 2in. × 2in. and it provides 6 volts as needed for this design.

Do not forget, whilst working on this chassis after completion, that a transistor is wired into it, and take appropriate precautions when making any modifications to prevent heat from damaging the transistor.

It has already been pointed out that a transistor stage is always fundamentally a power amplifying stage. Each stage is driven by current, which involves the provision of power at the input stage and not merely a voltage as is the case with a valve, and it gives an amplified power version at its output suitable for driving a subsequent transistor stage. Inter-stage coupling is arranged for optimum power transfer rather than for optimum voltage transfer. Whereas in a multistage valve amplifier all stages right up to the output stage require only low dissipation circuits (assuming Class A working; the driver stage of a Class B valve amplifier is more like the transistor case) a multistage transistor amplifier can be expected to be designed for successively greater dissipation stage by stage towards the output. This was seen in the two-stage audio amplifying circuit described in this series. The present purpose, however, is to deal with the final stage of the transistor amplifier—that which has the job of driving the loudspeaker.

As with valves, transistors can be operated in Class A, in which case the base bias is set so that the quiescent operating conditions (i.e., without a signal applied) are midway along the straight part of the collector characteristic, or in Class B in which case the transistor is biased back so that the quiescent state collector current is negligibly small. The Class A condition gives amplification with comparatively little distortion and either single output transistors or push-pull circuits can be operated in Class A. Class B, on the other hand, is fundamentally a distorting amplifier—in fact, a theoretically perfect Class B amplifier (if such were possible) would amplify only one half-cycle and would cut off the other half-cycle—and so for the purposes of audio operation two Class B transistors must be operated in push-pull, each amplifying one half-cycle only, but when the two outputs are combined in the output transformer there is, in effect, an amplified signal following both half-cycles of the input signal.

Class A

The maximum theoretical efficiency of a Class A stage in the case of either valves or transistors, is 50 per cent.: that means that no more than half the power drawn from the valve H.T. or transistor battery supply can be converted into an audio signal and any attempt to increase the drive beyond this

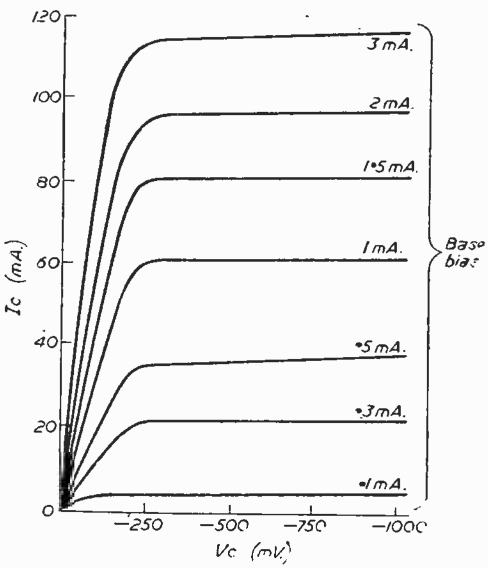

Fig. 39.—Low voltage collector characteristic—OC72.

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point merely introduces distortion without increase of output. This may not seem so good, but in practice even such efficiency cannot be attained. The maximum of 50 per cent. efficiency involves three impossible assumptions :

1. That there is no loss in the collector load, i.e., that the voltage drop in the load under D.C. conditions is nil. This requires a transformer having a primary that has sufficient inductance for the purposes of loading the transistor but with zero D.C. resistance. This is impossible, of course, but fortunately the primary inductance needed by a transistor for a given frequency range is comparatively small and so it can be wound in a small volume and with low resistance.

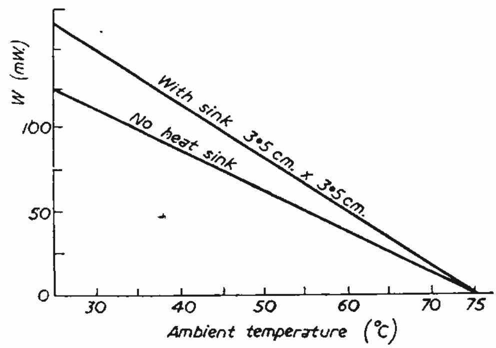

Fig. 40.—*Dissipation characteristic—OC*72.

2. That the transistor can be operated down to zero collector current. This cannot be so, either. There is a minimum level below which collector current cannot fall and this level is subject to variation with junction temperature ; this minimum has been referred to before in this series and is known as $I_{c(o)}$.

3. That the transistor can be operated with a collector swing down to zero volts. An attempt to do this could run into gross nonlinearity, and consequently severe distortion, because the transistor current gain falls off rapidly as collector voltages fall at the lower end of the characteristic.

Fortunately, with regard to 2 and 3, the transistor can operate down to quite low collector currents and voltages and so, in fact, efficiencies reasonably close to the theoretical maximum can be achieved.

There are two possible approaches to the design of a Class A amplifier. Either the need is for the maximum power output that can be obtained from a small transistor of limited permissible dissipation or else the transistor is more liberally rated for the purpose in hand, in which case the choice of power output rests with the designer who can determine the power by the circuit constants. The object of the exercise, in both cases, is to adjust the base bias current until the appropriate collector current is obtained.

Taking the idealised case of a transistor in Class A giving the theoretical optimum efficiency of 50 per cent., and bearing in mind that the maximum dissipation of power in a Class A circuit takes place in the no signal, or quiescent, condition, it follows from the definition that the power output obtained will be a half of that dissipation. So, if the intention is to get the maximum audio from a given transistor, signal conditions can be put aside temporarily and the D.C. conditions computed from the standard formula for power, i.e. :

$$W = I.E.$$

where W is the maximum dissipation, I is the collector current Ic and E is the applied battery voltage. The unknown is, of course, Ic so by manipulation of the equation :

$$Ic = \frac{W}{E}$$

If, on the other hand, the limiting factor is the power needed and not the permissible maximum dissipation, the first thing to do is to convert this audio power figure into a dissipation figure, which as above simply means multiplying by two. Then the same formula applies, i.e.

$$Ic = \frac{2P_L}{E}$$

P_L being the maximum audio power required in the load resistance.

In practice, allowance has to be made for the deviations from theoretical maximum efficiency. This has the effect of reducing the audio power that can be drawn as has been stated, due to the fact that the collector cannot swing to zero volts. This requires that the quiescent collector current must be set somewhat higher than was previously indicated if the transistor is to operate about the middle of its characteristic and the new Ic is found by reducing the factor E used in the above equation by an amount equivalent to the forbidden " territory " of collector voltage caused by curvature of the characteristic. It is wise to err on the safe side here, so commonly a half a volt has to be allowed for. Thus the equation for quiescent collector current becomes

$$Ic = \frac{2P_L}{E - 0.5}$$

This increase in Ic is strictly necessary only if it is intended to operate the transistor over the whole of the straight part of the characteristic. If the transistor is to be operated well within its rating it is not likely to swing so far as the curved regions and so the adjustment need not be considered.

This does not really help the man aiming at the maximum power from his transistor, however. He must still begin his calculation from the maximum dissipation point of view which, of course, still involves the total voltage applied so again he must use

$$Ic = \frac{W}{E}$$

By equating these two alternative ways of defining Ic it can be seen to what extent power output in practice falls short of 50 per cent., i.e.,

$$\frac{2\,P_L}{E - 0.5} = \frac{W}{E}\ (= Ic)$$

$$2\,P_L.E = W\ (E - 0.5W)$$

$$P_L = W\,\frac{(E - 0.5)}{2E}$$

$$= \frac{(E - 0.5)}{E}\ 50\%\ \text{of W.}$$

The effective drop in efficiency from the theoretical maximum is thus less significant the higher the voltage applied and so it is clearly better to increase the audio power output taken from a transistor by increasing the voltage applied rather than by increasing the current drawn from the same voltage source.

Let us try some examples :—

If a $1\frac{1}{2}$ volt source were to be used the efficiency

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when maximum power permissible is being drawn from a single transistor in Class A will be :—

$$P_L = \frac{1}{1.5} \times 50\% = 33\% \text{ of W.}$$

If a 6 volt system is in mind, such as the power supply used for the receiver developed in this series, or a car battery in the 6 volt range

$$P_L = \frac{5.5}{6} \times 50\% = 46\% \text{ of W.}$$

A 12 volt car system would provide only slightly higher efficiency though, of course, the current drawn would be halved because the voltage is doubled for the same dissipation. Actually

$$P_L = \frac{11.5}{12} \times 50\% = 48\% \text{ of W.}$$

Above, ½-volt was quoted as a safe limit of swing of the collector voltage, and to support this Fig. 39 gives the collector characteristic of the OC72 at low voltages. It will be seen that this limit errs on the side of safety so far as this transistor is concerned. Fig. 40 is given to show how dissipation varies with ambient temperature. It will be seen that at 75 deg. C. no collector current can be allowed because this is the limit of junction temperature and any dissipation would raise the junction temperature higher than ambient temperature. When ambient temperature is lower, the permissible dissipation is that which will raise the junction temperature to the limit. The curves illustrate the effect of fitting the transistor on to a small heat sink.

Circuit for Transistor Output Stage

The circuit of a Class A output stage is given in Fig. 41.

Now can be seen an additional cause of loss of supply voltage. This is the drop across the resistance in the emitter circuit. This resistance, and the transformer primary resistance, are generally arranged to drop around one volt, this being satisfactory from the point of view of stabilisation.

Variation in Supply Voltage

What has one to do about the variation in voltage that is bound to occur when a battery supply is used? Dry batteries lose voltage whilst in use but in the interests of economy they have to be used for a reasonable period of time. In the case of a car radio the accumulator may drop below the nominal value and also it will rise under charge, and the radio is likely to be used under either circumstance.

The method of approach again depends on whether the maximum possible output from a given transistor is needed or whether a predetermined output from a conservatively rated transistor is aimed at. In the case of a receiver operating from a dry battery the former is likely to be the case. The procedure is then to calculate the collector current for the maximum permissible dissipation at the peak battery voltage and one can do no more than tolerate the fall in dissipation—and of power output—until compelled by the inadequacy of results to replace the battery.

The car radio case is likely to take the alternative line. Very likely the transistor will be capable of giving more power output than it is decided to use (after all one does not take more out of the electrical system than necessary), so the thing to do is to calculate the collector current for the minimum output audio power likely to be acceptable at the lowest voltage likely to be encountered. An output of two watts is reasonable, and a 12 volt system is not likely to fall below 11 volts at times when the radio is in use. Then, allowing half a volt for curvature of the characteristic and one volt voltage drop in the series resistance :—

$$I_c = \frac{2 \times 2}{10 - .05} = .42 \text{ amps.}$$

and the base bias would have to be adjusted to give this value of collector current. This indicates a dissipation of $10 \times .42$, or 4.2 watts. The transistor chosen would have to be rated for a much higher dissipation than this, however, because the battery under charge when the car is running is likely to reach

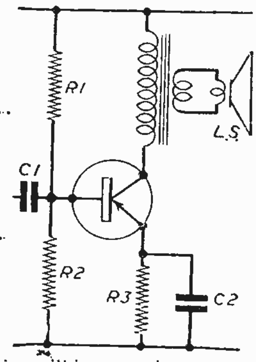

Fig. 41.—Basic circuit for a transistor output stage.

a voltage of 14. The base bias will increase in proportion as it is drawn from the same supply and will cause a similar increase in collector current. So now

$$I_c = \frac{.42 \times 13}{10} = .55 \text{ amps.}$$

and the dissipation $W = .55 \times 13 = 7.15$ watts.

This has been worked out allowing for the drop of voltage in the emitter lead, but without taking into account the effect of the stabilising circuits on the base current. Without such stabilisation it appears that a transistor capable of a dissipation about four times the audio power required must be used for a range of voltage supply to be expected in a car radio. Allowing for normal stabilisation things are not quite so bad, but even then a permissible dissipation three times the audio power acceptable as a minimum is desirable.

Load Resistance

The load to be applied to the transistor can be estimated, assuming the ideal transistor characteristics, which is near enough for the purpose, from the simple relationship of battery supply voltage and power output for which the circuit has been set up. Thus,

$$R_L = \frac{E}{I_c}$$

where E is the battery supply voltage and Ic is collector current. But as above

$$I_c = \frac{2\ P\ out}{E}$$

so by substitution

$$R_L = \frac{E^2}{2\ P\ out}$$

From this it is interesting to compute the circumstances under which the normal speaker impedances of 3 ohms and 15 ohms match the transistor directly without a transformer. The 3 ohm speaker is not likely to be much use for domestic or car radio with-

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out transformer because at a power supply of 6 volts it matches at an output of 6 watts, and for 12 volts it is higher, actually 24 watts. The 15 ohm speaker appears to be more hopeful because on a 6 volt circuit it matches for an output of 1.2 watts and on a 12 volt battery the matching output is almost 5 watts.

Thermal Runaway

It is with a power transistor that the dangers of thermal runaway are encountered. This phenomenon is due to the increase in temperature of the junction caused by the power dissipated. This increase in temperature itself increases the current flowing which in turn further increases the temperature. If the junction cannot easily lose the heat generated this feedback effect can build up until the transistor destroys itself. Even if conditions prevent self-destruction those conditions will cause distortion due to the resultant limitation of the current swing.

COMPONENT LIST FOR FIG. 41

R1—4.7 K Ω }
R2—1 KΩ } Dubilier ¼ Watt
R3—33 Ω }
C1—10μF 6 v. Daly H2 5/1
C2—100μF 6 v. Daly E2 49/1
TFR—Belclere BN1827

Only in the small transistors is it wise to operate the transistor by itself. In other cases a heat sink is provided. This is effected by mounting the transistor in thermal contact (not necessarily in electrical contact) with a piece of metal and transistor manufacturers give guidance with regard to the amount of metal needed for various levels of dissipation.

The principle of design of the base circuit follows the lines of the audio circuits already described.

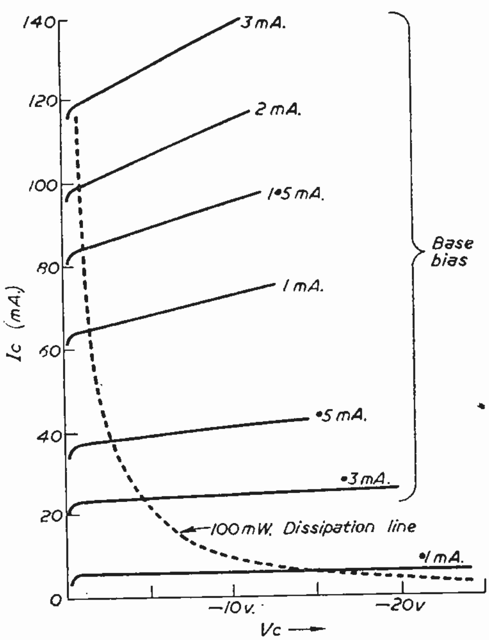

Fig. 42.—Collector characteristic—OC72.

Where large audio outputs are sought, however, it has to be remembered that a comparatively large power has to be fed to the base and in this case it may be necessary to design the driver stage as a power amplifier rather than a current amplifier.

Design for an Output Stage

Now a low power Class A single-ended output stage suitable for addition to the receiver developed during this series of articles and following the circuit in Fig. 41 will be designed. This will not involve the complications of high power drive and the audio amplifier circuit as already described will drive it. This method of operation is not likely to be entirely satisfactory for permanent use because of its comparatively low output, but it is set up as a logical step in the process of design as it uses one of the two transistors to be used in the next step in Class B push-pull. In fact, if possible, it would be as well to buy a matched pair ready for the final design and use one experimentally in the present circuit before proceeding to the more complicated one. The transistor is actually a Mullard OC72 and it is operated from the six-volt battery already provided for the rest of the circuit.

The permissible dissipation of the OC72 is seen from Fig. 40 to depend on the maximum ambient temperature under which it will be called to operate. For such cases as car radios using larger transistors and where the receiver has to work in confined spaces, this factor has to be given great thought. In the present case, however, operating a well ventilated situation is assumed and a temperature not exceeding 35 deg. C. will permit a dissipation up to 100 mW. without heat sink. If the temperature is likely to exceed this the same design would be satisfactory except that the transistor would have to be mounted on a "sink." A loss of 1 volt in the emitter resistance and output transformer primary is assumed. The maximum possible output is needed, so

$$Ic = \frac{W}{E} = \frac{100}{5} = 20 \text{ mA}$$

(To be continued)

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Many old receivers are in use in which the circuit is of the "straight" type and which, therefore, do not lend themselves very easily to conversion for Band III reception. The best thing in such cases is to modify the video section making it conform to modern practice, and then to fit a two or three station tuner, or if preferred, one of the commercial turret tuners. How to do this is explained in the current issue of our companion paper PRACTICAL TELEVISION now on sale.

An improved Frame Sync circuit is described and will interest those who feel they would like better interlacing, whilst other articles in this issue deal with how to make a Skeleton Slot Aerial, Scanning and Synchronisation, a Mismatch Distributor, The Booster Diode, Tracing Obscure Faults and Servicing the KB LFT 50/60.

Also to be found in this issue are the usual features, Correspondence, Underneath the Dipole, News from the Trade, etc.

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The Audio Fair—1958

DETAILS OF SOME OF THIS YEAR'S EXHIBITS

THIS year's Audio Fair was more comprehensive than last year's, and again depicted the many advances which have been made in Hi-Fi equipment. As usual the majority of apparatus on view consisted of amplifiers, pick-ups and associated gramophone equipment, loudspeakers and tape recorders. Many old friends were to be seen, as well as newcomers, and the various rooms which were reserved for demonstrations were, as usual, crowded to capacity. The following are some brief notes of some of the many items which were to be seen.

Scotch Boy Tape

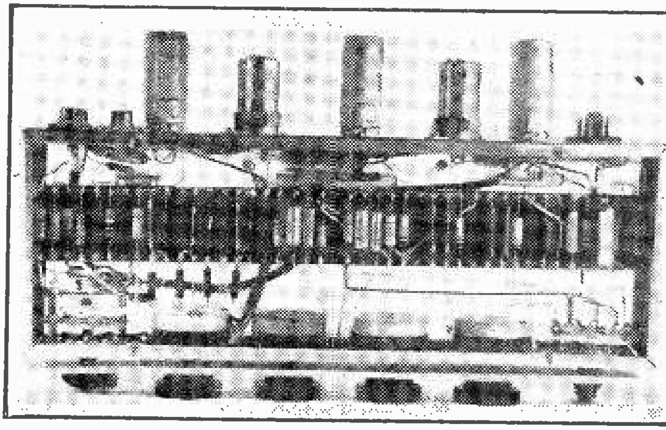
For the first time the entire range of the 3M Company's "Scotch Boy" Magnetic Recording Tapes was on show.

The display of tapes featured the three "Scotch Boy" recording tapes on various spool sizes:

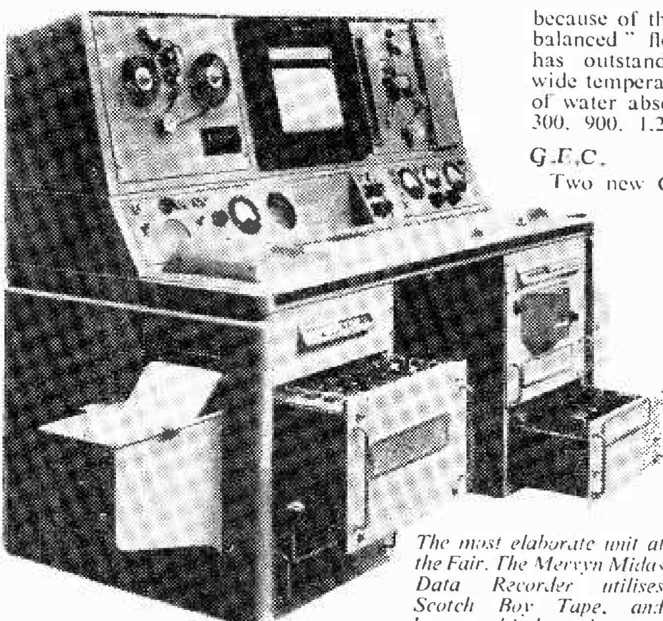
No. 111A Standard.—This has a standard brown oxide coating, on an acetate base, and is available in spools of 200, 600, 850, 1,200 ft. and other sizes for professional use.

No. 111V Super PVC.—Designed for extra strength and easy handling. With similar characteristics to No. 111A and with the same oxide coating, it is intended for applications where the handling, winding and storage features of PVC are preferred. It is available in spools of 200, 600, 850 and 1,200 ft. and in other sizes for professional use.

No. 150 Extra Play is a polyester based type with a dark red oxide coating and offers 50 per cent. more recording time for the same reel size, because of the extra-thin backing. The "weather balanced" flexible superstrong polyester backing has outstanding mechanical properties over a wide temperature range and an extremely low rate of water absorption. It is available in spools of 300, 900, 1,275, 1,800, 2,400 ft. and 3,600 ft.



The use of tag boards is well illustrated in this G.E.C. pre-amp.—the "88-50."



The most elaborate unit at the Fair. The Mervyn Midas Data Recorder utilises Scotch Boy Tape, and has a multi-channel system of recording.

G.E.C.

Two new G.E.C. developments in high-quality loudspeaker technique—one a complete unit which will be marketed, and the other a design for home constructors—were shown.

A specially constructed 50w amplifier and pre-amplifier—the "88-50"—is shown on this page. Offering improved performance and control range, the two units have inputs for a radio tuner, a magnetic or crystal gramophone pick-up, a microphone or a magnetic tape replay head. The pre-amplifier gives full playback facilities from any known programme source, using simple and economic circuits. It is designed to give an output of 0.5 volts r.m.s. for maximum signal level, corresponding to the input required by the amplifier.

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Mullard

The Mullard stand featured the universally available World Series audio valves, together with a range of alloy junction transistors for battery-operated audio amplifiers and pre-amplifiers.

The transistor range includes the OC16, an all-metal power transistor for the output stages of medium-power amplifiers; the OC72, which is available in matched pairs for push-pull output stages of low-power amplifiers; and the OC71 for use in pre-amplifier circuits.

W.B. (Whiteley Electrical)

The complete range of Stentorian High Fidelity Loudspeakers from 8in. to 18in. in diameter, as well as special loudspeakers from 1¾in. upwards, fitted with the patented cambric cone providing a quality of reproduction not otherwise obtainable except at many times the price, were shown.

The W.B.12 Quality Amplifier is available with either the "Standard" or "Major" Controls Units, embodying the most up to date designs and recently developed valves, and a special Whiteley output transformer. The Major Control Unit enables any pickup to be used with the W.B.12, and has a nine position selector switch in addition to separate treble, bass, "Filter," "Slope" and volume controls.

A further important addition is the W.B.6 combined amplifier and control unit, with 6 watts output, forming a compact unit size 11¾in. × 7in. × 4in. It has a selector switch for a range of inputs, full range bass and treble controls and separate volume control.

A new F.M. tuner was shown for the first time with a circuit of advanced design. An important feature is the use of printed circuit techniques to ensure maximum electrical stability, together with rigid mechanical structure, thus ensuring freedom from drift. The complete unit is housed in a sheet steel case designed to match the amplifier.

Collaro

Collaro Ltd. presented their Conquest Record Changer. This revolutionary 4-speed model is unique in that records of any dimension from 6in. to 12in. can be loaded and automatically played. There is no finger to be reset and no protrusions which might cause damage to records. The Conquest also has provision for manual play at all speeds, and automatically switches off after playing the last record. A double action cam is incorporated in the change speed control, thus eliminating all possibility of damage to the idler wheel if the speed control is operated while the machine is running. The record changer spindle is designed so that there is a gentle lowering of records from the stack, ensuring hundreds of playings without damage to the centre holes, and a sensitive velocity trip mechanism operates on all modern and most old records.

Another interesting exhibit was the new improved Tape Transcriptor, Mark IV, which incorporates several modifications to the previous design.

Further Notes on the Geiger Counter

REVIEWING the many readers' enquiries about the Simple Geiger Counter described in the April issue, a few points have arisen which may be of interest.

First, the G-M tube G24 is obtainable from 20th Century Electronics Ltd., King Henry's Drive, New Addington, Surrey, and the price is 35/-, postage extra. This tube measures 270 mm. in length, but type G12 measuring only 145 mm. will work almost as well and can be neatly strapped to the side of the box. This tube also costs 35/-.

The type numbers of the batteries used (OL230 and OL250) are those intended for deaf-aid sets, and suitable equivalents are Ever-Ready B106 for H.T., and either D18 or D19 for L.T.

The rectifier K840 is made by Sentercel, and the apparently over generous ratings are due to the fact that the forward and reverse resistances were the primary considerations in the choice of this component. The valves CK505 AX may be obtained from Service Trading Co., 9, Little Newport Street, Leicester Square, London, W.C.2, at 2/6 each, postage extra. This firm also has most of the other components in stock.

Those having difficulty in obtaining the midget neon may be interested to learn that the majority of cheap mains "circuit testers" contain nothing more than one of these neons with a series resistor and test prods attached.

A minor printing error in the wiring layout omits the connection between the junction of C1 and R4 and the grids of V2 and V3, but reference to the circuit diagram will reveal the missing wire.

The Choke

A more detailed description of the home-wound ringing choke has been requested by some, but this is not critical with regard to resistance and number of turns. For example, the two prototype chokes were rapidly wound on an electric motor with 40 s.w.g. D.S.C. enamelled wire, and the resultant winding was loose and spongy in texture, whereas the Teletron product is neatly wound with enamelled wire which occupies only half the volume.

Any breaks in the wire occasioned during winding must be rejoined by soldering, and the joint well insulated by Sellotape or transformer paper. The end connections must be particularly well insulated from each other and the rest of the winding, or sparking-over may occur.

A reference was made to Government publications of use to those going prospecting for uranium on their holidays.

The following works can either be purchased from the "Geological Survey and Museum," Exhibition Road, South Kensington, London, S.W.7, or they can be seen in the library of the museum.

(1) Dines, H.G. "Metalliferous mining districts of South-west England" (Mem. Geol. Surv. G.B., H.M.S.O., 2 Vols.).

(2) Davidson, C. F. "Uranium Deposits in Great Britain."

(3) Ponsford, D. R. A. "Radioactivity Studies of some British Sedimentary Rocks."

Any public library should be able to obtain these for readers.

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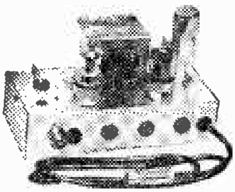

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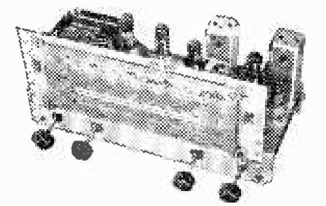

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5Z4	9 6	35L6	10 6	EF91	8 6	PL82	10 -
6AT6	8 6	EABC80	9 6	EL41	10 6	PL83	11 6
6K7	6 6	EB91	6 6	EL84	11 6	PY80	9 6
6K8	8 6	EBC41	10 6	EM85	11 6	PY81	9 6
6Q7	8 6	ECC83	9 6	EY51	12 6	PY82	8 6
6SN7	8 6	ECC84	12 6	EY86	14 6	PY83	10 6
6V6	7 6	ECF80	12 6	EZ40	8 6	U22	8 6
6X4	7 6	ECF82	12 6	EZ80	8 6	U25	12 6
6X5	7 6	ECH42	10 6	EZ81	8 6	UCH42	10 6
7C5	9 -	ECH81	10 6	MU14	9 6	UF41	10 -
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DAF96	9 -	ECL82	12 6	PCF80	10 6	UY41	8 6

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Cabinet Price, £3. 3. 0. Carr. and Ins., 3 6.

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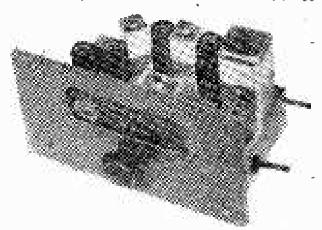

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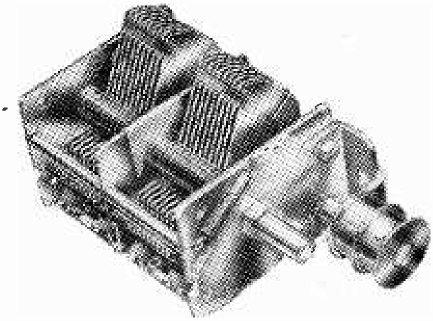

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Is a Pre-war Set Worth Servicing?

SOME DATA ON OLD MODEL RECEIVERS AND THE PROBLEMS INVOLVED IN SERVICING THEM

By "Serviceman"

MOST service engineers have, in the course of their work, run up against this problem. I have had many of these sets brought to me for service, and it has been a difficult problem to decide whether to service them or to advise the owners to scrap them. In many of these cases, the reason for people wishing to have them serviced is because they like the cabinet, which has often, especially in the case of radiograms, been kept in a very good condition. Most of the pre-war cabinets were of good, sound timber and not the thin ply of which many present-day cabinets consist. Generally, when one informs the owners that the set is not worth the cost of the servicing and suggest they purchase a new one, they reply that having heard the new sets they cannot compare with their old one. This is mainly because they have become accustomed to the tone of their old set, which in the case of most of the pre-war sets, had a sharp topcut in the amplifier and loudspeaker, thus giving what they consider was a mellow tone. When they hear the later day models giving a lot of top, to which their ears are not accustomed, they consider them harsh and not pleasant listening. My method of dealing with these sets is not to have any hard and fast rules about them, but to judge each case on its own merits

The Pros and Cons

In the case of people who I know cannot afford a new set, such as, for instance, old age pensioners, I do my best for them, if it is possible to put the set in order, with the chances of a reasonable further period of useful life, but I always inform them that owing to the age of the instrument I cannot guarantee that it will not break down again within 12 months.

In the case of people who can afford to purchase a new set, I point out that firstly the cost of servicing, including labour, new parts and valves, may be quite high and perhaps be more than the set is worth. Also I tell them that as all the component parts have already had a long life and to replace the lot would be out of the question, there would always be a possibility of one of these components breaking down within a short space of time after the set was serviced, and therefore no guarantee could be given. If they do not accept these conditions then I turn the job down.

Jobs to Reject

Should it be a case where they wish to retain the cabinet, then I suggest, if the set itself is in very bad condition, that a new chassis be installed in the cabinet. Care should be taken here to see that a chassis is chosen that does not necessitate cutting or drilling the cabinet for control spindle purposes.

Sets that are not worth while attempting to service are those with the old type side contact valves. These valves are practically unprocurable and to try and replace with five- or seven-pin types means a considerable amount of time and trouble. The main reason is that the holes in the chassis for these side contact valveholders are considerably larger than for other types. This means plates being cut out for normal valveholders and fitted on the chassis.

Any sets using the old 4 volt heater type, especially the five-pin types, should be carefully considered. Some of these valves are impossible to obtain and to convert to a 6 volt range would not be an economic consideration.

Other types with the old large type band pass coils that have gone open circuit should be bypassed. Replacements for these coils are hopeless. Rewinding takes up too much time, and consequently the cost of servicing becomes excessive. Other sets that I suggest should be rejected are those with rubber-covered leads, where the rubber is either perished or in a bad state. To attempt to do this type of job means practically complete rewiring.

Points to Watch in Servicing Old Sets

It is advisable in all cases to renew the electrolytic condensers, and also the rectifiers, valve or metal type, but it should be pointed out that then the H.T. voltage will probably be higher than before. This means that the bypass and coupling capacitors will be subject to a greater strain and as they are old there is a liability of their breaking down. When these electrolytics and rectifiers are changed, the set should be put on a soak test and checks made on all resistors for temperature rise. At any sign of this occurring, change the bypass condenser concerned, as it is probably leaking, which is often the prelude to short circuiting. It is also advisable to check voltages on valves, which will, in most cases, show up any other likely near failures. Old A.C./D.C. sets are those to view with great suspicion, as the heat radiated inside these sets is often much greater than in A.C. sets and this causes greater deterioration of the components. Mains dropping resistors or line cords should always be replaced, as this is where the greatest heat comes from.

Remarks on Valve Changing

From the foregoing the reader can see that, unless it is being done as a personal favour, or if the owner does not mind the cost, it is not advisable to undertake these jobs. Even when the greatest care is taken and an extended soak test given, one cannot be sure that the repair will last for a reasonable time, without another breakdown.

It often happens with these sets, that a valve

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has failed, and the correct replacement cannot be obtained, and a later type valve has been fitted with a base adaptor. Now it should be pointed out that, although the new valve is of the same type, has the same heater voltage and current, its characteristics are often considerably different. When fitting a valve of this description, always check up on anode, screen and cathode voltages. In the case of valves in tuned circuits, a slight alteration of trimmers may be necessary to allow for different inter electrode capacities of the old and new valves.

Changing Loudspeakers

Many of the old sets had electrically energised speakers and replacements are out of the question. It therefore becomes necessary to fit a permanent magnet speaker. In this case an L.F. choke will be necessary, to act as H.T. smoother in place of the loudspeaker field coil. In fitting this make sure the inductance and also the current carrying capacity of the winding is sufficient. It is better to use as large a choke as space will permit than to use a small one that will overheat and perhaps burn out.

International Car Radio Rally

WHAT is believed to be the world's first International Car Radio Rally will commence on June 25th in Britain and 26th on the Continent. The main difference between this and other motoring rallies is the fact that participants will be given their instructions over the air from Radio Luxembourg. The prime qualification for entry, therefore, is that participants' cars must be equipped with car radio. Instructions will be broadcast at frequent intervals throughout the rally in English, Dutch, French and German on two wavelengths—208 and 1293 metres.

The rally is organised by the Regional Motoring Club of South Holland and the Luxembourg Motoring Club. It is open to entrants from Great Britain, France, West Germany and Belgium, Holland and Luxembourg.

Starting points are London, Amsterdam, Paris, Brussels, Luxembourg and Bonn. It is planned that British entrants will spend the night of the 25th at Dover, crossing the Channel the following morning. At Rheims they will join the main route, as will participants from Luxembourg and Paris. Those setting out from Amsterdam, Brussels and Bonn will have met at Eindhoven (Holland) and will join the main route at Dinant. A reception centre has been arranged at Chaudfontaine (Belgium) and the rally finishes at Luxembourg in the late afternoon of the 27th.

Passengers

In contrast with other international rallies, each car will be permitted to carry more than two passengers. The organisers stress that the rally is in no sense a test of speed and endurance and, while some simple skill and regularity tests will be included, they will not affect the nature of the rally as a tourist event involving moderate speeds and easy map-reading. Participants will, therefore, have plenty of opportunity of enjoying the splendid scenery through which they will pass. The 800 mile route covers some of the most beautiful parts of the Low Countries, the Ardennes, the Eiffel and Northern France.

On June 28th a winding-up party will be held and prizes will be presented. Among other attractions will be an entertainment provided by artistes of international standing.

Entries

British motorists wishing to take part are invited to apply for further particulars to Competitions Department, Royal Automobile Club, Pall Mall, London, S.W.1. The latest date for entry is June 7th.

New Mullard Photo-cell

A NEW type of photo-electric cell which will enable the cost of many industrial control and detection devices to be reduced substantially will shortly be available in quantity for the first time in this country.

The new cell incorporates a specially constructed photo-sensitive element of cadmium sulphide, and is remarkable for its extremely high sensitivity: it is, in fact, some 20,000 times more sensitive than the conventional p.-e. cell.

Even from weak sources of light it will produce sufficient current to operate a large relay direct without the need for intermediate amplification. The electronic amplifier circuitry associated with most devices based on conventional photo-cells is therefore made unnecessary, with consequent savings in equipment costs, simplification of design, greater reliability and easier maintenance.

Furthermore, the cell will produce the current necessary to operate a relay with only a very low applied voltage. This is made possible by a special form of construction in which the resistance of the cadmium sulphide element is effectively reduced by an interdigital pattern of copper strips.

The cadmium sulphide cells will be mounted on standard valve bases indentical with those of the present Mullard range of conventional cells. Thus, when existing equipments are modified, special head mountings or probes designed for specific installations can be retained.

Advance Performance Details

Typical performance figures for a Mullard cadium sulphide cell with a photo-cathode of 1.8 square cm. effective area include the following:

From an illumination of 5ft.-lamberts, with a colour temperature of 1500 deg. K, the cell will produce approximately 20mA of current for an applied voltage of 10v. From the same illumination, but with a temperature of 2700 deg. K, the current is approximately 6mA. Within the limits of permissible power dissipation doubling the applied voltage gives a four-fold increase in current. Maximum dissipation is 1 watt at 25 deg. C and 200mW at 75 deg. C.

Dark current is extremely low: with 300v. applied to the cell it is not greater than 2.5 microamps at 25 deg. C.

Spectral response range is 4500 deg. A to 8000 deg. A, covering the entire visible spectrum and extending into the infra-red, with maximum response in the yellow/red region.

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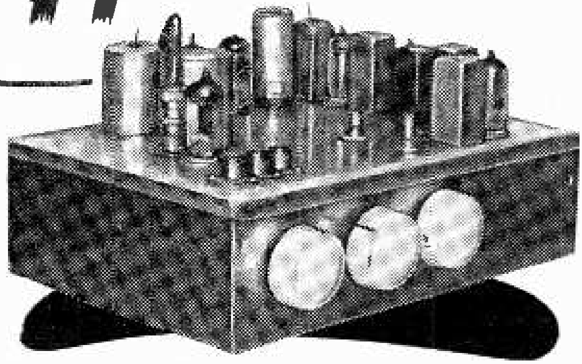
A Hi-Fi A.M. RECEIVER



How to Make a Self-contained High-quality Receiver, Using a Mullard 5-10 Amplifier for the Output Section. Full Cabinet Constructional Details Will be Given in Subsequent Issues

By R. Couvela

THIS receiver was built primarily with the intention of providing a reasonably high quality reproduction of recorded music from both gramophone and tape, but a considerable amount of effort has been spent on providing a radio-frequency feeder to give results similar in quality to those obtainable from the gramophone. The feeder unit is the part of greatest interest in this series, as it sets out to overcome the disadvantages of Amplitude Modulation broadcasts on the Medium and Long waves.

Immediately, of course, the query is raised, why not use the new Frequency Modulation transmissions? There are quite a variety of answers to this, some of which are given below:

The principal disadvantage of F.M. is the limitations of the variety of programmes which may be received. The prototype of this series receives the Light Programme, the Home Service (any region), and Radio Luxembourg, but there is no reason for selecting these three except for personal preference. The coil-packs available give a wide range of choice of stations, and, by constructing the coilpack at -

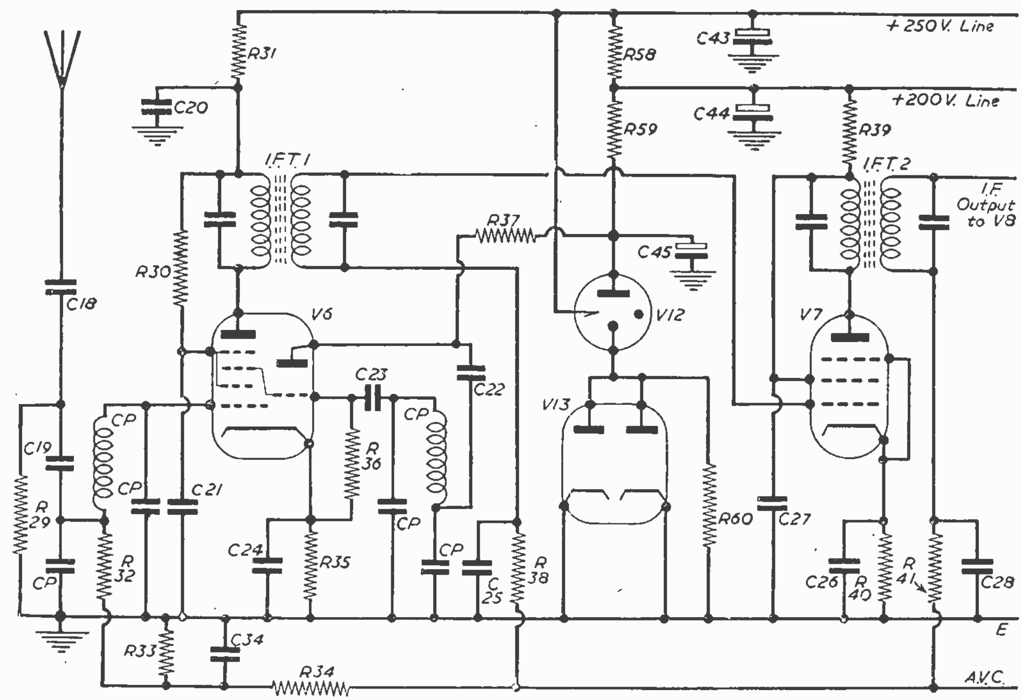


Fig. 1(a).—Circuit of the feeder section.

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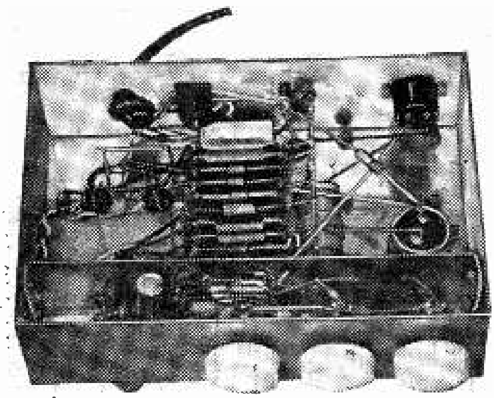
home. the constructor is not limited to three stations. In addition, of course, a variable tuning system could be installed by suitable modification of the constructional details.

Another disadvantage of F.M. is that only local stations can be received with ease (and quality), and this makes difficulties for "fringe areas."

The reader should from the first be clear that this receiver is not intended to satisfy the most stringent demands of the High Fidelity enthusiast, but rather to provide a unit which, while being well above the normal standard of quality, does not involve great expense or technical knowledge to construct.

The Circuit

The tuning of this receiver is carried out by an Osmor preset coilpack, of which there are several types available. to suit various requirements. When used with a conventional circuit, these coilpacks normally have adequate stability, but, as an added refinement, this receiver incorporates a stabilised H.T. supply for the oscillator section of the frequency changer. No previous stage is used, mainly because facilities are not available on the coilpack in use. but if it had been considered necessary. this difficulty could have been surmounted. The circuit has been found in practice to have adequate selectivity and sensitivity. The frequency changer and

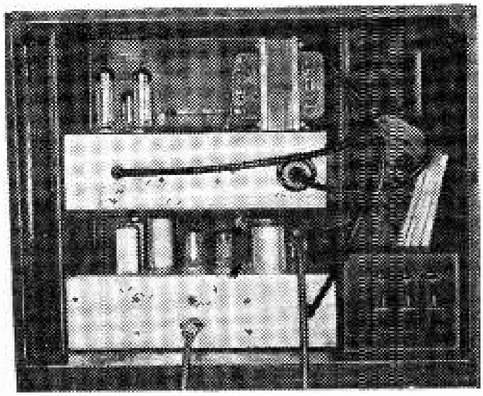


Underside view of the second unit, which includes the section shown in Fig. 1(b).

tuner sections are mounted in a separate compartment. screened from the rest of the set. and it should be noted that. due to the screening, it is not possible to operate the set without a short aerial.

In order to provide an output signal of more than average consistency of amplitude. especially when receiving Radio Luxembourg. it was considered necessary to amplify the A.V.C. supply.

In order to provide an adequate range of amplification values to make full use of the amplified A.V.C.. two stages of variable-mu I.F. amplification have been used.



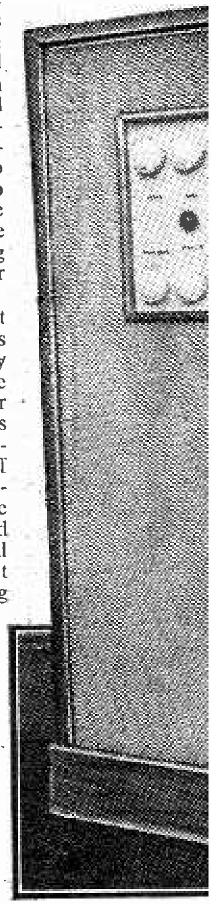
How the sections are housed in the upper part of the cabinet.

Following the detector stage the audio frequency signal is made available on a switch, in common with any other desired audio frequency signal. by which any one signal may be selected at will. A simple means is provided for regulating the amplitude of each signal. so as to allow them all to be adjusted to a similar level, to avoid the necessity of readjusting the volume control on changing from radio to gramophone, or vice versa.

It was thought desirable to fit a simple scratch filter at this stage, and this is performed by a single R.C. filter network. The filter is continuously variable for the sake of convenience. and is arranged to attenuate all frequencies above a fixed cut-off frequency at a rate of approximately six db per octave. The cut-off frequency may be fixed at any value between 2 kc/s and 20 kc/s by a knob on the front panel. at the latter setting having no effect on the amplifier performance.

The signal is then passed to an unbiased cathode follower circuit. which enables the output of this unit to be connected to any one of the wide range of load values, as required.

In normal use. the signal is then passed down a coaxial lead to a Mullard 5-10, or similar high quality audio frequency amplifier. The output is by a Goodmans Axiette loudspeaker in a cabinet



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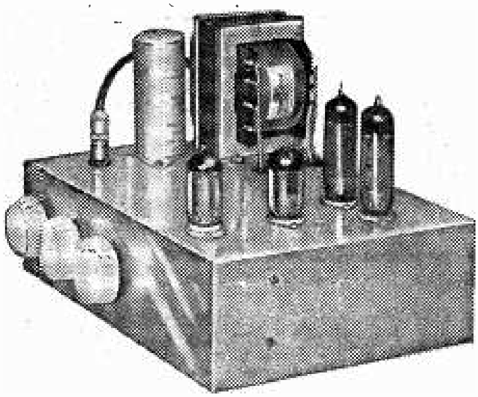
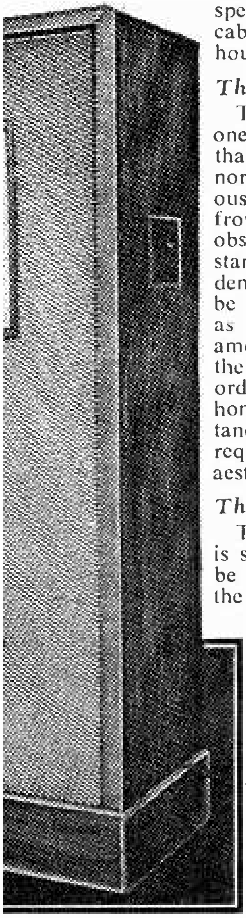


View of the second unit.



specially designed for it. This cabinet is integral with the housing of the main chassis.

The Cabinet

The complete unit is built into one cabinet. as it was intended that it should be used in a normal living-room. and numerous separate units are definitely frowned upon by non-technical observers under such circumstances. This requirement also demanded that the unit should be of attractive appearance, and as a result some considerable amount of planning went into the design of the cabinet in order to make it suitable for home construction whilst simultaneously fulfilling all other requirements. both technical and aesthetic.

The Feeder Unit

The circuit of the feeder unit is shown in Fig. 1(a) and should be mainly self-explanatory, but the following notes are intended as a comment on the design and function of the receiver. and also as an explanation of the few unconventional features. The treatment is stage by stage for easy reference. and, in order to save comment, the reason for not starting the numbering of the components at 1 is to avoid confusion with the reference numbers of components in the Mullard 5-10 booklet if you are going to use this in the complete set.

ed receiver.

The Frequency Changer Stage

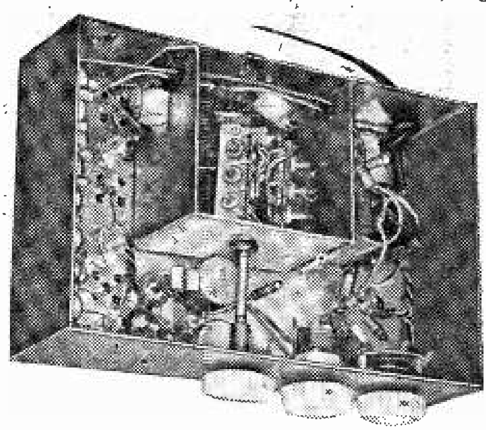
As has been stated earlier the tuning coilpack is an Osmor preset model. of which several versions are available. the prototype using type L.L.H. The circuitry of the coilpack has been included for easy reference, although the switching has been omitted for simplicity. The details of connections will be found in the instructions with the coilpack.

The valve, V6. is an Osram X.79, or equivalent. The hexode section is operated at an H.T. of 250 volts. decoupled by C20 and R31. An identical decoupling network is used on all stages. The H.T. supply to the anode of the triode is 150 volts stabilised: R37 is the anode load of the triode.

The aerial network. C18. R29, is intended to exclude 50 c/s signals from the aerial input. and thus eliminate modulation hum. In some areas, where this type of interference is common. R29 should be replaced by a R.F. choke, as recommended in the coilpack instructions.

Note that A.V.C. is fed to this section of the circuit at half the level used for the other stages. This is brought about by the potential divider R34, R33. The network R32. C34. is inserted to prevent stray signals from the A.V.C. line causing interference in the grid circuit of V6. An identical network is used on all stages. C19 is inserted to isolate the A.V.C. voltage from R32 from the earth on R29.

The oscillator uses a straightforward Colpitts circuit. this arrangement being perfectly normal in this application. Grid bias for this section is obtained in the usual manner for this arrangement. C23. R36 providing the "leaky grid" circuit.



Underside view of the section shown in Fig. 1(a).

The anode signal output of the stage is fed via I.F.T.1 to V7. The I.F. is 465 kc/s, and the I.F.T. is a Denco type I.F.T.11.

The I.F. Amplifier Stage

The "earthy" end of I.F.T.1 is fed with A.V.C., via the filter C25. R38, which is included

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to eliminate stray signals and interaction. The other end is connected to the grid of V7. and it should be noted that. by careful design. both this lead and the anode lead have been reduced to half an inch in length. Care should be taken when drilling the chassis to orientate the valveholder correctly so as to maintain this condition. The stage is fed by a decoupled H.T. of 200 volts. and is perfectly conventional in circuitry.

The valve is a Brimar 9D6 (Osram W77) or equivalent. This is a variable-mu R.F. pentode. on a B7G base.

The output of this circuit is fed via I.F.T.2 to a similar stage acting as a second I.F. amplifier. The only difference in the circuit of V8 is that the A.V.C. supply signal is taken via a capacitor C30 from the anode. so no further comment is necessary.

VALVES

V6	X79	Osram	Frequency changer	B9A
V7 / V8	W77 / 9D6	Osram / Brimar	Variable-mu pentode	B7G
V9	Z77	Osram	High-mu pentode	B7G
V10	D77 / 6A15	Osram / Brimar	Detector / A.V.C. rectifier	B7G
V11	L77	Osram	Triode	B7G
V12	QS 150/15	Osram	Stabiliser	B7G
V13	D77 / 6AL5	Osram / Brimar	Safety valve (see text)	B7G

The A.V.C. Amplifier Stage

This circuit is similar to the I.F. amplifiers. but is fed by an R.C. circuit. R44, C30. This stage, of course. has no A.V.C.. so R44 is earthed. The valve is an Osram Z77 or equivalent, although another W77 will work just as well without modification. The H.T is 200 volts, and the output is via I.F.T.4.

The A.V.C. Detector Stage

The circuit of the A.V.C. detector may appear confusing at first sight. but is. in reality. perfectly conventional.

As is normal, the signal is fed to the anode of a diode whose cathode is held at a positive voltage. decoupled by C35. The A.V.C. signal is then taken directly from this anode. It will be recalled that the circuit commonly used is similar. except that the cathode of the diode is also used as the cathode of the first audio frequency amplifier. The present arrangement is necessary here as a higher value of voltage delay is required due to the amplification of the A.V.C. signal. This voltage is obtained from the potential divider R47. VR48, of which VR48 is used to control the voltage. The procedure of setting this potentiometer will be described later.

The valve. V10a. is half a 6AL5 (Osram D77 or other equivalent).

The Signal Detector Stage

This stage is not quite the same as the circuit commonly used. because we take advantage of the fact that the cathode has only one use (instead of three. as is usual). and employ the diode in a simpler circuit. after the fashion of a half-wave power rectifier. The valve. V10b, is the other half of the double diode used as the A.V.C. detector. The choice of which section to use for which purpose is entirely a matter of convenience. but the screen between the sections should be earthed.

After detection. the audio signal is passed to an amplitude control. VR49. The reason for this is that it may be found that the signal obtained from the radio is considerably greater

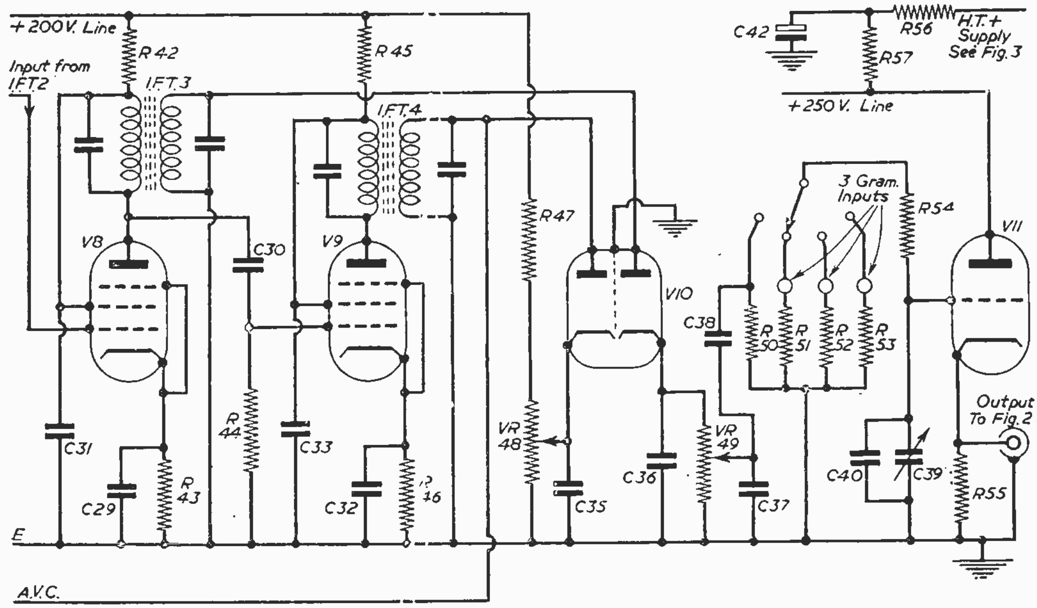

Fig. 1(b).—Circuit of the I.F.s and detector, with the first audio stage.

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than that from the gramophone, in which case VR49 is used to preset the signal to a lower level in order to minimise the necessity for adjusting the volume control on switching from radio to gramophone and vice versa. This control is preset, and does not appear on the control panel. It is very useful, especially in reducing the wear on the main volume control, and the advantages gained by its insertion easily justify the slight extra expense.

In order to ensure that no R.F. component remains in the signal after this stage, the control VR49 is decoupled on both sides by C36, C37.

The "Gram-radio" Switch

When designing this receiver, it was thought that it would be useful to fit a number of audio frequency input sockets, from which signals could be selected at will by means of a switch, but it is obviously superfluous to have any more than the two words "GRAM" and "RADIO" on the front panel. This will explain the apparent discrepancy between the diagrams. Further "Gram" channels are selected by turning the knob anti-clockwise, past the position marked.

It will be seen that each switch position has its own grid leak. There are two main reasons for this: first, to provide a load on the signal sources not in use, and to prevent the possible formation of static charges on the contacts, and secondly, to provide an internal arm of a potential divider, by means of which the gram or other external signals may conveniently be reduced in amplitude by the insertion of a series resistor. The reasons for requiring the latter are, of course, the same as those given for the insertion of VR49.

(To be continued)

LIST OF COMPONENTS

(The following items are required in addition to those needed for the Mullard Amplifier, Type 510.)

Resistors

All are ¼ watt minimum rating except where otherwise specified.

Resistor	Resistance	Dissipation	Function
R29	10 k		Hum freq. decoupler
R30	33 k	½ W	Dropper for V6/G2-3
R31	2.2 k		H.T. decoupler
R32	220 k		A.V.C. line blocker
R33	220 k		A.V.C. potl. divider
R34	220 k		(A.V.C. potl. divider)
R35	220 ohms		Cathode resistor, V6
R36	47 k		Grid bias resistor, V6t
R37	33 k	½ W	Anode Load, V6t
R38	220 k		A.V.C. line blocker
R39	2.2 k		H.T. decoupler
R40	220 ohms		Cathode resistor, V7
R41	220 k		A.V.C. line blocker
R42	2.2 k		H.T. decoupler
R43	220 ohms		Cathode resistor, V8
R44	220 k		Grid leak, V9
R45	2.2 k		H.T. decoupler
R46	220 ohms		Cathode resistor, V9
R47	150 k		H.T. potl. divider
VR48	50 k		H.T. potl. divider
VR49	250 k		Volume control
R50	1 M		Grid leak, V11
R51	220 k		Grid leaks, V11
R52	220 k		(Grid leaks, V11)
R53	220 k		(Grid leaks, V11)
R54	150 k		Scratch filter network
R55	220 k		Cathode load, V11
R56	1.5 k	3 W	H.T. voltage droppers
R57	1.5 k	3 W	(H.T. voltage droppers)
R58	1.5 k	3 W	(H.T. voltage droppers)
R59	3.9 k	2 W	(H.T. voltage droppers)
R60	10 k	2 W	Safety resistor for V12 (see text)
R61	1 MΩ		Discharge resistor

Coils

All I.F.T.s are Denco I.F.T.11, 465 kc/s.

Note: Connection instructions are included in the carton, and these should be closely adhered to. Pin 4 of I.F.T.4 should be earthed.

Coilpack is Osmor "Switchpack" (any type) or home-constructed switch unit using standard coils. N.B.—No special instructions available from this magazine. Connection instructions in carton.

Capacitors

Capacitor	Capacity	Voltage	Function
C18	0.01		Hum freq. filter.
C19	0.01		Isolating A.V.C. from earth
C20	0.01		H.T. decoupler
C21	0.01		Screen decoupler, V6
C22	150 pF		Isolating osc. coils from H.T.
C23	100 pF		Bias capr., V6t
C24	0.01		Cathode decoupler, V6
C25	0.01		A.V.C. decoupler, V7
C26	0.01		Cathode decoupler, V7
C27	0.01		H.T. decoupler
C28	0.01		A.V.C. decoupler, V8
C29	0.01		Cathode decouple, V8
C30	390 pF		Coupling capr., V8/V9
C31	0.01		H.T. decoupler
C32	0.01		Cathode decoupler, V9
C33	0.01		H.T. decoupler
C34	0.01		A.V.C. decoupler, V10
C35	0.01		Cathode decoupler,
C36	390 pF		R.F. filter
C37	390 pF		R.F. filter
C38	0.05		Coupling capr., V10/V11
C39	75 pF		Scratch filter
C40	75 pF		(Scratch filter)
C41	300 μF (2 x 150)	450	Main reservoir
C42	64 μF	450 One Can	Smoothing
C43	120 μF	(450 One Can)	(Smoothing)
C44	32 μF	350 One Can	Smoothing
C45	32 μF	(350 One Can)	(Smoothing)

(All Capacitors not otherwise specified should have minimum rating 250 VW.)

Sundries

Valveholders: 1—B9A with skirt and screen,
1—B7G with skirt and screen,
6—B7G (screens not essential).

Coaxial sockets (Aerialite) qty., 5.

Single aerial socket.

3 7in. lengths of 6 B.A. screwed rod (see Part 3).

1-pole, 4-way switch.

3-way connecting block (for power inlet).

Aluminium for chassis, nuts, bolts, wire, grommets, knobs, etc.

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A Tape Economiser

OBTAINING GOOD QUALITY SIGNALS AT LOW SPEEDS

By H. C. Parr

EVERY owner of a tape-recorder giving tape speeds of 3¾ and 7½in. per sec. must have tried the effect of recording music at the slower speed, and if he is accustomed to the wide frequency range of modern V.H.F. broadcasting and L.P. records, he must have come reluctantly to the conclusion that results are barely satisfactory. The trouble is, of course, that the tape

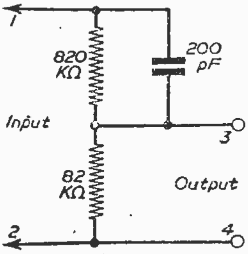

Fig. 1.—The circuit of the device described here.

output at this slow speed falls away rapidly at frequencies above about 1,000 cycles, and even with suitable compensation in the playback amplifier it is difficult to reproduce frequencies above about 5,000 cycles. The price one must pay for these frequencies is a doubling of the tape speed, and so of the running costs involved.

However, under certain circumstances to be mentioned later, it is possible to emphasise the upper frequencies while recording at 3¾in. so as to make up for the loss of output compared with that at 7½in. and so obtain results identical with those normally achieved at the faster speed. Fig. 1 shows the circuit of a very simple device which does this. It can be built up in a few minutes on the type of socket pair which is used for the "extension speaker" or "gram" connection of a radio.

The Apparatus

Fig. 2 shows the appearance when completed.

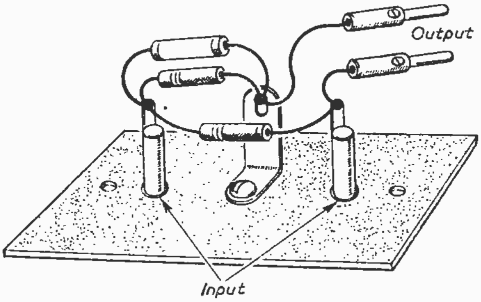

Fig. 2.—Layout of the parts.

If desired a small wooden box can be made with one side open so that the sockets can be screwed on to it with the "works" inside, and a small hole for the leads to be taken through. The appearance will then be as in Fig. 3.

The reader must suspect by now that there is some snag in expecting so simple a device to achieve so much, and he is not mistaken. The drawback is a reduction of 20 db in the available input, and so in general the device is useless when recording from a microphone, for the

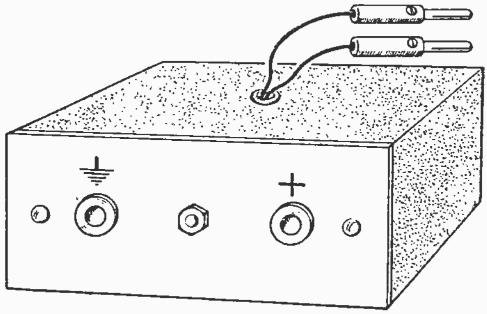

Fig. 3.—The finished unit.

resulting signal will not be strong enough to load the recorder fully. This does not apply when recording from the radio, whether the output be taken from the extension speaker terminals or direct from the tuner. The plugs shown in Figs. 2 and 3 are connected to the appropriate socket on the radio, and the output from the sockets shown is taken to the recorder through screened cable. If sufficient signal is not available when it is applied to the "radio" input, then the "microphone" input can be used.

Precautions

There are two precautions to be observed in using this device. Firstly, the terminals 2 and 4 must be connected respectively to the *earthy* side of the radio and recorder, or hum may be introduced. Secondly, since the purpose is to make the tape response at 3¾in. equal to that at 7½in., the playback amplifier, if it provides compensation for both these speeds, should be switched to the "7½" setting. If the switching is linked to the speed change mechanism some modification will be needed for the amplifier to be in the "7½" setting while the tape runs at 3¾in.

There will be no great difference in the behaviour of the recording level meter or magic eye, for in normal music the energy level is quite low at the frequencies involved.

The results at the slow speed, provided the recorder does not suffer from wow or flutter troubles, are then quite indistinguishable from those obtainable at 7½in. If the machine is used frequently for making permanent recordings from the radio, a considerable saving in tape costs will result.

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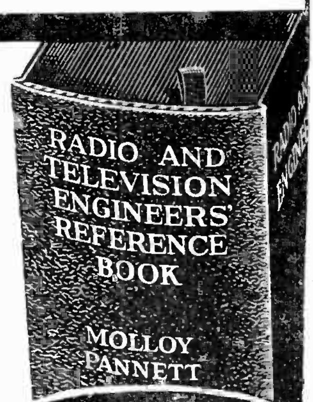

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6AL5	5/9
6AM6	8/6
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6AT6	7/6
6AU6	15/6
6B8	4/3
6BA6	8/6
6BE6	8/3
6BG6G	21/-
6BJ6	7/6
6BR7	12/-
6BW6	8/6
6BW7	9/6
6BX6	8/6
6C4	7/6
6C5GT	6/6
6C8	7/6
6C9	14/-
6CD6G	27/-
6D2	5 9
6CH6	7 6
6E5GT	10 -
6F1	19 6
6F6	10 6
6F12	8 6
6F13	18 6
6F14	15 -
6F15	15 6
6H6	3 -
6J5GT	6 6
6J6	7 6
6J7GT	10 -
6K7GT	10 -
6K8GT	12/3
6K25	18 6
6L1	15 -
6L6	7 6
6L18	12 4
6L19	21/-
6/30L2	13/-
6LD20	15 3
6N7GT	8 -
6P1	16 -
6P25	18 6
6P28	23 6
6Q7GT	10 6
6SA7GT	8 6
6SG7	9 -
6SH7	8 6
6SJ7	8/8
6SK7	9/6
6SL7GT	7/-
6SN7GT	8 6
6U4GT	11 6
6V6GT	7 6
6X4	7 8
6X5GT	8 6
7B7	8/6
7C5	8 6
7C6	8 8
7D5	21 -
7D6	21 -
7D8	21 -
7H7	8 6
7K7	17 -
7S7	12 7
7Y4	7 6
8D3	8 6
9BW6	14/9
10C1	18 -
10C2	18 6
10F1	23 6
10F3	21 -
10F9	12 6
10LD11	15 3
10P13	21 -
10P14	18 6
11D3	23 -
11D5	23 -
12A6	6 6
12AH8	10 -
12AT6	8 9
12AT7	8 9
12AU7	9/-
12AX7	9 -
12BA6	8 9
12BE6	9 3
12J5GT	7 -
12J7GT	10 -
12K7GT	10 6
12K8GT	12 3
12Q7GT	8 6
12SA7	8 6
12SC7	8 6
12SG7	8/6
12SH7	5 -
12SJ7	6 6
12SK7	8 6
12SQ7	10 6
12SN7	15 6
12Z3	15 -
14S7	14 6
19AQ5	9/-
19BG6G	21/-
20D1	14 6
20D2	23 -
20F2	23 6
20L1	23 6
20P3	21 -
20P4	23/6
20P5	21 -
25A6G	18 6
25L6GT	9 -
25Y5	10 6
25Z4	9 -
25Z5	10 -
25Z6	9 6
30C1	12 6
30F5	12 6
30FL1	12 6
30L1	11 -
30P4	23 6
30P12	12 6
30P16	10 -
35A5	10 6
35L6GT	10 -
35W4	8 -
35Z3	10 -
35Z4	8 6
35Z5	10 6
50C5	10 6
50CD6G	27 6
50L6GT	10 -
42	13 6
43	14 6
75	10 -
77	7 6
78	10 6
80	9 6
85A2	15 -
14H7	7 6
40SUA	15 9
41STH	23 6
61BT	15 -
61SPT	15 -
62BT	25/-
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304	8 6
305	8 6
328	9 6
329	9 6
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AC6 PEN	15 -
ACTP	29 6
ACHL	11 6
AC PEN	21 -
ACTH1	29 6
ACVP1	23 6
ACVP2	23 6
AZ1	15 6
AZ31	10 6
B36	15 6
B65	8 6
CIC	12 6
CCH35	21 -
CL33	18 6
CY1	15 6
CY31	15 6
D41	9 6
D42	9/6
D63	6 -
D77	5 9
D152	5 9
DAC32	9 9
DAF91	8 9
DAF96	9 6
DF33	9 9
DF91	8 6
DF92	6 6
DF96	8 9
DF97	9 6
DH63	10 6
DH76	8 6
DH77	7 6
DH107	10 6
DH719	9 6
DK91	8 9
DK92	11 6
DK96	9 6
DL33	9 9
DL35	13 6
DL92	8 -
DL94	8 -
DL96	8 9
EA50	2 -
EABC80	9 6
EAC91	10 -
EAF42	10 -
EB41	10 6
EB91	5 9
EBC33	7 6
EBC41	9 3
EBF80	9 6
EBF89	9 6
EBL21	21 -
EBL31	21 -
EC90	12 6
EC91	8 9
ECC33	8 6
ECC34	14 6
ECC35	8 6
ECC40	17 6
ECC81	8 6
ECC82	9 -
ECC83	9 -
ECC84	10 -
ECC85	10 6
ECC91	7 6
ECF80	12 6
ECF82	12 6
ECH21	21 -
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EF9	21/-
EF37A	10 3
EF39	7 6
EF40	15 -
EF41	9 6
EF42	12 -
EF50(A)	4 6
EF80	8 6
EF85	7/6
EF86	15 -
EF89	10 -
EF91	8 6
EF92	9 -
EL32	5 6
EL33	18 3
EL37	21 -
EL38	23 6
EL41	10 -
EL42	10 -
EL81	17 6
EL84	9 -
EL90	8 6
EL91	8 6
EM80	10 -
EM81	11 -
EY86	15/-
EZ35	9 -
EZ40	8 -
EZ41	10 6
EZ80	8 -
EZ81	8 -
EZ90	7 9
FC2	14 6
FC13	14 6
FC13C	14 6
FW4 500	12 6
FW4 800	16 -
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H30	4 9
H63	10 -
HL92	11 6
HL133DD	11 6
IW4 350	10/-
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KBC32	10 -
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KL32	10 6
KLL32	14 6
KL35	10 6
KT2	7 6
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KT44	12 6
KT55	18 6
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KT63	10 -
KT66	17 6
KT76	12 6
KTW61	9/-
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KTW63	9 -
KTZ41	9 -
KTZ63	10 -
L63	6 6
LN309	12 6
LZ319	12 6
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MHD4	18 6
MHL4	12 6
MKT4(5 7)	21/-
MSP4	15 -
MU14	10 -
N18	11 6
N19	8 -
N37	18 3
N78	11 6
N108	16 6
N142	9 6
N152	11 3
N150	10 -
PCF80	12 6
PCF82	12 6
PCL82	12 6
PCL83	12 6
PCC84	9 -
PENA4	11 6
PEN4VA	11 6
PEN46	6 -
PL33	13 6
PL38	23 6
PL81	16 6
PL82	9 6
PL83	11 6
PL820	21 -
PM2A	10 -
PM2HL	14 6
PM22A	18/6
PM24M	19 6
PM202	15 6
PY32	18 6
PY80	8 3
PY81	9 6
PY82	8 6
PY83	8 6
PZ30	18 6
R10	22 -
R19	19 -
SD6	12 3
SP4	15 6
SP41	3 6
SP42	12 6
SP61	3 6
T41	21 -
TDD4	18 6
TDD13C	18 6
TH41	23 6
TP22	12 6
TP25	23 6
U14	13 6
U16	11 6
U22	27 6
U24	27 6
U26	13 6
U31	9 -
U35	23 6
U37	23 6
U50	8 6
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U76	8/-
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U153	9 6
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UCL82	13/6
UCL83	16/6
UF41	9 -
UF42	17 -
UF80	10 -
UF85	10 -
UF89	10 -
UL41	9 6
UL46	21 -
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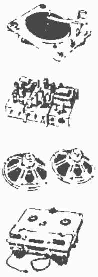

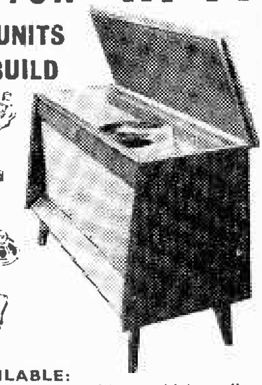

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A FREQUENCY COMPARATOR

A Simple Method of Frequency Checking Which Does Not Call for the Use of a Cathode-ray Oscilloscope. The Arrangement Described Here Makes Use of the Standard "Magic Eye" Tuning Indicator

By A. M. St. Clair

A STANDARD method of comparing and checking frequencies in the laboratory is by means of Lissajous Figures on the screen of a cathode ray oscilloscope. For the experimenter, who does not possess an oscilloscope, or who has only one which is tied up in another part of the rig at the moment when he wishes to check on some frequencies, an alternative and simpler method is desirable. In this connection it is ironic to note that in the professional laboratory, where frequency standards are expensive and reliable, there is likely to be a sufficient number of C.R.O.'s for monitoring their accuracy; but that the amateur, whose oscillators and signal generators are likely to be home-made and distinctly sub-standard will seldom have more than one C.R.O., and quite often not even that. It is thought, therefore, that the instrument described in this article will be of great use both to the serviceman and to the home constructor.

In the first place, any such device, to be of value over a wide range of frequencies, must make use of the cathode ray tube in some form or another. No other device can offer the speed and freedom from inertia necessary for H.F. use. But fortunately the cathode ray tube is available in a cheap and simple form perfectly suited to frequency measuring systems, a form requiring no EHT, no time-bases, no focusing devices, and no deflection arrangements. I refer to the "Magic Eye."

The Principle

Fig. 1 shows the principle of the device. The tube here is a 6E5. One frequency, f1 is applied to the triode grid, and appears on the target grid via the amplifying section of the magic eye. The other frequency f2 is applied to the target anode. If the two frequencies are approximately equal, this will result in periods when the target grid and anode are in-phase, alternating with periods when they are out of phase. The rate of alternation will be the beat frequency, the difference between f1 and f2, and this will, of course, be clearly visible in the form of a regular flickering of the display. If we adjust the variable frequency to obtain zero beat, it is then equal to the comparison frequency.

This is simple enough, and quite useful. But the great usefulness of the principle in practice depends upon two further facts. The device works not only when f1 = f2, but also when f1 = kf2 (or when kf1 = f2), where k is any whole number from one up to ten or twelve; and every amateur has at least one good frequency source, the 50 c/s mains. Hence, with the aid of a practical form of this instrument, we can use the mains to determine the accuracy of an audio oscillator in steps of 50 cycles up to 500 c/s; and hence, by means of a simple auxiliary oscillator, we can proceed up to 5,000 c/s, 50,000 c/s, etc. Likewise, from a single crystal oscillator, we can work downwards, in small enough steps to obtain excellent calibration, in checking a signal generator.

The Circuit

A suitable circuit, using a 6E5, is shown in Fig. 2. Here a triode is added to provide amplification for the f2 signal. Any valve you have available in the spares box will do, and there is no need to work under linear conditions. A pentode may be used, either triode-strapped or otherwise. Far from needing linear amplifiers, this system works better when the distortion is high, particularly when beating against harmonics. It is for this reason that rectifiers are wired into the grid circuits. They are for the introduction of deliberate distortion in order to sensitise the apparatus to harmonics.

An Alternative

An alternative scheme is shown in Fig. 3, using an EM34 magic eye. In this version, the signals are mixed in the common anode load, and the beat is fed to the eye through a low-pass filter. This is advantageous where R.F. signals are being monitored, since no R.F. reaches the eye itself. The possible frequency range of this variation is limited only by the valve used in the earlier stage (mixer), and the style of wiring. Since this particular form of instrument is sensitive to ripple

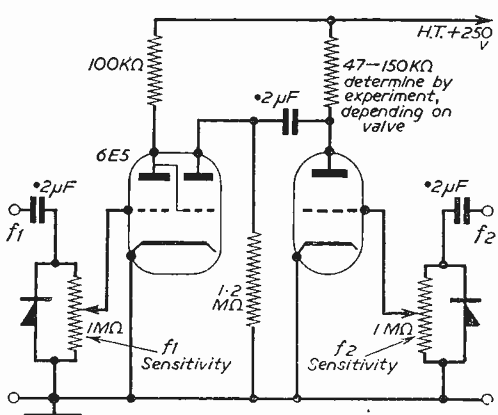

Fig. 2.—The circuit in a simple form.

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and variations in the H.T. line, a neon stabiliser is included. This limits the H.T. on the mixer to the lit voltage of the tube used; this is preferably a 120 volt tube, but even an 85 volt one will serve. The value of R1 should be adjusted experimentally to a point where the neon is just stably lit, and this resistor should be heavy enough to carry the full neon current as well as the valve supply. Otherwise, the circuit, for the same reasons as given above—no linearity requirement—is singularly uncritical. If a stabilised power supply is available there is no need to include the neon stabiliser, in which case the double triode may be given the full source voltage, with an attendant increase in sensitivity.

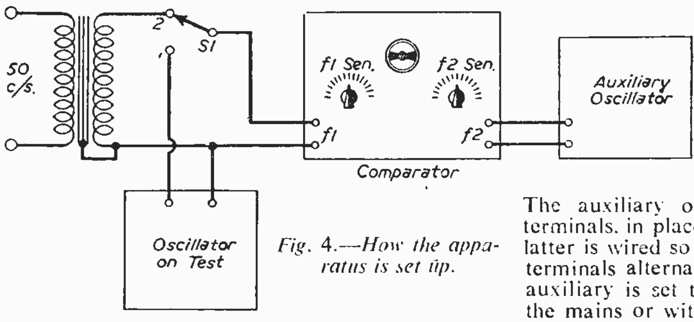

Fig. 4.—How the apparatus is set up.

Using the Unit

A word or two on how to use the equipment. Let us suppose that you have a home-built audio oscillator, such as has been often described in these pages, and that you wish to make an accurate calibration of its dial. Apply a voltage of about 2 to 5 volts A.C. derived from the 50 c/s mains via a suitable transformer to the f1 terminals. Apply the output of the oscillator to the f2 terminals. Adjust the output of the oscillator to a suitable level, and set it to a nominal 50 c/s as shown on the dial. A beat will be seen on the eye. Adjust the oscillator for zero beat, and mark the dial "50 c/s" at that point. Advance the oscillator dial to a nominal 100 c/s, and repeat the process. Working in this way you will obtain an accurate point on the dial for every 50 cycles up to 500 c/s. Beyond that, another oscillator is required; but it does not have to be accurate or even calibrated. Of course, if you have a second oscillator also requiring calibration, it will serve, and each oscillator will help in the calibration of the other. But if you have to build the auxiliary oscillator, keep it simple—a one-valve transformer coupled or R.C. job—because it does not even have to be stable for more than a few seconds on end.

The set-up is as in Fig. 4. The auxiliary oscillator is wired across the f2 terminals, in place of the oscillator under test. The latter is wired so that it may be switched to the f1 terminals alternatively with the A.C. source. The auxiliary is set to 500 c/s by beating with either the mains or with the oscillator under test, which is now accurate at 500 c/s. With the switch in position 1, the oscillator under test is made to beat with consecutive harmonics of the auxiliary, giving accurate calibration points at 500, 1,000, 1,500, 2,000 c/s, and so on up to 5 or 6 Kc/s. If a finer division is required, the auxiliary oscillator will have to be set to a lower frequency, say, 100 or 250 c/s. To cover a wider range, the auxiliary should be modified to work at a higher frequency. Before each reading, *immediately* before, the switch should be set to position 2, and the auxiliary thus checked against the mains.

The proceedings for checking, either up or down, against a crystal standard, are exactly the same in principle. The comparator finds a very useful application, rather less laborious, in checking an oscillator against a known standard. Here, we merely beat the setting of the uncalibrated oscillator against the setting of the standard without using either harmonics or auxiliaries. Broadcast stations can perform useful service as "known standards."

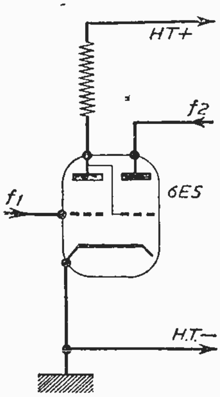

Fig. 1.—This circuit illustrates the principle of the arrangement described here.

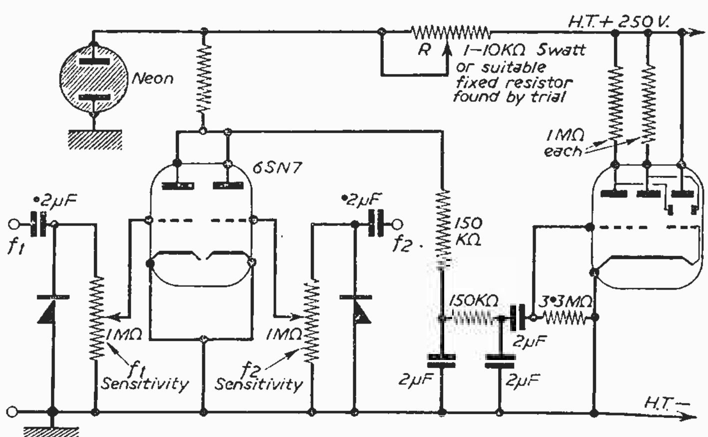

Fig. 3.—A circuit for an alternative scheme.

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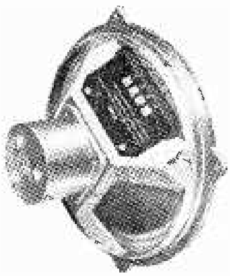

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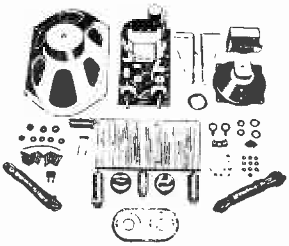

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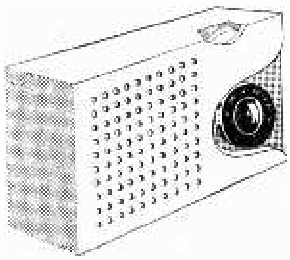

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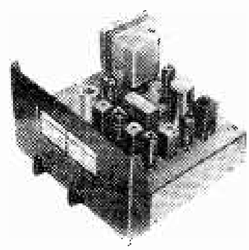

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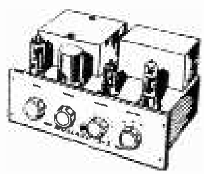

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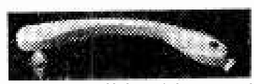

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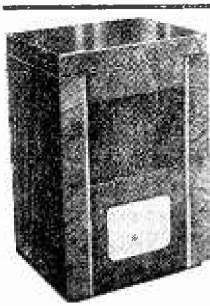

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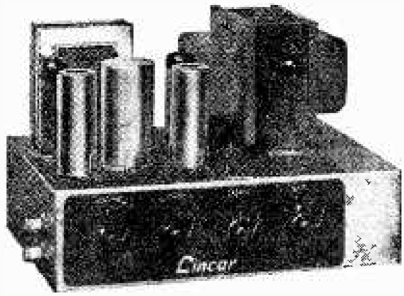

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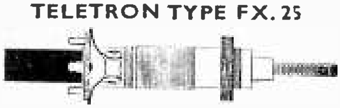

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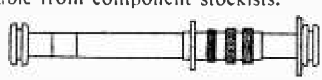

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TRANSMITTING TOPICS

MODULATING WITH THE CLAMP TUBE

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

ONE of the reasons why the clamp tube is a permanent feature of the present-day transmitters is the fact that it may readily be used to provide modulation. This is in addition to its value and original purpose of providing a "safety" device that protects the P.A. valve from excessive dissipation when drive or bias fails.

To elucidate the mysteries of "series screen," "gating" clamp and similar modulators, it must be realised that they are all forms of screen modulation. Consider the simple transformer coupled screen modulator of Fig. 1. This may be simplified to the choke coupled modulator shown in Fig. 2. If the choke is replaced by a resistor, we get the basic "clamp tube" modulator of Fig. 3. Thus the clamp tube system is purely "resistance coupled" screen modulation. Viewed in this way, there would hardly seem to be any need to stress this. However, a legend seems to have arisen in which "clamp modulation" is regarded as having esoteric and wonderful properties quite unrelated to screen modulation, and presumably conferring mysterious and nebulous benefits not to mention greater efficiency, than ordinary "old fashioned" screen modulators.

The cautious reader may now in fact begin to suspect that "simplifying" screen modulation down to a resistance coupled version may mean a sacrifice of efficiency. This is in fact the case, and a simple clamp tube modulator is not as effective as a straightforward transformer coupled screen modulator as shown in Fig. 1. Before considering this further, it is as well to consider the limitations and properties of screen modulation from first principles. Without repeating the "step by step" detailed arguments which the writer has previously given, the following points should be noted. Screen modulation is an "efficiency" method, and the simple forms suffer from the following limitation . . . that the actual R.F. carrier output is one-quarter of the carrier output that the P.A. valve is capable of giving under normal C.W. conditions at the same H.T. voltage. Due to efficiency considerations the maximum carrier output the P.A. valve is capable of giving at "all out" conditions is one-half that obtainable under C.W. conditions. To make this clear, if we have a P.A. stage running flat out at full anode dissipation at 100 watts under normal C.W. conditions, then with the same H.T. voltage under screen modulation conditions we shall only be able to run at 50 watts input, and at half the R.F. efficiency of normal operation. Hence our actual R.F. carrier output is that of a normal 25 watts P.A. stage. If we run under maximum possible dissipation and output, a substantial increase in H.T. voltage is necessary. Thus to take a familiar example, the humble 807 needs voltages of some 1,200 volts for "good" efficiency modulation. Below some 1,000 volts of H.T. the characteristics of the tube are not fully exploited. This is a far cry from the "simple low power rigs" that utilise "simple and economical" screen or clamp modulators. Thus some of the 10 watt topband rigs with clamp modulators are equiva-

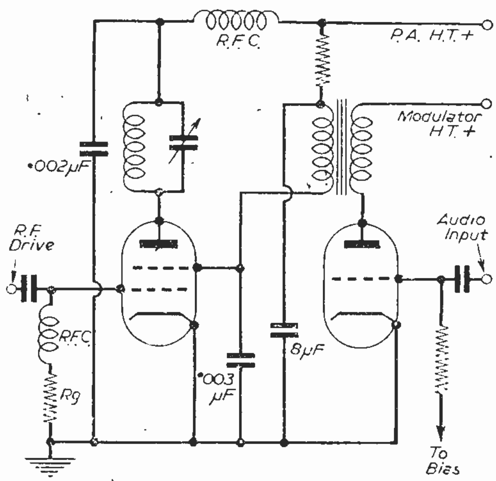

Fig. 1.—A conventional transformer coupled screen modulation circuit.

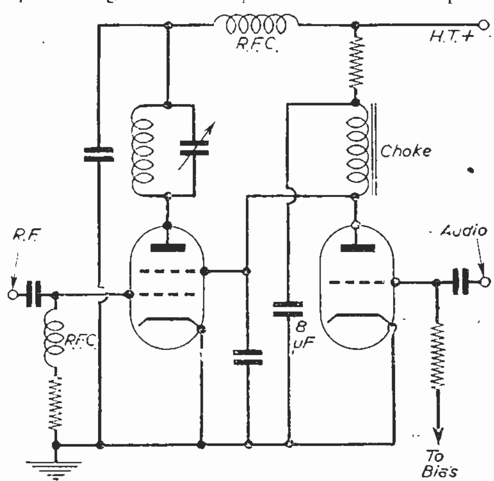

Fig. 2.—A choke coupled screen modulator.

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lent to, say, 5 watt anode modulated rigs. Thus a 6V6 "clamp tube" might just as well be utilised as an anode modulator when it would be capable of directly anode modulating at least a 9 watt P.A. stage running at full C.W. efficiency.

Advantages

Considerations such as the above thus tend to deflate the much boosted value of "clamp tube" modulators for users of simple low power rigs. Thus the Tx running at 40 watt P.A. input under clamp modulation, is at best equivalent to a 20 watt P.A. stage, and if a 6L6 clamp tube is

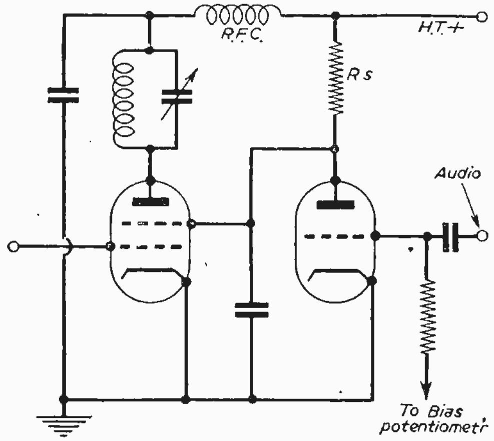

Fig. 3.—The conventional clamp tube modulator is, in effect, a resistance coupled screen modulator.

used that could modulate a 20 watt P.A. stage. What benefit is clamp tube modulation therefore, and surely it gives "better" results than that. At the risk of an explosion from the "defenders of clamp tubes," the efficiency figure for simple clamp tube modulators are as given. The chief advantage of the clamp tube modulator is that it is a simple system giving good speech with very simple audio equipment. To counterbalance the loss of carrier output, no separate modulator, powerpack and modulation transformer are required. Thus screen modulation systems merely require a small speech amplifier ahead of the clamp tube to provide clamp tube modulation. However, the fact that a simple system will provide good speech does not mean that a price is not paid in the form of loss of carrier. Moreover, the "efficiency" arguments indicate that the clamp tube system is hardly worthwhile for the low-power man, whereas a high-power C.W. rig can still run a respectable, though reduced, carrier output. An input of 150 watts clamp modulated, for example, equals a 75 watt anode modulated input . . . at least ideally. Thus, with high inputs, a clamp tube modulated rig can give a respectable amount of modulated carrier. Note, however, that there is a hidden fallacy to beware of. Just because one can run 150 watts of C.W. that does not mean that one can run 150 watts input of clamp tube modulated telephony. To be able to do that, the P.A. valve would have to be "oversized," and capable of some 300 watts of C.W. input. Thus the owner of a pair of 807's capable of just 150 watts of C.W. input would be able to run only about 75 watts of clamp modulated P.A. input. An amateur using an 813 in his P.A. stage, and with a power pack capable of some 2,000 volts output, could readily run an input of around 150 watts of clamp tube modulated input.

The above may seem to be discouraging to the amateur who has hoped that clamp tube modulation can automatically be applied to provide full modulation of his normal C.W. input. Unless his normal C.W. input is an unduly conservative one, both efficiency and power input must be reduced to obtain effective modulation. With this limitation, effective speech may be readily obtained. This leads us to consider how the amateur may "set up" his clamp tube modulator system for good modulation.

Satisfactory Circuits

As indicated, the audio input from a small speech amplifier (Fig. 4) is applied to the grid of the clamp tube. The circuit of Fig. 4 should be adequate to modulate the usual clamp tube circuits. It is best to adjust such systems by running the transmitter into some form of artificial load. According to the power level to be expected, a 12 watt car bulb or a 25, or 50 watt domestic light bulb should be tapped in across the aerial tuner in place of an aerial. Load up the full C.W. input with the clamp potentiometer turned for full carrier input, i.e., with the clamp tube fully cut off. This is the normal C.W. operation, and the electric lamp used as artificial load should be lit to full brilliance. With the receiver aerial removed, and the gain turned down, it should be possible to monitor the carrier. Alternatively a pair of phones and a germanium rectifier plus an R.F. pickup coil should enable the speech to be monitored. To adjust to approximately the correct clamp tube setting for modulation, turn the clamp tube bias potentiometer so that the clamp tube starts to conduct. This will be shown by the P.A. plate milliammeter falling back from its normal C.W. reading. Ruthlessly reduce the P.A. plate meter input to half the normal C.W. current reading. This is a good position to start modulation tests. To attempt modulation, cautiously advance the audio gain of the speech amplifier feeding the clamp tube, and listen to the quality of the speech on the monitor. If good, clear speech is obtained, observe the lamp used as a load. This should flicker upwards in brilliancy on speech. If no noticeable flicker is obtained, the modulation percentage is quite low. If this low modulation percentage gives very loud headphone signals on your monitor, reduce the gain or pickup of the monitor so that speech is reproduced at a low level. To avoid confusion an assistant may be pressed into service to speak into the mocrophone, or even a broadcast programme may be utilised as the audio input, provided one is sure no radiation of R.F. from your transmitter is occurring. Finally, one should be able to get enough audio gain to produce noticeable flickering of the load lamp. However, watch the P.A. plate meter.

(*Continued on page 305*)

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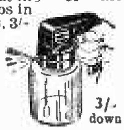

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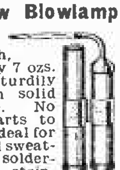

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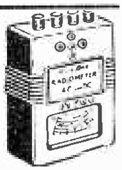

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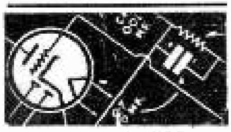

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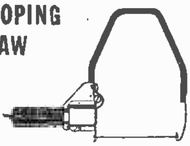

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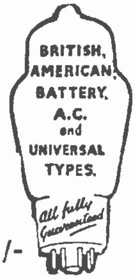

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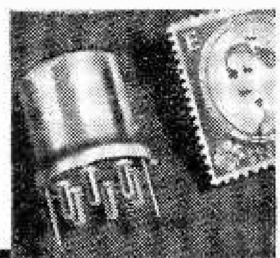

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It will be found that with enough audio input, and with adjustment of the clamp tube bias control, the P.A. plate meter will kick strongly. This is an indication of incorrect bias setting, and not (as some imagine) a demonstration of "modulation." This warning is necessary, as some operators with a kicking meter gleefully quote "peak modulated input" readings from the "maximum kick height" and delude themselves into believing they are running very efficiently. Actually the kicks are a warning that adjustments are not right. If the meter kicks violently upward, adjust the clamp tube bias potentiometer so that the P.A. draws more current. If the P.A. stage is drawing too much current, the P.A. meter will kick downwards, and the bias control for the clamp tube should be adjusted so that the P.A. stage draws less current. Finally, with the P.A. stage adjusted for minimum kicking, if the audio input is increased too much, kicking will take place irrespective of the bias control setting. In general the P.A. meter kicking slightly upwards seems to be a favourite position for good modulation and efficiency. However, this position is not far from the original trial position obtained by turning on the clamp tube so that the P.A. input is around half the normal full C.W. input. Cautious adjustment on the above lines, coupled with monitoring the signal on a simple crystal monitor will reveal much more about clamp modulation than might be suspected. If a cathode-ray tube modulation monitor is available, the results will amaze those who imagine that a wildly kicking P.A. meter is a sign of a high modulation depth, as it will reveal a very lop-sided modulation envelope. Moreover a cathode-ray modulation check will reveal that the modulation depth falls short of the 100 per cent. mark, no matter how much distortion is tolerated.

The fact that the modulation depth does not exceed the 100 per cent. mark, or in fact with the simple clamp tube modulator falls far short of it, is even hailed as an advantage by some. The severe clipping that occurs with excessive audio input produces exactly the same pernicious effects as overmodulation, viz., splatter and spread. The clamp tube modulator merely provides these effects below the full modulation mark, in at any rate the simple circuits generally described. As these effects are clearly audible to anyone with a monitor and a clamp tube modulated transmitter, the "advantage" of "not over-modulating" is largely illusory.

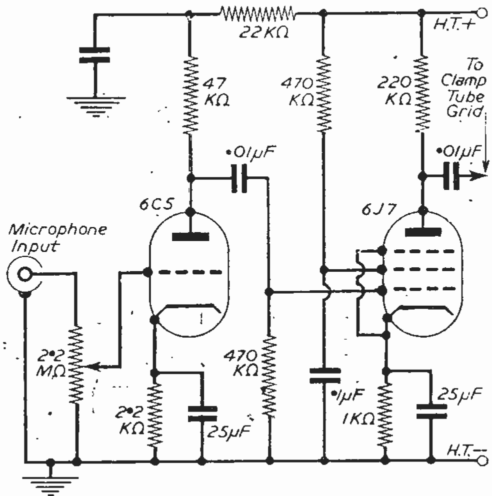

Fig. 4.—A simple two-stage speech amplifier preceeding the clamp valve is adequate to give good modulation from a crystal microphone. The current taken need only be a few milliamps at, say, 250 volts. The preamplifier may generally be fed from the transmitter power supplies without need for a separate power pack.

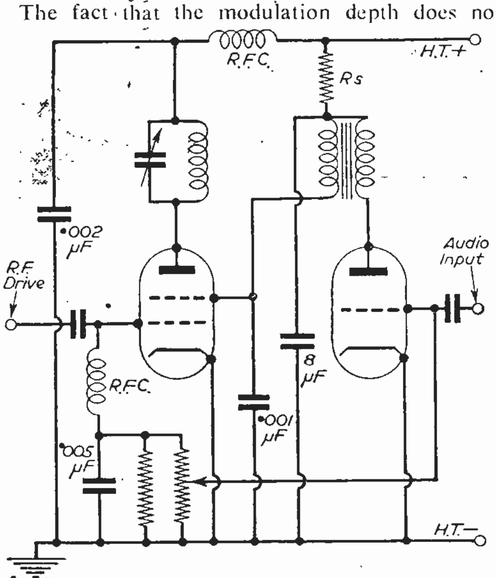

Fig. 5.—Transformer coupling combined with the conventional clamp valve permits of more effective screen modulation.

What is serious is the fact that one does not obtain full modulation with the simple clamp tube circuit. Even if the anode of the clamp tube could provide distortionless audio even when its anode swung down to zero volts, the carrier would still not be 100 per cent. modulated in a downward direction. This is because the screen must be swung appreciably negative to reduce carrier output to a full stop. With the generally used clamp tubes, an inspection of their triode characteristics reveals that generally the limit of reasonably distortionless swing in the negative direction is at a point where the screen and clamp anode are at a potential of around 50 volts positive. This seriously limits modulation depth ideally to some 66 per cent. in the downward direction for linear modulation. It is in fact why the "best" position of clamp bias adjustment is set so that there is a gentle upward kicking of the P.A. meter. By this means the upward or positive modulation is at its full level, with slight clipping of the negative peaks that would otherwise swing below the 50 volt mark. This somewhat increases distortion, but gives a somewhat higher effective modulation level.

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Full Modulation

Once adjustments reach the "somewhat" class, they are obviously at the mercy of the individual temperament of the operator, and tend to lead to the wildly kicking plate meter of the man who thinks he is getting his money's worth of modulation if the meter swings violently. This poses the question of whether there is a clamp tube circuit that will modulate fully. This question is settled by combining classical transformer coupled modulation with the clamp tube principle as shown in Fig. 5. This circuit will behave precisely as a normal clamp tube controlled P.A. By using a small audio coupling transformer, say, a step-up ratio of around two to one, the screen may be supplied with ample power. Where a small amount extra of modulation depth is still needed, an auxiliary by-passed dropper resistance may be inserted in series with the screen feed, as shown in Fig. 6. This by-passed series resistor cannot be made too big, as it will result in an excessive drop of screen potential unless adjustments are made to the main screen dropping resistor value. If the resulting increase in "stand-by" current may be tolerated, it is quite practicable to use an auxiliary screen dropper resistor by-passed for audio, and obtain full screen modulation with purely resistance coupled clamp tube modulation. This is illustrated in Fig. 7, and is recommended as a simple improvement that may be readily applied to existing "simple" clamp tube modulator circuits.

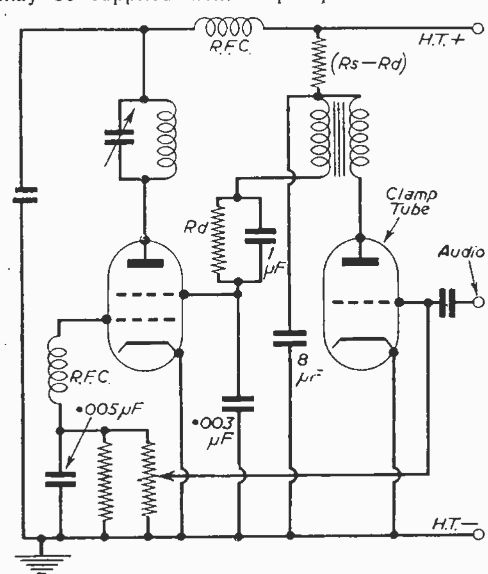

Fig. 6.—A small by-passed auxiliary dropper resistor (Rd) enables fuller modulation to be obtained. If Rd exceeds 1,000 ohms, the screen resistor should be reduced in value to compensate.

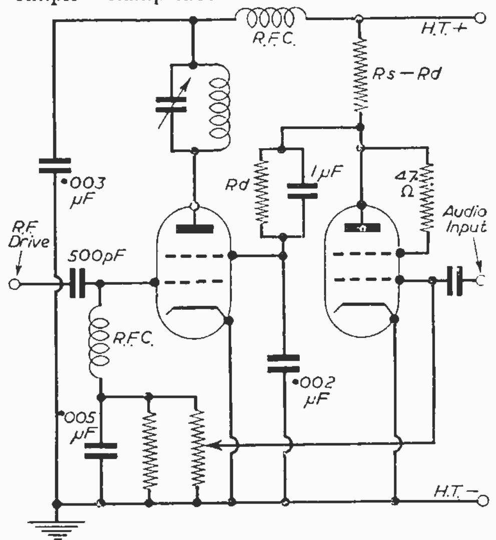

Fig. 7.—A by-passed auxiliary screen dropping resistor will enable even the simple clamp tube modulator to give deeper modulation. The clamp tube operates at a higher voltage than the P.A. screen, and is thus enabled to swing the screen volts to nearly zero volts. The auxiliary resistor should be a few thousand ohms.

News from the Clubs

EALING YOUTH RADIO SOCIETY

THIS club, whose main interests are: (1) Radio Construction, (2) Radio and TV Maintenance, (3) Amateur Radio Communication, would welcome new members. The meetings are held every Monday, 7.30 p.m. at the Brentside Centre (old Nursery School), Bordars Road, Hanwell, W.7. The club is sponsored by the Ealing Youth Sub-committee, and is open to boys between the ages of 14 and 20 years.

BRIGHTON AND DISTRICT RADIO CLUB

Hon. Sec.: R. Purdy, 37, Bond Street, Brighton, 1.

MORSE classes and "Fundamentals" classes are held on all evenings where possible to fit in with the existing programme.

As always, visitors and prospective members are invited to "drop in." May fixtures are as follows:

Tuesday, May 6th—Mullard Sound Film on the manufacture of television cathode ray tubes entitled "Made for Life." Committee meeting to arrange future programme.

Tuesday, May 13th—A talk by Mr. H. R. Henly, title to be announced.

Tuesday, May 20th—Mr. J. P. Clement, the "C.R.O."

Tuesday, May 27th—National Field Day. Final details to be arranged.

NORTHAMPTON SHORT WAVE RADIO CLUB (G3GWB)

Hon. Sec.: S. F. Berridge (G3ITW), 20, Ethel Street, Northampton.

OWING to altered domestic arrangements of the owner of the premises, meetings are still held at the Club Rooms, Allen's Pram Works, 8, Duke Street, Northampton, but on *Thursdays* instead of on Fridays. It is hoped to revert to the usual Friday meetings at the end of October. A No. 19 set is being prepared for portable operation during the summer months as "field days" are planned using the Club call-sign G3GWB P.

TORBAY AMATEUR RADIO SOCIETY

Hon. Sec.: G. A. Western (G3LFL), 118, Salisbury Avenue, Barton, Torquay.

THE Annual Dinner and Social held at the Oswalds Hotel, Torquay, was attended by over 50 members. XYL's and visiting hams and proved a marked success. The President, W. B. Sydenham (G5SY), expressed his pleasure in having such a well attended function, this being responded to by the Acting Chairman, F. D. Cawley (G2GM), who in his brief review of Club activities commented favourably upon the large increase of members during the past year. He extended a warm welcome to the committee members of the Exeter R.S.G.B. Group, which included the county representative, B. Munro (G3FLK).

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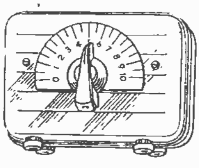

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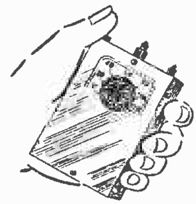

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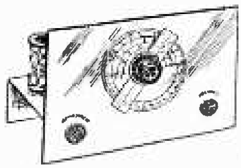

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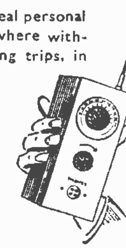

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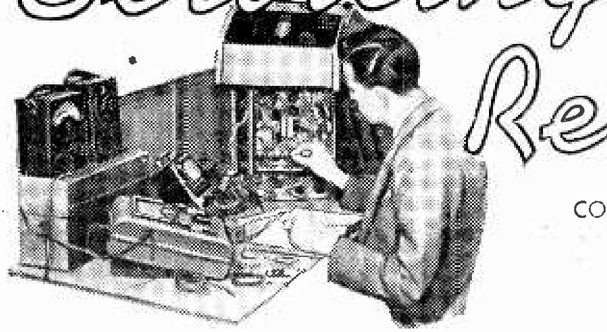

COSSOR TRANSISTOR RECORD PLAYER MODEL 544

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

AS an introduction to the commercial application of transitors, we deal this month with the Cossor Transistor Record Player (Fig. 1). While this instrument serves only as a record player and has no provision for the reception of radio signals, it represents admirably the way in which transistors are now used for the amplification of audio-frequency signals.

The full circuit is given in Fig. 2, from which readers will have little difficulty in following the signal path, in spite of the less familiar symbols of the transistors. From recent articles on the transistor, it will be recalled that, like a thermionic valve, a transistor requires a D.C. bias supply, and that the bias has to be arranged in the reverse direction between the collector and base.

In this sense, the transistor can be looked upon as two crystal diodes formed between the emitter and base and the collector and base (in the circuit at Fig. 1 the letters B, C and E around the transistor symbols represent base, collector and emitter respectively). These three points are often likened to the electrodes of a triode valve as follows: collector and anode, base and grid and emitter and cathode.

The forward direction of current in the emitter/base circuit due to the biasing gives this circuit a lower resistance, while a relatively higher resistance is possessed by the collector/base circuit which is biased in the reverse direction. When the current in the base/emitter circuit increases, the current in the base/collector circuit also increases, but to a greater extent. Generally speaking, this action is promoted by the emission of so-called positive holes from the emitter to the collector circuit with a consequent lowering of the resistance of the base/collector circuit.

The signal is applied to the transistor, so as to cause variation of the negative current in the base/emitter circuit, which results in an equal or greater variation of current in the base

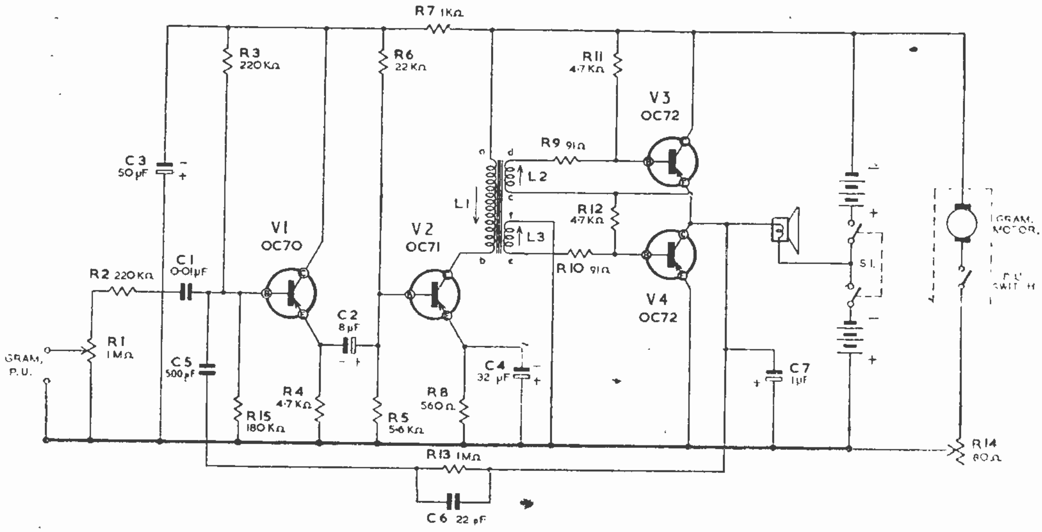

Fig. 2. Theoretical circuit of the record player.

collector circuit. Power gain is thus secured by reason of the *applied signal* causing a current change in a *low resistance* circuit while promoting a similar current change in a *high resistance* circuit. With these brief facts in mind we can investigate the Cossor circuit.

Circuit Description

The signal from the crystal pick-up is coupled to the base of the first transistor (V1) by way of the volume control R1 (note that in this case the slider of the control is connected to the pick-up and not to V1 as it would be with a thermionic valve), resistor R2 and capacitor C1. These serve as equalising and matching components from the pick-up to the transistor. The signal is thus applied to the base, which, as

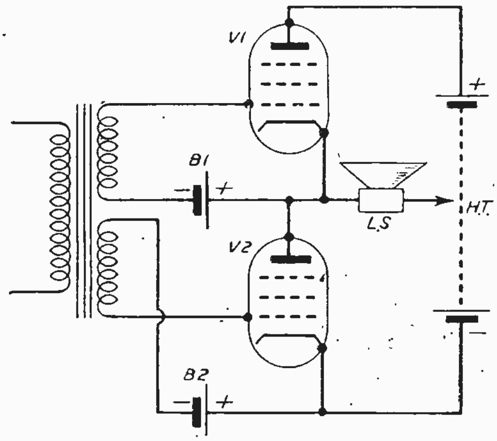

Fig. 3.—The single-ended push-pull output stage, using a tapped H.T. battery.

already mentioned, may be likened to the grid of a thermionic valve.

From the signal point of view, the collector of V1 is at chassis potential (via C3), and the output signal is taken from the emitter circuit. From the valve aspect, this means that anode is at chassis potential from the signal point of view, and that the signal is taken from the cathode. In other words, the stage is arranged in form analogous to the cathode-follower, and is usually referred to as a grounded-collector amplifier.

The advantage of this arrangement lies in the fact that it has a relatively high input impedance and can be matched into a pick-up circuit, for example, without calling for a transformer. Its output impedance is low, however, but this is often desirable as a matching artifice when the input impedance of a proceeding stage is fairly low, such as the input impedance of stage V2 in the Cossor circuit.

The second stage, in fact, consists of a grounded-emitter amplifier. Here the input impedance at the base is lower than the output impedance at the collector, and to avoid low frequency attenuation as the result of the low impedances involved coupling between V1 and V2 is made by way of an 8 μF capacitor C2. It will be appreciated, of course, that this stage has a distinct resemblance to a signal triode stage in which the cathode is grounded and the signal is taken from the anode.

The current variations in the collector/base circuit and the power produced by them is abstracted by the driver transformer, the primary winding being connected in the collector circuit of V2. The transformer is designed to drive the push-pull class "B" output transistors V3 and V4 to provide an audio output of some 300 mW with very little distortion.

The Output Stage

The output stage is worth investigation since it represents a fairly recent development (in valve circuits as well as transistors) which dispenses with the usual split-primary transformer in push-pull output stages. It is described by the curiously conflicting term "single-ended push-pull output."

Let us first look at the idea in terms of valves with which we are possibly more familiar. In Fig. 3 are shown the two output valves V1 and V2, but instead of being connected across the primary of a centre-tapped output transformer, they are effectively connected in series with the H.T. supply. The loudspeaker is connected between the anode/cathode junction and a centre voltage tap on the H.T. supply. On the face of it, it may appear that the loudspeaker is going to suffer a burn-out, but if the problem is considered a little more deeply it will become evident that the valves, H.T. and loudspeaker form a type of bridge circuit. This is, indeed, the case, and provided each valve is taking equal current, as governed by the matching and biasing, the circuit will be in balance and no current will flow in the loudspeaker speech coil. This is the static D.C. condition.

However, when the valves are driven alternately by the signal, the condition of balance will be disturbed in sympathy with the signal and the difference current will flow through the speech coil, thus causing it to operate precisely the same as if it were connected to the secondary of a conventional output transformer. One of the most expensive and distortion-producing components has by this means been eliminated, but since a transformer is not available for matching purposes, the impedance of the loudspeaker requires to be greater than that of a loudspeaker used with a conventional output stage. In this connection, the speech coil impedance necessary is half the optimum load of a single valve.

The circuit in Fig. 4 illustrates how the tapped H.T. supply can be avoided. Since the signal "sees" a low impedance over the whole of the H.T. battery, it matters little whether connection is made at a centre-tap or at one end. The out-of-balance D.C. is blocked by capacitor C.

The circuit at Fig. 2 shows clearly how the idea is extended to transistor circuits. Here a tapped bias source is adopted for V3 and V4. This is much a matter of convenience, though it does ease the balancing problem somewhat, since the tap is taken from the junction of two series-connected 4.5 volt batteries (Ever Ready AB28s

(*Continued on page 313*)

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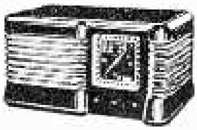

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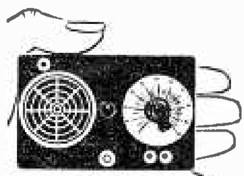

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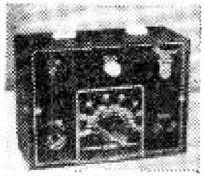

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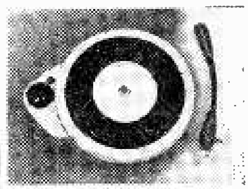

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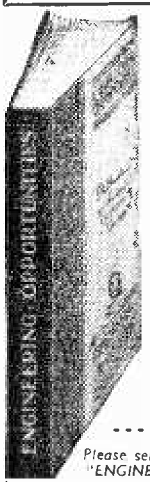

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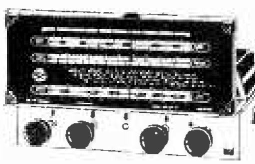

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or equivalents), which also serve to provide the required power for operating the Garrard Type BA1 record player by way of the speed control potentiometer R14.

As already mentioned, the two output transistors operate in class "B," or nearly so. In practice they pass a small quiescent current so as to reduce distortion as the result of transistor non-linearity. Potentiometer networks comprising R9, R11 and R10, R12 serve to bias the transistors in this way and also promote a small degree of negative feedback and damping of resonances formed by the transformer and transistor input capacitances. From our previous discussion, it will be clear that V3 and V4 are operated in the grounded-emitter mode.

Capacitor C7 smooths the effects caused by alternate "switching" of the output transistors, while resistor R13 and capacitor C4 form an overall negative feedback loop, giving some 10 dB of feedback at 400 c/s, and provide a lift in bass response due to the frequency selective nature of the circuit. Capacitor C6 is included to give enhanced stability at the higher frequencies.

Decoupling of the bias to V1 and V2 is secured by R7 and C3, as in ordinary valve circuits. The operating conditions of V1 are stabilised by R3 and R15 in conjunction with the emitter resistor R4, while the operating conditions of V2 are similarly stabilised by R6, R5 and R8.

Servicing Notes

As the operating conditions would be severely disturbed by shunting any network resistor by a resistor of relatively low value, and thus possibly result in permanent damage to a transistor, voltage checks within the circuit must be made with a voltmeter of, at least, 1000 ohms-per-volt sensitivity. Similarly, it is not desirable to make or break connection within the circuit with the amplifier switched on. For example, if a current check is required, the amplifier must first be switched off, the circuit broken and milliammeter inserted. The amplifier can then be switched on and the measurement made. The same applies, of course, on re-connecting the circuit.

The total "no-signal" current of the amplifier should range between 3.8 mA and 4.2 mA depending on the condition of the batteries. This is made up by current in the potentiometers, 0.4 mA of collector current in V1, 2 mA of collector current in V2 (taken between point A on L1 and the negative line) and 150 μA to 400 μA of collector current in V3 and V4. The out-of-balance loudspeaker current should not exceed 50 μA. Taken on a 20,000 ohms-per-volt instrument, V1 collector should register negative 8.25 volts, V1 emitter negative 2 volts and V2 emitter negative 1.25 volts.

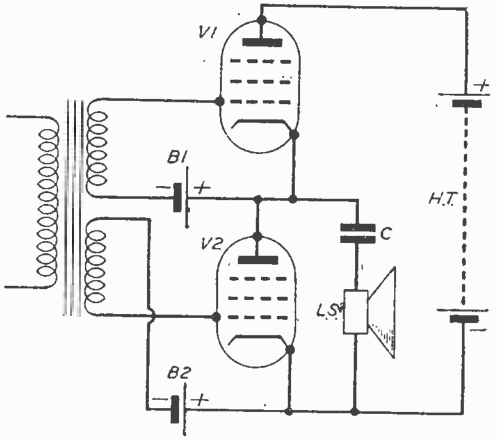

Fig. 4.—The H.T. tap can be avoided by the use of a coupling capacitor, C.

Transistors are very heat-conscious, and if overheated when operating are liable to destroy themselves in a very short time. They should thus be kept clear of soldering irons and other heat-producing devices. Soldering in and out of circuit should never be a prolonged process. A miniature low-power soldering iron is desirable, and even then a heat "sink" should be produced by a pair of long-nose pliers held tight on the transistor connecting lead, between the point of soldering and the transistor itself. Moreover, the transistor leads should not be bent close to the seal.

Inadvertently reversing the supply polarity will almost certainly destroy a transistor, and this should also be borne in mind when making *in situ* resistance checks with an ohmmeter. The negative terminal of most multi-range meters is usually in connection with the internal battery positive lead when used as ohmmeters—this is a point worth remembering.

When replacing components on the printed circuit, the faulty part should be snipped out so that sufficient connecting wire is available for the replacement part. The connecting leads of the new part should be tinned before attempting connection to the wire ends remaining above the board. In this way the heat period of soldering can be kept to a minimum.

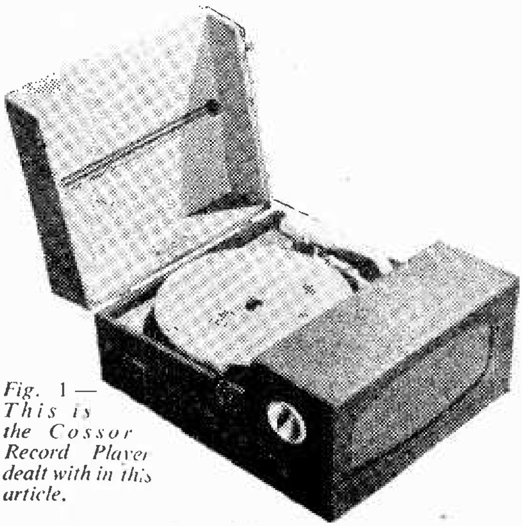

Fig. 1 — This is the Cossor Record Player dealt with in this article.

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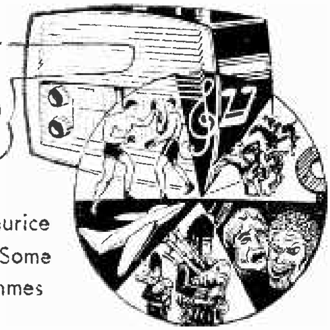
Programme Pointers



Our Critic, Maurice Reeve, Reviews Some Recent Programmes

ROMEO and Juliet, Paolo and Francesca, Antony and Cleopatra, Faust and Marguerite: and so on through hosts of others whose loves, invariably crowned with tragedy, have brought tears to millions of readers, theatregoers and opera audiences. Until we reach 1958, the age of Ron and Eth, the culmination of all earthly passion and desire, the *ne plus ultra* of trembling trepidity and the incarnation of inconsequential insipidity—desire under the aspidistra—whose saga of frustration and impotence pursues us weekly.

I have, of course, referred to those cerebral offsprings of Frank Muir and Denis Norden, radioed by Dick Bentley and Jimmy Edwards and so lugubriously impersonated by Wallas Eaton and June Whitfield.

Whither wendest them? How will they perish? Only Messrs. Muir and Norden know this. So far as we are concerned, they follow the pattern set by famous predecessors such as Dan and Doris Archer or Dr. and Mrs. Dale—also Peter Pan; they never grow up. So far as we can see into the future, they can only terminate their existence by consummating their love which would, of course, transmogrify them completely. But Ron and Eth married—there would be crowds besieging Broadcasting House and the G.P.O. commandering fleets of auxiliary vans to carry the protest mail there: it would be unthinkable and unpardonable.

In the meantime may Eth's romantic illusions remain unshattered and Ron's frightening timidity be continued for some time to come.

Talking About Music

Antony Hopkins has made a name for himself as a conductor and broadcast critic which is wholly justified. His Sunday evening series, "Talking About Music," is quite delightful, very informative and equally refreshing to the novice or the devotee. Mr. Hopkins always has a happy simile ready and can illustrate passages on the piano with no mean dexterity. His programmes are most enjoyable.

Lady Godiva, ever since she rode the streets of Coventry in a costume that wouldn't pay a dividend for any silk or nylon merchant these days, has been a godsend to lyric writers, music-hall jesters and dealers in ribaldry generally. A few years ago a famous judge had cause to remark that when he was a boy it took a sheep to dress a woman but, when he was speaking, it only required a couple of silkworms. The learned judge lived four or five hundred years too late.

In "Scandal at Coventry"—specially written for radio—Clemence Dane treated the subject seriously and quite beautifully. The "ride," to the accompaniment of the slow clop/clop of hooves, sounded most effective and suggestive. It provoked a thought: on television the scene would either have been produced in an inhibited or meaningless manner or completely exorcised, but in "blind" radio it remained undisturbed. Up radio!

Famous Trials

The Thompson-Bywaters murder trial was one of the most famous and exciting of all time. So it was natural that it would find a place in the "Famous Trials" series: No. 4, in fact. It made both a dramatic play and an historical documentary. Written by F. Tennyson-Jesse, commented on by Lord Birkett and produced by Nesta Pain, all the poignancy and futility of the wretched affair were made crystal clear, as was the savage brutality of sentencing Edith Thompson. Mary Wimbush played her with tragic simplicity and heartrending realism.

March 21st, 1918. That date means little or nothing to anyone younger than the present writer; not so much, perhaps, as Waterloo or Agincourt. But to those of his own generation it ushered in a period during which neither Lloyd George nor Haig themselves knew whether the first world war was not, after all, going to be lost. The programme, "The March Retreat" (the title seems something like a masterpiece of understatement), vividly recalled those pulsating days. I hope it is followed up by one which I style in advance "The Turn of the Tide and Victory." For it was less than eight months later that that frightful war was all over and "in the bag."

As there was nothing new to say about it, nothing new was sought. But, with the Fifth Army Commander himself taking part, plus several important participants, it was a stern reminder, well presented, of events which will for ever remain in the memories of those even remotely connected with it.

The Lyons

"Life With the Lyons" proceeds pleasantly if not always with perfect tranquility! They make a delightful family—they are, of course, very old friends now—and it is always a pleasure to pop in on them. The script maintains a reasonably high average with very few wholly dull sessions. Like "The Archers," they will never grow up; if they did, that would be that?

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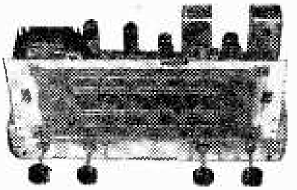

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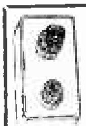

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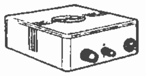

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The Editor does not necessarily agree with opinions expressed by his correspondents

Improving the "Soundmaster"

SIR,—The following suggestions will be found to improve the performance of the Soundmaster tape-recorder considerably:

1. Increase the value of the screen resistors of V1 and V2 to 330k. The 33k resistors specified and supplied in the kit are incorrect and ruin the performance of the instrument. (The circuit diagram is correct.)

2. To prevent flutter and wow, especially with long-play tapes, the 500 ohm resistor in series with the take-off motor should be increased to at least 2k. (10w.). The tape will not spill and the resultant "slack" flutter is completely damped out by the pressure pads.

3. The pinch-wheel cam spring may be shortened by about $\frac{3}{8}$in. to increase the pressure if there is any sign of slipping, though this should not be necessary.

4. The pressure pads should be applied as lightly as is consistent with good high-frequency response.—J. H. WHITELEY (G3AES) (Hull).

A Condenser Condition Tester

SIR,—Mr. J. Brown is apparently unaware of the excellent protection afforded by a metal rectifier shunted across a meter so as to give it a logarithmic scale, which is ideal for measuring the forming and leakage current of capacitors. The arrangement is shown in the accompanying circuit diagram. At very low voltages a metal rectifier has considerable resistance and makes little effect on the lower readings of the meter, but as the voltage is increased the resistance of the rectifier decreases and so shunts a greater proportion of the current away from the meter. Two half-wave metal rectifiers are used connected as shown in order to give protection in both directions, and the resistance in series with the meter is adjusted to get full-scale deflection at the current required.

A 1 mA meter shunted in this way can have a half-scale deflection of about 2 mA while reading 25 mA full scale, and for this a Westinghouse Type 2/6A rectifier, with its outside ends connected together, and a variable resistance of 2,500 ohms is suitable. Or the rectifier may be made up from an old copper-oxide one, using 6 discs for each section, no cooling fins being needed. A 5 mA meter can be used instead of the 1 mA, but the scale will be less open. The meter will need re-calibrating or a graph made, and great accuracy cannot be expected since the resistance of the rectifier varies somewhat with temperature, but it is quite good enough for testing.

Using a single resistor (R13, Fig. 1, April issue) to limit the current on all ranges is very unsatisfactory because if it is of sufficient value for the higher ranges it will grossly reduce the current at lower voltages, with misleading results. It is therefore best to put a limiting resistor in each range, except the lowest ones where there is sufficient resistance in circuit already to limit it to 25 mA.

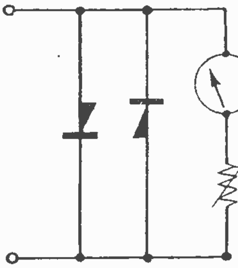
It is interesting to note that, using the circuit shown, a 5 mA meter can be made to read 1 amp. and yet have a half-scale deflection of under 15 mA. For this a Westinghouse L.T.-7A rectifier and resistance of about 130 ohms is required.—R. V. GOODE (Totland Bay).

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.

Intermittent Heater Circuit

SIR,—Occasionally an annoying fault occurs in A.C./D.C. sets which can prove difficult to trace. It is an intermittent heater, when the set has warmed up which results in all the valves having no heater current. The offending valve often will not show up when tested with no anode current taken, as it may not rise to the same temperature.

By a sketch, it can be seen that if a heater becomes o/c in a series heater chain, then the full mains volts are developed across the faulty



Safeguarding a meter. See Mr. R. V. Goode's letter on the left.

heater because with no heater current flowing there can be no voltage drop across the other resistances.

If a voltmeter is placed across a good valve, then when the break occurs the heater volts will fall to zero.

Therefore to determine which is the faulty valve a voltage check is made on each heater,

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when one rises as the fault occurs this is the valve concerned.--MONTY LEVY (Islington).

Using Old Eliminators

SIR.—In reply to H. Young (Reading). he may be interested to know that I have been using an *old battery eliminator* as a very useful condenser leakage tester for many years. All that is needed is a neon lamp and holder and a bracket to fix it on top of the eliminator: then fix two flexible leads in the H.T. positive and negative sockets with the neon in series with one of them. and terminated in spring clips.

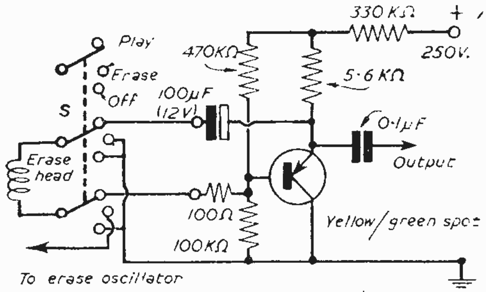
In use I find that condensers down to .005 μF give a useful indication on first switching on. Leaky condensers are immediately revealed by a steady glow or continuous flashing. High value resistors. which may give no indication on an ohmmeter. may also be readily tested for continuity.

I hope the above hint may be useful to Mr. Young and other readers. -H. E. HOWARD (Bournemouth).

Tape Recorder Improvement

SIR. —Almost all tape recorders have at least two heads. record-play. and erase.

The record-play head is in use all the time. but the erase head stands idle when playing back. or recording additions to a previous recording. This is obviously a waste of perfectly good head, and the following notes show how it may be used as a monitoring head and for giving echo effects. The illustration shows the system used. The signal from the low-impedance erase head is fed to a high gain transistor amplifier. The circuit shown gives a gain of about 300 and takes 0.8 mA from the 250v. supply. The output is suitable for feeding to a valve amplifier or to high-impedance headphones. Other types of transistor may be used if care is taken not to exceed their permitted voltage and current ratings. The spare contacts on most push-button tape decks can be arranged to give the switching arrangements S.



The tape recorder switching arrangement described by Mr. Dobson.

The quality of the output will depend on the erase head gap and the tape speed. Some top cut is inevitable with wider gaps. The device is most suitable for monitoring. when adding to recordings already on the tape. but interesting echo effects may also be obtained by feeding the monitoring signal from the erase head amplifier back to the record head.--J. DOBSON (Sheffield).

Aligning Alba Models 3211, 6221, 6231, 6241 and 6251

THE following are the trimming details for the alignment of the above receivers which were dealt with in our April issue.

Retune the generator to 154 Kc/s and the receiver to 1,950 metres and adjust L15 and L8 for maximum output. After tuning to 250 Kc/s (1,200 metres) and adjust CX6 and CX3 for maximum output.

Finally, the S.W. band: Tune the receiver to 50 metres and the generator to 6 Mc/s and adjust L13 and L6 for maximum output. Retune to 17 metres (17.65 Mc/s) and adjust CX4 and CX1 for maximum output. For best overall results the operations should be repeated for optimum tracking and sensitivity.

F.M. Alignment

Switch the receiver to F.M. and tune to the low-frequency end of Band II. Adjust the R.F. and oscillator trimmers C5 and C9 to the centre of their range. Connect a valve voltmeter between the junction of C7 and C8 on the F.M. tuner and adjust C10 for minimum reading, observing only the dip in meter indication which occurs when C10 is nearest its *minimum* value.

Connect a microammeter and series 200K resistor between pin 2 of V4 and chassis, with the positive meter terminal to chassis, apply a 10.7 Mc/s unmodulated signal across L5 and adjust L18, L12 and L11 for maximum indication on microammeter. Make a note of this reading. Transfer negative meter connection to point "T" on circuit diagram and carefully adjust the core in L19 for a meter reading exactly half of that noted above. Repeat all the operations given in this paragraph.

Reconnect the negative meter lead to pin 2 of V4. inject a 10.7 Mc/s unmodulated signal to the tuner by way of a tight loop of wire around the ECC85 and adjust L4 and L5 for maximum indication on the meter. It is recommended that a check of the F.M. I.F. response is made at this point by detuning the generator 100 Kc/s either side of the 10.7 Mc/s (plus and minus 100 Kc/s) and checking that the reduction in meter indication is no greater than 40 per cent. (3 db).

Set the receiver tuning to the calibration mark at the low frequency of Band II. inject into the Band II aerial terminals a signal of 87.9 Mc/s. deviated at 25 Kc/s. and adjust C9 and C5 for maximum indication on an output meter connected to the extension loudspeaker sockets. Tune the receiver to 95 Mc/s and retune the generator to coincide. Adjust the spacing between C7 and C8 for calibration at this frequency.

Disconnect meter and signal generator. connect F.M. aerial and adjust C1 for optimum sensitivity. Seal all trimmers lightly with wax.

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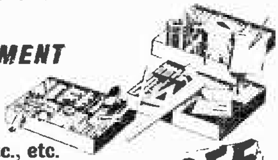

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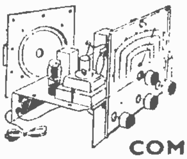

SUPER CHASSIS, 99/6

5 valve (octal) s het chassis, including 8" speaker. 4 control knobs (Tone, Volume, Tuning, w change sw.). 4 w band with position for gram P.U. and extension speaker. A.C. Ins., Carr., 5/6.

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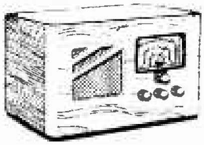
Made by famous manufacturer. R.F. E.H.T. unit included. Drawing 2/6 or **FREE** with order. Chassis in 3 separate units (Power, s vision, Timebase inter-connected). These chassis can easily be fitted into existing console cabinets. Less valves and tube. Channel 1-2-3-5. Easily converted to I.T.A. Ins., Carr., 10/6.



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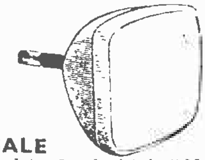

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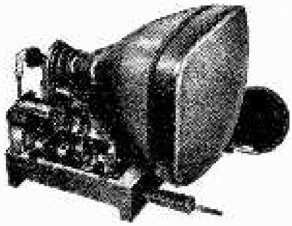

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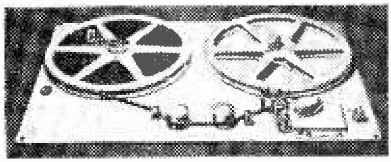

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AMPLIFIER kit, 2½ watt, record/replay, 2 recording positions, neon indicator, etc., **£5.18.0.** Power pack kit for above, **£2.18.6** (both without valves). Carr. and packing extra.

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This tape deck and amplifier is being used in the Antarctic by an Expedition member.

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News from the Trade

SIGNAL GENERATOR

A NEW signal generator is announced by Radio & T.V. Components. Details are as follows:

Coverage 100 Kc/s.—100 Mc/s. on fundamentals and 100 Mc/s. to 200 Mc/s. on harmonics. Metal case 10in. × 6¼in. × 5½in.. grey hammer finish. Incorporating three miniature valves and metal rectifier. A.C. mains 200/250 v. Internal modulation of 400 c.p.s. to a depth of 30 per cent.; modulated or unmodulated R.F.. output continuously variable 100 milli-volts, C.W. and mod. switch. variable A.F. output. Incorporating magic-eye as output indicator. Accuracy plus or minus 2 per cent. Price £6 19s. 6d. Or 25s. deposit and 6 monthly payments of 21s. 6d. Post & packing 5s. extra.—Radio & T.V. Components (Acton) Ltd., 23, High Street. Acton. W.3.

REDUCED BATTERY PRICES

THE Ever Ready Co.. (G.B.) Ltd., have released the latest edition of their price list for batteries in form of a wall chart.

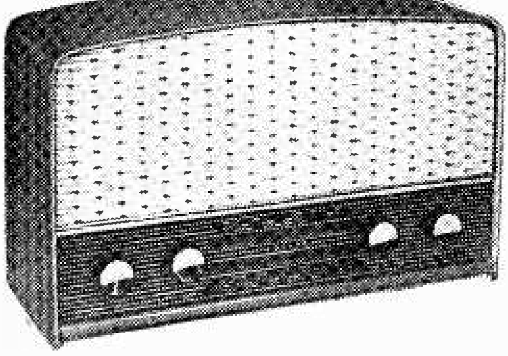
All types of radio. lighting. hearing aid, photoflash. electronic and transistor "power pack" batteries are listed. A special feature is the battery replacement list for radio receivers. gramophones and electronic equipment.

Convenient to be hung on wall or counter. and easy to read. the wall chart should be invaluable to Ever Ready dealers all over the country to whom supplies have been despatched.

"SOUND 777" PRICE INCREASE

OWING to the increase in the list price of the Collaro tape transcriptor from £22 to £25. Tape Recorders Ltd.. have found it necessary to amend the price of the "Sound 777" tape recorder from 40 gns. to 44 gns. list. They have also been faced with the additional rising costs of both labour and material and the total increases have been taken into consideration in fixing this new price.

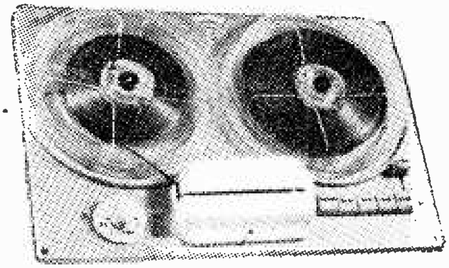
The "Sound 777." even at the new price. is still claimed to be the lowest priced 3-speed and fully automatic push button tape recorder in the world.—Tape Recorders (Electronics) Ltd.. 784-788. High Road. Tottenham, N.17.



The new Cossor A.M radio receiver.

THE MOTEK K9 TAPE DECK

WE again show this deck which. unfortunately. was incorrectly described in the caption in our April issue as The New Motor Tape Deck. The manufacturers, who submit each deck to exhaustive tests before despatch guarantee them for a period of 12 months and we understand that production of the Motek K9 is now in full swing to meet the ever increasing trade demand.—Modern Techniques, Wedmore Street, London, N.19.



The new Motek tape deck.

NEW COSSOR A/M RADIO RECEIVER

A NEW A.C./D.C. receiver. with printed circuit construction and high sensitivity 8in. × 5in. elliptical speaker. has been released by Cossor Radio & Television Limited. The receiver, Model 571. operates on long and medium wavebands. An attractive tuning scale, with calibration in red and green. is admirably set off in a veneered wooden cabinet.

Three Cossor "multiple" valves and rectifier and internal Ferrodyne rod aerial complete the specification of this attractive receiver which retails at £18 18s. (tax paid).—Cossor Radio & Television Ltd., Cossor House. Highbury Grove, London, N.5.

PHILIPS REDUCE PRICE OF "MUSETTE" PORTABLE RADIO

PHILIPS ELECTRICAL LTD., announce that the tax-paid price of their "Musette" battery portable radio receiver has been reduced from 12 gns. to 9½ gns. (List £7 4s. plus P.T. £2 15s. 6d.).

This reduction has been made possible by the adoption of new manufacturing techniques at the company's Croydon factory, the resultant savings in production costs being passed on to the public.

Full rebates will be granted to dealers to cover stocks in hand. A window streamer and showcard are also being supplied.—Philips Electrical Limited, Century House, Shaftesbury Avenue, London, W.C.2.

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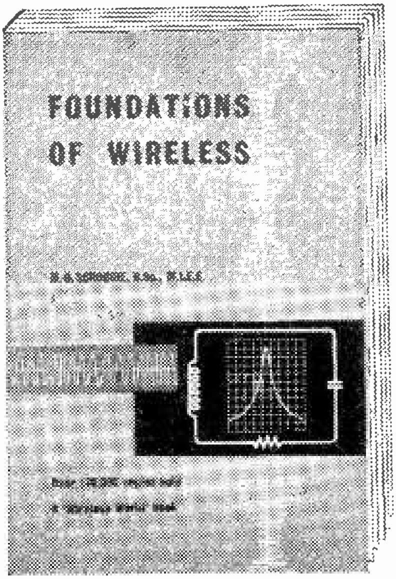

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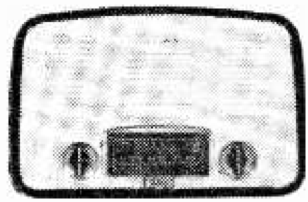

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AMPLIFIER UNITS TYPE A.1134A.—Two stage audio amplifiers which can be used for intercom. purposes, as a gram. amplifier and for use with crystal receiver, etc. Valves fitted are one each VR21 and VR35. Operate from 90 or 120 v. H.T. battery, 2 v. accumulator and 9 v. G.B. In neat metal cases, 7 x 5 x 4 ins. In new condition with connection details. PRICE ONLY **9/6.** post 3/-.

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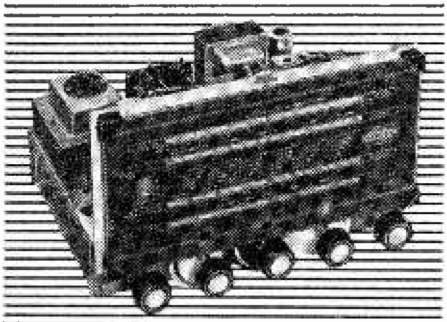

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AM/FM Model H4PP. Price **£29.3.10.** inc. P.T.

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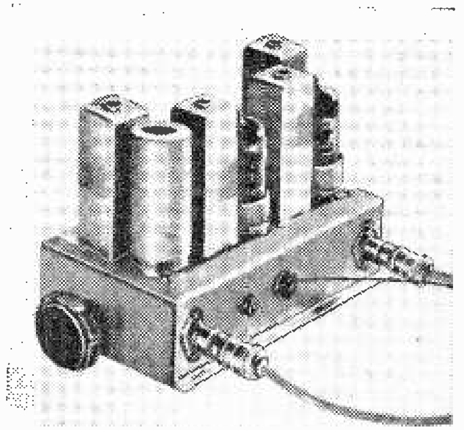
P.C.M. SWITCHED TUNER

(as described on P.205, last month's P.W.)

SUPERB RECEPTION of V.H.F.



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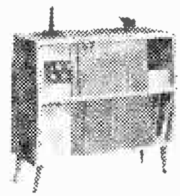

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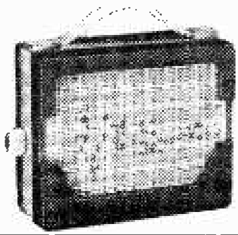

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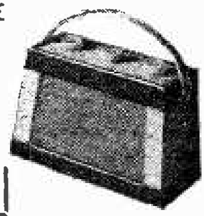

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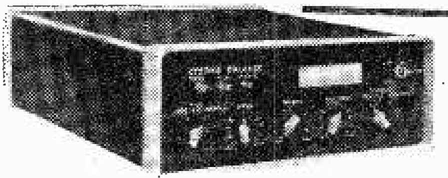

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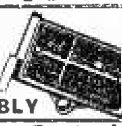

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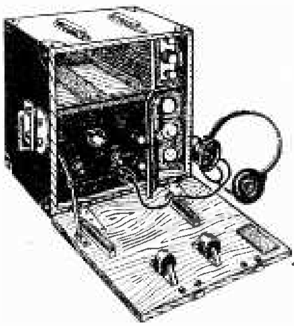

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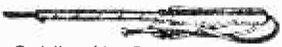

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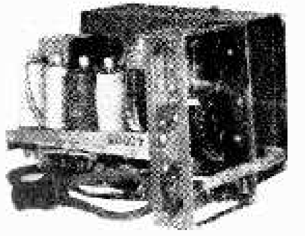

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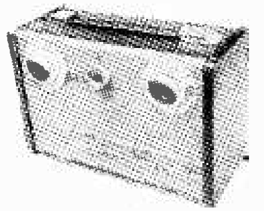

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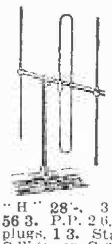

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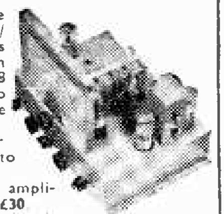

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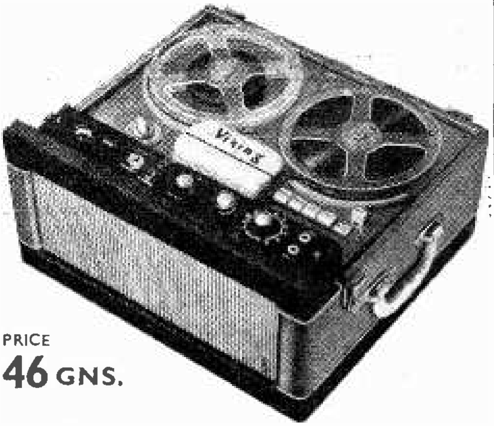

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AMATEUR WIRELESS AND WIRELESS MAGAZINE

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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.

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PRACTICAL WIRELESS, JUNE 1958

Published on the 7th of each month by GEORGE NEWNES, LIMITED, Tower House, Southampton Street, Strand, London, W.C.2, and printed in England by W. SPEAIGHT & SONS, Exmoor Street, London, W.10. Sole Agents for Australia and New Zealand: GORDON & GOTCH (A/sia), LTD. South Africa and Rhodesia: CENTRAL NEWS AGENCY, LTD. Subscription rate including postage for one year: Inland 19s., Abroad 17s. 6d. (Canada 16s.). Registered at the General Post Office for the Canadian Magazine Post.

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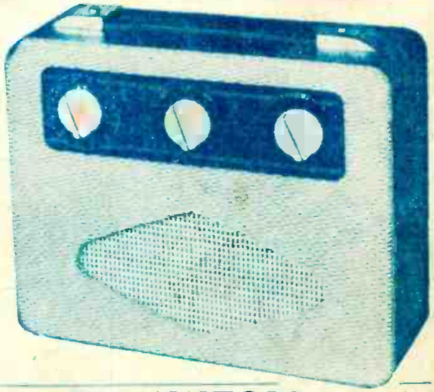

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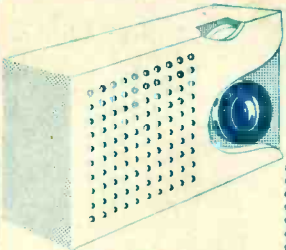

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