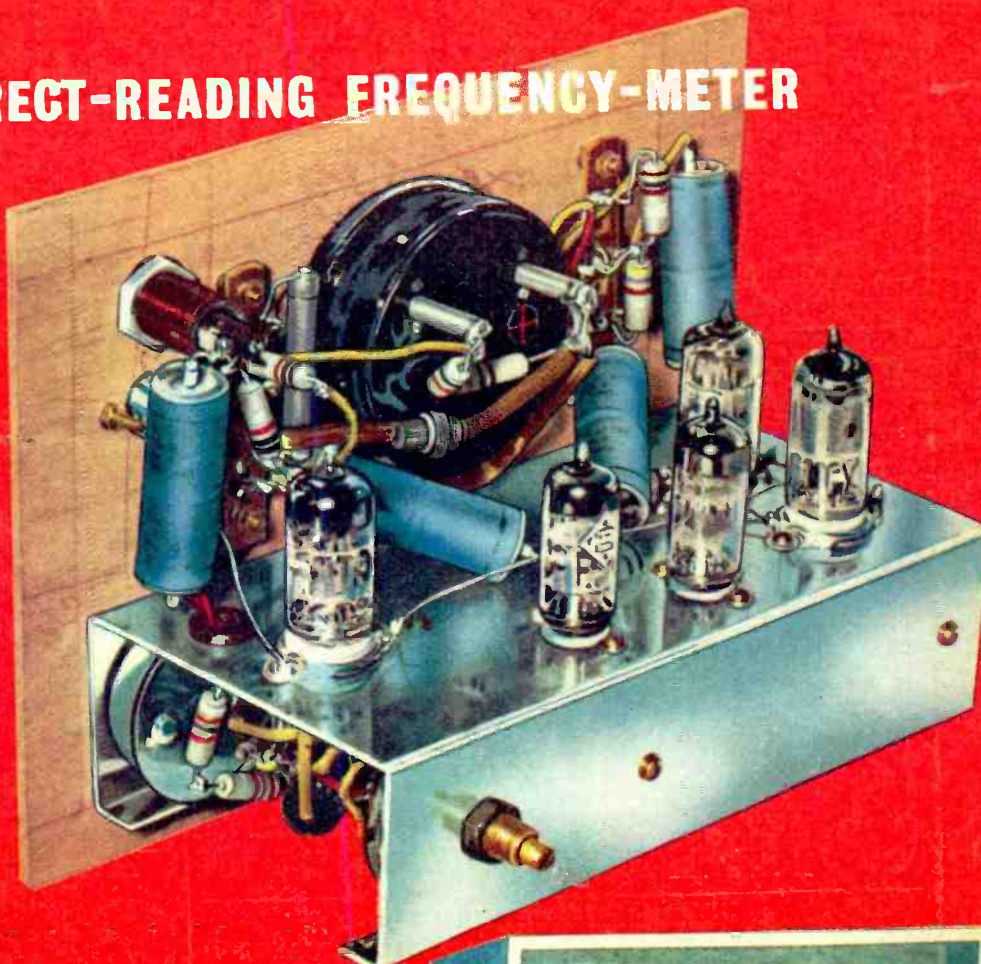
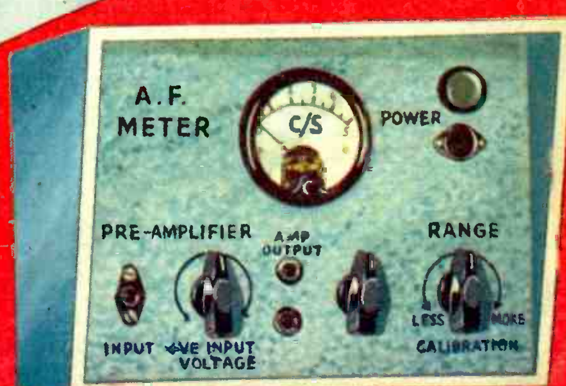
MARCH 1962

Practical WIRELESS

2/-

DIRECT-READING FREQUENCY-METER





Loudspeaker Cross-over Networks

Servicing Tape Recorders

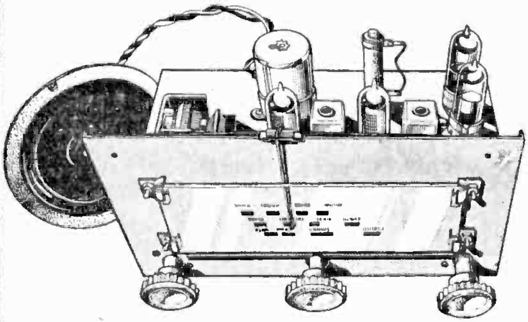
Transistorised Grid-dip Oscillator

HARVERSON SURPLUS Co. Ltd.

PLEASE TURN OVER FOR ADDRESS AND MORE BARGAINS

2 BAND SUPERHET CHASSIS with Speaker

ONLY £4.19.6
Plus 6/6 Post & Packing.



A quality 4 valve AC/DC superhet chassis made by a world famous manufacturer. Long and Medium wave coverage. Fitted with a cord and drum reduction tuning drive and attractive illuminated glass dial (size 6½ x 2½in.). Controls: Volume on/off, tuning and wave change. The receiver is self-powered, employing a mains dropper and a valve rectifier. Chassis dimensions 6¾ x 9 x 5½in. high. Supplied complete with a good quality 5-inch loudspeaker, valves (UCH42, UAF42, UL41, UY41), AC/DC mains input lead, ivory knobs, etc.

DON'T HESITATE, ORDER NOW! This unbeatable bargain is bound to sell out quickly at only £4.19.6, plus 6/6 post and packing.

COIL and TRANSFORMER SET FOR TRANSISTOR SUPERHET

3 I.F. Transformers, one oscillator coil, one driver transformer, and wound ferrite aerial (Med., Long and aerial coupling) 28/6 complete, post 1/-. 6-transistor printed circuit board to match 8/6, post 9d. Circuit diagram 1/6 extra.

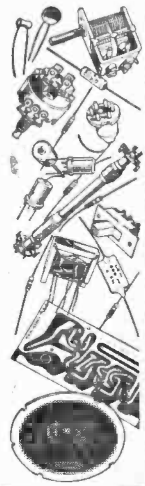
CONDENSER/RESISTOR PARCEL

50 mixed P.F. Condensers and 50 mixed Resistors. An assortment of useful valves. All popular sizes—all new—a must for the serviceman and constructor ONLY **10/-** P. & P. 1/-

SPECIAL OFFER 54-in. LOUDSPEAKER SILKS

Heavily woven in ivory and gold. Original price 35/- per yard length. OUR SPECIAL PRICE, 13/6 per yard length. P. & P. 1/6.

THE HARVERSON 6 TRANSISTOR & DIODE SUPERHET KIT



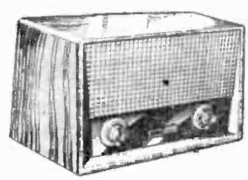
A first class 2 wave band transistor superhet in kit form.

★ Printed circuit panel (size 8⅛ x 2¾ins.)
★ 3 Pre-aligned I.F. Transformers.
★ Output Transformer.
★ 5 inch 5 Ω Speaker.
★ High gain Ferrite rod aerial.
★ First grade G.E.C. transistors.
★ Car aerial socket.
★ Push/Pull output.
★ All parts sold separately.

Owing to a fortunate purchase of components, all parts down to the minutest item with simple instructions.

ONLY **£5.9.6** Plus 2/6 P. & P.

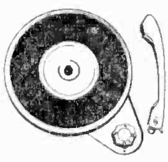
SUPER TABLE RADIO CABINET



A very fortunate purchase allows us to offer this quality table radio cabinet for only **18/6** (this cabinet cost the manufacturers 35/- each to make). The positions of the controls make it ideal for housing our 6 TRANSISTOR SUPERHET KIT described above. Beautifully finished in walnut and tygan.

OUR PRICE ONLY **18/6** Plus 1/6 P. & P. ins.

E.M.I. 4-SPEED PLAYER AND P.U.

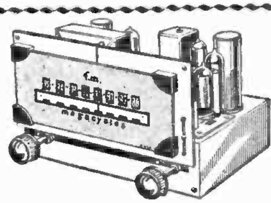


Heavy 8¾in. metal turntable. Low flutter performance 200/250V shaded motor with tap at 80V for amplifier valve filament if required. Turnover LP/78 head.

PRICE 89/6
Plus 4/6 P. & P.

BUILD THIS F.M. TUNER

F.M. UNIT MARK II



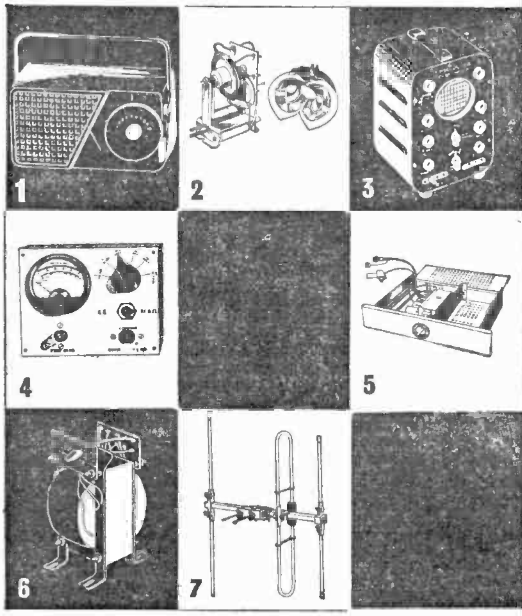
We proudly announce our MKII F.M. Tuner. This equipment combines quality (only specially selected top grade components are used) with simplicity of construction. The refinements provided, and the performance achieved are equal to many commercial models at twice the price. The completed tuner is supplied with an attractive metal front panel, finished in a choice of black crackle, glossy hammer green, or glossy hammer grey enamel.
★ F.M. Tuning Head by famous maker. ★ Guaranteed Non-drift. ★ Permeability Tuning. ★Frequency coverage 88-100 Mc/s. ★ OA81 Balanced Diode Output. ★ Magic eye tuning. ★ Smart front panel. ★ Two I.F. Stages and Discriminator. ★ Attractive maroon and gold dial (7 x 3in. glass). ★ Self-powered, using a good quality mains transformer and valve rectifier. ★ Valves used ECC85, two EF80's. EZ80 (rectifier) and magic eye. ★ Fully drilled chassis. ★ Everything supplied, down to the last nut and bolt. ★ All parts sold separately. Circuit diagram and illustrations, 1/6, post free.

£6.12.6 P. & P. 10/-

A FEW ONLY MARK I UNITS As previously advertised available **£4.19.6** Plus 8/6. P. & P.

Metal case (with front panel as fitted to Mk II unit) available for Mk I owners, 25/-, P.P. 1/9. (Front panel only 10/6, P. & P. 9d.)

CHECK with these BARGAINS



1. 3-TRANSISTOR POCKET RADIO with MINIATURE SPEAKER, FERRITE ROD. and 2 GERMANIUM DIODES. The only 3 transistor radio available at the price. Build it in 1 evening! Tunable over M/L waves. Complete with easy-to-follow instructions and all components (less batteries obtainable anywhere 1/3). 27/6. P. & P. 2/6. (All parts available separately.)
2. LINE E.H.T. TRANSFORMERS. Built-in line width control. 14kV. Scan coil, 90in. deflection on ferrite yokes. Frame O.P. transformer pl. 18kV smoothing condenser, suitable for 14in., 17in. or 21in. tubes. With circuit diagram. 29/6 plus 4/6 P. & P. As above, but for 625 lines, £2.10.0, plus 4/6 P. & P. Suitable Focus Magnet (state tube), 10/- plus 3/- P. & P.
3. OSCILLOSCOPE for D.C. and A.C. APPLICATIONS. A high gain extremely stable differential Y-amplifier (30 mV/C.M.). Provide ample sensitivity with A.C. or D.C. inputs. Especially suitable for measurements of transistor operating conditions where maintenance of D.C. levels is of paramount importance. Push-pull X amplifier: Fly-back suppression: Internal Time-base Scan Waveform available for external use: pulse output available for checking TV line O/P Transformers, etc. Provision for external—I/P and C.R.T. Brightness Modulation. A.C. mains 200/250 v. £15.15.0, P. & P. 8/- or 30/- deposit, plus P. & P. 8/- and 12 monthly payments of 26/6. FULL 12 MONTHS' GUARANTEE INCLUDING VALVES and TUBE.
4. A.C./D.C. POCKET MULTI-METER KIT. 2in. moving coil meter, scale calibrated in A.C./D.C. volts ohms and milliamps. Voltage range A.C./D.C. 0-50, 0-100, 0-250, 0-500. Milliamps 0-10, 0-100. Ohms range 0-10,000. Front panel, range switch, wirewound pot (for ohms zero setting), toggle switch, resistor and rectifier. 19/6. P. & P. 2/-. Wiring diagram 1/-, free with parts.
5. CHANNEL TUNER. Will tune to all Band I and Band III stations. Complete with P.C.C.84 and P.C.F.80 valves (in series) I.F. 16-19 or 33-38. Can be modified as an aerial converter (instructions supplied). 32/6, plus 4/- P. & P. HEATER TRANSFORMER to suit above. 200-250 v., 6/-. plus 2/- P. & P.
6. MAINS TRANSFORMERS. All with tapped primaries. 250-500 v. 70 mA 6.3 v. 2 amp. 10/6. P. & P. 3/-. 280-0-280v. 70mA 6.3v. 2A, 6.3v. 1A 10/6. P. & P. 3/-. 280-0-280 120mA 6.3v. 2A. 6.3v. 3A. 17/6. P. & P. 3/6.
7. WOLSEY 3-ELEMENT FOLDED DIPOLE. I.T.V. Aerial less mounting bracket for external use, complete with 12 yds. of coaxial cable. 15/-. P. & P. 4/-.
9. SIGNAL GENERATORS. Cash £6.19.6 or 25/- deposit and 6 monthly payments of 21/6, P. & P. 5/6. Coverage 100 kc/s to 100 Mc/s on fundamentals and 100 Mc's to 200 Mc's on harmonics. Case 10 x 6½ x 5½in. 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 millivolts. C.W. and mod. switch, variable A.F. output. Magic eye as output indicator. Accuracy ± 2 per cent.

10. SIGNAL GENERATORS. Cash £4.19.6. P. & P. 5/6. Coverage 120 kc/s to 84 Mc/s. Case 10 x 6½ x 4½in. Size of scale 6½ x 3½in. 2 valves and rectifier. A.C. mains 230-250 v. Internal modulation of 400 c.p.s. to a depth of 30 per cent, modulated or unmodulated R.F. output continuously variable 100 millivolts. C.W. and mod. switch variable A.F. output and moving coil output meter. Accuracy ± 2 per cent.

11. BATTERY RECORD PLAYER AND AMPLIFIER. 45 r.p.m. "Star" motor "Acos" crystal pick-up, 3 transistor push-pull amplifier complete with transistors. Output 500 milliwatts, 49/6. P. & P. 4/-.

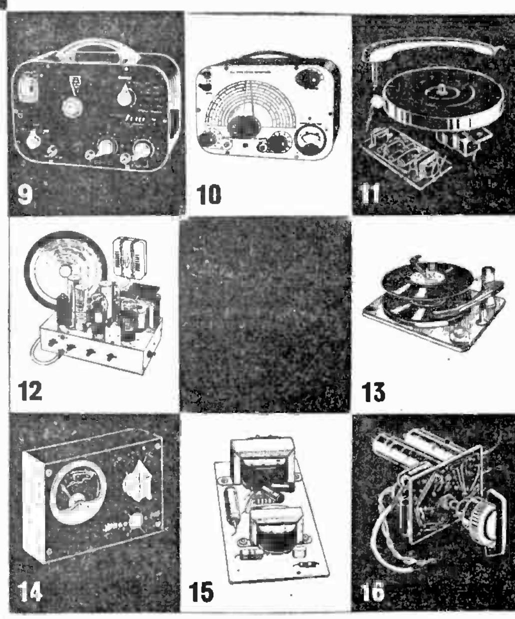
12. 8-watt PUSH-PULL 5 VALVE AMPLIFIER. A.C. mains 200-250 v. Size 10½ x 6½ x 2½in. 5 valves. For use with all makes and type of pick-up and mike. Negative feed back. Two inputs, make and gram. and controls for same. Separate controls for Bass and Treble lift. Response flat from 40 cycles to 15 kc/s. ± 2 db; 4 db down to 20 kc/s. Output 8 watts at 5 per cent total distortion. Noise level 40 db down all hum. Output transformer tapped for 3 and 15 ohms speech coils. For use with Std. or L.P. records musical instruments such as guitars, etc. Suitable for small halls, £3.19.6. P. & P. 6/-. Crystal mike to suit 15/-, P. & P. 2/-. 8in. P.M. Speaker to suit 12/6, P. & P, 2/-.

13. B.S.R. MONARCH UA8 WITH FUL-FI HEAD. 4-speed, plays 10 records, 12in., 10in., or 7in. at 16, 33. 45 or 78 r.p.m. Intermixes 7in., 10in. and 12in. records of the same speed. Has manual play position; colour, brown. Dimensions: 12½ x 10¾in. Space required above baseboard 4¾in. below baseboard 2¾in. Fitted with Full-Fi turnover crystal head. £6.19.6. P. & P. 5/6 With Stereo Head £7.19.6. P. & P. 5/6.

14. TRANSISTOR TESTER. For both P.N.P. and N.P.N. transistors incorporating moving coil meter. In metal case, size 4½ x 3¾ x 1¼in. Scale marked in gain and leakage. 19/6. P. & P. 3/-.

15. PUSH-PULL OUTPUT STAGE inclusive of transistors with input and output transformers to match 3 ohms speech coil, suitable for use with the POCKET RADIO. Kit of parts, including transistors. 19/6. P. & P. 2/-. Wiring diagram 1/6, free with parts.

16. PORTABLE AMPLIFIER. On printed circuit for A.C. Mains 200/250 v. Size 4 x 3in. with tone and volume control. Complete with Valves: ECL82 and EZ80. Output 2 watts. 39/6, P. & P. 3/-.



RADIO & T.V. COMPONENTS (Acton) LTD.

23B HIGH STREET, ACTON LONDON, W.3.

ALL ENQUIRIES S.A.E.
GOODS NOT DISPATCHED OUTSIDE U.K.

R.S.C. HI-FI TAPE RECORDER KIT

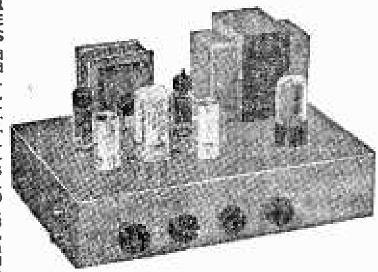
REALISM AT INCREDIBLY LOW COST, CAN BE ASSEMBLED IN HALF AN HOUR
The Recorder incorporates the Latest Collaro Studio Tape Transcriptor. The Linear LT45X High Quality Tape Amplifier listed £12.12.0 High Flux P.M. Speaker listed 30/-, empty Tape Spool, a Reel of Best quality Tape listed 22/6, and a Handsome Portable carrying Cabinet with latest attractive two-tone polychrome finish, size 18 x 13 x 9in. high, listed £4.10.0, and circuit. Total cost if purchased individually approximately £40. Performance equal to units in the £60-£80 class. S.A.E. for leaflet.

25½ GNS.
Carr. 17/6

H.P. TERMS. Deposit £5.7.6 and 12 monthly payments of 2 gns. Cash price if settled in 3 months.

HIGH FIDELITY 12-14 WATT AMPLIFIER TYPE A11

PUSH-PULL ULTRA LINEAR OUTPUT "BUILT-IN" TONE CONTROL PRE-AMP STAGES



Two input sockets with associated controls allow mixing of "mike" and gram, as in A10. High sensitivity. Includes 5 valves, ECC83, ECC83, EL84, EL84, 5Y3. 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 + 3 D.B. 30-30,000 c/s. Six negative feedback loops. Hum level 60 D.B. down. ONLY 23 millivolts INPUT required for FULL OUTPUT. Suitable for use with all makes and types of pick-ups and 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. 30 mA. and 6.3 v. 1.5 a. For supply of a **RADIO FEEDER UNIT.** Size approx. 12-9-7in. For A.C. mains 200-250 v. 50 c.p.s. Output for 3 and 15 ohms speakers. Kit is complete to last nut. Chassis is fully punched. Full instructions and point-to-point wiring diagrams supplied. Only **8 Gns.** Carr. 10/-
(Or factory built 51/- extra).
If required louvred metal cover with 2 carrying handles can be supplied for **18/9. TERMS ON ASSEMBLED UNITS. DEPOSIT 24/9, and 9 monthly payments of 24/9.** Send S.A.E. for illustrated leaflet detailing Ready-to-assemble Cabinets, Speakers, Microphones, etc., with cash and credit terms.

R.S.C. STEREO/TEN HIGH QUALITY AMPLIFIER

A complete set of parts for the construction of a stereophonic amplifier giving 5 watts high quality output on each channel (total 10 watts). Sensitivity is 50 millivolts, suitable for all crystal stereo heads. Ganged Bass and Treble Control give equal variation of "lift" and "cut". Provision is made for use as straight (monaural) 10 watt amplifier. Valve line-up ECC83, ECC83, EL84, EZ81. Outputs for 2-3 ohm speakers. Point-to-Point wiring diagrams and instructions supplied. Send S.A.E. for leaflet. **8 Gns.**
Full constructional details and price list 2/6. Carr. 10/-.
Kit can be supplied assembled, ready for use, for 59/6 extra.

BRADMATIC RECORDING HEADS. High Impedance Record/Playback **22/-.** Low Impedance Erase, 12/6.

TELEVISION RECTIFIERS 250 v. 200 mA, small size. Only **6/9** each.

COLLARO CONQUEST 4-SPEED AUTO-CHANGER, with high fidelity Studio pick-up. Latest model. For 200-250 v. 50 c.p.s. A.C. mains. Our price **£6.19.6.** Carr. 5/6.

COLLARO RC 457 4 SPEED MIXER AUTO-CHANGERS. Turnover Studio Pick-up head, for 200-250 v. A.C. **£7.19.6.** Carr. 4/6.

THE SKYFOUR T.R.F. RECEIVER. A design of a 3 valve long and medium wave 200-250 v. A.C. Mains receiver with selenium rectifier. High gain H.F. stage and low distortion detector. Valve line-up 6K7, SP61, 6V6G. Selectivity and quality excellent. Simple to construct. Point-to-Point wiring diagrams, instructions and parts list, **1/9,** maximum building costs **£4.19.6.** inc. attractive Walnut veneered wood cabinet 12 x 6½ x 5½in.

GL3A MINIATURE 2-3 WATT GRAM AMPLIFIER. For use with any single or auto-change unit. Output for 2-3 ohm speaker. For 200-250 v. A.C. mains. Size 11½ x 2½ x 2½in. Controls: Vol. and Tone with switch. Only **59/6.**

R.S.C. BATTERY CHARGING EQUIPMENT

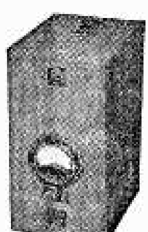
All for A.C. Mains 200-.250v., 50ccs. Guaranteed 12 months.

HEAVY DUTY CHARGER KIT 6/12 v. 6 amps. variable output. Consisting of Mains Transformer 0-200-230-250 v.: F.W. (Bridge) Selenium Rectifier: Ammeter, Variable Charge Rate Selector Panels, Plugs, Fuses, Fuseholder and circuit. **59/6.** Carr. 4/6.

DEAF AID EARPIECES. Low Impedance with lead, **8/9.** High Impedance Crystal **8/9.**

MICROPHONE INSERTS. Crystal type **6/9.**

SOLDERING IRONS. 230-250 v. 30 watts. First quality. For Radio work, **19/9.** Spare elements and bits available.



Assembled 6/12v. 4-5 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 finished. Fused and ready for use with mains and output leads. **69/9** Carr. 5/-
Terms: Deposit **13/3** and 5 monthly payments 13/3. 6/12 v. 3-4a., all facilities as above. Only **59/9,** carr. 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. Carr. 3/9
Only **49/9**

BATTERY CHARGER KITS Consisting of Mains Transformer. F.W. Bridge, Metal Rectifier, well ventilated steel case. Fuses. Fuse-holders. Grommets, panels and circuit. Carr. 3/6 extra.
6v. or 12v. 1 amp.......... **24/9**
As above, with Ammeters **32/9**
6 v. 2 amps............... **25/9**
6v. or 12v. 2 amps......... **31/6**
6 v. or 12 v. 2 amps. inclusive of Ammeter........ **42/9**
6 v. or 12 v. 4 amps......... **49/9**
6 v. or 12 v. 4 amps. with Ammeter and variable charge rate selector **59/9**

CHARGER AMMETERS. 0-1.5 a., 0-3 a., 0-4 a., 0-7 a., 0-25 a., 0-60 a. **8/9.**

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 .. **17/9**
350-0-350 v. 80 mA, 6.3 v. 2 a, 5 v. 2a .. **18/9**
250-0-250 v. 100 mA, 6.3 v. 2 a, 6.3 v, 1 a **21/9**
250-0-250 v. 100 mA, 6.3 v. 3.5 a. C.T. .. **19/9**
250-0-250 v. 100 mA, 6.3 v. 4 a, 5 v. 3 a .. **25/9**
300-0-300 v. 130 mA, 6.3 v. 4 a, 6.3 v. 1 a, for Mullard 510 Amplifier **29/9**
300-0-300 v. 100 mA, 6.3 v. 4 a, 5 v. 3 a .. **26/9**
350-0-350 v. 100 mA, 6.3 v. 4 a, 5 v. 3 a .. **26/9**
350-0-350 v. 100 mA, 6.3 v. 4 v. 4 a, C.T. 0-4-5 v. 3 a **26/9**
350-0-350 v. 150 mA, 6.3 v. 4 a, 5 v. 3 a .. **29/9**

FULLY SHROUDED UPRIGHT
250-250 v. 60 mA, 6.3 v. 2 a. 0-5-6.3v. 2a, Midget type 2½-3-3½n. **17/11**
250-0-250 v. 100 mA, 6.3 v. 4 a, 5 v. 3 a .. **27/9**
300-0-300 v. 100 mA, 6.3 v. 4 a, 5 v. 3 a **27/11**
350-0-350 v. 100 mA, 6.3 v. 4 a, 5 v. 3 a **27/11**
350-0-350 v. 150 mA, 6.3 v. 4 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 **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. 1.5 a twice, **17/6.**

OUTPUT TRANSFORMERS
Midget Battery Pentode 66:1 for 3S4, etc. **3/9**
Small Pentode, 5000Ω to 3Ω **3/9**
Small Pentode 7/8,000Ω to 3Ω .. **3/9**
Standard Pentode 5,000Ω to 3Ω .. **5/9**
Standard Pentode 7/8,000 to 3Ω .. **5/9**
10,000Ω to 3Ω **5/9**
Push-Pull 8 watts, EL84, or 6V6 to 3Ω or matched to 15Ω **9/9**
Push-Pull 10-12 watts to match 6V6 or EL84 to 3-5-8 or 15Ω **19/9**
Following types for 3 and 15Ω speakers:
Push-Pull 10-12 watts 6V6 or EL84 .. **18/9**
Push-Pull 15-18 watts, 6L6, KT66 .. **22/9**
Push-Pull for Mullard 510 Ultra Linear **29/9**
Push-Pull 20 watts, sectionally wound, 6L6, KT66, 807 etc. **49/9**

MIDGET MAINS
Primaries 200-250 v. 50 c/s.
250 v. 60 mA, 6.3 v. 2 a **11/9**
250-0-250 v. 60 mA, 6.3 v. 2 a. **12/9**
Both above size 2¾ x 2¾ x 2¼ins.

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

PARMEKO POTTED TYPES
200 mA, 12 H 100 ohms **16/9**
120 mA, 30 H 200 ohms **16/9**
120 mA, 8 H 50 ohms **13/9**

CHARGER TRANSFORMERS
All with 200-230-250 v. 50 c/s Primaries: 0-9-15 v. 1½ a, **11/9**; 0-9-15 v. 2 a, **14/9**; 0-9-15 v. 3 a, **16/9**; 0-9-15 v. 5 a, **19/9**; 0-9-15 v. 6 a, **23/9**; 0-9-15 v. 8 a, **28/9.**

AUTO (Step up/Step down) TRANS: 0-110/120-230/250 v. 50-80 watts, **13/9.** 250 watts **39/9** v. 150 watts, **27/9.**

MICROPHONE TRANSFORMERS
120:1 high grade, clamped, **6/9**; 120:1 Potted, Mu-metal screened, **9/9.**

R.S.C. (Manchester) Ltd. HULL, LIVERPOOL, LEEDS, BRADFORD, MANCHESTER

R.S.C. A12 STEREOPHONIC AMPLIFIER KIT WITH TWIN SPEAKERS

A complete set of parts to construct a good quality Stereo amplifier with an undistorted output total 6 watts. For A.C. mains input of 200-250 v. Outputs for matched 2-3 ohm speakers. Sensitivity 130 m.v. Ganged Vol. and Tone Controls. Preset balance control. Full instructions and point-to-point wiring diagrams supplied.

4 Gns. Carr. and pkg. 5/-

STEREO EQUIPMENT OFFER- Comprising A12 Kit. 2 matched 8in. L/Speakers, and Acos T/O Stereo head suitable most pickups. **£6.19.6** Carr. 7/6.

PICK-UP ARMS complete with Hi-Fi turnover crystal head. Acos GP54. Limited number brand new, perfect at approx. half price. Only **29/11.**

ACOS CRYSTAL MICROPHONES. Mic40 stand or desk. Listed 35/-. Only **27/9.** 39-1 Stick type. Listed 3 gns. Only **39/6.**

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/cs. 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 perforated cover with carrying handles can be supplied for **19/9.** The amplifier can be supplied, factory built with EL34 output valves and 12 months guarantee, for **14 Gns.**

11 Gns. Carr. 10/-

TERMS: DEPOSIT 33/9 and 9 monthly payments of **33/9.**
Suitable microphones and speakers available at competitive prices.

FULL RANGE OF LINEAR AMPLIFIERS ALWAYS IN STOCK.

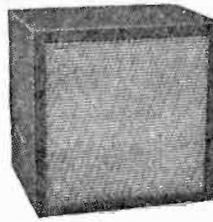
COLLARO JUNIOR 4-speed single player units and Hi-Fi crystal pick-up with turn-over head, **£3.19.6.**

B.S.R. UA8 4-SPEED AUTO-CHANGERS with Hi-fi turnover pick-up head. **£6.19.6.** Carr. 5/-.

Jason FMTI V.H.F/FM Radio Tuner design. Total cost of parts including valves, Tuning dial, Escutcheon, etc. **£6.19.6.**

LINEAR L45 MINIATURE 4/5 WATT QUALITY AMPLIFIER. Suitable for use with any record playing unit, and most microphones. Negative feed-back 12db. 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 7-5-5½in. high. Guaranteed for 12 months. Only **£5.19.6.** Send S.A.E. for illustrated leaflet. Terms: Deposit **22/6** and 5 monthly payments of **22/6.**

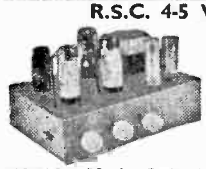
12in. 10 WATT HIGH QUALITY LOUD-SPEAKER IN POLISHED WALNUT FINISHED CABINET



Gauss 12,000 lines. Speech coil 3 ohms or 15 ohms. Only **£4.19.6** Carr. 5/-. Terms: Deposit **11/3** and 9 monthly payments of **11/3.**

12in. 20 WATT HI-FI LOUD-SPEAKERS IN CABINETS. Size 18 x 18 x 10in. Finish as above. Terms: Deposit **17/9** and 9 monthly payments of **17/9.** Only **£7.19.6.** Carr. 8/6.

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 71db. down 15db. of Negative feedback is used. H.T. or 300 v. 25 mA. and L.T. or 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/s. Output for 2-3 ohm 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 £4.15.0. or assembled ready for use 25/- extra, plus 3/6 carr.; or Deposit 22/6 and 5 monthly payments of 22/6 for assembed unit.

R.S.C. PORTABLE GUITAR AMPLIFIERS. (For 200-250v. A.C. Mains)

Junior 5 watts High Quality output. Separate Bass and Treble "Cut" and "Boost" controls. Sensitivity 15 m.v., Twin inputs. High Flux 8in. Loudspeaker "built-in". Handsome, strongly made Cabinet (size approx. 14 x 14 x 7in.) finished in attractive and durable policrome, and fitted carrying handle. Terms. Deposit £1 and 9 monthly payments of £1. **£8.19.6** Carr. 10/-

Senior 10 watts High Fidelity output Separate Bass and Treble "Cut" and "Boost" controls. Twin separately controlled high gain inputs so that two instruments such as Guitar and String Bass can be used at the same time. Two loudspeakers are incorporated, a high Flux 12in. for Bass notes and a 7 x 4 m. elliptical for Treble, Cabinet is well made and finished as Junior model. Size approx. 18 x 18 x 9in. H.P. Terms. Deposit 34/9 and 9 monthly payments of **34/9.** Carr. 10/-. **15 Gns.**

Super Hi-Fi 15 Watt. All facilities as 10 watt. Cabinet size 18x 18 x 10ins. Terms: Deposit **£2.11.6.** and nine monthly payments of **51/6. Cash 22 gns.** Carr. 12/6.

R.S.C. BASS REFLEX CABINETS, JUNIOR MODEL. Specially designed for W.B. HF1012 Speaker, but suitable for any good quality 10in. speaker. Acoustically lined and ported. Polished walnut veneer finish. Size 18 x 12 x 10in. Handsome appearance. Ensure superb reproduction for only **£3.19.6.**

STANDARD MODEL. As above but for 12in. speakers. Size 20 x 15 x 13in. Especially recommended for Plessey Dual Concentric Speaker, **£5.19.6.** Suitable legs with brass ferrules. 25/- per set of 4.

PLESSEY DUAL CONCENTRIC 12in. 15 ohms HIGH FIDELITY SPEAKER (12,000 lines) with built-in tweeter (completely separate elliptical speaker with choke, condensers, etc.) providing extraordinarily realistic reproduction when used with our All or similar amplifier. Rated 10 watts. Price only **£5.19.6.**

P.M. SPEAKERS. 2-3 ohm. 2½in. Perdio **21/9.** 5in., **17/9.** 6½in., **16/9.** 8in., **19/9.** 8 x 5in. **25/9.** 10in. **26/9.** 10 x 6in. **29/9.** 12in. **29/11.** 10in. W.B. "Stentorian" 3 or 15 ohms type HF1012 10 watts, hi-fidelity type. Recommended for use with our All Amplifier. **£4.12.9.** 12in. R.A. 3 ohms 10 watts (12,000 lines), **59/6.**

TWEETERS. Plessey 3Ω **19/9.** 15Ω **25/9.**

HI-FI CRYSTAL PICK-UP HEADS. (Turnover type with sapphire stylus.) Acos. Standard replacement for Garrard B.S.R. and Collaro. **19/9.** Acos. Stereo-Monaural **49/9.** Ronette Stereo/Monaural **59/6.**

R.S.C. EQUIPMENT CABINET. Dimensions and outer appearance identical with Standard Bass Reflex Cabinet. Top hinged. Bass board adjustable. Will take Tape Deck or Player Unit, and Amplifier plus F.M. or A.M./F.M. Unit. Only **6 gns.**

SUPERHET FEEDER UNIT. Design of a high quality Radio Tuner Unit (specially suitable for use with any or our Amplifiers). Delayed A.V/C. 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, instructions and priced parts list with illustration. **2/6.** Total building cost **£4.15.0.** For leaflet send S.A.E.

R.S.C. BATTERY TO MAINS CONVERSION UNITS

Type BM1. An all-dry battery eliminator. Size 5½ x 4½ x 2in. approx. Completely replaces battery supplying 1.4 v. and 90 v. where A.C. mains 200-250v. 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.**

LINEAR TAPE PRE-AMPLIFIER Type LP/1. Switched Negative feedback equalisation. Positions for Record in. 3¾in., 7½in. and Playback, EM84 Recording Level Indicator. Designed primarily as the link between a Collaro Tape Transcriptor and a high fidelity amplifier, but suitable for almost any Tape Deck. Only 9 gns. S.A.E. for leaflet.

TERMS: C.W.O. or C.O.D. No C.O.D. under £1. Post 1/9 extra under £2. 3/3 extra under £5. Open 9 to 6. Weds. until 1 p.m., except Manchester open all week. Trade supplied. S.A.E. with all enquiries.

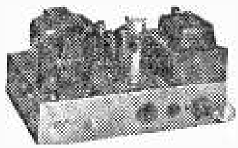
R.S.C. (M/C) Ltd. Mail Orders to 29-31 Moorfield Road, Leeds 12. Personal Shoppers to any of branches below—

51 Savile St., Hull | 73 Dale Street, Liverpool 2 | 5-7 County (Mecca) Arcade, Briggate, Leeds 1 | 8-10 Brown St. (Market St.), Manchester 2 | 56 Morley Street, (Above Alhambra Theatre). Bradford

STERN'S MULLARD DESIGNS

Designed by MULLARD—presented by STERN's strictly to specification

COMPLETE KIT OF PARTS
MULLARD "5-10" MAIN AMPLIFIER

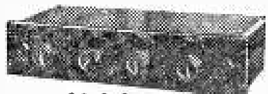


For use with the MULLARD 2-valve pre-amplifier with which undistorted power output of up to 10 watts is obtained. We supply SPECIFIED COMPONENTS AND NEW MULLARD VALVES, including PARMEKO MAINS TRANSFORMER and choice of the latest Ultra-Linear PARMEKO or the PARTRIDGE Output Transformer.

COMPLETE KIT OF PARTS (PARMEKO Output Trans.). **£10.0.0**

Alternatively we supply ASSEMBLED and TESTED. **£11.10.0** INCORPORATING PARTRIDGE OUTPUT TRANSFORMER, £1.6.0 EXTRA.

MULLARD'S PREAMPLIFIER TONE CONTROL UNIT



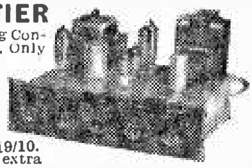
Employing two EF86 valves, and designed to operate with the MULLARD MAIN AMPLIFIERS, but also perfectly suitable for other makes.

PRICE COMPLETE KITS OF PARTS **£6.6.0** ASSEMBLED AND TESTED **£8.0.0**

Supplied strictly to MULLARD'S SPECIFICATION and incorporating:

- Equalisation for the latest R.I.A.A. characteristics.
- Input for Crystal Pick-ups, and variable reluctance magnetic types.
- Input (a) Direct from High Imp. Tape Head. (b) From a Tape Amplifier or Pre-Amplifier.
- Sensitive Microphone Channel.
- Wide range BASS and TREBLE Controls.

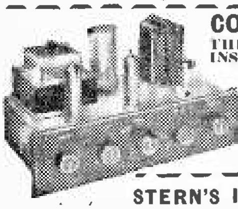
COMPLETE MULLARD "5-10" AMPLIFIER



The popular and very successful complete "5-10" incorporating Control Unit providing up to 10 watts high quality reproduction. Only Specified Components and new MULLARD VALVES are supplied including PARMEKO MAINS TRANSFORMERS and choice of the latest PARMEKO or PARTRIDGE ULTRA-Linear Output Transformers.

KIT OF PARTS **£11.10.0** OR ASSEMBLED and TESTED **£13.10.0**

H.P. Dep. £2.6.0, 12 months at 17/-. Dep. £2.14.0 12 months at 19/10.
ABOVE incorporating PARTRIDGE OUTPUT TRANS. £1.6.0 extra



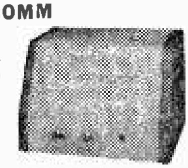
COMPLETE MULLARD "3-3"

THE IDEAL AMPLIFIER FOR A SMALL HIGH QUALITY INSTALLATION PROVIDING EXCELLENT REPRODUCTION OF UP TO 3 WATTS OUTPUT

COMPLETE KIT OF PARTS **£7.10.0** OR ASSEMBLED and TESTED **£8.19.6**

(plus 6/6 carriage and insurance) H.P. Terms: Deposit £2.0.0 and 8 months at £1.0.0. Complete to MULLARD'S SPECIFICATION including Mullard valves and a PARMEKO OUTPUT TRANSFORMER.

STERN'S INTER-COMM BABY ALARM



A small versatile Unit employing the new MULLARD ECL86 valve and designed to provide two (or three) way conversation up to extreme distances. Operates from A.C. mains 200 to 250 Volts.

PRICES . . . MASTER UNIT and ONE EXTENSION

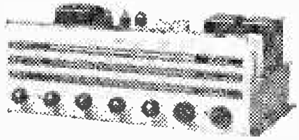
KIT OF PARTS **£6.17.6** ASSEMBLED AND TESTED **£8.0.0**

Consists of a MASTER UNIT, size only 8¾ x 5¾ x 6in. and ONE EXTENSION (a second extension may be added to any time). The Master Unit incorporates switching and power supply and with the chassis completely isolated from the mains is operated in absolute safety. Cases covered in quality leatherette.

ARMSTRONG RADIOGRAM CHASSIS

FULL RANGE IN STOCK, please enclose S.A.E. for leaflets.

STEREO 12 (MK. 2) (Illustrated)



£44.15.0

Deposit £9.0.0, 12 months at £3.5.7

The most complete chassis ever produced, combines AM and FM Tuners, a Stereo Control Unit and two High Fidelity Amplifiers in one compact unit, provide a total of 16 watts for both mono and stereo. Other features include: inputs for tape recording, play back, pick-ups and stereo radio (should this come about); separate wide range bass and treble controls and balance control.

STEREO 55 **£33.15.0**

Deposit £6.15.0, 12 months at £2.9.6

A junior version of the Stereo 12 Mk. 2 providing ten watts output, five watts from each amplifier and covering the VHF and Medium wavebands.

COMBINED ORDER PRICE REDUCTIONS

(a) The KIT OF PARTS to build both the "5-10" Main Amplifier and the 2-valve PRE-AMP CONTROL UNIT H.P. Dep. £3.7.0 and 12 months at £1.2.9.......... **£15.15.0**

(b) The "5-10" and the 2-stage PRE-AMP both ASSEMBLED and TESTED H.P. Dep. £3.16.0 and 12 months of £1.7.8.......... **£18.18.0**

With Partridge O/put Transformer £1.6.0 extra.

RECORD PLAYERS

The Latest Models are in stock, many at reduced prices.

Send S.A.E. For Illustrated Leaflet.

THE NEW GARRARD "AUTO-SLIM" 4-speed Autochanger with Crystal Pick-up **£8.10.0**

COLLARO "JUNIOR" 4 SPEED SINGLE RECORD PLAYER with separate Crystal Pick-up Carriage and Insurance 5/- **£3.15.0**

Above Pick-up separately for £1.6.6

The NEW COLLARO C60 4-speed Autochanger unit with Studio "O" Pick-up...... **£7.19.6**

The E.M.I. 4-speed Single Record Player with crystal Pick-up **£6.9.6**

B.S.R. MODEL UA14. A 4-speed mixer Autochanger with Crystal Pick-up **£7.10.0**

Available incorporating the B.S.R. STEREO Pick-up, plays L.P. and 78 Records **£8.13.10**

GARRARD MODEL TA/MkII 4-speed Player fitted high output Crystal Pick-up.. **£8.10.0**

GARRARD MODEL RC209. Autochanger 4-speeds. High output. Crystal Pick-up.. **£9.19.6**

Carriage and Insurance on each above 5/- extra.

SPECIAL CASH 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 Mushroom 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) 6½in. P.M. SPEAKER 18/9. Carriage and Insurance 4/- extra.

MULLARD FOUR CHANNEL MIXER UNIT

Self powered with Cathode follower output. Incorporates Two inputs for MICROPHONES One for CRYSTAL PICK UP and a fourth for RADIO or TAPE

Complete Kit of Parts **£8.8.0**

Assembled and Tested **£10.0.0**

TERMS: Deposit £2 and 12 months at 15/-.

MODEL I.L. one microphone input matched for moving coil or Ribbon Mike. £1.17.0 extra.

JUBILEE MK. 2 £31.15.0

Deposit £6.7.0 12 months at £2.6.7

A Hi-Fi mono chassis giving eight watts push-pull output and covering VHF, medium and long bands. Tape recording and play back inputs.

AF208 £23.15.0

Deposit £4.15.0 12 months at £1.14.10

An AM/FM chassis providing 5 watts output and covering the full VHF and medium wavebands. Tape recording and playback inputs.

STERN RADIO LTD.

Dept. P.W. 109 FLEET ST., LONDON, E.C.4

Telephone: FLEET STREET 5812/3/4

ALPHA Valves by return post

AZ1	10/-	FC13	5/6	VR105/30	8/-	6SK7	6/-
AZ31	10/-	FW4/500		VR150/30	7/6	6SL7GT	8/-
DAF96	8/-		10/-	VU39 (MU		6SN7GT	7/6
DF96	8/-	GZ32	11/6	12/14)	8/9	6SQ7	9/3
DK96	8/-	HL23DD	8/6	Y63	7/6	6U4GT	12/-
DL96	8/-	HL42DD		1A7GT	13/6	6V6G	5/-
EABC80	9/-		10/-	1C2	11/6	6V6GT	7/9
EAF42	9/6	KT2	5/-	1C5GT	12/6	6X4	7/6
EB91	4/6	KT33C	6/-	1H5GT	9/-	6X5G	7/-
EBC33	6/9	KT61	10/-	1N5	10/6	6X5GT	7/-
EBC41	8/9	KT101	6/-	1R5	7/6	6/30L2	12/6
EBC90	8/6	KTW61	6/6	1S5	6/6	7B6	10/6
EBC91	8/6	OZ4	4/6	1T4	5/6	7B7	8/6
EBF80	9/9	PCC84	12/-	3D6	5/-	7C5	8/-
EBF83	13/11	PCC85	8/6	3Q4	7/6	7C6	8/-
EBF89	9/6	PCF80	8/9	3Q5GT	9/6	7H7	8/-
EBL21	23/3	PCF82	11/6	3S4	7/6	7S7	9/6
EBL31	23/3	PCL83	13/6	3V4	8/-	7Y4	6/6
EC90	4/6	PCL84	10/-	4D1	3/-	10F1	12/6
EC91	15/11	PL36	13/6	5R4GY	9/6	10P13	22/3
ECC81	8/-	PL81	11/-	SU4G	5/-	12A6	5/-
ECC82	7/6	PL82	8/6	5V4	11/6	12AH8	12/-
ECC83	9/-	PL83	9/6	5Y3G	8/-	12AT7	7/6
ECC84	10/-	PL84	9/6	5Y3GT	7/6	12AU7	8/-
ECC85	9/6	PX25	12/6	5Z4G	9/-	12AX7	8/-
ECF80	12/-	PY80	7/6	6A7	10/-	12BA6	9/-
ECF82	10/6	PY81	8/6	6A8G	9/-	12BE6	9/-
ECH42	9/6	PY82	7/-	6AK5	5/-	12C8	7/-
ECH81	9/-	PY83	8/6	6AL5	4/-	12J7GT	10/6
ECL80	9/6	PEN4VA		6AM5	7/6	12K7GT	6/6
ECL82	10/6		10/-	6AM6	4/-	12K8GT	13/6
ECL83	15/-	PEN25	5/-	6AQ5	7/6	12K8M	13/-
EF36	3/6	PEN45	8/-	6AT6	8/6	12Q7GT	6/6
EF41	9/6	SP4	5/-	6BA6	7/6	12SK7	6/-
EF50	5/-	TH21C	9/-	6BE6	7/6	12SL7	8/-
EF50SYL	7/-	TP22	8/-	6BH6	9/-	12SN7GT	
EF80	7/-	U10	9/6	6BJ6	9/-		10/-
EF85	7/-	U25	13/6	6BW6	9/-	15D2	7/9
EF86	12/6	U26	12/-	6C4	4/6	25A6G	8/-
EF89	8/9	U50	8/-	6C5GT	6/-	25L6GT	10/-
EF91	5/9	UABC80	9/-	6C6	5/6	25Z4	9/6
EF91(BVA)		UAF42	9/6	6D6	5/-	25Z5	7/-
	7/6	UBC41	8/6	6CH6	7/6	25Z6	10/-
EF92	6/-	UBC81	11/4	6F6G	7/-	30FL1	10/6
EF183	18/7	UBF80	9/-	6F6M	7/6	30L15	23/3
EF184	15/-	UCC84	10/11	6J5GT	5/-	30P4	15/-
EK32	7/-	UCC85	9/6	6J5M	6/6	30P12	12/6
EL33	10/-	UCH42	9/6	6J6	4/-	30PL1	12/6
EL41	9/-	UCH81	9/6	6J7G	6/6	35Z3	12/6
EL84	9/-	UCL82	11/6	6K7G	3/6	36L6GT	10/-
EL91	4/6	UCL83	13/6	6K7M	6/9	25Y5	9/-
EM34	9/6	UF85	9/-	6K8G	6/6	35Z4GT	8/-
EM80	9/6	UF89	9/-	6K7GT	5/9	42	8/-
EM81	10/6	UL41	9/-	6K8GT	10/-	35Z5GT	9/6
EY51	9/6	UL84	9/-	6L6G	8/-	50L6GT	8/6
EY86	10/-	UU6	19/3	6L6M	9/6	75	10/6
EZ40	7/6	UY1N	12/6	6L18	11/6	80	8/6
EZ41	7/6	UY41	6/6	6N7GT	7/6	142BT	3/6
EZ80	7/-	UY85	7/-	6Q7G	7/6	210DDT	4/6
EZ81	7/6	VP23	5/-	6Q7GT	9/6	210VPT	3/6

TRANSISTORS

V6/2R	9/3	XB102	7/6	OC44	11/-
OC45	10/-	OC70	6/6	OC71	6/6
OC72	8/-	OC73	16/-	OC75	8/-
OC77	15/-	OC78	8/-	OC81	8/-
OC84	11/-	OC170	13/6	OC171	14/6

GERMANIUM DIODES

OA70	3/-	OA73	3/-	OA79	3/9
OA81	3/-	OA85	3/-	OA91	3/6
OA95	3/6	CG6E	4/-	CG12E	4/-
GEX34	4/-	GD9	4/-	GD4	4/-

AUTOMATIC RECORD CHANGERS

BSR Monarch UA14.........£6.19.6
Collaro C60 Studio.........£7.19.6
Garrard Autoslim £8.19.6

SINGLE RECORD PLAYERS

E.M.I. 4 speed with pick-up £4.9.6
BSR Monarch GU6.........£4.19.6

METAL RECTIFIERS

Battery Charges Types, 12 volt. 2 amp 7/-, 3 amp 10/-, 4 amp 12/6, 5 amp 14/6.

CHASSIS

Aluminium, undrilled, all 2½in. deep, 6 x 4in. 4/6, 8 x 6in. 6/3, 10 x 7in., 7/3, 12 x 3in. 5/9, 12 x 5in. 6/9, 12 x 8in. 8/6, 14 x 3in. 6/-, 14 x 9in. 12/-, 16 x 6in. 9/3, 16 x 10in. 14/-.

LOUDSPEAKERS—ALL 3 OHM IMPEDANCE

Round Types—1¾in. 17/6, 2½in. 17/6, 5in. 15/-, 6½in. 16/6, 8in. 17/6, 12in. 29/6. Square Types—2½in. 18/6, 3in. 19/6, 4in. Tweeter 12/6. Elliptical Types—6 x 4in. 15/6, 7 x 4in. 15/6, 8 x 6in. 17/6, 10 x 6in. 21/-. We also have in stock TSL Lorenz LPH65 £1.17.8, WB HF812 £4.5.6, WB HF912 £4.10.6, WB HF1012 £5.2.6, 12in. RTC 15 ohms unit £5.5.0.

MICROPHONES

Acos Mic. 39/1. Stick Type 37/6. Table Stand for above 7/6. Floor Stand Adaptor 12/6. TSL Type M1 Dual Impedance Microphone with High (50,000 ohms) or Low (200 ohms) matching, 84/-. TSL Stick Microphone MX3 35/-. Acos Mic.40 19/6. Acos Mic.45 29/6. Microphone Model BM3 45/-. Table Stand to suit above 12/6.

CHASSIS CUTTERS

Type 1A, ⅝ x ¾in. 23/-; Type 2A, 1 x 1⅛in. 26/9; Type 3A, 1¼ x 1¼in. 27/3; Type 4A, 1¾ x 2in. 36/3.

EXTENSION LOUDSPEAKERS

Plastic covered cabinet, cream and grey, with 8in. unit and volume control, 37/6. As above, 5in. unit, without volume control, 27/6.

LOUDSPEAKER CABINETS

Baffle type, walnut finish, for 8in. units, 21/-; 10in. units, 25/6; 7 x 4in. units, 17/6.

MAINS DROPPING RESISTORS

For Ultra Twin 50, both types, 5/3 ea. For Philips 141U, 5/3 ea. For Pye Piper, 6/9 ea. For KB Rhapsody 7/6 ea.

TV DOUBLE POTENTIOMETERS

For Ekco T208, T209, etc., 13/6. For Bush TV53, 56, 57, etc., 13/6 ea. For Pye V14C, etc., 13/6.

RECORDING TAPE

5in reel, 600ft., Acetate,............13/6
5in. reel, 900ft., PVC..................21/-
7in. reel, 1200ft., Acetate 23/-
7in. reel, 1800ft., PVC...............37/6

RECORD PLAYER CASES

Baseboard cut suitable for a BSR UA14, available in red, turquoise, grey and black/yellow. 63/- ea.
Amplifier and Loudspeaker to suit above, 65/-.

MARTIN RECORDAKIT

**Kit for use with the Collaro Studio Deck. Amplifier assembled and tested with 5 BVA valves, controls, switches, transformers, knobs and full instructions. 3 watts output, Magic Eye indicator, separate volume controls for recording level and built-in loudspeaker. Input sockets for use with microphone radio and pick-up, etc. External speaker socket..................£11.11.0
This amplifier can be fitted into your own cabinet, or a smart two tone leatherette covered wooden case complete with 9 x 5in. high quality loudspeaker can be purchased for £5.5.0.
The Collaro Studio Deck, complete at £10.19.6.**

BLUE PRINTS AS ISSUED WITH "PRACTICAL WIRELESS". SEND STAMPED ADDRESSED ENVELOPE FOR DETAILED PRICE LISTS FOR MINI-AMP, CITIZEN, TUTOR.

MULTI-RANGE TEST METERS

Pifco All in One Radio Meter, 32/6.
Test Master Model 200H, 20,000 ohms per volt, £6.19.6.
Caby Model A10, £4.17.0.
Caby Model B20, £6.10.0.
Taylor Model 127A, £10.10.0.

TRANSISTOR KITS, ETC.

Alpha Kit, Six Transistor, 2 Waveband superhet, £10.19.6.
P.W. Printed Circuit Transistor Six, in the new cabinet, £7.19.6.
3 Valve TRF Kit, in contemporary wooden cabinet, £5.19.6.
Repanco 1 Valve Battery Receiver Kit, complete with headphones, battery, etc., 45/-.

CATALOGUE

OUR 1962 CATALOGUE IS NOW AVAILABLE. PLEASE SEND 1/- IN STAMPS FOR YOUR COPY. TRADE CATALOGUE ALSO AVAILABLE, FOR WHICH PLEASE ATTACH YOUR BUSINESS LETTER HEADING

ALPHA -RADIO SUPPLY CO.

**103 LEEDS TERRACE
WINTOUN STREET
LEEDS 7**

TERMS: Cash with Order or C.O.D. Postage and Packing Charges extra. Single valves 9d., Minimum Parcel Post charges 2/-. Please include sufficient postage with your order. Minimum C.O.D. fees and postage 3/6. These Postal Rates apply to U.K. only. For full terms of business see inside cover of catalogue. Personal shoppers 9 a.m. to 5 p.m. Mon. to Friday, Saturday 10 a.m. to 1 p.m.

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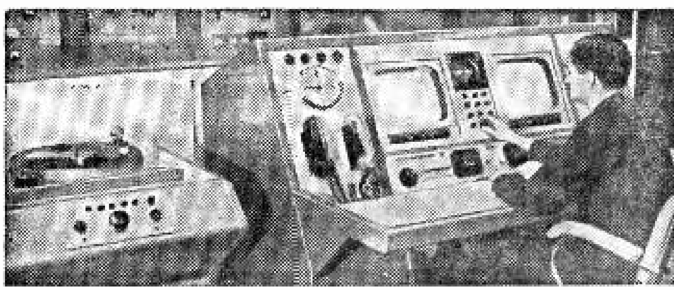
Practical Radio Courses

Gain a sound up-to-professional-standards knowledge of Radio and Television as you build **YOUR OWN** 4-valve T.R.F. and 5-valve superhet radio receiver, Signal Generator and High-quality Multimeter. At the end of the course you have three pieces of permanent and practical equipment and a fund of personal knowledge and skill. ICS Practical Radio courses open a new world to the keen Radio amateur.



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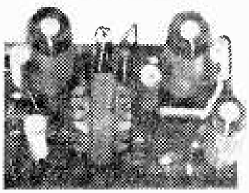
3.62

1½ WATT TRANSISTOR AMPLIFIER

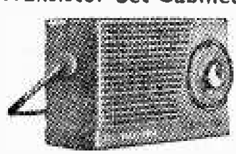


4 transistors including two in push-pull—input for crystal or magnetic microphone for pick-up—feed back loops—sensitivity 5 m/v—output 1½ watt peak into 35 ohm speaker. Speakers available. Price 62/6. Postage and Insurance 2/6.

Transistorised Stethoscope

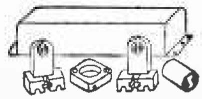
Trace signal right through, Radio, T.V., Tape amplifier: Hi-Fi, etc.—simplest way to fault-find—carry it like a fountain pen—all parts including transistor barrel crystal, everything except battery, 12/6 plus 1/6, data included or separately 1/6. Or complete with deaf aid type earphone, 20/-.

Transistor Set Cabinets



Very modern cream cabinet, size 5¼ x 3 x 1⅛in. with chrome handle, tuning knob and scale. Price 7/6, plus 1/6 postage and packing. Special quotations for quantities.

FLUORESCENT LIGHT BARGAIN



Kit of Parts comprising: choke, two lamp holders, starter holder and starter, 40 watt, 19/6; 80 watt, 23/6. Plus 2/- post and insurance.

THIS MONTH'S SNIP!

PHILCO STEREO RECORD PLAYER CABINET. A beautifully made fabric covered cabinet size 17 x 15 x 9½in., designed to take amplifier, autochanger and two speakers, top speaker being removable for stereo. Must have cost at least £4 each to make, available at the special snip price of 45/-, plus 5/- carriage and insurance.

SIMMERSTAT HEATER REGULATOR

Suitable to control elements, heaters, soldering irons and boiling rings up to 2,500 watts. Completely adjustable, normal price 55/- each, special snip price 12/6, plus 1/6 postage and insurance.

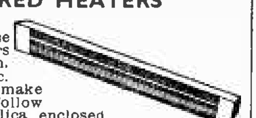
LIMITED QUANTITY ONLY!

Waterproof heater wire. 16 yds. length. 70 watts. Self regulating temperature control. 10/-. Post Free.

MAKING A CONVECTOR HEATER?

We can offer a copper clad element rated at 1,500 watts. 2ft. long, only 17/6, plus 2/6 postage. This heater can be controlled by the Simmerstat described on this page.

INFRA-RED HEATERS



Make up one of these latest type heaters ideal for bathroom, kitchen, bedroom, etc. They are simple to make from our easy to follow instructions—uses silica enclosed elements designed for the correct infra-red wavelength (3 microns). Price for 750 watt element and instructions 15/6, plus 2/6 post and insurance.

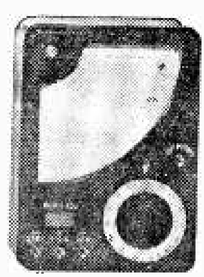
SUB-MINIATURE COMPONENTS

1. **Ferrite aerial** with Long and Medium Wave Coils, 4½in. long, for pocket superhet, complete with circuit showing component values, etc., 7/6.
2. **Ferrite aerial,** as above, but ⅜in. diameter, 8in. long, for table model receiver or portable. 10/6.
3. **Three I.F. Transformers** with oscillator coil and circuit details to work with item 1. 19/6.
4. **Three I.F. Coils** and oscillator to work with item 2. 23/6.
5. **Smallest possible electrolytics,** 1MFD, 2MFD, 4MFD, 6MFD, 8MFD, 10MFD, 20MFD, 30MFD, 50MFD, 100MFD, 200MFD, all 1/9 each.
6. **Smallest ¼ watt resistors,** all 10 per cent values, 5d. each.
7. **Miniature condensers,** .1, 1/-; .05, .04, .02, .01, all 8d. values, below this 7d.
8. **Miniature slide switch** double pole change over, 2/6.
9. **Edgewise volume controls,** 2K, 5K, 10K and 20K, 2/6 each.
10. **Small edgewise controls** with switch, 2K, 5K, 10K and 20K, 4/9 each.
11. **Red Spot Transistors,** tested and suitable all A.F. applications, 2/6.
12. **White Spot Transistors** tested and suitable as I.F. or mixer, 3/6.
13. **Set of six Mullard transistors** for superhet in original packets, fully guaranteed, comprising OC44, OC45, OC81D and matched pair OC81, £2 the set.
14. **Special sub-miniature diodes,** 1/6 each.
15. **Surface Barrier transistors,** 5-10 Mc/s, 6/6 each; 10-15 Mc/s, 8/- each; 20-30 Mc/s, 9/- each; 40-50 Mc/s, 15/- each.
16. **Push-Pull Driver and Push-Pull output transformers** for pocket superhets, 150 mW, 10/- pair; 400mW, 15/- pair; 750 mW (driver only, no o.t. needed), 8/6, all complete with circuit details.
17. **Smallest Tuning Condenser,** size approx. ⅞in. sq., 165pF and 65pF, with trimmers, 12/6 each.
18. **Oscillator coil** to suit the above, 6/-.
19. **Three I.F.s,** 455 k/c sub-miniature to suit items 17 and 18, 18/- the set.
20. **Jackson 00 2-gang tuning condensers,** 208pF plus 176 pm, spindle tapped 6BA, with trimmers, 10/6, less trimmers 9/6.
21. **Tuning condensers** for items 1 and 3, 9/6.
22. **Tuning condensers** for items 2 and 4, 10/6.
23. **Printed circuit** for items 1 and 3, 6/6.
24. **Printed circuit** for items 2 and 4, 7/6.
25. **2½in. speaker,** 3 ohm, 19/6; 80 ohm, 19/6.
26. **3in. speaker,** 3 ohm, 18/6; 80 ohm, 18/6.
27. **5in. speaker,** 3 ohm, 18/6; 35 ohm Hi flux, 19/6; 35 ohm Super Hi flux, 22/6.
28. **Elliptical speaker,** 7 x 4, 3 ohm, 19/6; 35 ohm, 19/6.
29. **Battery connectors,** large, 1/- pair; miniature, 1/- pair.

TRANSFILTERS

Save alignment problems and improve performance. Use instead of I.F. transformer. Complete with circuit 8/6 each

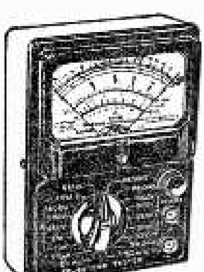
MULTI-METER BARGAINS!



MODEL 200H (Illus. on right). 20,000 ohms per volt, 20 ranges comprising AC volts, 5 ranges up to 1,000V D.C. volts, 6 ranges up to 2.5KV, DC current, 3 ranges up to 26 ohms, resistance, 2 ranges up to 6 meg. capacity 2 ranges up to .1, decibels —20 to +22. Scale cornerwise to the equivalent of 4 in. movement is a pocket size instrument measuring 4½ x 3½ x 1in. Complete with test prods, battery and operating instructions, price **£6.19.3,** post free.

MODEL EP10K. Similar in size and appearance to 200H except that this is 10,000 ohms per volt and maximum DC volts 1,200 instead of 2.5K, also no capacity range. Price **£5.19.6.** Post free.

ALL METERS BRAND NEW AND FULLY GUARANTEED



MODEL TP5S. (Illus. on left). 20,000 ohms per volt, DC volts, 5 ranges up to 1,000 AC volts, 5 ranges up to 1,000 resistance, 2 ranges up to 10 meg., capacity 2 ranges up to .1 decibels —20 to +26. One switch control, really beautifully made precision instrument, size only 3½ x 5½ x 1⅜in., price only **£5.19.6.** Post free.

MODEL TP10. Similar in size and appearance to TP5S, but sensitivity 2,000 ohms per volt, price **£3.19.6.** Post free.

MODEL U1. A robust instrument of 1,000 ohms per volt sensitivity AC/DC volts up to 1,000. DC current up to 500, resistance up to 200K, size 5¼ x 3½ x 2⅛ins. complete with test prods, single switch control, large easily read scale, price only **£2.19.6.** Post free.

Britain's MOST Popular Portable . . .

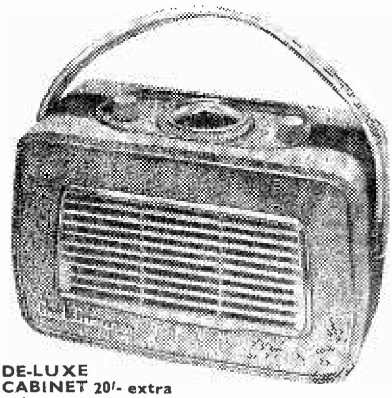
The "GOOD COMPANION"

CAR RADIO & PORTABLE

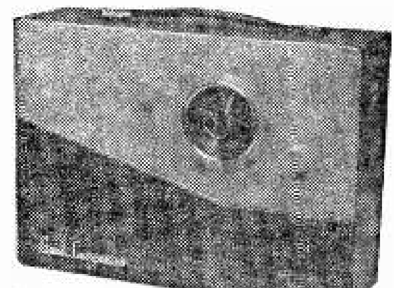
One of the finest of its kind available. The design is the combined efforts of our technicians and of those of several of the leading manufacturers in the country, and the resulting set has a performance as good as if not superior to those selling at £20 and more *It has the eight transistor set performance.* Features include **American Philco R.F. transistors and Mullard A.F. transistors**—Q.P.P. output giving 750 mW—full coverage on Medium and Long—very fine tuning arrangement—excellent reception of difficult stations like 208—variable feed-back control—full tonal qualities—really superior looking cabinet size 11 x 8 x 3in. approximately—car aerial attachment—several months' operation from battery costing only 3/6.

Circuit employs six transistors and two diodes, it incorporates all latest refinements, and oscillator. I.F. Transformers are pre-aligned so no instruments are necessary. Anyone who can solder competently can make this set. The instructions are fully comprehensive with plenty of illustrations. Service is available in the unlikely event of your getting into difficulties. All components fully guar.

Price of all components and Standard Cabinet **£9.19.6** **Post and Insurance 5/- Battery 3/6 extra.**
or with De Luxe Cabinet £1 extra.



DE-LUXE CABINET 20/- extra



STANDARD CABINET

MK2 CIRCUIT

uses latest ceramic transfilters in place of the normal I.F. transformers. This saves alignment problems and improves performance. **Price 10/- extra.**

AGENTS

wanted to build up our Companion Receivers. Send addressed envelope for full particulars.

The "POCKET COMPANION"

This is without doubt the most modern and best pocket set available. It uses the very latest I.F. transfilters, Philco R.F. transistors, airspaced tuning condenser in Superhet circuit covering M.W. and L.W. Complete building cost **£6.15.0.** Battery 2/-. Post and Ins. 2/6. Data free with parts or separately 2/6.

The "TREMENDO COMPANION"

If you don't mind the battery consumption being a little higher and you want really big output then order The "Tremendo". This has an undistorted output of almost 1½ watts and is probably the most powerful home constructor set available today. Complete building cost of this is **£10.15.0**, which includes the transfilter (Mk. II circuit) batteries cost 3/6 (two required).

All components for the

IMPROVED PIMPERNEL

5 Transistor Radio

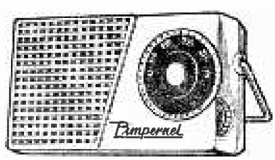
that works really well!

ONLY

69/6

Postage and Insurance 2/6

Battery 2/-



This remarkable little receiver uses 5 transistors and 2 diodes. 3in. Moving Coil Speaker, Tuning Condenser, Volume Control with On/Off switch, latest type circuitry giving excellent station separation and ample volume at good tone. Push-pull output circuit ensures long life from PP4 battery.
All components included for Medium Wave operation in handsome plastic case with carrying handle as illustrated.

Demonstrations at all branches

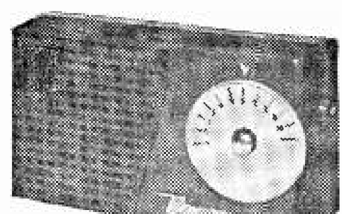
Circuit diagram FREE with parts or 2/- separately.

OPTIONAL EXTRAS

All components and switch for Long Waves	8/6
Motif "Pimpernel"	2/-

THE POCKET "4"

Proved without doubt the easiest of all to make!



Circuit comprises 2 HF transistors reflexed to equal 4 stages. Permanent germanium diode and high gain AF output stage, fitted with miniature speaker, proper tuning condenser, volume control and in case with handle as illustrated (less monogram), completely portable. **No aerial or earth required.**
Pocket 4 uses 3 transistors and 1 diode, price **42/6**, plus 2/6 post and insurance.
Pocket 5 uses 4 transistors and 1 diode and has feedback control, price 55/-, plus 2/6 post and insurance.
Prices are for medium wave models, long or medium versions 6/6 extra.

GOOD RESULTS EVERYWHERE

Nothing can be more disappointing than to find that despite care in making up, your radio just will not work or needs a long high aerial and water pipe earth. We can prove good results in all areas and we guarantee all components for 12 months. Hundreds of testimonials received. Send in confidence. Plans free with parts, or separately 1/6. Demonstrations at all branches.

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. Callers may use any one of the Companies below.

266 London Road, Croydon.	**29 Stroud Green Rd., Finsbury Park, N.4.**	**520 High Street North Manor Park, E.12.**	**42-46 Windmill Hill. Ruislip, Middx.**	**246 High Street, Harlesden, N.W.10.**
Phone: CRO 6558	Phone: ARChway 1049	Phone: ILFord 1011	Phone: RUIslip 5780	Phone: ELGar 4444
Half day Wednesday	Half day Thursday	Half day Thursday	Half day Wednesday	Half day Thursday

VALVES
BY RETURN OF POST
THE MOST COMPREHENSIVE COMPETITIVE VALVE LIST IN THE COUNTRY

10% DISCOUNT SPECIAL OFFER TO PURCHASERS of any SIX VALVES marked in black type (15% in dozen). Post: 1 valve, 6d. 2-11, 1/-..

NEW LOW PRICES GUARANTEED 3 MONTHS

FREE TRANSIT INSURANCE. All valves are new or of fully guaranteed ex-Government or ex-equipment origin. Satisfaction or Money back Guarantee on goods if returned unused within 14 days.

OZ4	5/-	6J5GT	4/-	12E1	17/6	DF96	7/3	EM80	7/9	8U25	16/-
1A5GT	5/-	6J6	4/-	12J7GT	9/-	DH63	6/-	EM81	8/6	8U2150	4/6
1A7GT	11/-	6J7	8/6	12K7GT	4/9	DH76	5/-	EM84	9/-	T41	7/6
1C5GT	9/-	6J7G	4/9	12K8	11/-	DK32	11/-	EM85	10/-	TDD4	7/6
1D5	8/-	6J7GT	7/6	12K8GT	9/6	DK91	5/6	EN31	16/-		
1D6	9/9	6J8	9/6	12Q7GT	5/-	DK92	7/-	EY51		U14	8/-
1H5GT	9/9	6K6GT	6/6	12SG7	5/-	DK96	7/3	Small	7/9	U18	8/-
1L4	3/3	6K7	5/9	12SH7	3/6	DL33	8/-	EY86	7/6	U22	6/9
1LD5	3/6	6K7G	2/3	12SJ7	5/6	DL35	9/-	EZ35	5/6	U24	16/-
1LN5	4/9	6K7GT	4/6	12SK7	4/9	DL65	6/-	EZ40	6/6	U25	11/6
1N5GT	9/9	6K8GT	8/9	12SN7GT	7/9	DL75	6/-	EZ41	7/-	U26	9/9
1R5	5/6	6K25	7/6	14S7	14/9	DL82	9/-	EZ80	6/-	U31	7/-
1S4	8/-	6L1	12/6	19AQ5	7/6	DL91	8/-	EZ81	6/6	U33	14/-
1S5	4/6	6L6G	6/6	19BG6G		DL92	6/-	FW4/500	8/-	U35	12/6
1T4	3/6	6L18	9/-		19/-	DL94	6/9	FW4/800	8/-	U37	26/-
2A3	6/6	6L19	11/-	20D1	9/6	DL96	7/3	GT1C	7/-	U50	5/9
2A7	9/6	6LD3	8/-	20F2	9/6	DW4/350		GZ32	8/9	U52	4/9
3A4	4/9	6LD12	6/9	20L1	16/-		8/-	GZ34	12/6	U76	5/6
3A5	9/-	6LD20	7/9	20P1	8/9	DW4/500		HABC80	9/6	U78	5/-
3D6	4/6	6N7	7/6	20P3	12/6		8/-	HL41DD		U191	12/6
3Q4	7/-	6P1	7/6	20P4	18/-	EABC80	6/9		8/3	U281	9/6
3Q5GT	8/-	6P25	8/6	20P5	15/-	EAC91	4/6	HN309	19/-	U282	15/-
3S4	6/-	6P28	12/6	25A6G	8/-	EAF42	8/-	HVR2	10/6	U301	15/-
3V4	6/9	6Q7G	6/-	25L6G	6/9	EB41	7/-	1W4/350	7/6	U309	6/9
5R4GY	12/6	6Q7GT	8/6	25L6GT	7/9	EB91	3/-	1W4/500	7/6	U329	6/9
5T4	8/-	6R7G	8/6	25Y5G	8/-	EBC33	4/9	KLL32	8/6	U339	11/-
5U4G	4/9	6SA7	5/6	25Z4G	7/-	EBC41	8/-	KT32	6/9	U801	19/-
5V4G	7/9	6SG7	4/9	25Z5	8/-	EBC81	7/9	KT33C	4/6	UABC80	8/-
5Y3G	5/9	6SH7	3/-	25Z6G	8/-	EBF80	7/9	KT36	12/6	UAF42	7/9
5Y3GT	5/9	6SK7	5/-	30C1	7/-	EBF83	9/6	KT44	7/6	UB41	7/9
5Y4G	11/-	6SL7GT	5/9	30F5	6/-	EBF89	8/6	KT45	8/6	UBC41	7/9
5Z4	11/-	6SN7GT	4/6	30FL1	9/6	EBL21	12/6	KT61	8/6	UBC81	9/6
5Z4G	7/6	6SQ7	5/9	30L1	6/9	EBL31	17/6	KT63	5/9	UBF89	7/6
5Z4GT	11/-	6SS7	3/6	30P4	9/6	EC91	4/6	KT76	8/6	UBL21	14/6
6/30L2	9/-	6U4GT	10/6	30P12	7/6	ECC31	7/6	KTW61	5/9	UCC84	14/6
6A6	4/9	6V6G	5/-	30P16	6/6	ECC32	4/-	KTW62	5/9	UCC85	7/-
6A7	10/-	6V6GT	6/-	30PL1	9/6	ECC33	4/6	KTW63	5/9	UCF80	15/-
6A8G	8/6	6X2	7/9	35L6GT	8/6	ECC34	9/-	KTZ63	5/6	UCH21	12/-
6A8GT	13/6	6X4	5/-	35T	25/-	ECC35	6/-	L63	2/9	UCH42	7/3
6AB8	7/-	6X5G	5/-	35W4	6/9	ECC40	14/-	LN152	7/-	UCH81	8/-
6AC7	3/3	6X5GT	5/6	35Z4GT	5/6	ECC81	5/6	MU14	7/6	UCL82	9/9
6AG5	3/-	6Y6G	7/6	35Z5GT	8/-	ECC82	6/-	N37	11/-	UCL83	13/6
6AG7	7/6	7A7	8/6	41	7/6	ECC83	6/6	N78	13/-	UF41	7/6
6AK5	5/-	7B6	9/-	42	7/6	ECC84	8/-	N108	16/-	UF42	5/6
6AL5	3/-	7B7	7/9	50C5	9/-	ECC85	7/9	N152	8/6	UF80	7/-
6AM6	3/-	7C5	7/3	50CD6G		ECC88	16/-	P41	4/6	UF85	7/6
6AQ5	6/-	7C6	7/6		19/-	ECC91	4/-	P61	2/9	UF86	14/6
6AT6	5/9	7H7	7/3	50L6GT	8/6	ECF80	8/6	PABC80		UF89	7/-
6AU6	7/6	7K7	9/6	52KU	10/6	ECF82	8/6		11/6	UL41	7/-
6B7	8/6	7Q7	8/6	53KU	10/6	ECH21	12/6	PCC84	6/9	UL44	11/-
6B8G	3/-	7R7	10/6	61SPT	11/-	ECH35	7/6	PCC85	8/3	UL46	9/9
6BA6	5/9	7S7	9/-	62BT	13/6	ECH42	8/6	PCC88	14/-	UL84	7/-
6BE8	5/9	7V7	7/9	75	6/6	ECH81	7/9	PCC89	9/-	UM80	9/6
6BG6G	15/-	7Y4	6/9	78	6/6	ECH83	8/3	PCF80	7/-	UU6	12/6
6BH6	6/-	7Z4	7/-	80	5/9	ECL80	7/-	PCF82	7/3	UU7	9/6
6BJ6	6/-	8D3	3/-	83	9/6	ECL82	9/6	PCF84	16/-	UU8	17/-
6BR7	9/6	10C1	11/6	185BT	19/6	ECL83	11/6	PCL82	7/3	UY1N	11/-
6BW6	7/6	10C2	14/6	803	19/-	EF22	7/-	PCL83	10/6	UY21	11/-
6BW7	5/6	10C14	8/-	807(A)	5/6	EF36	3/3	PCL84	7/6	UY41	6/-
6BX6	4/9	10F1	5/9	808	6/6	EF39	4/6	PEN45	8/6	UY85	6/6
6C4	3/6	10F9	10/6	813	55/-	EF40	12/-	PEN46	5/-	VP41	5/6
6C5	5/6	10L14	7/-	832A	14/-	EF41	8/-	PL33	8/3	VR105/30	
6C6	3/9	10LD3	7/9	866A	11/6	EF42	7/6	PL36	9/6		6/9
6C9	11/-	10LD11	14/6	9004	2/-	EF50-BR	2/-	PL38	16/6	VR150/30	
6CD6G	19/6	10LD12	8/-	ATP4	2/9	USA	3/-	PL81	8/6		6/9
6CH6	7/6	10P13	11/-	AZ31	8/-	EF54	3/3	PL82	6/6	W61M	11/-
6D2	3/-	10P14	9/-	B36	7/9	EF80	4/9	PL83	6/6	W76	4/9
6D3	9/6	10P18	7/-	CIC	9/6	EF85	6/6	PL84	8/-	W81	7/3
6D6	4/3	12A6	4/9	CBL1	26/6	EF86	9/-	PL820	8/6	X61M	11/-
6F1	4/9	12AC6	15/-	CBL31	21/-	EF89	6/9	PX4	12/6	X63	8/6
6F6G	5/9	12AD6	17/-	CCH35	14/-	EF91	3/-	PX25	9/6	X65	11/-
6F12	3/-	12AE6	13/9	CL33	9/6	EF92	4/6	PY31	9/-	X66	11/-
6F13	8/9	12AH8	9/-	CY31	9/-	EF96	3/-	PY32	10/-	X76M	11/-
6F14	9/6	12AT6	7/3	D77	3/6	EL32	4/6	PY80	6/9	X78	21/-
6F15	9/6	12AT7	5/6	D152	5/9	EL33	7/9	PY81	6/6	X79	16/6
6F16	8/-	12AU6	9/6	DA30	12/6	EL35	7/-	PY82	6/-	X81M	9/-
6F19	6/6	12AU7	6/-	DAC32	9/9	EL41	8/-	PY83	7/-	Y63	6/3
6F23	6/6	12AX6	6/6	DAF91	4/6	EL42	8/9	PZ30	9/6	Z63	4/9
6F32	6/6	12BA6	7/6	DAF96	7/3	EL83	11/-	R18	11/-	Z66	9/6
6F33	6/6	12BE6	7/6	DET19	2/9	EL84	7/-	R19	11/-	Z152	4/9
6J5	4/3	12BH7	9/9	DF33	9/9	EL91	4/-	SP41	2/6	Z719	4/9
6J5G	3/-	12C8	6/6	DF91	3/6	EM34	7/6	SP61	2/6	ZD152	7/9

Tubes

Carr. & Ins. 17/6

HIGHEST QUALITY—NEW LOW PRICES

GUARANTEED

MOST MULLARD, MAZDA, COSSOR, EMITRON EMI-SCOPE, BRIMAR, FERRANTI TYPES.		6 Months	12 Months	NEW TYPES
	12in.	£1.15.0	£3.10.0	MW31/74 £4-0-0
	14in.	£2. 0.0	£4. 0.0	MW 36/24 £5-0-0
	15/17in.	£2.15.0	£4.15.0	CRM 172 MW 43/64 £6-0-0
	21in.	£3.15.0	£5.15.0	

EXTENSION SPEAKERS

Covered in Attractive Rexine. Gold Metal Fret. Size: 8 x 6 x 3½in. **21/6**

Baffle Type. Polished wood front with Gold Metal Fret. Size: 11½ x 7½ x 3½in. **22/6**

MAINS AMPLIFIERS

3 Valve, 3 watt, 8 in. Speaker, in two tone cases, with controls. P. & P. 6/-. **19/6**

P.M. SPEAKERS

3 ohm, Top Makes. Performance Guaranteed.

8in. 6in. **8/-** 5in. 7x4 **11/-** 10in. 10x6 **13/-**

CONDENSERS

25 Mixed, Electrolytic. Many popular sizes. List Value £5. Our Price. **10/-**

P.V.C. Connecting Wire

100 yds. Single Strand. Special Price. **7/6**

200 yds., ditto. 12/6.

RECORDING TAPE

"Brand Five" 7in. 1200 ft., 23/6; 7in, 1,800 ft., 32/6 5in., 600 ft. 15/-; 5¾in., 1,200 ft., 21/6.

GET15

Latest G.E.C. High Power, Contact cooled, Manufacturer's matched pair Transistors, with Push-pull Input and Output Transformers and Amplifier Circuit. Knock Out Price. **29/-**

13 CHANNEL T.V.s

Table Models. Famous Makes. Absolutely Complete. These sets are unequalled in value due to huge purchase direct from source. They are untested, and not guaranteed to be in working order. Carr. etc., 15/-.

12in. **£2.19.0** 14in. **£4.19.0**

VALVES

GUARANTEED 3 months soiled.

PL81 **4/6** EY51 **4/6** U25 **8/-**

ACCUMULATORS

1 cell, 2 v., 3-5 amps., 3/-; 12 cells, 24 v., in teak case, 27/6. Unused bargain. P. & P. 4/-.

RECTIFIERS

For Chargers, selenium full wave, 12 volt, 3-4 amps, 9/6; (Carr. 1/-). 250 v. 80 mA, 5/-; RM1, 6/6; RM2, 8/-; RM3 9/-; RM4, 15/6; RM5, 21/-; 14A86, 17/-; 14A97, 23/-; 14A100, 25/-; 16RC1-1-16-1, 7/9; 18RA1-1-16-1, 7/9; 18RD2-2-8-1, 14/-; 14RA1-2-8-2, 17/-; 14RA1-2-8-3, 20/-.

TRANSISTORS

Yellow Spot, 2/9; Green Spot, 2/6, Red Spot, 3/6; White Spot, 4/6; Ediswan XB104, 8/6; XA103 (4 Mc/s), 10/-; XA104 (6/8 Mc/s), 12/-; O.C. 44, 15/6; O.C. 45, 15/-; O.C. 70, 14/-; O.C. 71, 8/-; O.C. 72, 12/-; (Matched Pairs, 22/-); V15/10P (10 watt power), 14/-; Yellow/Green, 5/-.

MULTIMETERS

Reads A.C. and D.C. volts to 1000. 5 ranges at 1000 ohms per volt. D.C. current, 3 ranges to 500 milliamps. Resistance reading to 200K in 2 ranges. Complete with Prods. **£2.12.6**

CO-AX

standard and low loss, 25 yds., 12/6; 50 yds., 22/6; 100 yds., 42/6; Co-ax. Plugs, 1/3; Wall outlet boxes, 3/6.

T.V. PROJECTION UNITS

Complete Standard Philips optical units with Mullard MW6-2 projection tube (untested) at a fraction of cost. **£3.10.0**

13 CHANNEL TUNERS

B.B.C./I.T.A. famous makes complete PCF80, PCC84. 38 Mc/s. I.F. Amazing value. **19/-**

UA20 AUTOCHANGERS

Latest B.S.R. 10 mixed records. Unrepeatable. A real "Buy". P. & P. 4/-. **£6.19.0**

4-speed Record Players

Latest Turntable, together with lightweight Staar Galaxy dual sapphire crystal turnover pick-up head. Amazing value (pick-up only 19/-). Carr. 3/-. **£3.10.0**

HEADPHONES

Ex-Govt. quality, with Jack-plug. Per pair. **7/6**

Mirror Galvanometers

Evershed and Vignoles, 45 second swing, high sensitivity, gunmetal cases with spares, transit case. Unused. A "MUST" for School Laboratories. **£3.10.0**

100 RESISTORS 6/6
100 CONDENSERS 10/-

Miniature Ceramic and Silver Mica Condensers, 3pF to 5,500pF. LIST VALUE OVER £5.

SILICONE DIODES

125 v., 300 mA, 2in. series make superior R.M.4, or R.M.5, etc. Each **8/-**

GERMANIUM DIODES, general purpose, 9d. each, 8/- doz.

TEST SETS TYPE 74A

A service 'scope easily convertible for standard use, 200/250 v., A.C., all valves, E.C.R.30 tubes, excellent case worth £10. Our price **£4.10.0**

TECHNICAL TRADING CO.

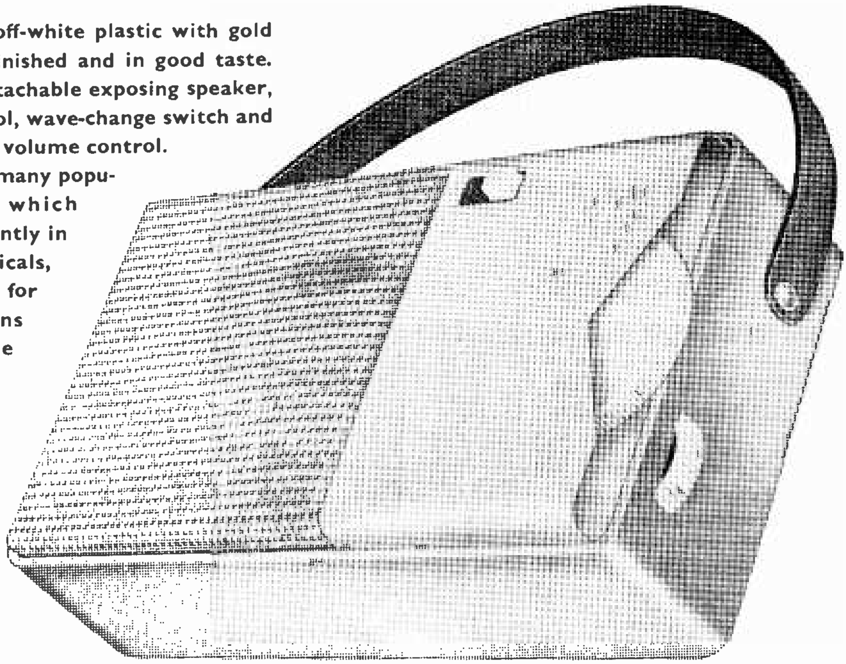
Post: 2 lbs. 2/-, 4 lbs. 2/6. 7 lbs. 3/6, 15 lbs. 4/- etc. No. C.O.D ALL ITEMS LESS 5% AND POST FREE IN DOZENS. (Callers always welcome). LIST OF 1000 SNIPS, 6d.

350-352 FRATTON ROAD, PORTSMOUTH.

P.W. POCKET SUPERHET

TRANSISTORISED PRINTED BOARD VERSION

The case is off-white plastic with gold grille, well finished and in good taste. Top faces detachable exposing speaker, tuning control, wave-change switch and built-in edge volume control. Suitable for many popular designs which appear currently in radio periodicals, as well as for older designs which have appeared during the past year or so.



Price 12/6d.

Size
$5\frac{3}{4}'' \times 3\frac{1}{2}'' \times 2''$

Coloured photo-illustration on request.

The Pocket Superhet is a high quality miniature receiver for operation on Medium and Long Waves. The circuit uses 6 special transistors and incorporates modern miniature matched components of the best quality which combine to give superb performance normally associated with much larger sets. The printed board construction ensures success to every enthusiast able to follow the simple Step-by-Step instructions.

Some Osmor Stockists:

Henry's Radio Ltd., 5 Harrow Road, London, W.2
Clyne Radio Ltd., 162 Holloway Road, London, N.7
Surbiton Park Radio Ltd., 48 Surbiton Road, Kingston, Surrey
Norcol Ltd., Castle Road, Camberley, Surrey
Sound Reproducers Ltd., 7 Jepson Road, E.7
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SIMPLE "STEP-BY-STEP" INSTRUCTIONS INCLUDING WIRING DIAGRAMS THEORETICAL CIRCUIT PHOTOGRAPHS AND BLOWN UP DIAGRAMS
1/6d.

ALIGNMENT & FAULT FINDING SERVICE

(Details on Request)

OSMOR

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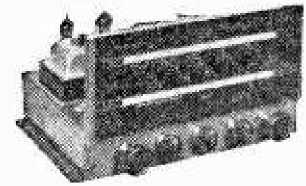
418 BRIGHTON ROAD, S. CROYDON, SY.

ARMSTRONG AF208 AM/FM RADIOGRAM CHASSIS



★ Full VHF Band (87-108 Mc/s and Medium Band, 187-570M) ★ Valves ★ 5 Watts Output ★ 15db Negative Feedback ★ Separate wide range Bass and Treble Controls ★ 2 Compensated Pick-up Inputs ★ Frequency Response 30-22,000 c.p.s. ±2db ★ Tape Record and Playback Facilities ★ Continental Reception of Good Programme Value ★ For 3, 7½ and 15 ohm speakers. Send S.A.E. for leaflet.

PRICE **22 GUINEAS** Carr. Free

LATEST "EMI" 4 SPEED SINGLE RECORD PLAYER

Acos Hi-Fi Pick-up for LP. and/or 78, 7, 10 and 12in. records. Silent motor, heavy turntable. auto stop. Complete on Base-plate.

Special offer **£6.5.0** post free.

or with Stereo/Monaural pick-up £6.19.6.

SINGLE-PLAYER BARGAIN

Ready-built, complete with BSR TU9 4-speed gram pick-up unit. Handsome portable case. 3-watt amplifier with 2 valves and speaker. List price £12.12.0. OUR PRICE £9.9.0. Post 4/-. Fully guaranteed in manufacturer's sealed cartons.

New Boxed VALVES 90-day Guarantee

1R5	7/6	6K8G	7/6	EA50	1/6	EZ80	7/6
1S5	7/6	6L6G	10/6	EABC80	8/6	E1148	1/6
1T4	6/-	6N7M	6/6	EB91	6/-	HABC80	
2X2	3/6	6Q7G	8/6	EBC33	8/6		12/6
3S4	7/6	6SA7	6/-	EBC41	8/6	HVR2A	6/6
3V4	7/6	6SJ7M	6/6	EBF80	10/-	MU14	9/-
5U4	7/6	6SN7	6/6	ECC84	9/6	PCC84	9/6
5Y3	7/6	6V6G	6/6	ECF80	9/6	PCF80	9/6
5Z4	9/6	6X4	7/6	ECH42	10/6	PCL82	11/6
6AM6	5/-	6X5	6/6	ECL80	10/6	PEN25	6/6
6B8	5/-	12A6	7/6	ECL82	10/6	PL81	12/6
6BE6	7/6	12AT7	8/-	EF39	5/6	PL82	10/6
6BH6	9/6	12AU7	8/-	EF41	9/6	PY80	7/6
6BW6	9/6	12AX7	8/-	EF50	5/6	PY81	9/6
6D8	6/-	12BE6	8/6	EF80	8/-	PY82	7/6
6F6	7/6	12K7	6/6	EF86	12/6	SP61	3/6
6H6	3/6	12Q7	6/6	EF92	5/6	UBC41	9/6
6J5	5/6	35L6	9/6	EL32	5/6	UCH42	9/6
6J6	5/6	35Z4	7/6	EL41	9/6	UF41	9/6
6J7G	6/6	80	9/6	EL84	8/6	UL41	9/6
6K8GT	6/6	807	5/6	EY51	9/6	UY41	8/-
6K7G	5/-	954	1/6	EZ40	7/6	U22	8/-

SETS OF VALVES

DK96, DF96, DAF96, DL96, 8/6 each or 27/6 set.
1R5, 1T4, 1S5, 3S4 or 3V4. .. 19/6
6K8, 6K7, 6Q7, 6V6, 5Z4 or 6X5. .. 27/6
ECH42, EF41, EBC41, EL41, EZ40. .. 37/6
ECH81, EF89, EBC81, EL84, EZ80. .. 39/6
12K8, 12K7, 12Q7, 35L6, 35Z4. .. 35/-

NEW ELECTROLYTICS — FAMOUS MAKES

TUBULAR		TUBULAR		CAN TYPES	
1/350V	2/-	50/350V	5/6	16/45V	5/-
2/350V	2/3	100/25V	3/-	32/350V	4/-
4/450V	2/3	250/25V	3/-	100/270V	5/6
8/450V	2/3	500/12V	3/-	2,000/6V	4/-
8/500V	2/9	8+8/450V	3/6	5,000/6V	5/-
16/450V	3/-	8+8/500V	5/-	32+32/350V	5/-
16/500V	4/-	8+16/450V	3/9	32+32/450V	6/-
32/450V	3/9	8+16/500V	5/6	32+32+32/350V	7/-
25/25V	1/9	16+16/450V	4/3	50+50/350V	7/-
50/25V	2/-	16+16/500V	6/-	64+120/350V	11/6
5/50V	2/-	16+32/350V	4/6	100+200/275V	12/6

C.R.T. BOOSTER TRANSFORMERS

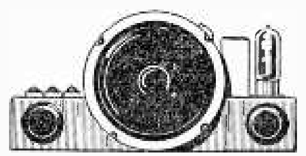
For Cathode Ray Tubes having heater cathode short circuit and for C.R. Tubes with tailing emission. Full instructions supplied.

Type A. Optional 25% and 50% Boost. 2V or 4V or 6.3V or 10.8V or 13.3V. Mains input. 12/6

TYPE A2. High quality. low capacity. 10/15pF. Optional boost 25%, 50%, 75%. Mains output. 16/6

Type B. Mains input. Low capacity. Multi output 2, 4, 6.3, 10 and 13V. Boost 25% and 50%. This transformer is suitable for all TV tubes, 21/- each.

COMPLETE RADIO £4.19.6 post free



4 Mullard valves, 5in. speakers, frame aerial. 4 pre-set stations. 1 long, 3 med. wave. **Superhet Circuit.**
Size 9 x 6 x 5¼in. high. Tested ready for use. 200/250 v. A.C.—D.C. Mains.

MAINS TRANSFORMERS 200/250 v. A.C.
Postage 2/- each transformer.

STANDARD, 250-0-250, 80 mA, 6.3 v. 3.5 a. tapped 4 v. 4 a. Rectifier 6.3 v. 1 a 5 v. 2 a or 4 v. 2 a. 22/6 ditto, 350-0-350 .. 29/6
MINIATURE 200 v. 20 mA, 6.3 v. 1 a. 10/6
MIDGET, 220 v. 45 mA, 6.3 v. 2 a. .. 15/6
SMALL, 220-0-220, 50 mA, 6.3 v. 2 a. 17/6
STD., 250-0-250, 65 mA, 6.3 v. 3.5 a. .. 17/6
HEATER TRANS. 6.3 v. 1½ amp. .. 7/6
Ditto, tapped sec. 2, 4, 6.3 v., 1½ amp .. 8/6
Ditto, sec. 6.3 v. 3 amp 10/6
GENERAL PURPOSE LOW VOLTAGE, 2a 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 24, 30 v. .. 22/6
AUTO TRANSFORMERS, 150 w. .. 22/6
0, 120, 200, 230, 250 v., 500 w. .. 82/6

O.P. TRANSFORMERS. Heavy Duty 50 mA, 4/6. Multiratio, push-pull, 7/6. Ditto, 10 w., 15/6. Miniature, 384m etc., 5/9. **L.F. CHOKES** 15/10H. 60/65 mA. 5/-; 10 H. 85 mA, 10/6; 10 H., 150 mA, 14/-.

TELEVISION REPLACEMENT Line Output Transformers from 45/- each, New Stock

and other timebase components
Most makes available
S.A.E. with all enquiries.

FULL WAVE BRIDGE SELENIUM RECTIFIER: 2, 6 or 12 v. 1½ amp., 8/9; 2 a., 11/8; 4 a., 17/6.
CHARGE TRANSFORMERS. Tapped input 200/250 v. for charging at 2, 6 or 12 v., 1½ amps., 15/6. 2 amps., 17/6; 4 amps., 22/6. Circuit included.
4 AMP CAR BATTERY CHARGER with ampmeter Leads, Fuse Case, etc., for 6 v. or 12 v., 69/6.

BOOKS list S.A.E.

40 Circuits for Germanium Diodes 3/-
"W.W." Radio Valve Data. 6/-.
High Fidelity Speaker Enclosure, 5/-
Valve and TV Tube Equivalents. 9/6.
TV Fault Finding, 5/-.
Quality Amplifiers, 4/6.
Radio Valve Guide. Books. 1. 2. 3 or 4, 5/- each.
Transistor Superhet Receivers, 7/6.
Practical Radio for Beginners, 3/6.
Master Colour Code Chart. 1/6.

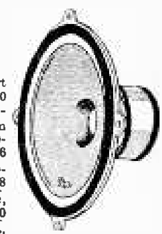
PYE STEREOPHONIC PLAYER

Complete with Garrard TA MKII Stereo unit and self contained quality stereo amplifier, size 14¼" wide x 17" deep x 8½" high. Brand new in maker's box with full instructions and guarantee. OUR PRICE £12.10. Carriage and Insurance, 10/-.
Suitable for use with any two 3 ohm loudspeakers.

LOUDSPEAKER P.M. 3 OHM. 2½, 3, 4in. 19/6. 5in. Rola, 17/6; 8in. Plessey, 19/6; 7in. x 4in. Rola, 18/-; 6½in. Rola, 18/6; 10 x 6in. 27/6; 10 in. Rola, 30/-; 4in. Tweeter, 25/-; 12in. R.A. 30/-; 13½ x 8in 45/-.
STENTORIAN HF1012. 10in. 3-15 ohms, 10 w., 95/-.

BAKER SELHURST LOUDSPEAKERS

Details S.A.E.



12in. Baker 15w. Stalwart 3 or 15 ohms, 45-13,000 c.p.s. 90/-
12in. Baker Stalwart. foam suspension, 15 ohms, 40-13,500 c.p.s. .. £6
12in. Stereo, 12w., 35-16,000 c.p.s. .. £8
12in. Baker Ultra Twelve, 20 c.p.s. to 25 kc/s. £17.10
15in. Auditorium, 35 w., Bass. 20 c.p.s. to 12 Kc/s. £15

TWIN GANG TUNING CONDENSERS. 365 pF, miniature 1in. x 1½in. x 1¾in., 10/-. 500pF Standard with trimmers, 9/-; midget, 7/6; with trimmers, 9/-
SMALL 3 gang 500 pF, 17/-.
SINGLE 25 pF, 50 pF, 75 pF, 100 pF, 160 pF, 5/6. Solid dielectric 100, 300, 500 pF, 3/6.
CONDENSERS. New stock. 0.001 mfd. 7 kV; T.C.C., 5/6; Ditto, 20 kV., 9/6; 0.1 mfd., 7 kV, 9/6. Tubular 500 v. 0.001 to 0.05 mfd., 9d., 0.1, 1/-; 0.25, 1/6; 0.5/500 v., 1/9; 0.1/350 v., 9d.; 0.1/2,000 v. 0.1/1,000 v., 1/9; 0.1 mfd., 2,000 volts, 3/6.
CERAMIC CONDS. 500 v. 0.3 pF to 0.01 mfd., 9d.
SILVER MICA CONDENSERS. 10% 5 pF to 500 pF. 1/-; 600 pF to 3,000 pF, 1/3. Close tolerance. (± 1 pF) 1.5 pF to 47 pF, 1/6. Ditto 1% 50 pF to 815 pF, 1/9; 1,000 pF to 5,000 pF, 2/-.

465 kc/s SIGNAL GENERATOR Total cost 15/-. Uses B.F.O. Unit, ZA 30038 ready made. **POCKET SIZE** 2½ x 4½ x 1in. Slight modifications required, full instructions supplied. Battery 7/6 extra 69V+1½V. Details S.A.E.

Wavechange Switches. 2 p. 2-way 3 p. 2-way, short spindle, 2/6; 8 p. 4-way 2 wafer, long spindle. 6/6; 2 p. 6-way, 4 p. 2-way. 4 p. 3-way, long spindle, 3/6; 6 p. 4-way, 1 p. 2-way, long spindle. 3/6.

Wavechange "MAKITS", Wafers available; 1 p. 12 wafer, 2 p. 6 wafer, 3 p. 4 wafer. 4 p. 3 wafer, 6 p. 2 wafer. 1 wafer, 8/6; 2 wafer, 12/6; 3 wafer, 16/-; additional wafers up to 14, 3/6 each extra.

Toggle Switches, s.p., 2/-; d.p., 3/6; d.p.d.t., 4/-. Ex. Gov. s.p.d.t., 1/-.

CRYSTAL MIKE INSERT
by Acos 8/6
Precision engineered.
Size only 1⅝in. dia. x ¼in.

ACOS CRYSTAL MIKE 40 .. 25/-
DE LUXE STICK MIKE .. 35/-

Valveholders. Pax. int., oct., 4d. EA50. 6d. B12A, CRT. 1/3. Engl and Amer. 4, 5, 6 and 7 pin. 1/-. MOULDED Mazda and int. oct., 6d.; B7G, B8A, B8G, B9A, 9d. B7G with can, 1/6. B9A with can, 1/9. Ceramic EF50, B7G, B9A, int. oct., 1/- 7BG. B9A cans, 1/- each.

THE ORIGINAL RADIO COMPONENT

Our written guarantee with every purchase.

Bus 133 or 68 pass door
S.R. Station Selhurst

Volume Controls

Long spindles. Midget 5 K ohms to 2 Meg.
No. Sw. 3/-. D.P.Sw. 4/6
Linear or Log Tracks.

80 ohm CABLE COAX

Semi-air spaced ¼in. Stranded core **6d. yd.**
40 yds. 17/6. 60 yds. 25/-
Fringe Quality Air Spaced. **1/- yd.**

TRIPLEXERS Bands I, II, III 12/6
COAX PLUG .. 1/- **LEAD SOCKET** .. 2/-
PANEL SOCKETS 1/- **OUTLET BOXES** 4/6
BALANCED TWIN FEEDER yd. 6d. 80 or 300 ohms.
DITTO SCREENED per yd. 1/6. 80 ohms only.
WIRE-WOUND POTS. 3 WATT. Pre-set Min. TV Types. All values 10 ohms to 25 K. 3/- ea. 30 K., 50 K., 4/-. (Carbon 30 K., to 2 meg., 3/-)
WIRE-WOUND 4 WATT Pots. Long spindle. Values, 50 ohms to 50 K., 6/6; 100 K., 7/6.
PHILIPS TRIMMERS, 30 pF, 1/-.
TRIMMERS. Ceramic. 30, 50, 70 pF, 9d.; 100 pF., 150 pF. 1/3; 250 pF., 1/6; 500 pF., 750 pF., 1/9.
RESISTORS. Preferred values. 10 ohms to 10 meg., ¼ w., 4d.; ½ w., 4d.; 1 w., 6d.; 1½ w., 8d.; 2 w., 1/-.
HIGH STABILITY. ½ w., 1%, 2/-. Preferred values. 10 Ω to 10 meg. Ditto 5%, 100 Ω to meg., 9d.

5 watt / 10 watt / 15 watt { **WIRE-WOUND RESISTORS** 25 ohms—10,000 ohms } 1/3 / 1/6 / 2/-
12.5K to 50K 10w 3/-

AMERICAN "BRAND FIVE" PLASTIC RECORDING TAPE

			Spare Plastic Reels
Double Play	7in. reel, 2,400ft.	60/-	
	5in. reel, 1,200ft.	37/6	
Long Play	7in. reel, 1,800ft.	35/-	3in. 1/6
	5¾in. reel, 1,200ft	23/6	4in. 2/-
	5in. reel, 900ft.	18/6	5in. 2/-
Standard	7in. reel, 1,200ft	25/-	5¾in. 2/-
	5in. reel, 600ft	16/-	7in. 2/6

"Instant" Bulk Tape Eraser and Head Defluxer, 200/250 v. A.C., 27/6. Leaflet, S.A.E.

Radio Screwdriver 5in. 6d.
Neon Mains Tester Screwdriver, 5/-
Solder Radiograde, 4d. yd., ½lb. 5/-.
Black Crackle Paint. Air drying, 3/- tin.

HIGH GAIN TV PRE-AMPLIFIERS BAND 1 B.B.C.

Tunable channels 1 to 5. Gain 18db. ECC84 valve. Kit price 29/6 or 49/6 with power pack. Details **6d.** (PCC84 valves if preferred.)
BAND III I.T.A.—Same prices. Tunable channels 8 to 13. Gain 17dB.

Paxolin Panels, 10 x 8in., 1/6.
Miniature Contact Cooled Rectifiers. 250V 50mA. 7/6; 250V 60mA. 8/6; 250V 85mA. 9/6; 200mA. 21/-; 300mA. 27/6.
Selenium Rect. 300V 85mA, 7/6.
Coils Wearite "P" type. 3/- each. Osmor Midget "Q" type. adj. dust core, from 4/- each. All ranges.
Teletron D.W.R. L. and Med. T.R.F. with reaction, 3/6.
Ferrite Rod Aerials, M.W., 8/9; M. and L., 12/6.
Osmor Ferrite Rod Aerials. L. and M. for transistor circuits, 10/- each.
Ferrite Rods, 8 x ⅜in., 2/6.
H.F. Chokes, 2/6. **Osmor QC1**, 6/9.
T.R.F. Coils, A/HF, 7/- pair; HAX. 3/-, Repanco DRR2, 4/-. DRX1, 2/6.

Aluminium Chassis, 18 s.w.g. Plain, undrilled. 4 sides, riveted corners, lattice fixing holes. 2½in. sides, 7 x 4in. 4/6; 9 x 7in., 5/9; 11 x 7in., 6/9; 13 x 9in., 8/6; 14 x 11in., 10/6; 15 x 14in., 12/6; 18 x 16 x 3in., 16/6.
Aluminium Panels, 18 s.w.g., 12 x 12in. 4/6; 14 x 9in., 4/-; 12 x 8in., 3/-; 10 x 7in., 2/3, 8 x 6in., 2/-.

AUTOCHANGER ACCESSORIES

Suitable player cabinets (except 4 H.F.) 49/6
Amplifier player cabinets (except 4 H.F.) 63/-
2-valve amplifier and 6½in. speaker 95/-
3-valve amplifier and 6½in. speaker 105/-
Wired and tested ready for use with above.

CRYSTAL SET BOOKLET, 1/-.
CRYSTAL DIODE G.E.C., 2/-. **GEX34, 4/-. OA81, 3/-.**
HIGH RESISTANCE PHONES. 4,000 ohms, 15/- pr.
MIKE TRANSF. 50 : 1, 3/9 ea.; 100 : 1, Potted, 10/6.
SWITCH CLEANER. Fluid squirt spout, 4/3 tin.

JASON FM TUNER COIL SET.

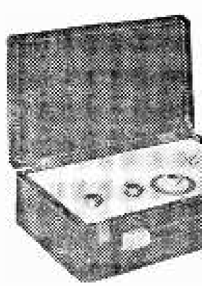
29/-. H.F. coil. aerial coil, oscillator coil. two i.f. transformers 10.7 Mc/s, detector transformer and heater choke. Circuit and component book using four 6AM6, 2/6. **Complete Jason FMT.1 Kit.** Jason chassis with calibrated dial, components and 4 valves. £6.5.0.

JACKS. English open circuit, 2/6. Closed circuit, 4/3. Grundig type, 3 pin, 1/3.
JACK PLUGS. English, 3/-. Grundig. 3 pin. 3/6.
Wirewound Ext. Speaker Control, 10Ω 3/-.
ALADDIN FORMERS and cores. ¼in., 8d.; ⅜in., 10d.
0.3in. FORMERS 5937 or 8 and cans TV1 or 2, ½in. sq. x 2½in. or ½in. sq. x 1½in., 2/- with cores.
SLOW MOTION DRIVES. Epicyclic ratio 6-1, 2/3.
SOLON IRON, 25W. 200V or 230V. 24/-.
MAINS DROPPER. 3 x 1½in. With adjustable sliders. 0.3A, 1,000 ohms, 4/3; 0.2A, 1,000 ohms, 4/3.
LINE CORD. 0.3A 60 ohms per foot, 0.2A 100 ohms per foot. 2-way. 1/- per foot; 3-way 1/- per foot.
MIKE TRANS. 50-1, 3/9; 100:1, potted, 10/6.
P.V.C. Conn. Wire, 8 colours, single or stranded, 2d. yd. Sleeving, 1.2mm, 2d.; 4mm, 3d.; 6mm, 5d. yd.
SPEAKER FRET. Gold cloth, 17 x 25in., 5/-; 25 x 35in., 10/-. Tygan, 52in. wide, 10/-; 26in. wide, 5/- ft. Samples, S.A.E. Expanded Metal, Gold, 12 x 12in., 6/-.

I.F. TRANSFORMERS 7/6 pair

465 kc/s slug tuning miniature can 1¾ x ¾ x ¾in. High Q and good band width. Data sheet supplied.

"REGENT" 4 VALVE



"96" RANGE VALVES
KIT PRICE **£6.6.0.**
carr. 4/-

PRINTED CIRCUIT BATTERY PORTABLE KIT

Medium and long wave. Powerful 7 x 4in. high Flux Speaker. T.C.C. Printed Circuit and condensers. Components of finest quality clearly identified with assembly instructions. Osmore Ferrite Aerial Coils. Rexine covered attache case cabinet. Size 12in. x 8in. x 4in. Batteries used B126 (L5512) and AD35 (L5040), 10/- extra. Instructions 9d. (free with kit). Mains Unit ready made for above, 39/6. Sold separately. Details free.

MONARCH RECORD PLAYER

BUILD IT YOURSELF using **4-SPEED BSR MONARCH AUTOCHANGER READY BUILT 3W. AMPLIFIER. HANDSOME PORTABLE CASE. HIGH FLUX LOUDSPEAKER. FULL INSTRUCTIONS SUPPLIED.**
Carr. and Ins. 5/-. Total Price **£12.10.0**

RECORD PLAYER BARGAINS

Post 2/- each

4 Speed Autochangers:

BSR, U.A.14	£7.10.0
Collaro Autochanger	£7.19.6
Garrard "Slimline"	£8.17.6
Garrard RC209	£9.9.0
Garrard RC210	£10.10.0

4 Speed Single Players:

Garrard TA Mk. II	£8.8.0
Model 4SP	£6.17.6
Garrard 4 HF Transcription	£17.19.6

Garrard Stereo Heads £2 extra.
All Sapphire Stylii available from 6/-.

ARDENTE TRANSISTOR TRANSFORMERS

Type D3035. 7.3 CT: Push Pull to 3 ohms for OC72, etc., 1 x ⅞ x ⅞in., 9/6.
Type D3034. 1.75 : 1CT. Push Pull Driver for OC72, etc., 1 x ⅞ x ⅞in., 9/6.
Type D3058, 11.5 : 1 Output to 3 ohms for OC72, etc., 1 x ⅞ x ⅞in., 9/6.
Type D167, 18.2 : 1 Output to 3 ohms for OC72, etc., ⅞ x ⅞ x ⅞in., 12/-.
Type D239, 4.5 : 1 Driver Transformer. ⅞ x ⅞ x ⅞in., 10/-.
Type D240 8.5 : 1 Driver Transformer. ⅞ x ⅞ x ⅞in., 10/-.

ARDENTE TRANSISTOR VOLUME CONTROLS

Type VC1545, 5K with switch, dia. 0.9in., 8/-
Type VC1760, 5K with switch, dia. 0.7in., 10/6
Deaf aid ear piece xtal or magnetic, 7/6.

WEYRAD

COILS AND TRANSFORMERS FOR A 2-WAVE TRANSISTOR SUPERHET WITH PRINTED CIRCUIT AND FERRITE ROD AERIAL

Long and Medium Wave Aerial—RA2W. On 6in. rod, 7/16in. diameter, 208pF tuning, 12/6.
Oscillator Coil P50/1AC. Medium wave. For 176pF tuning, 5/4.
1st and 2nd I.F. Transformers—P50/2CC. 470 kc/s. 11/16in. diameter by ⅞in. high, 5/7.
3rd I.F. Transformers—P50/3CC, to feed diode detector, 6/-.
Driver Transformer—LFDT2. 1 5/16 x ⅞ x 1⅛in., 9/6.
Printed Circuit—PCA1. Size 2¾ x 8½in. Ready drilled and printed with component positions, 9/6.
7 x 4in., 35 ohm Speaker, 25/-.
These components are approved by transistor makers and performance is guaranteed.
Constructor's Booklet 2/-.

NEW MULLARD TRANSISTORS
Audio OC71 6/- R.F. OC44 10/6
OC72 7/6 OC45 9/6
Sub-miniature Electrolytics (15V). 1μF, 2μF, 4μF, 5μF, 8μF, 25μF, 50μF, 100μF, 2/6. Diodes OA71, OA81, 3/-. GEX 34, 4/-.

B.B.C. Pocket 2 Transistor. M.W. and L.W. Radio Kit, 22/6. Phones 7/6 or deaf aid earpiece, 7/6. Batt. 2/-.

"P.W." POCKET 6 TRANSISTOR KIT MK.II WITH LATEST OSMOR MODIFICATIONS. ALL PARTS, PRINTED CIRCUIT AND CABINET. OSMOR DESIGNED KIT, £8.15.0.

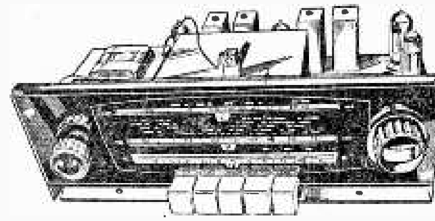
COMPONENT SHOP SPECIALISTS

P. and P. charge 1/-, over £3 post free. C.O.D. 2/-.

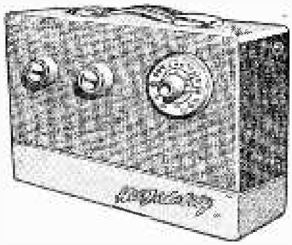
337 WHITEHORSE ROAD WEST CROYDON
Telephone: THO 1665
(Export welcome. Send remittance and extra postage).

BRAND NEW AM/FM (V.H.F.) RADIOGRAM CHASSIS AT £14 (Carriage Paid)

A.C. ONLY. Chassis size 15 x 6¾ x 5½in. high. New manufacture. Dial 14½ x 4in. in black and gold.
Pick-up. Ext. Speaker. Ae., E., and Dipole Sockets. Five push buttons—OFF L.W.. M.W., F.M. and Gram. Aligned and tested O.P. Transformer. Tone Control. 1,000-1,900 M.; 200-500 M.; 88-98 Mc/s Valves EZ80 rect.. ECH81. EF89. EABC80. EL84. ECC85.
Speaker and Cabinet to fit chassis (table model). 47/6 (post 2/6).
10 x 6in. ELLIPTICAL SPEAKER. 20/-. to purchasers of this chassis.
TERMS:—(Chassis) £5 down and 5 Monthly Payments of £2, or with Cabinet and Speaker £5.10.0 down and 6 Monthly Payments of £2
Cheap Room Dipole for V.H.F. 10/-. Feeder 6d. yard.



THE "CANTATA" 6-TRANSISTOR AND DIODE PORTABLE



COMPLETE KIT FOR ONLY

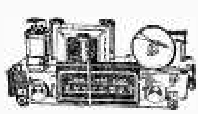
£7.19.6

(post 3/6)

★ 500mW push-pull output. ★ Ferrite rod aerial.
★ Car aerial socket and coil. ★ M.W. and L.W. full coverage.
★ Operates on two 4.5v. cells. ★ Printed circuit board 8¾ x 2¾in.
★ All holes drilled and component positions marked on reverse side of board.
★ Booklet of full instructions 2/6 for 16p. (refunded on purchase of kit).
★ Size 9 x 3¾ x 7in. ★ 8 x 2¾in. P.M. high quality speaker.
★ Attractive Vinair covered cabinet, two tone.
★ Two batteries 5/6 the pair.
★ High Sensitivity. ★ Good selectivity.
★ Mullard transistors OC44, 2 x OC45, OC81D, and 2 x OC81.
★ Top grade Weymouth Radio Coils and transformers.
★ Alignment service if required 17/6 (inc. post).
★ Write for list of prices.
★ All parts supplied separately.
★ Note the total cost—no extras at all.
★ Built in two hours.

AUTOMATIC RECORD CHANGERS. ALL 4-SPEED WITH TURN-OVER CRYSTAL CARTRIDGE (carr. 5/- extra). Latest UA14. £7.10.0. Collaro C.60 Studio model, plays any records, 7-12in. only £7.15.0. Motor board for UA8, UA14 or Collaro 3/6 (post 1/6). Both UA14 and C.60 fitted monaural cartridge but wired for stereo.

BEREC BATTERY RADIO IN MAKER'S CARTON. Valves DK96, DF96, DAF96, DL96. Two Short Wavebands 16 to 49 M. and 25 to 75 M. Cabinet 12 x 7½ x 6in. ONLY £5 (2/6 p. & p.): MW and SW £5.4.0 (plus 2/6 p. & p.).



SELF-POWERED VHF TUNER CHASSIS. Covering 88-95 Mc/s. Mullard permeability Tuner. Dims. 10½ x 4½ x 5in. high ECC85, EF91, EF91 and 2 diodes. Metal Rectifier. Mains transformer. Fully wired and tested. Only £7.14.0 (carr. pd.). Room dipole 10/-. 300 ohm twin feeder, 6d. yd. Tuner without power pack £6.14.0 (carr. paid).

PUSH-PULL AMPLIFIER £4.15.0

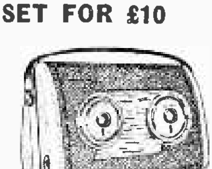
(4/- Carr.)

Brand new 200-240 A.C. mains Bass. treble and vol. controls. With valves EZ80, ECC83 and 2-EL84 giving full 8 w. Chassis 12 x 3½ x 3½in. With o.p. trans. for 2-3 ohm speaker.

Front panel (normally screwed to chassis) may be removed and using as "flying panel". Stereo version 2 x 4 w. same price.

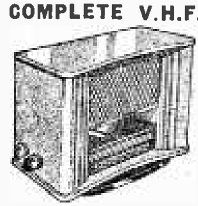
THIS SUPERB SET FOR £10

A really elegant 6-transistor radio covered in sponge clean Duracour fabric, in latest two tone shades. M.W. and L.W., ferrite rod, provision for car aerial. 2-colour scale. With PP9 battery giving 300 hours use. Weighs under 4 lbs. With carrying handle. 12 x 7½in. high x 4½in. at base tapering to 2in. at top. Brand new. fully guaranteed. £10. Carr. paid. Worth £16.



COMPLETE V.H.F./A.M. RADIO FOR £12.10.0

(carr. paid)



Brand new set, in superb walnut cabinet (size 19 x 8½ x 14½in. high). Covering 90-100 Mc/s. 16-49 M., and 200-500 M. Mains trans. 200-250 v. with 2 tappings. Ferrite rod aerial for A.M. Controls: volume on/off, tone, tuning, w/change. Gram and ext. speaker position provided. Valves 12AT7, 12AH8, 6BJ6, EABC80 6BW6 and metal rectifier. Fully guaranteed. Today's Value £20.

COLLARO STUDIO TAPE TRANSCRIPTOR. 3 MOTORS, 3 SPEED. 1⅞, 3¾ and 7½ I.P.S. Push buttons. £10.17.6 (10/- carr.) incl. spool.

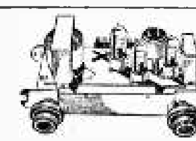
SUPERIOR GRAMOPHONE AMPLIFIER 3 valves, 4 watt

13½ x 7½in. (2¾in. front to back). 3 front controls. bass. treble. vol. on-off. 6½in. round speaker: UY85, UF80 and UL84. Mains trans. 200-240ac; "gold" fret front. ONLY 70/- (p.p. 3/6).

GRAMOPHONE AMPLIFIER

With 5in. SPEAKER Baffle 12½ x 6in. ECL82 and Rectifier. Tone and Volume On/Off switch. Two Knobs. Ready to play. Useful for Stereo. ONLY 57/-, post 3/-.

3-VALVE AMPLIFIER (INC. RECT.). 2½ watts. ECC83, ECL82 and EZ80. Controls, volume bass and treble. On/off switch. Overall size 13½ x 6 x 4½in. over valves. Mains and O.P. trans. and 6½ x 4½in. Celestion speaker. Suitable for microphone input and for guitar amplifier. A.C. only.



70/- P. & P. 4/-.

MAINS OPERATED RADIO CHASSIS AND AMPLIFIER OF FAMOUS MANUFACTURE

Chassis 10 x 5½ x 4in. front to back. Valves: UBC41, UCH41, UF89, UL84 with metal rectifier. 5in. speaker. Ferrite rod aerial. Tone, vol. and gram. position. Covers L. and M. waves. Limited quantity at only £6 (5/- carr.) Complete with small dial. Unused and in working order.

UNREPEATABLE OFFER OF AM-FM CHASSIS AT ONLY £9.9.0 carr. pd.

A small quantity of Printed Circuit chassis by famous manufacturer. Valves UY85, UCH81, UF89, UABC80, UL84 and UCC85. O.p. trans. for 2-3 ohm speaker. Chassis 14 x 7 x 7in. Front controls concentric, left—Vol. and Tone; right—W/c and Tuning. "Gold" centre knobs provided. 2-dial bulbs. Sockets, AE; E; Ext. sp; P.U. Mains isolating transformer free. Covers Long, Med., VHF (87-101 Mc/s). Unused slightly tarnished, but not dirty; New Mullard Valves; not our manufacture, so no guarantee. Dial in gold and brown, size 13 x 3½in.

Send 6d. (stamps will do) for 20 page illustrated catalogue. All New Goods. Delivered by return. (C.O.D. 2/- extra).
ALL ITEMS GUARANTEED 12 MONTHS—B.V.A. VALVES 3 MONTHS.—CLOSED SATURDAY.

GLADSTONE RADIO
"SCALA," CAMP RD. FARNBOROUGH, Hants.
Farnborough 3371

Practical Wireless

Vol. XXXVII No. 661 MARCH, 1962.

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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, London, W.C.2. Owing to the rapid progress in the designs of wireless apparatus and to our efforts to keep readers in touch with the latest developments, we give no warranty that apparatus described in our columns is not the subject of letters patent.*

MORE BLUEPRINTS

FREE with every copy of our April issue will be the latest PRACTICAL WIRELESS blueprint. However, this free blueprint—value 5s.—will differ from those we have recently given away; it will be printed on *both* sides. In other words, there are two complete designs on the blueprint. More free blueprints will be given away with the May and June issues thus giving a total of 6 PRACTICAL WIRELESS designs of free blueprints.

This series of blueprints has been arranged to cater both for the advanced constructor and for the comparative beginner; the sixth design needs more skill and experience than the first. However, the April blueprint has Design No. 1 on one side and Design No. 4 on the other. This will mean, of course, that the beginner will be able to build No. 1 while the more experienced will be interested in No. 4.

THE APRIL BLUEPRINT

Design No. 1 is a two-valve battery-operated receiver covering short waves—the P.W. International short wave two. The nature of short waves is such that reception is possible from many foreign countries; The prototype sets have received transmissions from Moscow, Sofia, Ankara and many other places. The circuit of the set is designed to facilitate construction by the novice. The text of the article will be comprehensive and give additional information on how to obtain the best results.

Design No. 4—the P.W. Regency—is a 4-transistor portable receiver covering medium and long waves. It is sufficiently sensitive to give reception of several Continental stations and it has its own internal ferrite rod aerial. The expense of construction has been kept to a minimum for the results to be expected.

THE MAY BLUEPRINT

This will feature a two-valve mains-operated receiver using comparatively few components to give coverage of medium and long waves and include provision for playing gramophone records (to enable the unit to form the basis of an inexpensive radiogram). This set will be design No. 2.

The second side of this blueprint will deal with a 6-transistor superhet battery-operated receiver covering medium and long waves—design No. 5. A readily available plastic cabinet is used and the receiver is very sensitive and selective and will compare favourably in performance with many of the commercially available sets.

THE JUNE BLUEPRINT

We shall not release full details of designs numbers 3 and 6 until next month since the date of publication lies so far ahead. However, we can mention that this blueprint will feature a sensitive, switch-tuned mains-operated VHF/F.M. receiver—using a crystal controlled oscillator circuit.

Order your copies of the April, May and June issues *now*—if you delay, you may miss this series of blueprints.

Our next issue dated April, will be published on March 7th.

Round the World of Wireless

POTENTIAL AND CURRENT NEWS

Guglielmo Marconi in the room in the old Barrack Hospital, on Signal Hill, St. John's, Newfoundland, where he was successful in detecting Morse signals from Poldhu in Cornwall, 2,200 miles away.

Broadcast Receiving Licences

THE following statement shows the approximate number of Broadcast Receiving Licences in force at the end of November. 1961, in respect of wireless receiving stations situated within the various Postal Regions of England, Wales, Scotland and Northern Ireland. The numbers include Licences issued to blind persons without payment.

Region	Total
London	672,45
Home Counties	626,26
Midland	458,27
North Eastern	487,79
North Western	421,62
South Western	368,43
Wales and Border Counties	216,72
Total England and Wales	3.251,580
Scotland	354,125
Northern Ireland	113,371
Grand Total	3.719,076

Two 300MW Turbine-Generators for Canada

THE contract for two 300MW steam turbine-generator sets for Lakeview Power Station on the shore of Lake Ontario, near Toronto, Canada, has been awarded to Associated Electrical Industries Limited. The order has been placed by the Hydro-Electric Power Commission of Ontario. This is the second order for 300MW turbine-generators to be received by AEI for Lakeview; the first order, which was for sets of similar design, was announced in March 1960.

Certain major items of the turbine-generators will be manufactured in Canada principally by the Canadian General Electric Company, to AEI designs.

Nigerian Firm to Manufacture Radio and TV Receivers

A NIGERIAN firm — Nigerian Electronics, Ltd., of Lagos—will manufacture radio and television receivers under a licence and technical assistance agreement announced recently by Westinghouse Electric International Company of the U.S.A. It will be the first full-scale electronics manufacturing operation in West Africa.

Ownership of the company is shared by the Western Regional Government of Nigeria, a group of Nigerian nationals, and Ad. Auriema, Inc., of New York City, exclusive U.S. representatives. Plant personnel is drawn entirely from West Africa.

The licence covers all Westinghouse models of home radio receivers as well as black and white television receivers.

First product of the firm's newly-built factory at Apapa, a suburb of Lagos. will be a three-band, transistor portable short-wave radio receiver. The unit is similar to a model manufactured by the Westinghouse plant at Metuchen, New Jersey, in the U.S.A.

Radio Links in Australia

THE General Electric Company Limited is to provide radio equipment for two SHF radio relay systems for the Australian Post Office, one between Sydney and Orange and the other between Brisbane and Mount Matheson.

The Sydney-Orange link will be equipped to provide a two-way telephony system and a one-way television link. One channel in each direction will be used as a standby (protection) channel and will be switched into service should a working channel fail or become degraded.

The Brisbane-Mount Matheson system will provide a duplicate (main and standby) one-way television link.

Each radio frequency channel operates in the 6000Mc/s frequency band and is capable of carrying 960 speech channels or a television programme.

Equipment will be supplied for five repeater stations, two between Brisbane and Mount Matheson and three between Sydney and Orange.

The equipment will be manufactured at the Company's Telephone Works in Coventry.

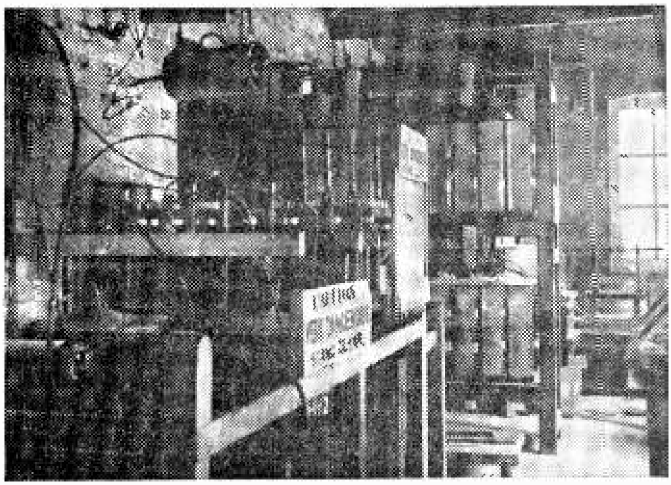
Dorset Radio Link Transmitter

AFTER two and a half years' service on an unattended site at Eggardon Hill, Dorset, a microwave radio link transmitter has been returned by the British Broadcasting Corporation to the manufacturers, EMI Electronics Ltd., for conversion to a different frequency.

The original klystrons were still in good order after 20,000 hours continuous running.

This link is part of a chain between Southampton, Rowridge (Isle of Wight) and North Hessory Tor (Plymouth) which relays BBC television programmes to and from the West of England.

After the radio frequency unit has been converted from 4000Mc/s to 7000Mc/s band, the link will go back into service for



Part of the transmitting station built at Poldhu for Marconi's experiments. On the extreme left are the transformers, on the right is the spark gap and the banks of capacitors can be seen in the wooden rack.

the BBC without any major overhaul being necessary.

Marine Radio Station

THE Irish Department of Posts and Telegraphs have placed a contract with Telecommunications Limited, Dublin, one of the Pye Group of companies, for the re-equipping of the marine radio stations at Malin Head in the North and Valentia in the South West extremity of Ireland.

The equipment ordered consists of a number of Pye 1kW medium frequency transmitters equipped for 3-channel operation and remote control.

Minister of Aviation to Open Eleventh Electrical Engineers Exhibition

THE Minister of Aviation, Rt. Hon. Peter Thorneycroft, will open the eleventh Electrical Engineers (A.S.E.E.) Exhibition at 12 noon on Tuesday, 20th March, 1962.

This will be the second time Mr. Thorneycroft has opened this important show; the first time was in 1956. Since then the exhibition has doubled in size and has firmly established itself as Britain's largest "shop window" of electrical equipment and draws engineers and buyers from every part of the world.

Each year a special section of the exhibition is devoted to a particular aspect of the electrical industry; in 1962 the feature will be "Electricity in Aviation". In a display area covering 5,000sq.ft the Royal Air Force and the Ministry of Aviation will be showing a comprehensive range of electrical apparatus, accessories and components used in aircraft and on the ground.

Radar for Swedish Navy

AN order for radar display units has been placed with the Electronic Apparatus Division of Associated Electrical Industries Ltd. by the Swedish Navy Board. These units are to operate in conjunction with coastal surveillance radar equipment previously supplied by AEI. They will be made at the AEI factory at Blackbird Road, Leicester.

Valves Ordered for Czechoslovakia

THE Electronic Apparatus Division of Associated Electrical Industries Ltd. has received an order for welder-type ignitrons and over-temperature thermostats from Exico Ltd., London, for export to Czechoslovakia. This is nearly half the 1961 quota for electronic and communications equipment for export to Czechoslovakia, fixed at £50,000 which also takes into account cables, radio and television receivers, sound reproducing equipment, valves and components. As far as can be ascertained, the AEI industrial valves will be used mainly in the motor-car industry.

The valves being supplied include the AEI BK34 with a maximum demand rating of 2400kVA and a maximum average anode current of 355A. The types BK34 and BK24 also included in the order have maximum demand ratings of 1200kVA and 600kVA, with maximum average anode currents of 140A and 56A respectively.

Diamond Jubilee of Transatlantic Radio

SIXTY years ago—on the 12th December, 1901—Guglielmo Marconi became the first to send a wireless signal across the Atlantic. This remarkable achievement with such primitive equipment marked the birth of world-wide communication.

During the spring of 1900, Marconi had succeeded in sending reliable signals from St Catherines in the Isle of Wight to The Lizard in Cornwall, a distance of 186 miles. This encouraged his belief that by using larger aerials and far more powerful transmitters he would be able to achieve transatlantic distances. Scientists were highly sceptical, many said it was impossible because of the curvature of the earth.

Marconi determined to make the attempt. A transmitting station nearly one hundred times more powerful than any previously constructed was built at Poldhu, near Mullion, in Cornwall. Enormous aerials were erected at Poldhu and at Cape Cod in Massachusetts, but both were wrecked in severe gales. Another, less ambitious in design, was put up at Poldhu while Marconi and his two assistants sailed to Newfoundland where, from the top of Signal Hill, a receiving aerial was hoisted, at the third attempt, by means of a kite.

At 12.30 p.m. (Newfoundland time) on December 12th, 1901, Marconi and his assistant G. S. Kemp, using one of the primitive receivers of the period with a telephone earpiece heard a faint succession of S's in Morse code. Signals from Poldhu, 2,200 miles away, had crossed the Atlantic.

To commemorate this historic achievement, a Special Exhibition was displayed at the Science Museum, London, from the 13th December to 25th January. Among the many historic exhibits and original photographs, a notable feature was a recording of Marconi's voice telling in his own words of how success was achieved.

transistorised feeder unit

THIS EQUIPMENT MAY BE USED WITH AN AMPLIFIER TO FORM A LOCAL STATION RECEIVER

By R. Murray-Shelley

WHEN used in conjunction with almost any medium or high gain amplifier, this unit will form a very efficient local station radio receiver. There are several advantages of a transistorised circuit over a more conventional valve circuit. In the first place, the use of transistors enables the size of the unit to be reduced; another important point is that the power consumed by the unit is negligible—it is conveniently supplied from batteries—and thus no power connections have to be made to the main amplifier as is usually the case.

The aerial signal is passed via C11 to the coil which is tuned by the pre-set condensers C1 and C2. Which one of these is used depends upon the station required. An extension of the tuning coil serves as the secondary of a step down transformer, the output of which is taken to the base and emitter of the first transistor. The radio frequency signal is amplified by this component in the normal way, a small portion of it being fed back in the positive sense via the pre-set trimmer C5, which acts as a reaction control. The signal appearing at the collector of the first transistor is demodulated by the two germanium diodes.

The audio output from these is fed back via RFC1 to the base of Tr1 transistor which now acts as an audio amplifier. The amplified audio signal is taken from the collector of the transistor, and fed, via RFC2, to the primary of the interstage transformer T1 (ratio 5:1). The secondary of this transformer feeds the base and emitter of the second audio transistor. This tran-

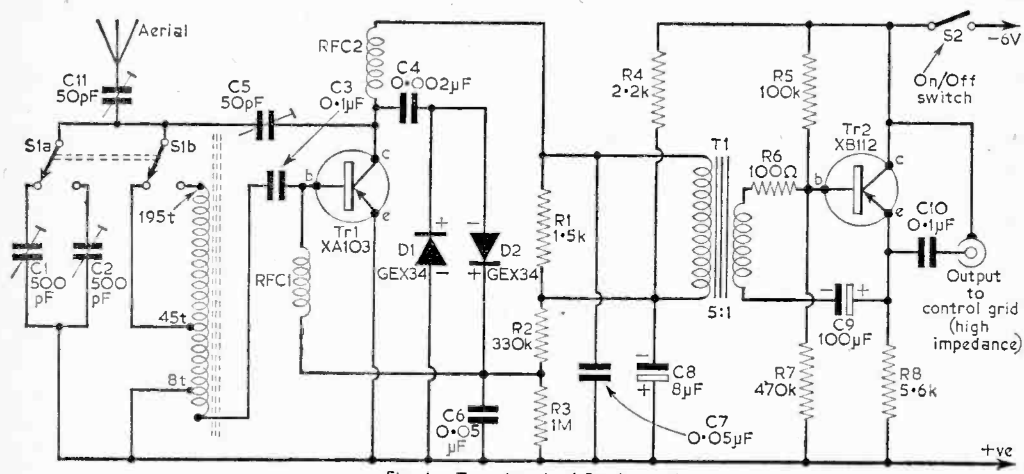


Fig. 1—Transistorised Feeder-unit.

In this circuit, the output impedance is high enough to match into most valve circuits. Another feature of the unit is the provision of pre-set switch tuning, which proves to be very satisfactory in practice.

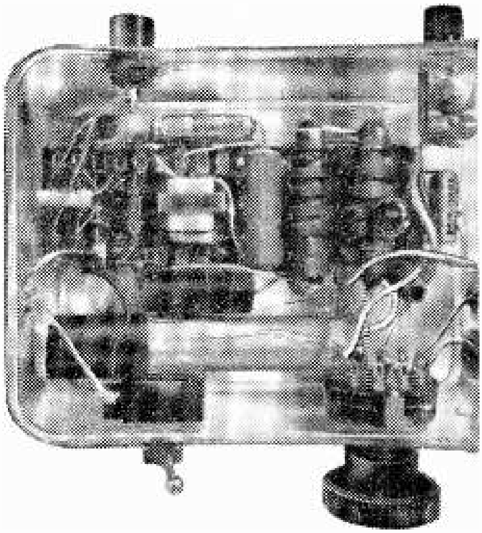
The Circuit

The feeder uses two transistors together with two germanium diodes. The fact that a radio frequency transistor is capable of functioning equally well at audio frequencies is made use of in this design, the first transistor being "reflexed" to provide additional gain. The effect is almost that of using three transistors.

sistor is arranged so that it has a high output impedance, making it suitable for feeding into a valve amplifier having a characteristically high input impedance.

Power Supplies

The tuner requires only 0·7mA or less, at a potential of 6V. This is most easily obtained from a battery. Either a 6V battery designed for transistor work, or one made up from four 1·5V cells connected in series, may be used. The possibility of using mercury cells may also be considered. These have an EMF of 1·3V, and five connected in series would be suitable. Mercury cells are obtainable



An underchassis view of the unit.

at reasonable prices from advertisers in "Practical Wireless".

In the prototype, the battery was not housed in the unit, but was connected to it via a polarised socket. The use of such a socket is important to ensure that the battery is always connected with the correct polarity. Should the battery be connected the wrong way round, then there is a very real possibility of destroying the transistors. The battery could, however, be mounted within the case of the feeder. The life of the battery depends, of course, upon how much the equipment is used, but in most instances it will remain serviceable for many months.

COMPONENTS LIST

Resistors:

R1	1·5k	R5	100k
R2	330k	R6	100Ω
R3	1M	R7	470k
R4	2·2k	R8	5·6k

Condensers:
- C1 500pF trimmer
- C2 500pF trimmer
- C3 0·1μF—low voltage working
- C4 0·002μF—low voltage working
- C5 50pF trimmer
- C6 0·05μF—low voltage working
- C7 0·05μF—low voltage working
- C8 8μF 6VW electrolytic
- C9 100μF 15VW electrolytic
- C10 0·1μF 150VW
- C11 50pF trimmer

Transistors:
Tr1 XA103 Tr2 XB112

Chokes:
RFC1, RFC2 Radio frequency chokes—not critical—see text

Diodes:
D1 and D2 Germanium diodes—GEX34

Switches:
- S1 2-pole, 2-way rotary switch
- S2 Single-pole, single-way switch

Transformer:
T1 Step down transistor transformer, ratio approx 5 : 1

Sundries:
6V battery—see text
Plastic container, polarised socket, coaxial output socket, 8in. length of 5/16in. diameter ferrite rod

Construction

The tuning coil is constructed first. Details of this assembly, together with dimensions are given in Fig. 2. The core of the coil consists of two 4in. lengths of 5/16in. diameter ferrite rod side by side. Ferrite rod is usually supplied in 8in. lengths, and thus it will be necessary to cut the rod to secure the correct sizes. This is most easily accomplished by filing a nick in the rod at the point where it is to be cut, and then snapping it in half at that point. Care should be taken in this operation, since, although ferrite materials are extremely hard, they are also very brittle. The wire gauge or the type of insulated copper wire used is not critical. The dimensions given refer to a coil made of 34s.w.g. enamelled wire.

Housing

The whole unit is housed in a plastic box, the size of that used in the prototype being 5½in. x

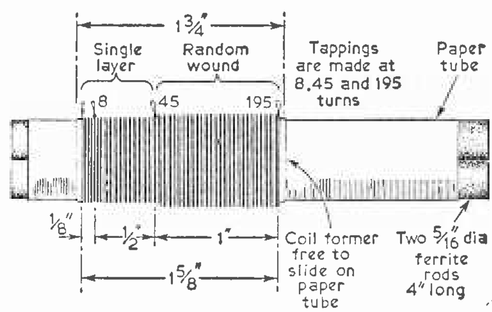


Fig. 2—Details of the tuning coil.

4½in. A metal box is not suitable, since this would screen the ferrite assembly. The switches and the several sockets are mounted on the walls of the box itself. To enable this to be done, it is necessary to make holes in the plastic. Attempts to drill this type of material, using ordinary twist drills, usually end in failure owing to fracture of the plastic. The plastic is, however, easily pierced using a hot soldering iron or other heated metal tool.

Group Board

An eighteen way group board is used to mount the main electronics assembly. The miniature transformer T1 is glued to this board. The group-board in turn is glued to the plastic box. The wiring is not, in general, particularly critical, though the connections to the tuning coil should be kept as short as possible and care should be taken when soldering the transistor and the diodes —a heat shunt should always be used in soldering components of this kind. Construction is easier of the wiring of the group board is carried out before this component is mounted in the plastic case.

The output is taken via a coaxial socket, and coaxial or screened cable. The centre connector of the socket should go to C10, and the screen to the negative line. This ensures that the negative line of the feeder is connected to the chassis of the amplifier.

The feeder should on no account be used with an amplifier of the A.C./D.C. variety, which may in some circumstances have a live chassis.

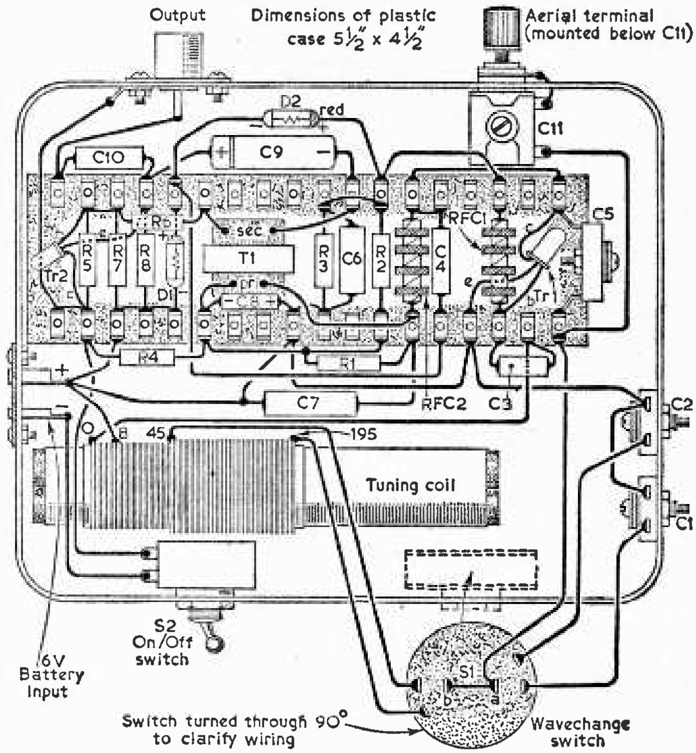


Fig. 3—The underchassis wiring of the unit.

Components

Construction is simplified if miniature components are employed, in that it is easier to accommodate all the components in the fairly limited space available. The resistors need only be rated at $\frac{1}{4}$W or $\frac{1}{2}$W, and all the condensers, with the exception of C10 may be of low working voltage.

The radio frequency chokes are not critical, though their inductances should be fairly high. Small chokes such as are used in very high frequency apparatus are not suitable for this application. It is recommended that the specified radio frequency transistor be used. The choice of audio transistor is less critical.

Adjusting the Feeder

The wiring should first be checked thoroughly, and the unit connected to a medium or high gain amplifier. The battery should next be connected, taking great care to see that the polarity is correct. An aerial is then connected to the appropriate terminal. This aerial need only be five or six feet long; indeed, in some areas close to the transmitter, an external aerial may not be necessary, sufficient signal being obtained from the ferrite aerial in the feeder itself.

Condenser Settings

The pre-set trimmer C5, should first be set to a low capacity. and the aerial trimmer, C11, screwed up fairly tight. The coil is slid to one end of the ferrite rods. The unit is now switched on, and S1 is switched to the medium wave position (i.e. 45 turns of the coil are in circuit). The trimmer corresponding to this position (C1 in Fig. 1) is then adjusted in conjunction with the position of the coil on the ferrite rods, until the local Home Service broadcast is heard at maximum strength. C5 and C11 are then adjusted for best reception. C5 should be adjusted to a position so that the unit is on the point of oscillation. The coil should now be fixed in position on the ferrite rods with glue. S1 is then switched to the Long Wave position and C2 adjusted to receive the Light Programme (1,500m). No further adjustments of C5 or C11 are normally required.

Directional Effects

When using a very short aerial, it may be found that the feeder unit has directional properties; i.e., the signal is stronger when the whole unit is turned in one particular direction. This is due to the directional nature of the ferrite rod assembly which provides a maximum signal when at right angles to the direct line from the receiving position to the transmitter.

The output of the unit is sufficient to allow it to be used with all but the smallest amplifiers. Its small size makes it ideal for building into portable record players and the like. In such cases a telescopic aerial could be used.

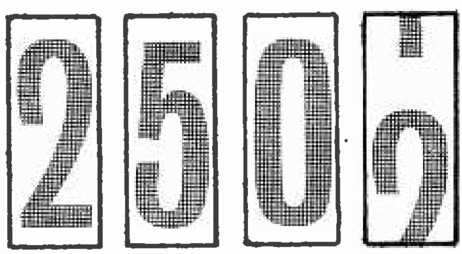
Other Stations

The feeder is essentially designed to provide local station reception of high quality. It may, however, be possible to add other pre-set stations on the medium wave band, the Third Programme being particularly suitable. ■

THIS UNIT WAS ORIGINALLY DESIGNED FOR USE WITH A SIMPLE GEIGER HEAD, BUT IT WILL OPERATE SATISFACTORILY FROM ANY SUITABLE INPUT SOURCE

By A. Cole

A DIGITAL



COUNTER

(Continued from page 927 of the February issue)

ALTHOUGH at the slower counting rates, the bias setting is not in the least critical, many counts will be missed at higher rates if the bias is set too far below the critical value. However, no damage is possible when the counter is blocked on account of too high a bias setting, but the low setting where V4 conducts permanently should be avoided. If the constructor wishes to modify the circuit to make it impossible to reach this dangerous point, then (after switching off) he should measure the resistance from VR1 slider to chassis when set to the onset of this permanent condition for the H.T. supply he intends to use. This value of resistance increased by about 25% to 50% should be inserted between the bottom end of VR1 and chassis, and a new value potentiometer inserted to replace VR1, having a value of 500k less the inserted fixed resistance. Alternatively, the appropriate region of VR1 can be marked in red, or a protruding bolt inserted as a stop at the appropriate point, so that the knob cannot be turned past that point. In any case, it is always advisable to have a meter connected in the main H.T. feed. The resting current of the whole amplifier, at 250V H.T., should be about 2 to 5mA, and will be between 75 and 100mA on pulses. It is highly advisable to use a stabilised H.T. supply for this amplifier, though not essential. If a non-stabilised supply is used, it should at least have choke-condenser smoothing, not mere resistor-condenser smoothing, and have an output smoothing condenser of at least 50μF. However, if the constructor has already built, or intends to build, the stabilised H.T. supply appearing in the pages of this magazine, this is far more suitable to operate the present equipment, and will already incorporate the required current meter. It will be found that the maximum accurate counting rate is higher with a stabilised H.T. supply, and the general stability over many running hours is then also more reliable even at slow counting rates.

Principle of the Geiger-counter Tube and Geiger-head Circuit

The author's Geiger head is included in a larger chassis containing other associated circuitry, such as integrators and average-value display, which are of no interest for this article. These associated circuits only serve a useful purpose in making measurements on radiation of much greater intensity than is ever likely to be encountered in the atmosphere or rainwater, etc., which the author, however, encounters in other laboratory work.

A Geiger tube is a special gas-filled cold-cathode diode, similar to a neon tube. The case forms the cathode, and a central axial wire forms the anode. The applied voltage is such that a discharge almost but not quite takes place. As soon as any particle or quantum of atomic radiation enters the space occupied by the tube, it causes ionisation in the tube, and thus initiates a discharge, in other words tube current flows. This causes a sudden positive voltage pulse across R17 (in Fig. 2), and this is applied to the grid of the cathode follower V6. Tube current is quenched within a few millionths of a second, partly on account of chemical effects within the gas-filling of the tube, and partly on account of the drop across R14 causing the voltage to fall below the striking value. The tiny capacitor C10 was found to be required by the author, as otherwise the voltage on the tube fell too rapidly, so that the pulse was too short to be registered. It is *essential* that C10 be made no larger than necessary, as otherwise the average tube current is excessive, and will damage the tube. In some cases the circuit stray capacities will already be sufficient, in which case no actual physical component will be needed for C10. The constructor should connect a calibrated oscilliscope to the coaxial output socket, and adjust C10 until the peak voltage of the output pulses is about 25. It is an advantage to make C10 in the form of about an inch of tightly twisted flex, and progressively cut this shorter and shorter, until 25V output, and no more, is obtained.

The purpose of the cathode follower, V6, is to decoupled the output fully from the Geiger-tube circuit, so that no back-action disturbance from the subsequent counter is possible. Furthermore, it transforms the pulses to low impedance, so that cable-losses and distortion, in the connection to the subsequent counter, are negligible. The constructor is strongly advised not to run the Geiger-head circuit from a power supply feeding other apparatus too, nor to run any other circuits from the power supply feeding the Geiger head.

Uses and Experiments possible with this Equipment —Radioactivity Checks for Atmosphere, Rain-water, Tap-water, etc.

A count is made for at least six to twelve hours with the Geiger head just standing in the room. It is not necessary to count any particular exact period, but merely to note the precise number of minutes actually counted. The count made is divided by this number of minutes, giving an *average count per minute* without a test sample.

A test-tube containing the sample to be tested is then inserted in the Geiger head, and again a count made for at least six hours, without having otherwise altered anything from its previous state. In the same manner, an *average count per minute* is calculated, this time applicable to the presence of the test sample. Any significant increase, compared to the average without the sample probably represents radioactivity that the sample possesses. The longer the period of counting, the more significant is any difference detected, i.e. the more can we say "the sample *has* the radioactivity detected as difference" instead of "it *probably* has it". For the small increases of radioactivity to be expected from atomic bomb tests, in rain-water, counts need to be over periods of some hours to be worthwhile.

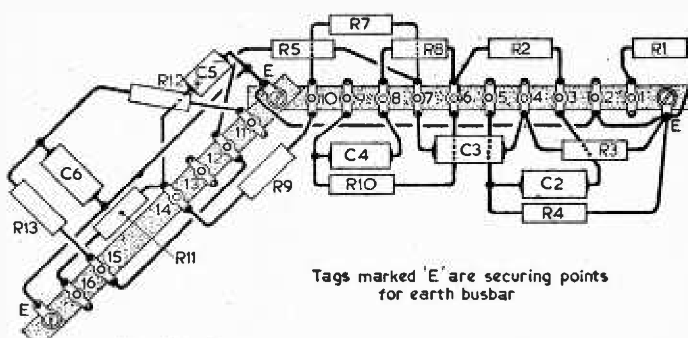


Fig. 3b—Component and tag-strip wiring in the counter unit (see also Fig. 3a—last month).

Interpreting Results

The reason for this is as follows: The normal count, of about 20 per minute with the tube used, is fully irregular. Counts in individual minutes may be as low as 12 or less, and in other individual minutes as high as 30 or more. But if one counts over, say two hours, i.e. 120 minutes, it is highly unlikely that the *average* will deviate as much. Thus, whereas a difference of even 75 per cent in the counts of two single minutes is not all that startling, a difference of only 25 per cent in the averages of two counts, each for an hour, is already very significant. The radioactivity in rainwater may represent only 10 per cent increase above the normal average rate, and thus a count of many hours is needed before this definitely proves itself as a *persistent* increase in long-period averages, as only then is the probability small that such an increase has occurred by pure chance.

Preparation of Samples

Some discussion is also necessary regarding the method of preparing samples of rainwater for measurement. It is fully pointless just to fill rain-water into the test-tube as it falls out of the sky, for if under such circumstances any significant increase of counting rate were ever detected, then it would be a cause for the greatest alarm, representing radioactive contamination of the severest nature. The author's extensive experiments showed that present levels of radioactivity in rainwater lie some 500 to 2000 times lower than those conveniently measurable with the apparatus here described. Thus very considerable *concentration* is needed prior to making measurements, and the best way of doing this is discussed further below. The author has been able to do some useful work using only about 200-fold concentration factors, though this then needs rather long counting times, during which the ever-present small fluctuations of the cosmic background effect can cause considerable error. Nevertheless, 200 seems to be the minimum usable concentration factor. The same remarks apply, of course, whether rainwater, drinking water, spa-water, or any other liquid test-samples are concerned.

Accuracy

If the total number of pulses counted in a given measuring period of T minutes in N pulses, then the most probable statistical fluctuation is the square root of N. This "most probable statistical fluctuation" is defined as the average difference of individual measurements from the average result of many exactly similar measurements under precisely the same conditions. Consequently the square-root of N, subsequently divided by T, gives the statistical fluctuation of results to be expected in the value of "counts-per-minute". Thus, to be considered as "significant", the increase of counting rate produced in measurements with a sample must be as many times as possible as great as the expected random statistical fluctuation.

Let us take the practical numerical example with which the experimenter will be concerned in the apparatus here described. Counting rates of about 20 per minute will be obtainable, giving a total of ten thousand counts in 500 minutes. The square root of ten thousand is 100, and this therefore represents the random fluctuation of the exact total counted which may be expected, *on the average*, if the experiment is repeated many times under precisely the same conditions. A probable error of 100 in 500 minutes represents a probable error of 0.2 in the count per minute average. This is 1% of the actual average counting rate. The same percentage error is to be expected in the

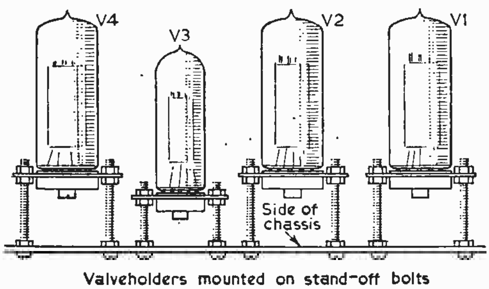


Fig. 3c—The valves in the counter unit are mounted underneath the chassis as shown above.

cosmic count without test-sample, and in the subsequent count with sample. Because the "signal" interesting us—namely, the activity of the test sample, is given by the *difference* of the two *nearly equal* counts, the individual errors add, and we have an uncertainty of 2 per cent., plus or minus, of the total counting rate involved. To be reasonably safe in saying the "signal" is significant in indicating radioactivity of the test sample, it should lie at least a factor of 5 higher than the fluctuation; i.e., be about 10 per cent. of the total counting rate.

Thus, for a counting time of 500 minutes (roughly overnight), with the described apparatus having a counting rate of about 20 per minute, the samples measured must have an activity leading to a rise of at least 2 per minute in the counting rate, and must be prepared with this aim in mind. Under this condition, because the "signal" is then 5 times the fluctuation ("noise"), the quantitative accuracy of measurement results for the radioactivity of the sample is "plus-or-minus 20%".

Improving Accuracy

Greater accuracy results if the sample has higher activity, or if the time of counting is increased. Increasing the activity of the sample incurs more expense in preparation (see below), but has the advantage that the increase of accuracy is directly proportional to the increase of concentration. Increasing the counting time is basically cheaper, but has two severe disadvantages. Firstly, the accuracy increases only with the square root of the counting time, so that to get a tenfold increase in accuracy a counting time 100 times as long is needed, which greatly aggravates the second disadvantage—namely, that the cosmic background itself is subject to fluctuations over such long periods. These fluctuations are in addition to the normal statistical ones, and have other more physical reasons in connection with the sun, the ionosphere, etc. It is thus highly advisable, if attempting any measurements requiring counting time exceeding 24 hours total for both component measurements together, that "interlace" be employed. This involves alternate measurements with and without sample, each for several hours, and using averages of the respective sums for calculating the final results.

At any rate, the advantages of using as high a degree of initial concentration as one can afford in preparing samples should have been made clear by now! It is now required to give details of the best method of preparing water samples, devised from the author's experiments. The same method is used for rainwater, tapwater or spa-water. The final volume of the prepared sample should be chosen accurately standard as 10c.c., and an appropriate small chemical measuring vessel should be procured, to make up the sample to exact volume before filling into the Geiger-counter test-tube. A few small glass beakers of about 100c.c. should also be obtained. Regarding chemicals, a 250c.c. bottle of dilute nitric acid (1 part acid to 4 parts water) is needed. This should be kept in a glass-stoppered poison bottle, and great care exercised, as the solution is highly poisonous and corrosive.

Volume of water

About a gallon of the water to be tested is required as starting point, and should be boiled to dryness in a small saucepan on the kitchen stove, subsequently kept strictly only for such experiments. A saucepan holding no more than a quart should be used, filling in more original water as it evaporates. The water should be cleaned as far as possible prior to boiling, using paper or fine cloth filters, to avoid too much scum towards the end of the concentration process. When all the water has been boiled dry, the deposits in the saucepan should be swilled with about 5c.c. of the dilute nitric acid (care!), and all transferred as completely as possible into one of the small glass beakers. After allowing the insoluble dirt to settle, the clear liquid is poured off completely into the 10c.c. measuring vessel, and made up to exactly 10c.c. with tapwater. This now represents the finished sample, which can be filled into the test-tube in the Geiger head. Remember that the sample is, chemically, dilute nitric acid, and thus very corrosive. Do not spill any drops into the electronic apparatus!

The author finds that a boiling-time of about 4 hours is required on a good kitchen gas range to deal with a gallon of water in this manner, at a cost of about 4s. gas-consumption. This cost would be high if all one could do with the sample thus prepared were to make one measurement, and say whether or not it were radioactive. But in fact there is much more to be done. Once one has prepared two or three such samples, one can measure them repeatedly at intervals of a few days or weeks, and investigate the rate of decline of the activity.

(To be continued)

loudspeaker CROSS-OVER Networks

By K. Berry

HOW TO MAKE NETWORKS FOR ANY IMPEDANCE AND FREQUENCY.

PROPRIETARY loudspeaker crossover networks are fairly expensive items, and are not always available with the required impedance and crossover frequency. This article gives details of how to design and make crossover networks for any impedance and frequency.

Basic Theory

Loudspeaker crossover networks are in fact perfectly straightforward prototype (or constant-K) filter sections or half-sections. The mathematical theory of these filters may be found in any standard text-book and it is not proposed to deal with it here.

Two types of filter are used in these networks. One is a low pass filter, which, as the name would suggest, passes only frequencies *below* its cut-off frequency. Signals above this frequency are subjected to attenuation and the amount of attenuation increases with frequency. The circuit configuration of such a filter is shown in Fig. 1, where both a whole and a half-section are depicted. The second type of filter is a high pass filter, which passes without attenuation only those frequencies *above* its cut-off frequency, frequencies below being subjected to attenuation. In this case, the degree of attenuation increases as the signal frequency decreases. A high-pass filter section and a half-section are also shown in Fig. 1.

Attenuation

If a prototype low-pass filter section is designed to have a certain cut-off frequency, it does not start to attenuate sharply at that chosen frequency. In practice, it will be about 20% above the cut-off frequency before 6dB of attenuation is reached, though at a frequency 20% below *f*c, the filter will introduce an attenuation of about 1¼dB. This performance is typical of prototype filters. Filter sections can be designed to have a very rapid attenuation if so desired, but such filters lie outside the scope of this article. If it is desired to feed a high frequency loudspeaker or "tweeter", this may be done in one of three ways (see Fig. 2);

(a) It can be connected in series with a single capacitor of suitable value.
(b) It can be fed via a high-pass half-section filter.
(c) It can be fed via a high-pass whole-section filter.

Method (a) is not normally considered satisfactory since the rate of attenuation below the crossover frequency is insufficient. Both methods (b) and (c) are acceptable. though method (b) is, in fact, the method normally used.

The rates of attenuation below *f*c, per octave (2·1 frequency change), are:—

(a) capacitor feed	6dB/octave
(b) half-section filter	12dB/octave
(c) whole-section filter	18dB/octave

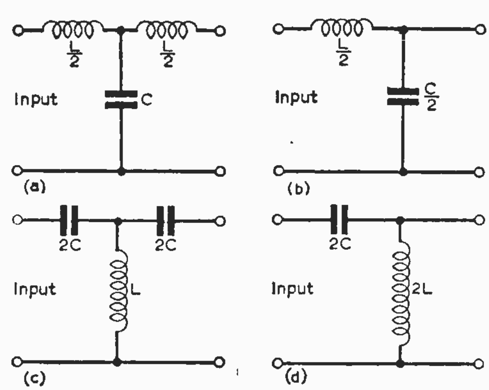


Fig. 1 a—Low-pass filter—whole-section; b—low-pass filter—half-section; c—high-pass filter—whole-section; d—high-pass filter—half-section.

Design Data

Prototype filter sections are designed from the following equations

Low Pass

$$fc=\frac{1}{\pi\sqrt{(L.C)}}$$

$$Z=\sqrt{\left(\frac{L}{C}\right)}$$

High Pass

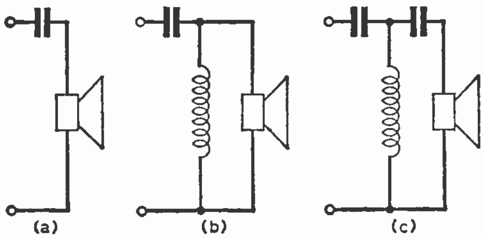
$$fc=\frac{1}{4\pi\sqrt{(L.C)}}$$

$$Z=\sqrt{\left(\frac{L}{C}\right)}$$

where *f*c is the cut-off frequency in cycles per second, Z is the impedance of the filters and L and C are the values of inductance and capacitance in Henrys and Farads.

To save the necessity for long calculations, these formulæ have been re-arranged and partly worked out as below:—

Low Pass	High Pass
$L=\frac{318Z}{f}\mu H$	$L=\frac{79{\cdot}5}{f}\mu H$
$C=\frac{318}{fZ}\mu F$	$C=\frac{79{\cdot}5}{fZ}\mu F$



where f is the desired cross-over frequency in kc/s and Z is the loudspeaker voice-coil impedance in ohms.

Example

Design a loudspeaker crossover network with a crossover frequency of 5kc/s. The loudspeaker speech coil impedance is 15Ω.

Low Pass

$$L=\frac{318Z}{f}=\frac{318\times 15}{5}=954\mu H$$

High Pass

$$L=\frac{79{\cdot}52}{f}=\frac{79{\cdot}5\times 15}{5}=238{\cdot}5\mu H$$

$$C=\frac{318}{fZ}=\frac{318}{5\times 15}=4{\cdot}24\mu F$$

$$C=\frac{79{\cdot}5}{fZ}=\frac{79{\cdot}5}{5\times 15}=1{\cdot}06\mu F$$

The actual values of the components required for the half-section filters will therefore be:—

Low Pass
Inductor (½L) 477μH
Capacitor (½C) 2·12μF
High Pass
Inductor (2L) 477μH
Capacitor (2C) 2·12μF

In other words—the components needed for the high and low pass half-sections are the same. It should be noted that will not be as case if whole section filters are used. The circuit for network designed above is shown in Fig. 3. Table 1 gives component values required for certain specific frequencies for 3 and 15Ω loudspeakers.

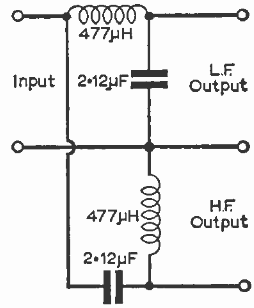
Construction

When the component values for the desired network have been arrived at, all that remains is to make the unit.

The capacitors should preferably be paper or metallised paper types. However, certain of the values listed in Table 1 preclude the use of such capacitors, and resort must therefore be made to electrolytic capacitors. These may be either of the reversible type or of the uni-directional type. If the latter are employed their working voltage should be not less than 25 times the maximum A.C. voltage to be applied to them. Thus for a 15W amplifier using 15Ω loudspeakers, the capacitors should have a working voltage of not less than 25×15=375, whilst for a 3W amplifier using 3Ω loudspeakers the voltage required is only 25×3=75.

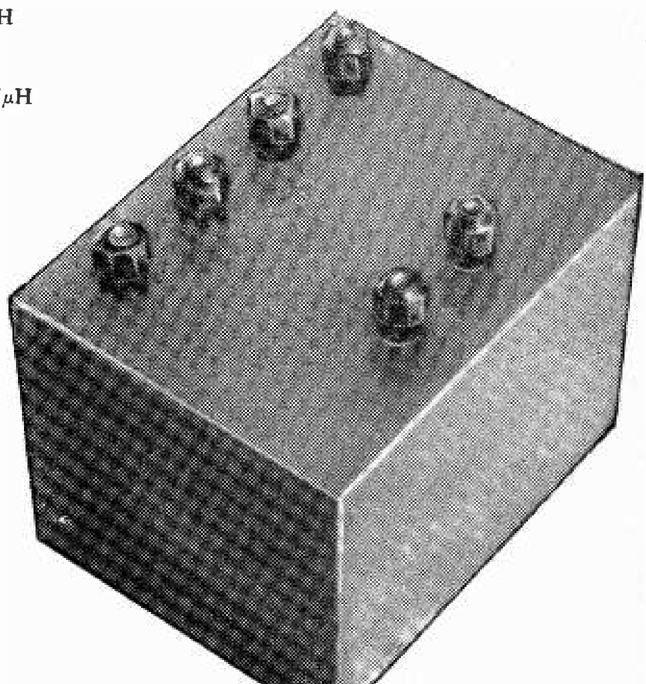
Fig. 2 (left), a, b and c—Methods of feeding a "tweeter".

Fig. 3 (right)—The circuit of a 15Ω, 5kc/s crossover network.



Performance

A 5kc/s crossover network was made up and the performance measured both with half-section filters and with whole-section filters. The results of this test are shown in Fig. 4. The greater attenuation of the whole-section filters can be seen clearly.



The finished unit.

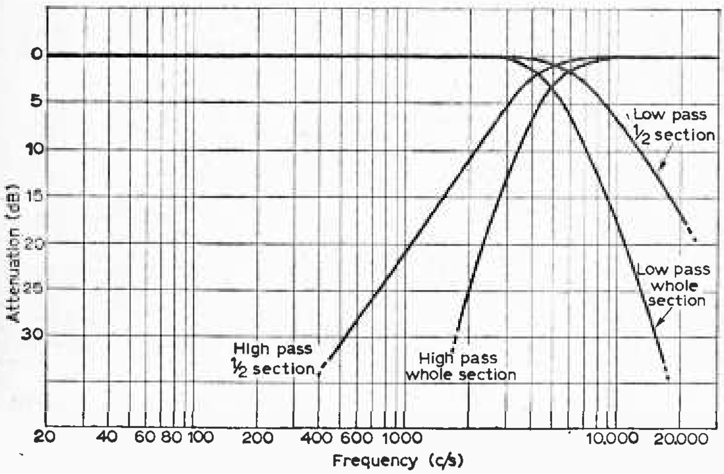


Fig. 4—The response curves of a 5kc/s crossover network with half-section and whole-section filters.

capacity of the capacitor is given by 3180/RμF. where R is the value of the resistor in ohms. The voltmeter used for this test should be of not less than 500Ω/V on A.C.

The inductors, fortunately, present little difficulty. For ease of construction, the coils are wound on number 22s.w.g. enamelled wire wound on a 3in. diameter former. The coils are "random wound" over a length of about ½in., and when the required number of turns has been wound, the coil is slipped off the coil former and bound together with insulation or other suitable tape. For coils made as described above, an inductance of 340μH will be obtained with a coil of 50 turns. The number of turns required for a given inductance, X μH, may be calculated from the expression $N=50\sqrt{\frac{X}{340}}$ turns

The quantity of wire required may be calculated from the fact that a coil of 50 turns weighs 1¾oz.

These coils, being air-cored have an inductance which is independent of current, and cannot, unlike iron-cored coils, introduce distortion.

Tolerances

It is felt that is should be pointed out here that if strictly accurate results are to be obtained, the actual capacity of the capacitors employed in crossover networks, whether paper or electrolytic, should be close to their calculated value. Since paper capacitors have a typical tolerance of ±20%, and electrolytics a tolerance of −20+100%, this is not easy to ensure. Many capacitors, when measured, do, in fact, have values of capacitance which are very much closer to their nominal value than their tolerances allow.

TABLE I

Crossover Network Component Values

Impedance	3Ω		15Ω	
Frequency	Inductor	Capacitor	Inductor	Capacitor
0·5kc/s	954μH	106μF	4780μH	21·2μF
1·0kc/s	477μH	53μF	2390μH	10·6μF
2·0kc/s	238·5μH	26·5μF	1195μH	5·3μF
5·0kc/s	95·4μH	10·6μF	478μH	2·12μF
10·0kc/s	47·7μH	5·3μF	239μH	1·06μF

To ensure complete success, the exact value of the capacitors should be measured on a capacity bridge. Information on the use and construction of such bridges may be found in earlier issues of this magazine. However, if a bridge is not available, *paper* capacitors (not electrolytics) can be measured with sufficient accuracy by the following means. Connect the unknown capacitor in series with a variable resistor and connect the series combination to a 50c/s A.C. supply, the voltage of which does not exceed ¾ of the D.C. working voltage of the capacitor. Adjust the series resistor until the voltage measured across the capacitor is the same as that measured across the resistor. The

Coil Spacing

When the capacitors and inductors have been obtained, it only remains to make a suitable assembly and wire it together. The inductors should be spaced at least 3in. from one another and should be kept 2-3in. away from any large metal object. If the coils are at right angles to one another, then there is no limitation on their spacing. A finished crossover network, mounted in a wooden case is shown in the illustration on page 1007.

How Transistors Work

By B. N. Rolfe

A BASIC, NON-MATHEMATICAL EXPLANATION

(Continued from page 811 of the January issue)

WHEN we were discussing Tests 1, 2, 3 and 4 of Fig. 1 (in the January issue) it was intimated that the ratio of reverse to forward resistance could be used as a measure to assess the goodness of a transistor. With a good transistor the ratio should be at least 25:1, but with high quality components the ratio may be as high as 100:1, or even greater.

Low-power transistors will in general have a forward resistance about 100Ω and a reverse resistance in excess of 50,000Ω (50k). If both resistances (forward and reverse) are high or infinite, then that particular junction is open-circuit. If there is no difference between forward and reverse resistances, whether the actual values are high or low, the junction is leaky or short circuited. Both junctions, relative to base, should be checked, since if only one is good while the other is either open or shorted, the transistor is useless.

Leakage is checked as was shown in Fig. 8, but it should be noted that temperature has a marked effect on the resistance values obtained, so keep the component away from a soldering iron or bench light while performing resistance tests.

One of the reasons why a transistor works is because a change in collector current is brought about by a change in base current. This is not the complete story, however, for there would be little point in using a transistor if a change in base current only produced an equivalent change in collector current.

Amplification

We know that, with a valve, a small change in control grid voltage produces a change in anode current and that this change is reflected as a change in voltage across the high impedance anode load. We also know that, because a small change in anode current causes a relatively large change in voltage across the load, compared with that at the grid, a valve provides a means whereby a small voltage at the input is amplified to a larger voltage at the output. In other words, the small change in voltage at the grid gives rise to a larger change in voltage across the anode load.

To be any good, the same thing must happen with a transistor—and it does. This is brought about mainly because the base-emitter junction is biased for forward current and as a consequence has a low resistance which produces a fairly high current from a low voltage. The collector circuit, on the other hand, has a higher resistance, which means that for a given collector current a higher voltage can be applied to the collector through a higher value resistor. This is because the collector circuit cannot be biased for forward conduction. It will be recalled that collector conduction is promoted essentially by the base current.

Current Gain

A transistor would be said to have a current gain of 100 if a change of 5mA were caused in the collector circuit by a base current increase of 5/100mA, that is 50μA. We can understand how a transistor gives voltage amplification by considering the circuit in Fig. 10. Here, the base is biased to the correct working point by battery B1. Now, suppose an input signal is applied in such a way in relation to R1 that it causes an alteration in base current. If the signal were a pure sine-wave, it would add to the battery voltage on one half cycle and subtract from it on the other half cycle. Let us suppose that the input signal is 50mV peak to peak across 1,000Ω (R1); this would cause a total current change of 50μA in the base circuit (Ohm's law).

If the transistor has a current gain of 100, then there would be a 5mA change in current in the collector resistor R2. If R2 also has a value of 1,000Ω, as shown, a change of 5V peak to peak would occur across it (Ohm's law again). Clearly,

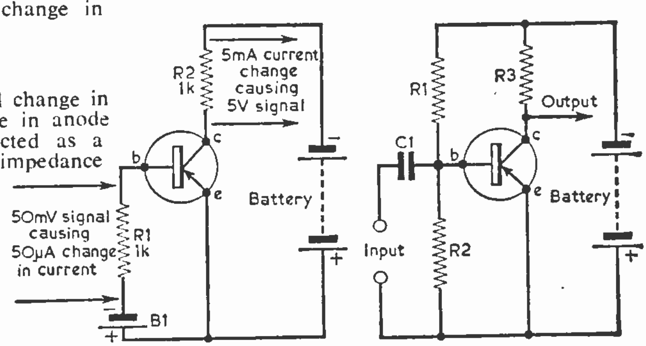


Fig. 10 (left)—How a transistor acts as a voltage amplifier.
Fig. 11 (right)—A circuit in which the base bias battery has been eliminated.

then, the transistor has served to step up the 50mV input signal by 100 times to 5V.

If the collector resistor had been 5,000Ω, the same reasoning will show that the output would have been 25V peak to peak. There are, of course, limits to the output voltage that can be obtained, depending on the type of transistor and circuit characteristics, and there are various other factors which alter slightly the simple example above.

The Use of a Common Battery

A transistor requires two voltage sources, one for biasing the base and the other for energising the collector. Fortunately, both sources are negative to emitter with *pnp* transistors (positive to emitter with *npn* types), and for this reason it is possible to eliminate one battery and arrange a potential-divider to tap-down the required bias for the base.

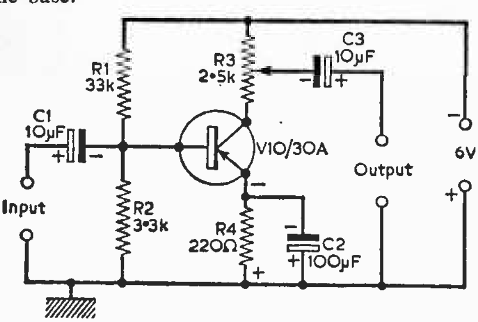


Fig. 12—The circuit of a practical audio amplifier.

This feature is shown in Fig. 11. Here the battery is connected negative to collector and positive to emitter, as is normal. In addition, a potential-divider comprising R1 and R2 in series is connected across the battery. At the junction of R1 and R2, relative to battery positive, exists a negative voltage of a value governed by the ratio of R1 to R2. The ratio is arranged in relation to the battery voltage and the type of transistor so that the correct base voltage is present at the junction, and the latter is connected to the base as shown.

The input signal is applied to the base through the isolating capacitor C1 to prevent the D.C. conditions from being affected by the input source load. It is also usual to feed the output from the collector through a similar capacitor (or transformer) to subsequent stages.

A Practical Transistor Amplifier

We can now consider a practical amplifier, and a circuit of such a device is given in Fig. 12. This is very little different from the hypothetical arrangement of Fig. 11, for C1 is the input capacitor, R1 and R2 form the base divider, R3 is the collector load and C3 is the output capacitor. In this case, the collector load is a potentiometer which acts as a volume control to feed the required audio output to the following stage. This technique is often adopted in small A.F. amplifiers, where the amplifier is used to strengthen weak signals from a microphone or pick-up so that they will fully drive the main amplifier or control unit.

It will be noted that the input and output capacitors are electrolytic types, which are required owing to the relatively low input and output impedance of a transistor circuit. With valve circuits, A.F. is usually coupled through 0·1μF capacitors, or even lower values. This is possible because of the high grid input and anode output impedance, but if similar values were used for audio coupling in a transistor circuit, there would be a considerable loss of lower frequencies because the reactances of the coupling capacitors would rise to greater values than the effective input and output loads. We must always remember that while a valve works essentially on input voltage, a transistor works on input current.

When a transistor rises in temperature whether because of an increase in the "ambient" (surrounding) temperature, or because of the current passing through it, its collector current increases. This increase in collector current causes the transistor to become even warmer which results in a further increase in collector current. This state of affairs is likely to continue until the transistor fails, and is called "thermal runaway".

It is essential that some method of counteracting this effect is incorporated in transistor circuits, otherwise transistor equipment would be extremely unreliable, to say the least. The resistor R4 in Fig. 12 serves this purpose, and is sometimes called the stabilising resistor. It is wired in series with the emitter and it therefore passes both collector and base current, and across it is developed a voltage that is proportional to the current and resistance values. With *pnp* transistors, the voltage is negative at the emitter with respect to battery positive, as shown on the diagram.

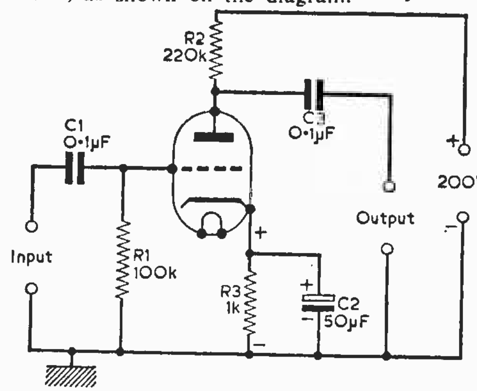


Fig. 13.—The valve equivalent of the amplifier of Fig. 12.

Now, if the collector current were to rise owing to an increase in the temperature of the transistor or from another cause, the negative voltage at the emitter would also rise (because a larger current would be flowing in the resistor). An increase in the negative emitter voltage is exactly the same as a decrease in the negative voltage at the base with respect to the emitter.

Now, the less negative base will result in a fall of collector current (remembering that an increase in collector current is promoted by an increase of negative base bias), so the transistor will cool

(Continued on page 1016)

16m TO 175m TRANSISTOR S.W. TUNER

A UNIT DESIGNED TO BE USED WITH A SEPARATE AMPLIFIER

By F. Neville Hart

(Continued from page 904 of the February issue)

ALTHOUGH the extending aerial of the receiver will normally be used for reception, it will be found, however, that in order not to upset the trimming, and also avoid flatness in tuning, it is best merely to wind 3 or 4 turns of the "lead-in" around the extending aerial, without actually connecting it to the set. An earth is a considerable help in avoiding hand capacity effects, but if the tuner is used with a mains L.F. amplifier a series condenser of not more than 1000pF, with a rating of 350VW, should be inserted. In any case, owing to the risk of a high voltage surge for a fraction of a second reaching the transistors through the condenser, try it without. There may be sufficient earthing from the chassis connection to the amplifier, also made through a condenser. With a battery

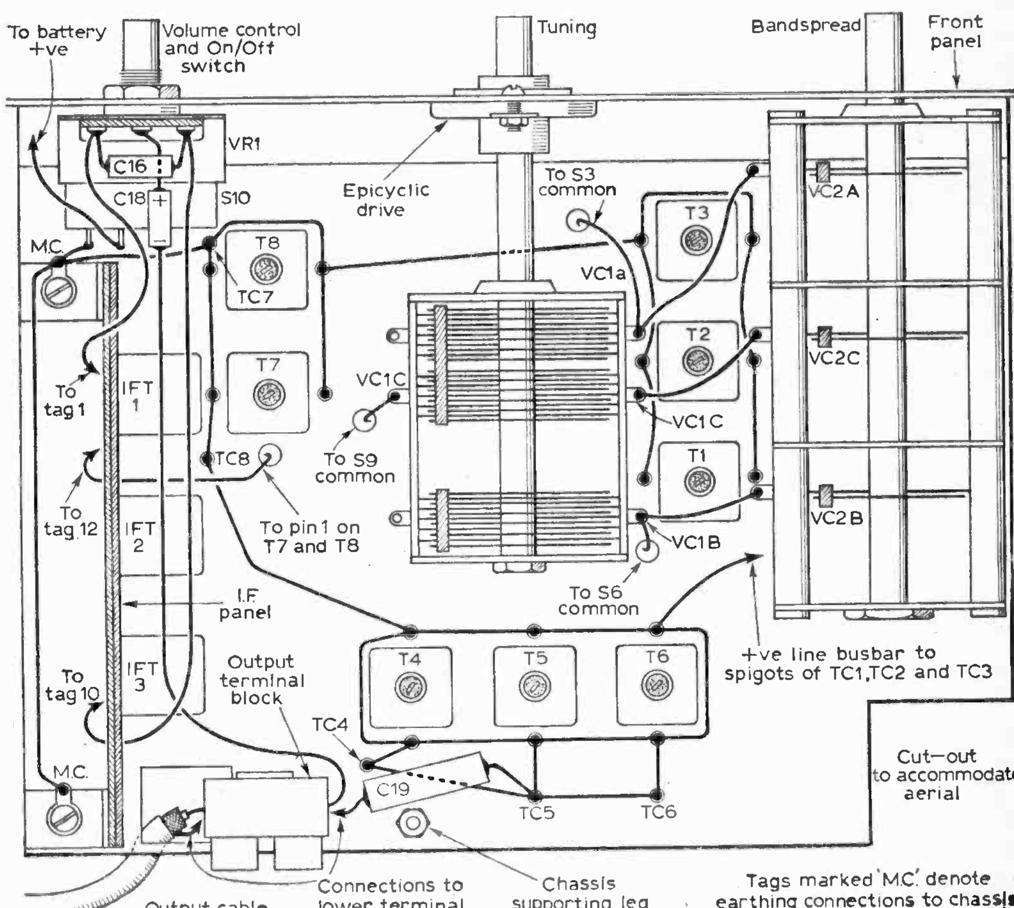


Fig. 3—The above-chassis wiring diagram.

amplifier, either valve or transistor, an earth is a definite and safe advantage.

Bandspread

Bandspread is used; in the prototype a 3-gang surplus condenser has been adapted, by taking off plates, leaving about 20/30pF, but if a 3-gang type is not obtainable, a 2-gang one will do, omitting the section tuning the aerial coil, for this stage is the flattest in tuning and the variation in tuning of the other stages is sufficient to provide adequate bandspread without loss of volume.

If, as is found with many surplus low capacity variable condensers, the unit has no "stop", one can split a piece of wire insulation and stick it on the end of a condenser plate with adhesive. This will prevent the moving plates from progressing further than maximum and minimum capacity.

Three-gang Condenser

The Jackson "OO" tuning condenser 176 and 208pF with an additional 208pF is used. It can be obtained to order from component stores. Beehive trimmers are specified (30pF), but the flat "postage stamp" type would do as well.

Only one oscillator coil is used for both ranges 2 and 3, the second harmonic being used for the 16m to 35m range.

Construction of the Set

The R.F. base-plate, of aluminium, must be cut to size, the position of the coil cans marked and the square apertures carefully made, so that the cans may be pushed through with gentle pressure, first bending at right angles their soldering "lugs". The holes can best be made by drilling a series of holes inside the area to be removed, pushing or cutting out the unwanted piece and filing to fit. Small holes must be drilled to coincide with the soldering lugs. When these are bent flat against the aluminium, wire can then be threaded through, wound round the cans and soldered to the "lugs". This will hold them tightly in position, earthing them well, when the wire is continued to a good earth point, such as battery positive or the tuning condenser earthing tag (see Fig. 3).

Holes are drilled to take the earthy ends of the beehive trimmers which are similarly fixed by winding the tinned wire round the "stalk" projecting on the top side, and soldering with a fairly hot iron. These fixing wires will all be joined together and earthed also.

Brackets

The angle brackets to hold the R.F. base-plate to the front panel should be mounted next. Exact measurements for these are not given, for constructors may have suitable types handy, or those purchased may have different hole spacing. They should be mounted with a portion protruding for ¾in. so that when joined to the front panel, enough space is given to push wires through. It is as well to use steel brackets of sufficient length to give firm support to the two panels. The two tag-strips each side can be mounted with the angle brackets, if the holes coincide. The tuning condensers can also be mounted with suitable bolts, placing a soldering tag on the one nearest the rear of the main condenser.

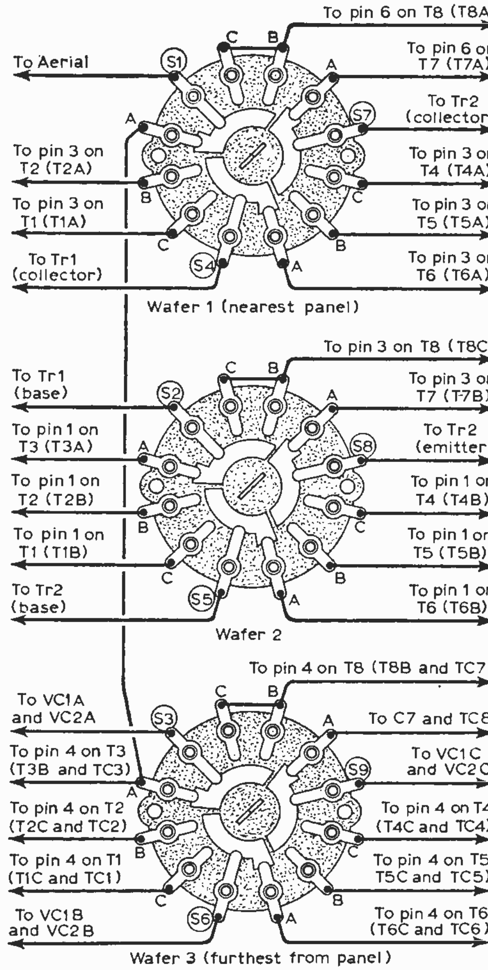


Fig. 4—The band-switching wiring diagram.

An epicyclic gear is used with the main condenser, and the front panel should be offered up before drilling the hole for the gear to ensure that the spindle will come true when it is fixed to the panel.

It is essential that no strain either way should be put on the spindle, and that it slips easily into the epicyclic gear, as tuning may be stiff, or the moving plates forced to touch the fixed ones.

Output

A double or coaxial connector can be mounted on a bracket, on the R.F. plate, to take the output lead to the amplifier jack. In the prototype a 5in. brass bolt is passed through the R.F. plate and held with nuts, so that it forms a "leg" on each side, in order to support the whole set upright when the front panel is on, facilitating testing and alignment.

When the holes have been drilled in the front panel, the switch and the volume control can be mounted, taking care to see that the hole for the band-spread condenser spindle is in the correct position. A template should be made, to ensure that the fixing bolts for the wave-change switch are correctly placed, unless it is a "one hole fixing" type.

I.F. Panel

The I.F. panel is treated quite separately, there being only three leads from the main R.F. panel, i.e., the negative line, positive line, and the oscillator collector circuit output. A paxolin panel is mounted on a double ten-tag soldering strip, which is sold in the required size, and consists of two strips supported at each end by an angle-bracket. If a solid tag-board can be obtained, so much the better. There is just enough room for the I.F. cans and their resistors and condensers, with the diode. Square holes are cut in the paxolin to take the cans, and a few extra holes drilled to push wire through.

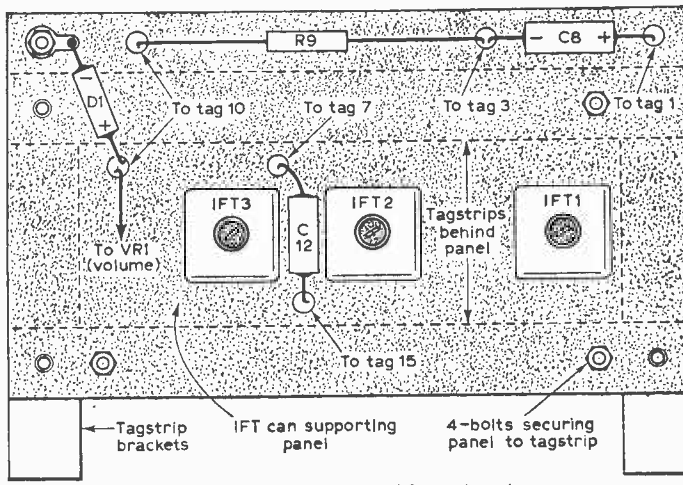


Fig. 6—The rear of the I.F. tag-board.

Can Fixing

The holes for the cans should be marked out so that, when mounted, their two fixing lugs fall opposite a soldering tag on the strips. These are soldered together, thus holding the cans firmly in place. These tags should be connected to the positive line, earthing the cans.

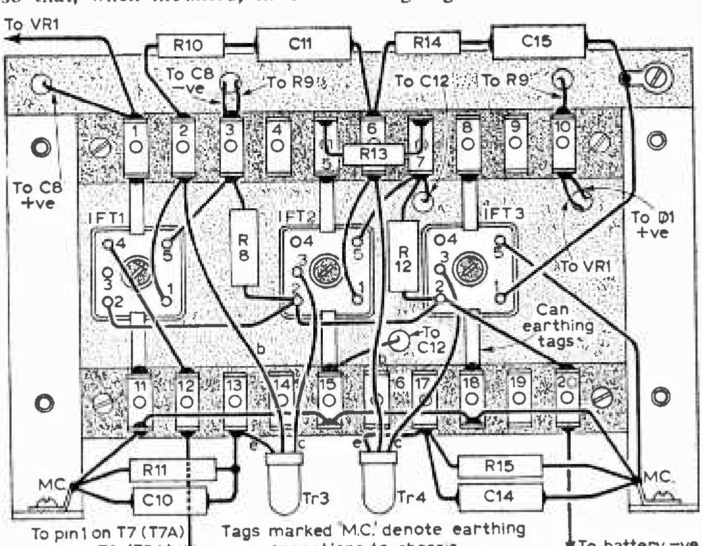


Fig. 5—The front of the I.F. tag-board.

The wiring of the I.F. panel is done in the same way as the R.F. panel, the positive line wires first, negative line next, then the resistors and condensers.

Sleeving

Wiring of the base-plate can now be started, wiring all the earth leads first, with bare, tinned copper 24s.w.g. wire, which is used for all other wiring, too. For the other leads sleeving of various colours is recommended for easy reference, a colour code being formed and written down.

Condensers and resistors can be soldered into place, and the stator plates of the tuning condensers wired in circuit with as short leads as possible.

Switch Wiring

The more inaccessible tags of the wave-change switch must have leads soldered on so that when the two panels are joined the other ends can be cut to the right length. Sleeving can be placed over these to ensure identification.

The stator tags of the bee-hive trimmers are so placed that they are above the required pins on the coil cans, and the wire is then pushed through into the hollow of the pins, the whole being soldered quickly but with enough solder to make a good joint. As the transistor connections are easily accessible these can be left until after complete assembly.

Assembly

The front panels and the R.F. base-plate can now be joined, the various leads from the wave-change switch cut as short as possible and soldered to their respective pins on the cans, and tag strips.

(To be continued)

Short-wave Listeners' Log

SOME short-wave listeners who are particularly interested in receiving amateur stations seem to be confused by the methods of operating which are used. There are customary systems which are, in fact, helpful for all concerned, and the new S.W. listener should soon make himself familiar with them.

When there is any chance of the town or locality being misunderstood, it is usual to spell these phonetically. This is especially necessary in contacts between stations in different countries.

Phonetic spelling is simply the use of easily understood words with the required initial letters. There are several lists of these, so it is pointless to give any one list in full. Quite popular is a list of names, such as Adam, Baker, Charlie, etc. However, many overseas amateurs use country, capital city, and similar names, such as America, Boston, Canada, etc. Various mixtures, and original words, are also often heard.

The same system is used to identify call-signs. For example, Uncle King Henry is simply "UKH". George 3 London Zebra would, of course, be G3LZ, and so on.

"CQ" Calls

When listening on the amateur bands, some stations will almost certainly be heard calling "CQ". This is an invitation by the calling station for any other station who hears him, to reply. The call-sign of the calling station will be repeated at frequent intervals. The station may then say he is "standing by" or may conclude with "K". This is an invitation for listening stations to transmit, and one or more replies should then be heard, if within range.

When stations are in contact, the station transmitting should give his call-sign last. For example, if the transmission concludes with "W1ZXY, G6XYZ, K" it is G6XYZ who is transmitting, not W1ZXY.

If stations are working each other, and are in different countries, this frequently gives an easy increase in the number of countries logged. Or a station in an easy, fairly near country may be heard in contact with a station in a remote, rare country. If so, when the first station passes the transmission over, it is quite likely that the rare country will then be heard, replying on the same frequency.

Q-code

Various "Q signals" are often used and will frequently be heard. Some of these are: QRM, interference; QRT, stop sending; QRZ, who is calling?; QSL, acknowledgment; QSO, communication or contact; QSY, change of frequency; QRP, decrease power, or low power; QRO, increase power, or high power; QTH, location.

A message such as "Too much QRM, could not copy your QTH, please repeat," would thus mean, "There is too much interference for me to copy or understand your town or location, please repeat". If conditions were very bad, with long-distance working for example, the message might begin "Too much Queen Roger Mary".

All amateur stations should always give both the call of the station being worked, and their own call, at the beginning, and at the end, of each transmission.

A QSO (period of communication or contact) is most often between two stations, but may be spread among three or more, who pass the transmissions round to each other in turn. Participants may be in the same, or different, countries. Some may "Go QRT" or sign off, while others may join in by giving their calls and announcing that they are on the frequency.

How Transistors Work

(Continued from page 1012)

down and a condition of "thermal equilibrium" will exist in the circuit.

In some respects, the emitter resistor is rather like the cathode resistor of a valve, and, since it passes collector current, it will have some influence on the base bias. It cannot provide base bias, of course, because it makes the base go positive (or less negative) with respect to the emitter and the base calls for a negative voltage. It thus detracts from the bias provided by the potential-divider, and this must be taken into account when the circuit is designed.

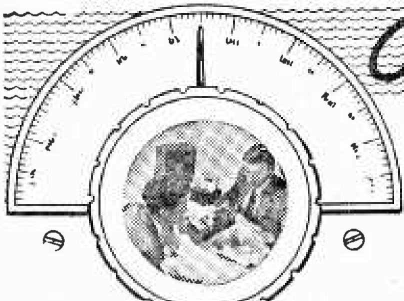
Like an unbypassed cathode resistor, an unbypassed emitter resistor will have developed across it a signal voltage. With a valve this gives rise to negative feedback, but with a transistor it would be likely to cause instability and other disturbing effects, unless the circuit were designed specifically for the resistor being left unbypassed. Usually, however, a large value electrolytic capacitor shunts the resistor (C2 in Fig. 12).

At this stage it would be useful to compare a transistor A.F. amplifier with its valve counterpart. Such a circuit is given in Fig. 13. Here, there is a $0{\cdot}1\mu F$ input coupling capacitor C1, and similar value output capacitor C3. R1 is the grid resistor, R2 the anode load resistor and R3 the cathode bias resistor which is bypassed for A.F. by the $50\mu F$ electrolytic capacitor C2.

It is interesting to compare the cathode circuit in Fig. 13 with the emitter circuit in Fig. 12. Across the cathode resistor is developed a voltage which is positive at the cathode relative to H.T. negative (caused by the cathode current). Since the grid is returned to H.T. negative through R1, it is thus negative with respect to the cathode by a value equal to the voltage across R3. The valve requires a negative grid bias and, since there is no grid current, this is adequately provided solely by the cathode resistor.

As with a triode valve, a transistor may be arranged in any configuration. That shown in Fig. 12 is known as the "common emitter" mode which, of course, is equivalent to the "common cathode" mode of a valve—Fig. 13.

(To be continued)

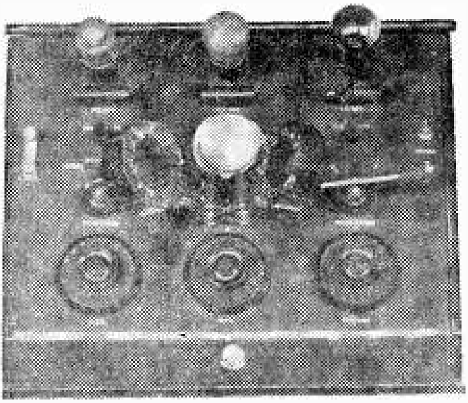


On Your Wavelength

BY THERMION

Artificial Troposphere

REGULAR readers of this page may remember my remarks in the December, 1961, issue under the above heading. I mentioned the experiment recently carried out by the U.S.A., in which a rocket was used to fire copper needles — millions of them — into space to form a metallic belt around the earth from which signals could be bounced from one part of the earth to another. Apropos of these remarks I mentioned how I had wondered what effects current atomic bomb tests will have on radio communication, and whether the radiations which result remain for all time in space, and perhaps gradually may make a complete screen round the earth.



A view of Mr. Munro's vintage receiver, which is still in good working order.

Upon reading my remarks in the December issue, a reader, who prefers to remain anonymous, has submitted the following contribution to the point which I put up for discussion.

"Regarding radiations emitted from atomic explosions remaining and accumulating in space, this is in principle not to be disputed. If not complete, then at least partial continuous accumulation is scientifically established. That such an accumulation could disturb ordinary wireless communications, if it reaches sufficient intensity, is also quite true.

"The question thus boils down to asking whether this sufficient intensity is likely to be reached. and here the answer seems to be a pretty definite 'No'. The following reasoning should make this point of view clear.

"The sun itself is simply nothing else but one colossal atomic hydrogen bomb, and has used exactly the same energy-producing processes for countless centuries, as man had only learned to produce on earth in recent years. The nuclear intensity of the sun corresponds to the explosion of many thousands of atomic bombs per second, of the largest size man has yet made. Yet all this radiation from the sun has succeeded in producing through the ages, as regards radio communication, is our well known ionosphere, and its well-known effects on short-wave radio, etc.

"Admittedly, the sun is about ninety million miles distant from us, but nevertheless, the discrepancy between the rate of release of atomic energy on the sun and from man-made devices is so great that the man-made contribution to a radiation belt screening the earth is vastly smaller than that present due to the sun anyway. Furthermore, space itself is so vast, that colossal amounts of radiation can accumulate in it without any appreciable rise of local intensity.

"The dangers of atomic bomb fall-out are of a different nature. Here we have unstable atoms of debris thrown into the atmosphere, which drift with the weather, to be washed down later in rain somewhere. The unstable atoms in this rain will then explode later, giving *new production* of *local* radiation. But this unstable atomic debris in the air will not disturb radio communication any more than an ordinary fog does, to which this debris is analogous."

I really must thank this reader for having taken the trouble to write to me with such a clear and concise explanation; we may now rest reassured.

Vintage Sets

A reader in, Occumster, Caithness—Mr. D. J. Munro—has sent me two photographs of a wireless set which he has in his possession, and the set can be seen in the illustration on this page. Mr. Munro informs me that the makers' stamp on the cabinet is that of A. J. Stevens (1914) Ltd., Wolverhampton. Apparently the receiver is still in perfect working order and when used with a loudspeaker it gives enough volume for the average room. The lid on top can be raised for the connection of the aerial, battery supply etc.

Our thanks to Mr. Munro for sending such an interesting letter. Any other readers who care to send me details or photographs of their vintage sets are invited to do so—I will pay for all photographs which are published in "On Your Wavelength."

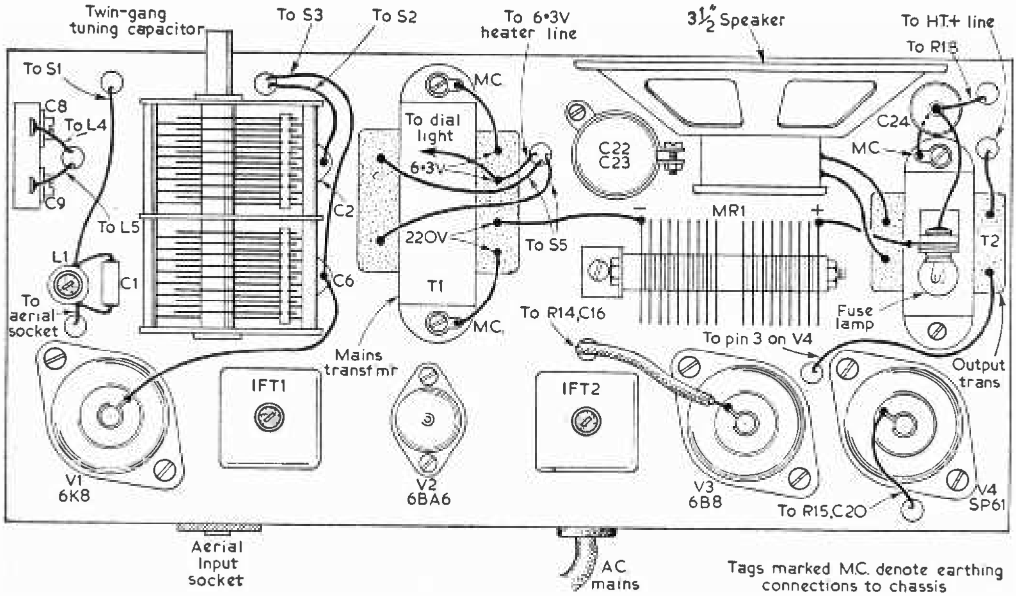


Fig. 3—The above-chassis layout of components.

(Continued from page 902 of the February issue)

LAST month the circuit was described and now this article goes on to deal with construction and alignment.

The components are mounted on an aluminium chassis. There is nothing critical about the positions of the components but the arrangement which was shown in Fig. 2 (last month) allows reasonably short connections in the R.F. and I.F. sections and gives good balance when the set is lifted by its carrying handle. Wiring diagrams are given in Figs. 3 and 4. In these, the wiring and components have been opened out for clarity; in construction, the connections should be no longer than necessary. Flexible PVC covered wire is recommended for the heater circuit and 22s.w.g. tinned copper for the remainder, lengths of more than an inch or so being covered with sleeving. Connections to the wave-change switch should be made before the oscillator coils are fitted, apart from which, construction can proceed in any desired order. The 3½in. speaker and the tuning scale, measuring 4½in. x 3in., are fitted on a piece of ⅛in. hardboard in which suitable apertures have been cut, and this is bolted to the front chassis runner in three places. No other support is needed. The holder for the fuse bulb is soldered to the top of the output transformer; a large iron is needed for this.

Testing

When construction is complete, a check should first be made with a meter applied between C24 and chassis, that there are no shorts in the H.T. wiring. The power can then be switched on and a preliminary check made to see that voltage is present at the valve electrodes, after which the H.T. line voltage should be measured. If it exceeds 230, the values of R17 and R18 should be increased

midget mains SUPERHET

A HIGHLY SENSITIVE DOMESTIC RECEIVER

By V. E. Holley

to bring it down to this figure. The background at this stage should be virtually silent. If, however, trouble should be experienced with hum pick-up at the grid of V3, it may be completely eliminated by modifying the detector circuit as shown in Fig. 5. This arrangement is open to technical objection in that the A.C. shunt load on the signal diode is considerably increased, thereby introducing a certain amount of distortion, but this is not a high fidelity receiver and no adverse effect snould be noticed.

trimmer C5, at the same time moving the tuning condenser back and forth a little, until a combination of settings is found which gives maximum response, i.e. where the signal and oscillator circuits track exactly. Note the dial reading (Point A). Now carry out a similar procedure at 600kc/s, with the padder capacity, C8, and again note the dial reading where exact tracking is found (Point B). Return to Point A and repeat the whole process several times till no further improvement is obtained. The oscillator now tracks correctly near

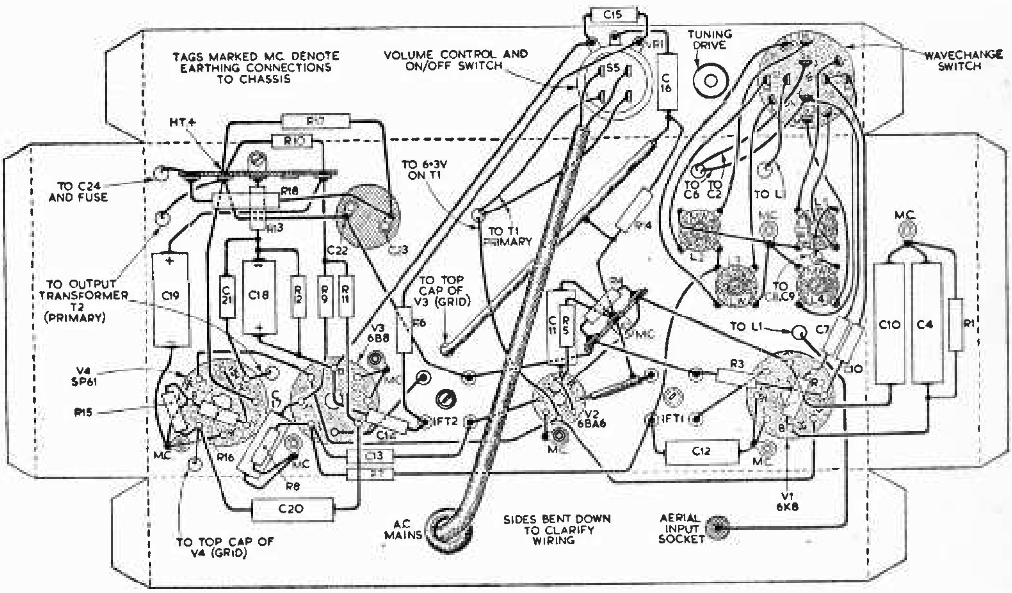


Fig. 4—The underchassis wiring diagram.

I.F. Alignment

If a signal generator is available, inject at the grid of V1 a modulated 465kc/s signal, advance the volume control and adjust the cores of the I.F. transformers for maximum response from the loudspeaker. The injected signal should be kept as small as possible and should be reduced in amplitude as the circuits come into line.

Signal and Oscillator Circuits

The first step is to adjust the medium wave aerial coil to cover the desired range, which it will be assumed is from 1500kc/s to 550kc/s. Set the medium waves padder, C8 to about two-thirds capacity and, with the switch in the medium wave position, and the tuning condenser fully open, inject a 1500kc/s signal at the aerial socket. Tune for maximum response with the trimmers, C3 and C5. Close the condenser fully and inject a signal of 550kc/s; tune for maximum by manipulating the cores of the aerial and oscillator coils. Repeat the process at each frequency until no further improvement can be obtained. Correct three-point tracking of the oscillator can now be achieved as follows. Set the tuning condenser to 1400kc/s and inject a signal of this frequency at the aerial. Tune with the

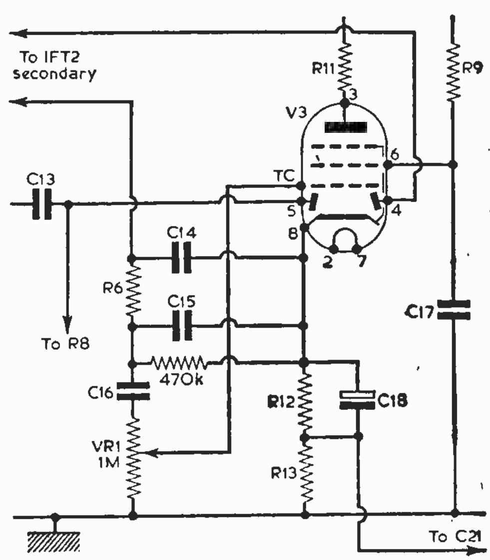


Fig. 5—An alternative detector circuit.

each end of the band and at some unknown intermediate point which, for proper performance, ought to be about 900kc/s. Inject a signal of this frequency and find the exact tracking point by manipulation of the tuning condenser and the oscillator core; note the dial reading (Point C). Move to Point B and tune a 600kc/s signal with C8. Repeat the adjustments at points C, A and B in that order till no further improvement can be obtained and finish off by adjusting C5 at point A.

Long Wave Band

The trimmers C3 and C5 require no adjustment on this band since the alteration in stray capacities due to switch operation is negligible Close the tuning condenser fully and adjust the core of L3 and the L.W. padder C9 using a frequency of 150kc/s. The oscillator can then be tracked at points B and C as for medium waves, using frequencies of 160kc/s and 200kc/s respectively.

All the foregoing operations should be carried out with a signal just sufficient to obtain a response, so that the AGC system is not brought into action.

Alignment without a Generator

If a generator is not available pre-tuned I.F. transformers should be used. Set the wave-change switch to long wave and tune in the Light Programme on 200kc/s. Adjust the I.F. cores for optimum results. Only small adjustments should be required to compensate for stray capacities; do not make any large alterations or the prealignment will be lost.

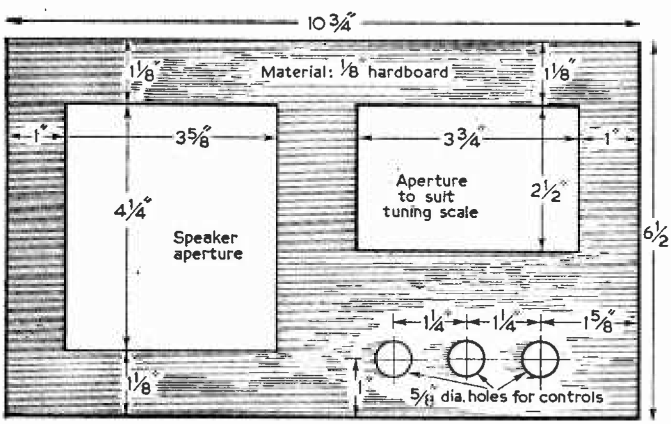
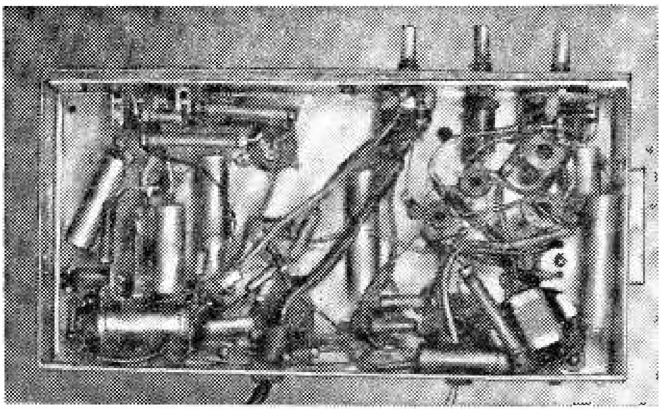


Fig. 6—The dimensions of the front of the cabinet.

Without a generator, it will not be possible to check the range of the signal circuits exactly but it is usually possible to find transmissions at each end of the band from which a reasonable approximation can be made. For tracking the oscillator, select three transmissions as close as possible to the frequencies of points A, B and C and proceed as previously described.

Oscillator Amplitude

If, when the receiver is correctly aligned, it is found that whistles are troublesome at various points on the scale, it is probable that the oscillator amplitude is too great. This may be remedied by inserting a resistor of from 100Ω to 300Ω between C10 and the switch S4.



An underchassis view of the receiver.

Operation

In most areas, satisfactory reception of the BBC programmes will be obtained with about three feet of wire as a "throw-out" aerial, though the signal to noise ratio will, of course, be improved in less favourable situations by a more efficient arrangement. An earth is not necessary, though it will reduce mains-borne interference if this proves troublesome.

Cabinet

A cabinet in which to house the receiver is easily made without any complicated joinery and with only simple tools. The constructor will require some plywood, glue, glass-paper, panel pins, a saw, a hammer and a carpenter's brace and bits. Cut out the top from ¼in. plywood. 10½in. x 5⅝in. and the bottom from the same material, 10½in. x 5½in. The sides should be of ⅛in. oak-faced ply, and should each measure 6⅜in. x 5½in. Another piece of ⅛in. faced ply, 10¾in. x 5½in. is fitted as an overlay on the top, so giving the effect of rebated corner joints and providing a rebate of ⅛in. along the rear edge of the top in which the back of the cabinet can be fitted. The manner in which these five pieces of wood are assembled will be clear from Fig. 7.

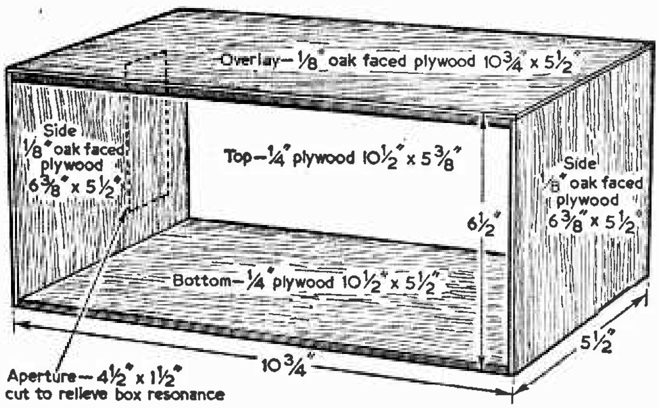


Fig. 7—The method of assembly of the cabinet.

The front of the cabinet should be cut from ¼in. faced ply to the measurements given in Fig. 6, though the aperture for the tuning dial may, of course, have to be adjusted in size, shape and position to suit the scale used and the height of the tuning condenser spindle above the chassis.

Assembly

The top and overlay should first be glued together so as to form the ⅛in. rebate at each end and along the back. When this is dry, a trial assembly of the remaining pieces can be made, using ½in. panel pins, driven half-way home. Some care is needed in driving the pins through the front into the sides which are only ⅛in. thick, but

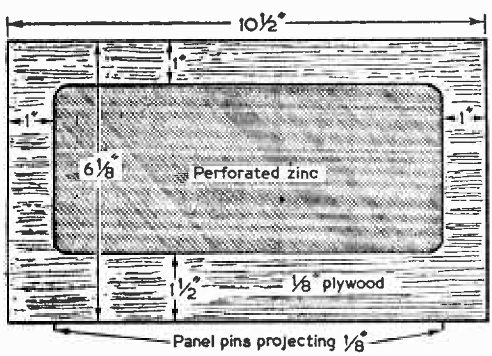


Fig. 8—The back of the cabinet.

with small gauge pins and a light hammer it is not really difficult. Having obtained a satisfactory fit, dismantle, apply glue to the joints and re-assemble, driving the panel pins right home. Some of the modern glues set hard enough to blunt wood-working tools so it is as well to wipe away the surplus around the joints while it is wet.

Finishing

The panel pins should be punched in so that the heads are a little below the surface and the resulting indentations and any other blemishes filled with plastic wood of the colour in which the cabinet is to be finished. This is important because plastic wood does not readily absorb wood dyes.

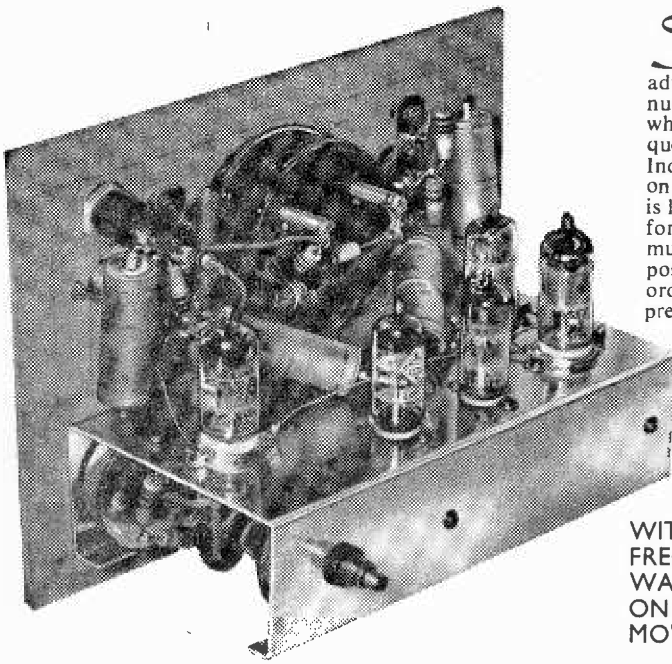
When this is dry, sand all over with No. 2 glasspaper, removing any projections at the corners and places where filler has been applied and finish off by giving a good rub down all over with No. 0 paper. Wood dye of the desired colour can now be rubbed in with a rag wad. A very satisfactory and durable final finish can be obtained with little effort by rubbing into the wood a compound of self-drying oils marketed by several of the well-known polish manufacturers for sealing wood floors. About three applications will be needed, with a light rub down between each. When this has been carried out, the carrying handle can be fitted and the speaker aperture covered with suitable material. Four small rubber buffers fitted to the bottom will improve the appearance and avoid damage to any polished surfaces on which the receiver may stand.

Fitting the Receiver

Place the receiver in position and drill upwards through the bottom and through the end flanges of the chassis, holes about 3/32in. in diameter, one at each end. Enlarge and countersink the holes in the wood only. Wood screws of suitable diameter can now be inserted and will have a self-tapping action as they enter the aluminium, so securing the receiver firmly in position. As some of the H.T. wiring is above the chassis, it is desirable to fit a back to the cabinet. This can conveniently be of ⅛in. ply cut to size and have the centre cut out as in Fig. 8, in the interests of acoustics and ventilation. The aperture can be covered with perforated zinc, secured to the wood with an impact adhesive. Two panel pins should be driven into the bottom edge as shown and the heads filed to points which can be pressed into the bottom of the cabinet; the top can be secured with a couple of small wood screws.

Acoustics

With the particular speaker used in the prototype, an undesirable box resonance was noticed. This was relieved by cutting a second aperture, 4½in. x 1½in., in the left hand side of the cabinet as shown in the illustration. ■



THIS useful instrument for the advanced experimenter can serve a number of purposes, the principal of which is the measurement of the frequency of any input waveform. Indication is on a virtually linear scale on a moving coil meter, and the reading is largely independent of the exact waveform of the input, provided that a minimum amplitude is exceeded and that positive-going transitions at least of the order of those on a sine wave are present on the waveform.

Uses

Subsidiary uses of the instrument are manifold. Thus it includes as first stage, a one-valve pre-amplifier with a gain of 100, and a maximum output voltage of 25r.m.s, with a cathode-follower

WITH THIS INSTRUMENT, THE FREQUENCY OF AN INPUT WAVEFORM WILL BE SHOWN ON A LINEAR SCALE ON A MOVING COIL METER.

By E. Dexter

A direct-reading

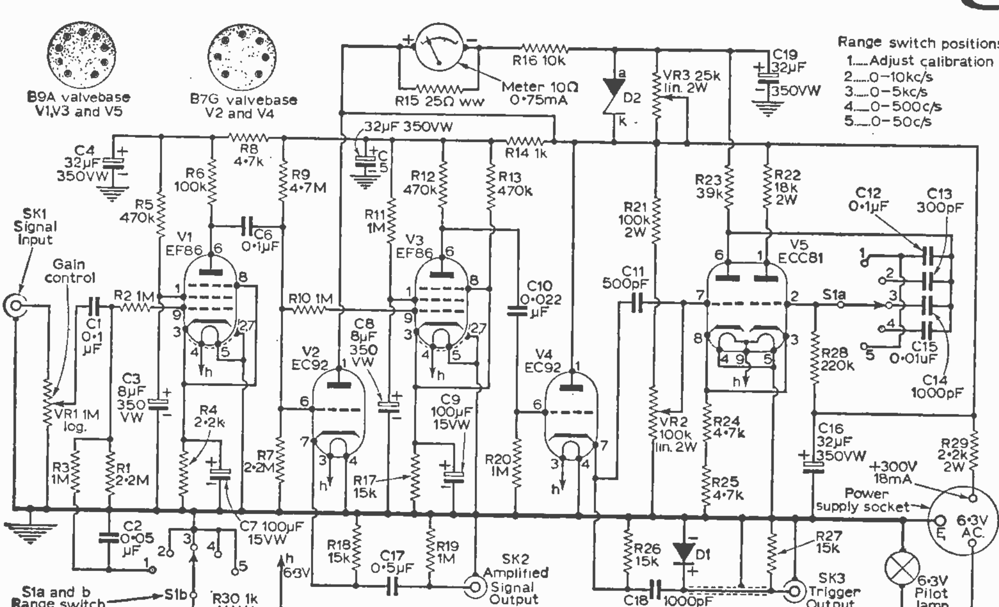


Fig. 1—The complete circuit diagram.

output stage. This can be used *independently* for any of the normal purposes for which such an amplifier may be required. An amplified version of the input signal, undistorted, but of reversed polarity, can still be taken from the pre-amplifier-output while measuring the frequency, or monitored there on a pair of headphones or a small loudspeaker.

The second stage of the instrument is a pentode limiter squarer, again feeding an output cathode follower embodying a differentiator and negative clipper circuit using a silicon rectifier. At the output provided, short positive trigger-pulses of about 30V amplitude appear, at a repetition frequency equal to the input-waveform frequency. These trigger pulses may be used to start the timebases of a triggered oscilloscope, etc. The third stage of the instrument is an integrating monostable multivibrator (flip-flop), used as the frequency measuring stage. Any reasonable combination of ranges desired can be obtained by appropriate choice of condensers for this stage, and an internal calibration check against the mains frequency is provided.

Geiger Counter

All stages will operate satisfactorily on a pulse-input of the type obtained from a Geiger counter, and the pre-amplifier will also amplify such pulses admirably well. Using a Geiger head of the type published in another article, which has a Geiger tube and simple positive-signal cathode-follower output, the frequency meter here described is usable *as it stands* as an integrating radiation intensity meter. The pulses from the Geiger head are fed into the input stage, and the meter shows the average number of pulses per second, which can be converted into the usual radiation-intensity units using the calibration-factor of the particular Geiger tube in use, or by comparison with a standard radiation meter.

The time-constant of the indicating meter circuit is about one-third of a second, so that all fluctuations slower than this in the input (as will certainly be present on, for example Geiger counter input) will be followed faithfully by the meter, whereas faster fluctuations of the input signal frequency are automatically averaged.

Introduction to Pulse Circuits

It is not easy to make this circuit function properly if two basic requirements are not satisfied. Firstly, a sufficient basic knowledge in theory and practice of conventional radio and amplifier circuitry. Secondly, possession, or availability for use, of a small oscilloscope and a valve-voltmeter, as well as an audio-signal generator, preferably calibrated. Home-made equipment according to plans published in the past in P.W. and P.TV. is ideal.

It is perhaps not out of place to suggest to the really serious constructor, who will possibly wish to build the instrument described in this article

FREQUENCY-METER

COMPONENTS LIST

Resistors (All 1W ±20% Carbon unless otherwise stated)

R1	2·2M	R16	10k
R2	1M	R17	15k
R3	1M	R18	15k
R4	2·2k	R19	1M
R5	470k	R20	1M
R6	100k	R21	100k 2W
R7	2·2M	R22	18k 2W
R8	4·7k	R23	39k
R9	4·7M	R24	4·7k
R10	1M	R25	4·7k
R11	1M	R26	15k
R12	470k	R27	15k
R13	470k	R28	220k
R14	1k	R29	2·2k 2W
R15	25Ω w.w. (see text)	R30	1k

VR1 Potentiometer 1M log. 2W
VR2 Pre-set Potentiometer 100k lin. 2W
VR3 Potentiometer 25k lin. 2W

Condensers:

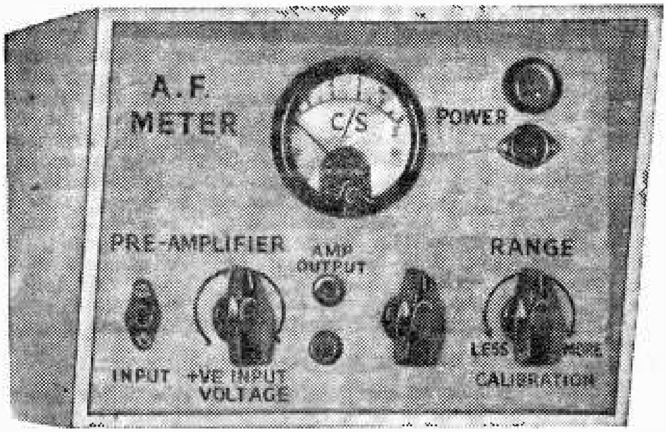
C1 0·1μF 500VW
C2 0·05μF 500VW
C3 8μF 350VW electrolytic
C4 32μF 350VW electrolytic
C5 32μF 350VW electrolytic
C6 0·1μF 500VW
C7 100μF 15VW electrolytic
C8 8μF 350VW electrolytic
C9 100μF 15VW electrolytic
C10 0·022μF 500 VW
C11 500pF ceramic (see text)
C12, C13 } See text { C14, C15
C16 32μF 350VW electrolytic
C17 0·5μF 500VW
C18 1000pF ceramic
C19 32μF 350VW electrolytic

Valves:

V1, V3 EF86 V2, V4 EC92 V5 ECC81
D1 Silicon Rectifier, 250V 250mA or similar
D2 12V 150mA zener diode

Sundries

Meter: 0·75mA/10Ω (see text)
Ceramic switch, 2-pole, 5-way
Pilot lamp
3-pole panel-fitting power socket (tape-recorder type)
3 coaxial sockets, panel fitting
Valveholders; 2 B7G, 3 B9A (ceramic)
3 pointer knobs
Aluminium 1/16in., 8in. x 8in. Wood for Cabinet
Tagstrip, bolts and usual accessories



A view of the front panel

for use in advanced experiments in circuit techniques, that he build his oscilloscope, valve voltmeter and audio signal generator first, before the present circuit, as such instruments will be needed in any case. It is also quite in order, if desired, to build the instrument described in this article as an addition to, say, a comprehensive signal generator, including the present circuit on the main chassis or on a subsidiary chassis within the same cabinet. If the constructor is building a signal generator, he could leave space free until later.

Wiring Considerations

The circuit in this article will serve as a useful introductory exercise to acquaint the newcomer to pulse-circuits with some of the practical aspects. Some brief general remarks on this subject are not out of place, In pulse circuits, we are very often dealing with large signal amplitudes of tens or hundreds of volts, and are primarily interested in changing waveform *shape* rather than amplitude. Thus stray couplings are not of quite the same importance as in conventional amplifiers, as the fractions of a volt involved are of secondary importance at the high signal amplitudes present. Thus, it is often better to dispense with screened leads as far as possible, and tolerate the small extent of feedback produced, rather than cause the far more serious waveform-deformation of all amplitudes produced by the phase and frequency distortion resulting from the unwanted stray capacities of screening. Where screened leads must be used in pulse circuits, these must be of low capacity coaxial type. Ordinary audio cable is seldom satisfactory.

A "pulse" is basically any waveform containing very sudden changes of voltage, akin to the idea of "transients" in conventional amplifier terminology. As will be known to the constructor, any stray capacities will "round-off", i.e., destroy the steepness, of transients, because of the charging time required by the capacities. Thus, unless this type of deformation of the waveform is deliberately desired at the point in question in a pulse circuit, stray capacities remain the constant problem. Layout and design should be such as to minimise these. It is in many cases the effect of stray capacities which ultimately sets an upper frequency limit to satisfactory performance of a pulse circuit.

Ranges

Bearing in mind the remarks just made, it is clear that any conventional amplifier (the stray capacities and other circuit defects of which are so low that frequency distortion and phase distortion are quite negligible over the whole range of harmonic components contained in a given waveform) will be capable of amplifying that waveform with negligible distortion of shape. Now, consider a good square wave, with its sudden

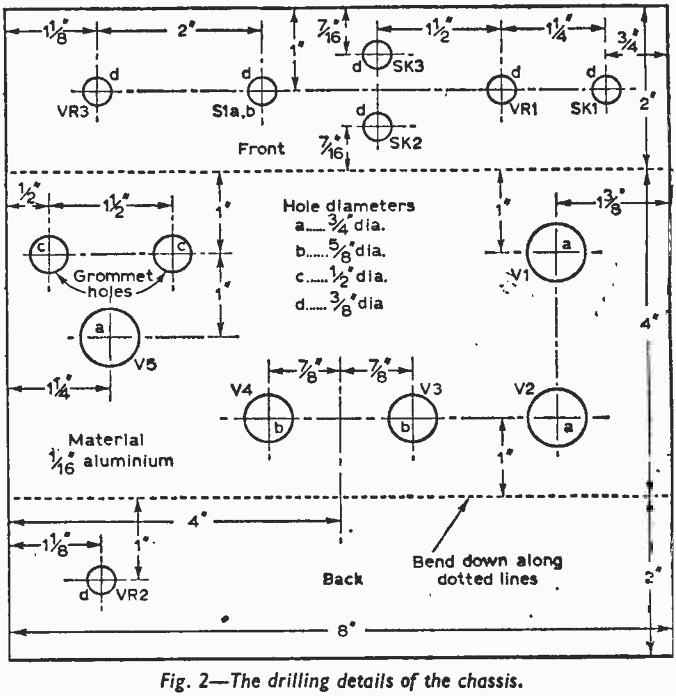


Fig. 2—The drilling details of the chassis.

alternate positive and negative transitions, as the ultimate example of pulse types of waveform, Fourier analysis shows that harmonics up to the fifth, at least, and preferably up to the tenth, must pass satisfactorily through an amplifier, if the "square" form of the wave is not to be appreciably rounded off. Thus we need much higher frequency ranges in equipment dealing with non-sinusoidal waves, and pulse-amplifiers and equipment fall under the category of "video" amplifiers.

In the instrument described in this article, modest ranges up to 10kc/s fundamental frequency are present on the prototype. There is no reason against the constructor attempting to install considerably higher ranges, and he will very likely be successful in doing so, as long as certain points mentioned later in this article are watched carefully. A second method to increase the range to higher fundamental frequencies is to include a frequency-divider stage in front of the input. This has definite advantages. Firstly, in the author's experience, it is easier to make such frequency-dividers work well at high frequencies than it is to make the integrating multivibrator of the present circuit run well above 10kc/s. It must be remembered, from the above remarks, that a 10kc/s range already requires the presence of signal components up to 50kc/s.

Prototype

The circuit as published in this article was found to operate quite reasonably with a 0 to 50kc/s upper range, simply by replacing C13 with a value between 50 and 100pF. But this range will no longer be anywhere even approaching linear, on account of stray capacities being then of the same order as the capacitance value used for C13, so that a separate calibration on the meter scale will be required for this range. Indeed, *slight* non-linearity of scale, in the form of slight opening-up at low readings and slight cramping near full-scale, may be present on all ranges, so that the finished instrument should be calibrated initially against an already calibrated audio oscillator, on all ranges.

The writer has not found this non-linearity appreciable on any of his scales for the four ranges incorporated, 0 to 50c/s, 0 to 500c/s, 0 to 5kc/s, and 0 to 10kc/s. Thus one linear scale is used for all on the meter. The writer preferred to leave out a 0 to 25kc/s range, with its extra calibration, as his personal uses of the instrument will seldom require this, but the hi-fi enthusiast, who will use this instrument on good audio-amplifiers, and experiments therewith, should include this range instead of the 10kc/s range.

(To be continued)

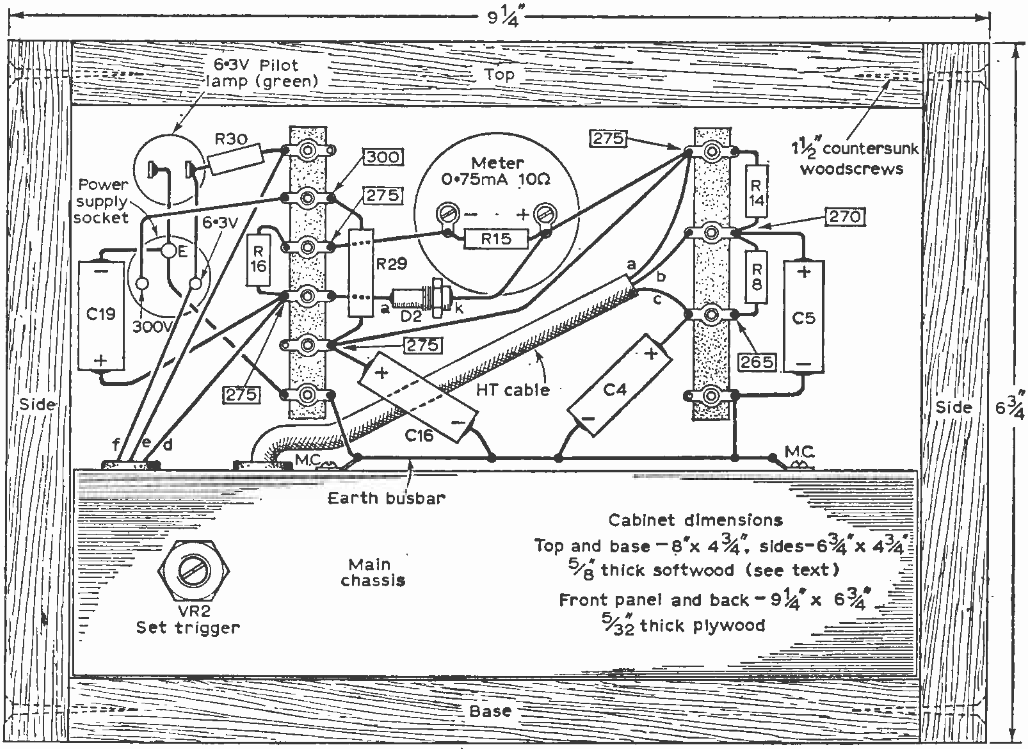


Fig. 3—The wiring at the rear of the panel and case details.

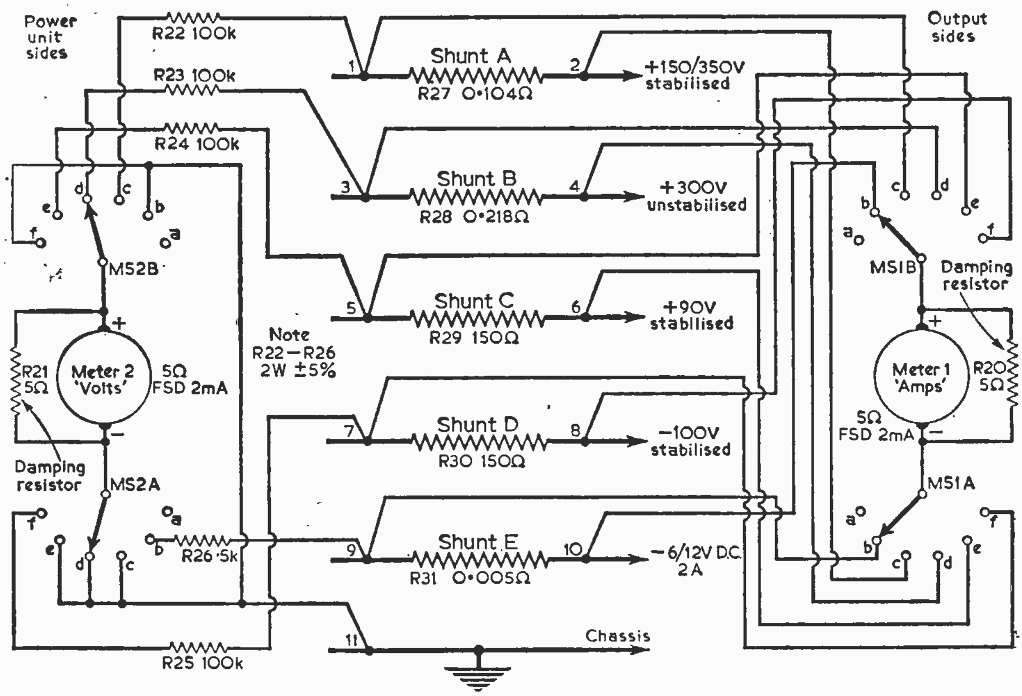
Experimenter's POWER-PACK

(Continued from page 908 of the February issue)

DETAILS OF THE CIRCUIT SWITCHING

By M. L. Michaelis

As stated last month, this unit is built in four sub-units arranged, so that when assembly is complete, spatial interlocking is achieved within the cabinet. The constructor can base the final construction on the guiding dimensions given here from the author's prototype unit. Only after careful consideration should constructional work be commenced, as only then can the exact dimensions necessary be determined. The author, however, used standard size components throughout in his prototype unit, so that in fact little departure from his construction will normally be needed, unless the constructor wishes to use particularly awkward components that may be in his junkbox. In that case, the author would feel that a conventional chassis construction should be reverted to, rather



METER 2

a:	Off	
b:	−6/12V D.C. (20V range)	
c:	+150/350V	(400V range)
d:	+300V	(400V range)
e:	+90V	(400V range)
f:	−100V	(400V range)

METER 1

a:	Off
b:	−6/12V D.C. (2A range)
c:	+150/350V (100mA range)
d:	+300V (50mA range)
e:	+90V (4mA range)
f:	−100V (4mA range)

Fig. 7—The theoretical circuit of the monitor meters. See also Fig. 6 (last month) for the positions of the shunts in the main circuit. Note also the resistor voltages which were given in the Components List.

than attempt too drastic a modification of the "spatial" design here published. It must also be stressed that this power supply, when finished, will very likely form one of the most valuable key items of the workshop, and thus a little extra trouble and expense in obtaining optimum components will repay itself well in the form of reliability and efficient service.

Cable Forms

Particular care is required in making the inter-unit cable-bunches between the tagstrips. If these are too short, repairs and servicing later will be unnecessarily awkward. If they are too long, there is danger of damage by pinching or chafing when the large quantity of wire is stuffed away in the assembled unit. The correct lengths are such that any part may be detached by removing the appropriate cabinet screws, and then pulled clear far enough for easy insertion of a small soldering iron or other tools to any part of the detached portion. By removing all cabinet screws, the whole power unit can be "exploded" at any time, without breaking any electrical connections. This is required for more drastic servicing, or for later modifications.

Finally, the usual warning. Take great care to connect the mains plug correctly. The earth pin (the large pin) of the plug goes to the chassis-line and transformer cores, and the live pin (marked "L" inside modern 3-pin plugs) goes to the fuse and mains switch. The unit could be lethal if the live pin were connected in error to the chassis-line.

Circuit Description—(1) Switching

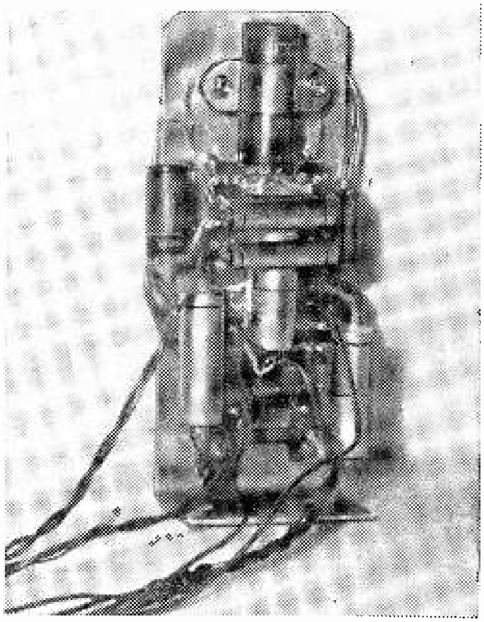
Fig. 6 (last month) showed the complete theoretical circuit apart from the monitor meter circuitry, for which only the shunts and connections 1 to 11 were shown. The complete metering circuitry is shown in Fig. 7.

Two conventional transformers are used. One large 350-0-350V winding rated at 100 to 150mA, with two 6·3V windings tapped at 4V, and rated at 2·5A and 4A respectively. The second transformer is a smaller one, with a 250V 80mA winding and a 6·3V 4A winding tapped at 4V. The larger transformer must have a primary winding tapped at 110V, and not be of the type now often found which has two separate 110V primaries, which are connected in series for 220V and in parallel for 110V. Only the tapped type of primary can be used for providing the 110V output envisaged in this power supply.

The only reason why one side of the A.C. heater outputs, and thus also one side of the low-volt D.C. output, is earthed is because V2 requires this to prevent excessive heater-cathode potential differences in this valve. If one of the transformers can be purchased with an additional 6·3V winding (it need only have about 0·5A rating) for feeding V2, then neither side of the heater supply outputs need be earthed, and earthing can take place externally as desired. As already mentioned, the D.C. low-voltage output has the positive side earthed in the author's unit, to conform with normal custom and requirements in transistor circuitry.

Pilots

The 6·3V winding of the smaller current rating on the large transformer is used to heat the stabiliser valve V1, switched via one contact of the relay Rly 1. The 4V tapping of the same winding is used for the mains and 110V supply pilot lights, thus fully loading this winding. These pilot lights are fitted with 6·3V bulbs, which give adequate brilliance, and far longer life, operating at 4V. The mains pilot is fitted with a green glass, and wired direct to the 4V tapping on this winding; it thus comes on as soon as the mains is switched on. The 110V pilot is fitted with a red



A rear view of the rectifier sub-chassis.

glass, and is also wired via a second contact on the 110V switch (which is thus a double-pole on/off switch S2), and comes on only if mains and 110V are switched on, i.e. if 110V output is actually present. Fuses are placed on the supply side of switches, so that possible switch faults are also interrupted by the fuses. Slow fuses should be used throughout, as fast fuses are liable to blow due to the surge upon switching on the inductive circuitry represented by the transformers. It is far safer to use a low-rating slow fuse than a high-rating fast fuse.

S3 and S4 represent the H.T. switches. S3 is simply a double-pole on/off switch, whereas S4 is a double-pole on/on switch, i.e. two poles (a and b) are made in one position and broken in the other, whereas two other poles (c and d) are broken in the first position and made in the second. This merely represents a special form of double-pole double-throw toggle switch.

S3 is the main H.T. switch. One contact switches the A.C. side of the 300V unstabilised

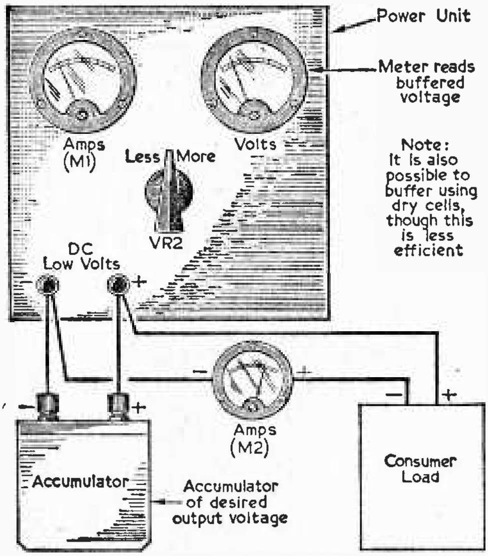


Fig. 8—Method of buffering the accumulators. Adjust VR2 until M1 reads the same current as M2; then the power unit is supplying all the power to the consumer load and the accumulator is neither charging nor discharging, but is merely stabilising the voltage.

If M1 reads higher than M2, then the difference current is charging the accumulator. If M1 reads lower than M2, then the accumulator is discharging to supply the difference to the consumer load.

supply, and the other contact switches the energising current to the A.C. relay Rly 1 and to the red H.T. pilot lamp L3 fitted with a 10V 0·2A bulb. Thus if S3 is off, no H.T. outputs at all are possible, and the pilot lamp cannot be lit. As soon as S3 is switched on, either of two H.T. output conditions are possible, depending upon the setting of S4. With S4 "up", i.e. making contacts A and B the relay and pilot lamp receive 4V A.C. via contacts A on S4 and S3. This is insufficient to energise the relay, and thus the main stabilised H.T. and the minus 100V supplies remain dead, as they can only be fed over the relay contacts. But the 10V pilot lamp glows dimly, showing that the H.T. supplies are partially on, to the extent that the 300V unstabilised supply is operating, and also the plus 90V supply derived from it. This switch setting is intended for operating small equipment such as a valve voltmeter, an oscillator, etc., when the main H.T. supply is otherwise not needed. Thus the valves and equipment need not then be run unnecessarily off load. As is seen, the main H.T. circuits are still completely dead in this position. Two relay contacts are breaking the 350-0-350 A.C. feed, so that even the rectifiers and smoothing are dead. A third relay contact is breaking the heaters of V1, and contacts D on S4 are still breaking the heaters to V2, whereas contacts B on S4 are shorting the anode of V2A to earth, thus removing H.T. from this valve, although the 300V supply is on. This function of contacts B on S4 also serves to discharge the 300V supply through R13 after switching everything off.

If S4 is now also switched "down", i.e. breaking A, B and making C, D, then the relay and pilot lamp L3 receive 10V A.C. via C instead of 4V via A as previously. This causes the relay to switch on, and the pilot lamp to run at full brilliance. V2 receives heater voltage via D on S4, and the H.T. short is removed because B on S4 has opened; thus V2 can operate. As soon as the valves have warmed up, all H.T. outputs are present.

S3, the H.T. main switch, overrides S4; and S1, the mains on/off switch, overrides everything.

Advantages of Switching

This seemingly complicated switching circuitry has in effect many distinct advantages. Firstly it makes do with perfectly normal simple components, in spite of the requirements of switching a large number of circuit items simultaneously at relatively high voltages. Secondly, it leads to a very simple result as far as panel controls are concerned, giving merely a couple of toggle switches there. Thirdly, it fully meets the requirement, that the main H.T. stabiliser circuitry can be left absolutely dead if only the 300V unstabilised supply is required, thus preventing unnecessary wear of components.

The A.C. relay used is a small three-phase contactor rated at 400V 2A on the contacts, such as is to be found in various appliances using motors, such as washing machines, refrigerators, etc. If only types with a magnet winding for 200/250V A.C. mains are obtainable, then the constructor will have to rewind the coil. This is not difficult, as only about 100 to 200 turns will be required for a 10/12V A.C. coil. The mains coil should be stripped of all windings, and then sufficient turns of enamelled copper wire of about one fiftieth of an inch to one twenty-fifth of an inch in diameter wound on to make the relay pull in securely at 10V A.C., but make no attempt to move at 4V A.C. Having achieved this, if the current taken at 4V A.C. (in the non-operating position) exceeds about half an amp, then series resistance should be included until the current falls below half an amp under these conditions. If this resistance has then impaired the security of operation at 10V A.C., the minimum number of extra turns needed for secure operation should be added again. However, it should be possible to procure such relays ready made with 10/12V magnet windings. It is, of course, essential to use a relay in this circuit, as no ordinary toggle switch will withstand 350-0-350V switching on an inductive circuit without serious danger of flashover sooner or later. It is not possible to use ordinary small D.C. relays either, for two reasons. The contact spacing is insufficient in such relays, and the current rating is too small. Contact resistance is also not reliably small enough for switching the 1·5A heater supply of V1 as required. Thus it is absolutely essential to use a proper 3-phase power-contactor A.C. relay, which thus has the proper voltage and current rating.

We now come to a discussion of the heater supplies, etc. The A.C. 4A outputs at 4/6·3/10/12·6V are operative as soon as the mains on/off switch is on, and thus they have no additional switching. But they are individually protected by a total of four fuses, fitted with slow 4A cartridges. The low voltage D.C. supply for heaters, battery

(Continued on page 1058)

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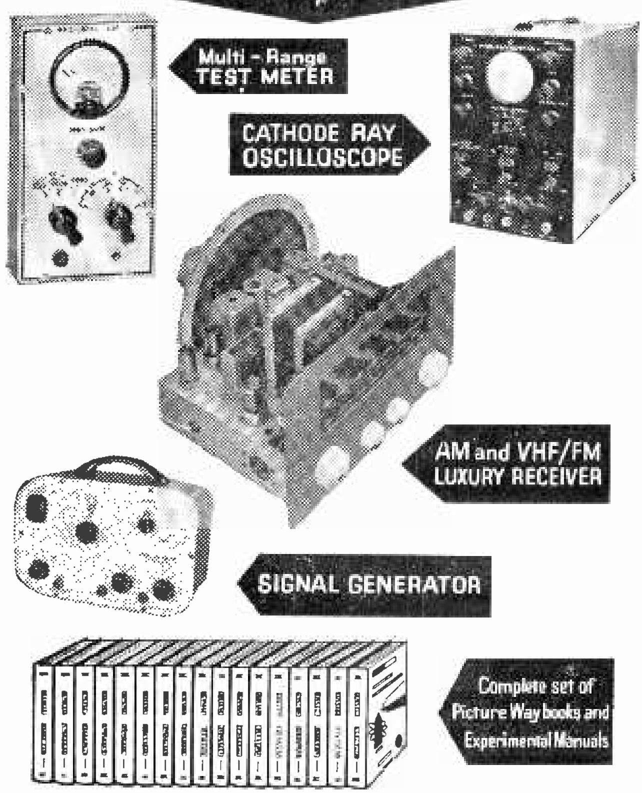

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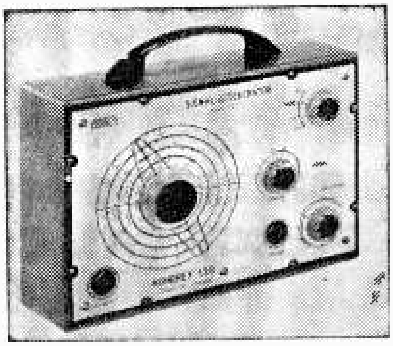

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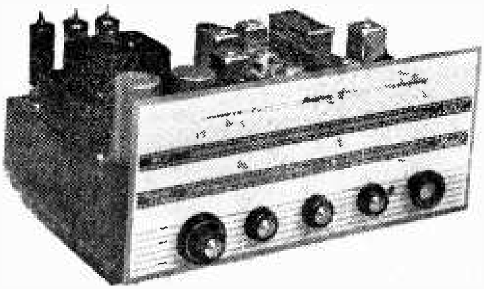

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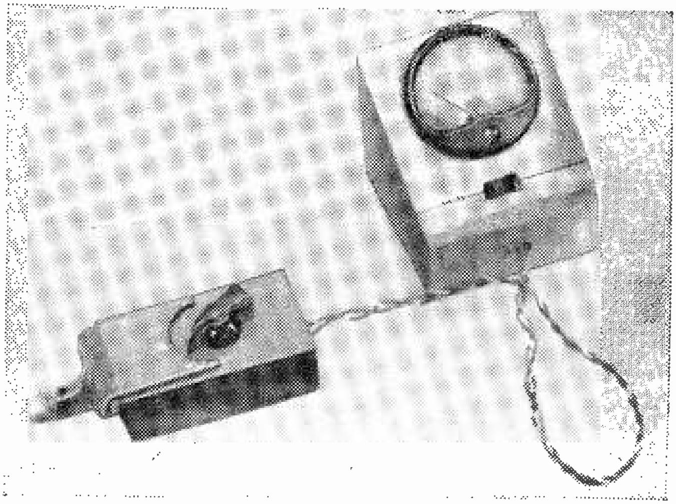
IN THIS DESIGN THE METER AND OSCILLATOR ARE BUILT INTO TWO SEPARATE CASES. By M. R. Lord



The meter and oscillator connected.

THE uses of the normal type of grid dip oscillator are well known to all radio enthusiasts; but it suffers from the disadvantage of size, even if the meter and power supply are not in the same case as the oscillator. The presence of a valve means that the unit is large and, also, the normal GDO needs a sensitive, and correspondingly expensive, meter.

However, by the use of one transistor in the oscillator, and another to amplify the change of current, these two objections can be removed, and the oscillator can be built into a very small case.

The Circuit

This GDO consists of two units connected by a few feet of flex; the oscillator and a small box containing the meter, battery, and meter amplifier.

The oscillator uses a single OC170 (Tr1) and will operate up to at least 25Mc/s. The voltage across L3 is rectified by the diode, filtered, and applied to the base of Tr2.

When the oscillator coil is brought near to a circuit tuned to the same frequency, power is absorbed from the oscillator circuit, and so the voltage applied to the base of Tr2, and hence the current flowing through the meter, alters. The variable resistance VR1 serves to limit the current flowing through Tr2 and the meter.

Construction

The oscillator is built in a small box made of bakelite or some such material. The dimensions used in the prototype are shown in Fig. 2, but these will obviously vary if a tuning condenser of different size is used; the tuning capacity used by the author was a twin gang midget type of about 100pF per section, only one section being used.

The associated resistors and capacitors are mounted on a paxolin board by threading their lead wires through small holes drilled in the paxolin, as shown in Fig. 3. This board was then glued inside the box (see Fig. 2).

The plug-in coil is made by cementing a ⅜in. diameter coil former, minus base, to a B9A plug. The arrangement of the coil winding is shown in Fig. 4. The actual frequency range covered will

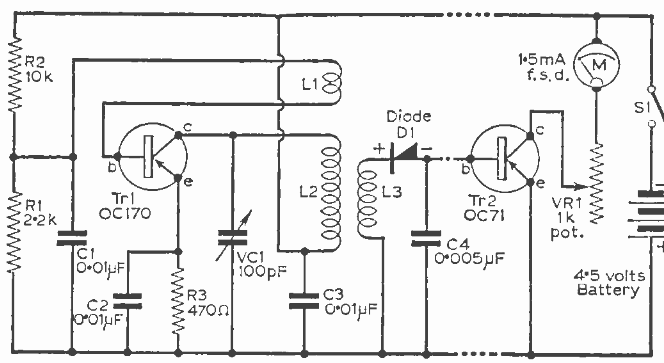


Fig. 1—The circuit of the grid-dip oscillator.

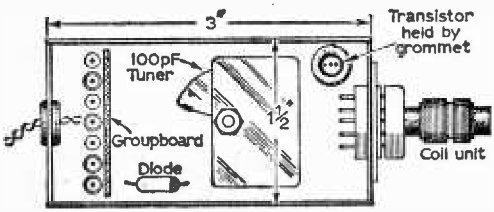
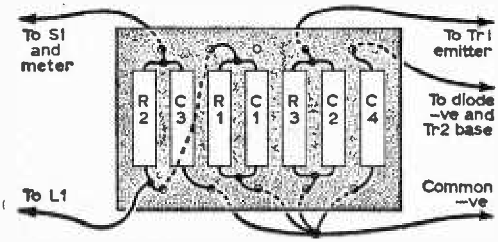


Fig. 2 (above)—The general layout.
Fig. 3 (below)—The group-board layout.



depend upon the tuning capacitor used as well as the number of turns on L2, but as a guide, 30 turns on L2 gave a frequency range on the prototype of 8·5—14·5Mc/s.

L1 should have about one third as many turns as L2, and L3 about half as many. After winding, the coils are smeared with polystyrene cement to fix the turns in place.

The coil socket, a B9A valveholder, is cemented to the case with an impact adhesive. Tr1 is held in place by pushing it inside a rubber grommet that is glued to the inside of the case.

The meter case can be to any design. In the prototype, VR1 was mounted inside the case, but it would be better mounted on the front panel as it has to be adjusted fairly often. The scale is drawn on an L-shaped piece of Perspex which forms part of each coil assembly, as can be seen from the illustrations. This avoids the crowding of figures that would occur if all the scales were drawn on the front of the oscillator.

Calibration

If a calibrated short wave receiver is obtainable, calibration is easy. One end of a piece of wire is plugged in the aerial socket of the receiver, and the other end is looped around the coil. The receiver is then tuned from the low frequency end, with the BFO turned on, until a whistle is heard, the receiver is then tuned to the same frequency as the GDO. The receiver and GDO are then tuned together to some frequency, such as 8 or 9 Mc/s as indicated on the receiver, the GDO tuned to give zero beat on the receiver, and the scale marked with the appropriate number. (The accuracy of the receiver can be checked against standard frequency transmissions.) This process is repeated at 1Mc/s or 0·5Mc/s intervals to calibrate the whole scale.

Operation is simple; the coil is brought near to the coil to be investigated, and the tuning altered until the meter reading shows a dip or rise. The dial reading corresponding to maximum rise or dip is then equal to the resonant frequency of the tuned circuit under investigation.

By virtue of its design, it can also be used as a sensitive absorption wavemeter without any modification, although care must be taken not to subject it too high a signal, or there is a danger of damage to the transistor. ■

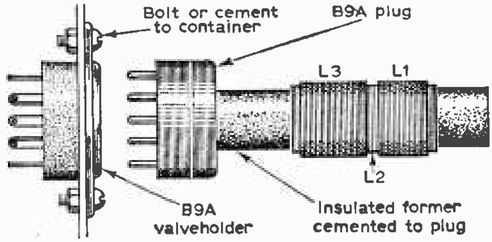
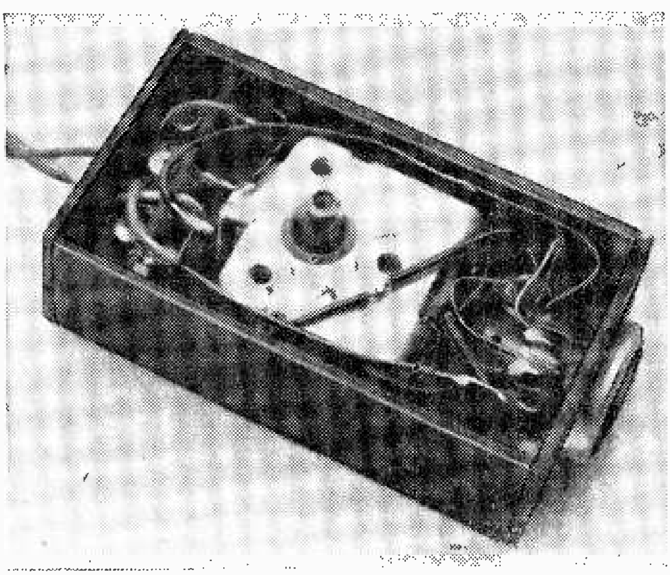


Fig. 4—Winding coils on a B9A base.

COMPONENTS LIST

Resistors:			
R1	*2·2k*	*R3*	*470Ω*
R2	*10k*	*VR1*	*1k pot.*
Capacitors:			
C1	*0·01μF*	*VC1*	*100pF (see text)*
C2	*0·01μF*	*TR1*	*OC170*
C3	*0·01μF*	*TR2*	*OC71*
C4	*0·005μF*		

Meter: *About 1·5mA f.s.d.*
Diode: *Any H.F. germanium diode*



A view of the oscillator

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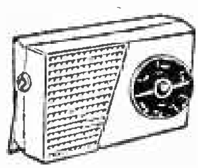

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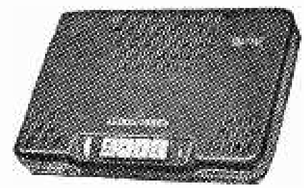

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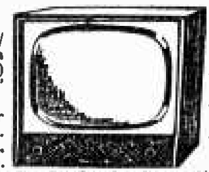

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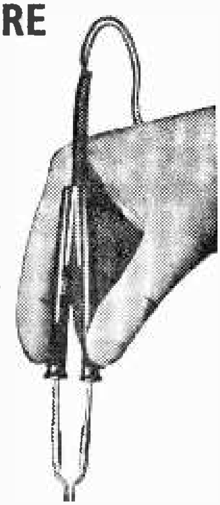

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SERVICING TAPE RECORDERS

FAULTS, SYMPTOMS AND THEIR REMEDIES FOR DOMESTIC EQUIPMENT

By T. S. Smith

IN this new series for the experimenter the overall construction of tape recorders will be dealt with; how a recording is made and reproduced; how the various circuits work. Various fault symptoms and conditions will also be described.

Basic Knowledge

This approach is essential, since it is virtually impossible to repair a tape recorder successfully without a basic knowledge of how the equipment functions. Indeed, the amateur recordist stands a far better chance of securing better recordings if he knows how the various items operate.

To play a tape record (sometimes called a pre-recorded tape) a "replay head", an amplifier and

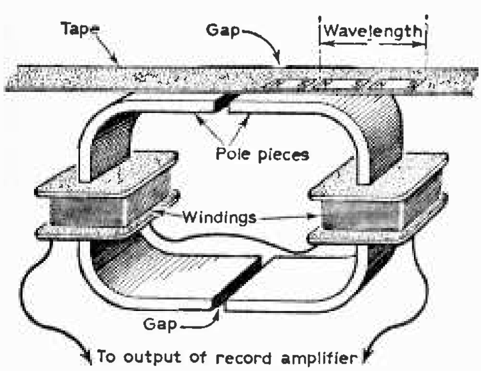


Fig. 1—How the magnetic field between the gap of the record head produces small magnets on the coated side of the tape.

loudspeaker and some mechanism capable of causing the coated side of the tape to pass at a constant speed past the replay head, are required.

When all these things are set up, the magnetic "sound pattern" on the tape is converted back across the replay head to the original electrical impulses, as were present at the microphone during the recording.

The impulses are amplified first in terms of voltage and then in terms of power so that they are able to work a loudspeaker, as if the original microphone were connected to the input of the amplifier, instead of the replay head.

Gain and Equalisation

There are two important points here. One is that the electrical impulses from the replay head are extremely weak, so great amplification is required—more, for instance, than is required for an ordinary medium-quality gramophone pick-up. This means, then, that it is not usually possible to connect a tape replay head across the pick-up terminals of a radio or radiogram and expect to obtain tape reproduction. A head amplifier and some form of equalisation (see below) would, at least, be required.

Secondly, the signal output from a replay head is not constant over the whole of the audio-frequency spectrum. The output peaks towards the centre of the spectrum and diminishes fairly quickly (depending upon the tape speed) towards the high-frequency end. There is also a drop at the low-frequency end. In order to correct this apparent shortcoming, the amplitude of the signal has to be corrected against frequency, and this is accomplished by an equalisation network which gives, in effect, high-frequency lift, and a certain degree of bass boost. Such a network has to be included either before, or after, the head amplifier, and, as this introduces an overall "insertion loss", an even greater gain from the replay amplifier is required.

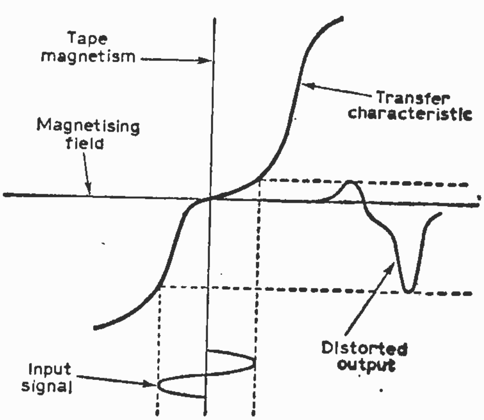


Fig. 2—A distorted tape signal can be produced by the "transfer characteristic".

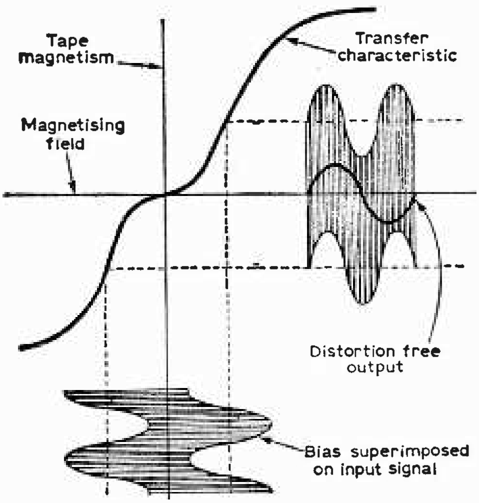
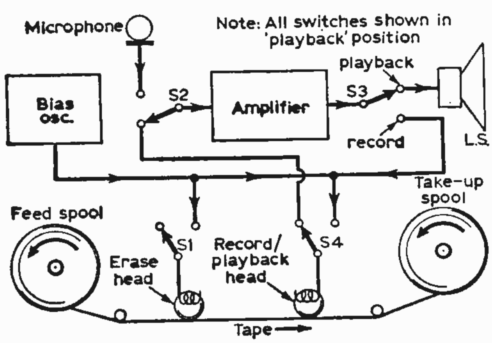


Fig. 3 (above)—A supersonic bias superimposed on the recording signal at the record head eliminates the transfer distortion.

Fig. 4 (below)—The basic record/playback switching of a domestic recorder.



Recording

So much for replay. Now to deal with the recording side. To make a tape recording, a recording head, an amplifier, an oscillator and, again, some mechanism to drive the tape at a constant speed past the recording head are needed. Some programme material to record is also required.

If the programme is from a microphone, then this would be connected to the input of the amplifier, while the output would be connected across the recording head. The microphone converts the sound waves to electrical impulses, which are considerably magnified by the amplifier. The output of the amplifier is designed in such a way that quite large current changes occur in the "electromagnet" of the recording head. These current changes, of course, occur in direct sympathy with the electrical impulses from the microphone caused by the sound waves.

Thus, across the pole pieces of the recording head occur variations in magnetic field, of polarity and strength determined by the original sound. As the tape passing the pole pieces is coated with a substance that is influenced by magnetism, small magnets are, in fact, formed on the tape. The length of the small magnets is governed by the frequency of the sound, while the strength is governed by the loudness of the sound. The general idea is illustrated in Fig. 1.

Here, it will be seen that the pole pieces are in two sections with a gap at the top and bottom. Non-magnetic shims are used to fill the gaps and the whole assembly is clamped mechanically. The small magnets can be seen on the tape, and the wavelength of the recorded sound is related to the length of the magnets. The lower the wavelength, the higher the frequency, so for high audio frequencies the magnets are very small indeed.

The replay head is of very similar construction, and on almost all domestic machines the same head is used for both record and replay. As would be expected, the top gap dimensions have quite a bearing on record and replay (especially on replay), and to a certain limit, the smaller the gap the better the high-frequency reproduction. More will be said about that later.

The Need for a Record Bias

Because the magnetism imparted on to the tape by reason of the magnetic field set up between the pole pieces of the recording head is not linearly related to the magnetic field, severe distortion would result on replay from a recording produced simply as described above. This is called "transfer distortion." and results from the residual magnetism retained by the tape during the recording cycle. The "kink" which produces the distortion is shown on the transfer characteristic in Fig. 2.

In order to counteract the effect of the "transfer kink" a "supersonic" bias is superimposed on to the tape along with the record signal. The bias, being slightly above audio-frequency, cannot be heard on the recording. Fig. 3 shows how this supersonic bias eliminates the distortion.

At this stage it should be understood that the amplitude of the bias has quite an influence, not only on the quality of the recording, but also on its "signal-to-noise" ratio. It is also very important that the bias signal be as pure as possible. Excessive harmonic content makes it virtually impossible for the bias to rid the transfer characteristic of its kink completely, and another kind of distortion may also occur. It is for this reason that high-quality recorders use push-pull bias oscillators. Some machines have a control for adjusting the bias amplitude, but before haphazard adjustment is made to this control it is as well to refer to the instruction manual, as the recording level and type of tape are related to the bias amplitude. We shall have more to say about that later.

Erasure

The bias oscillator also serves another purpose—it energises the erase head so that prior to making a recording the originally recorded material is wiped off the tape. The erase head is rather like the record and replay head, but does not require to be so exacting in its construction.

(Continued on page 1057)

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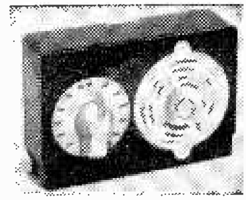

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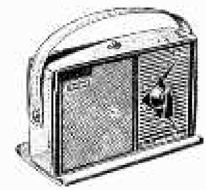

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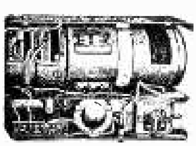

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FAULTS IN VHF/F.M. RECEIVERS

5-Transistor I.F. Stages

By G. J. King

(Continued from page 961 of the February issue)

TRANSISTORISED A.M./F.M. receivers follow a pattern which is very similar to that of valve counterparts. Transistor versions may appear to be extra complicated, but this is superficial, almost certainly resulting from a lack of familiarity with transistor techniques. Fig. 13 shows a rather interesting circuit of the I.F. stages of such a receiver, and the apparent complexity here is due essentially to the tuned circuits and switching arrangements. This circuit is a follow-on of the VHF transistorised tuner which was dealt with in Part 4 of this series (last month).

Switching

Although all the various switches are ganged, there are two distinct switching functions: one which changes the circuit from A.M. to F.M., and vice versa, and the other simply for A.M. wavechange. The switches which are concerned with the A.M./F.M. change are suffixed with the letter "A", while those which deal with L.W. and M.W. switching in the A.M. section are suffixed "B". The former switches are shown in the "F.M." position, while all the latter switches are shown in the "open" position.

In the "F.M" position, transistor Tr3 operates simply as an I.F. amplifier, but in the "A.M." position its function is changed to oscillator/mixer (i.e., frequency changer). In both positions, transistor Tr4 operates as I.F. amplifier. It will be recalled that Tr3 and Tr4 are the transistor counterparts of valves V2 and V3 in the circuit given in Part 2 of this series.

F.M. Operation

It is probably best to investigate the circuit first under "F.M." conditions. The 10·7Mc/s F.M. I.F. from the VHF tuner is applied direct to the base

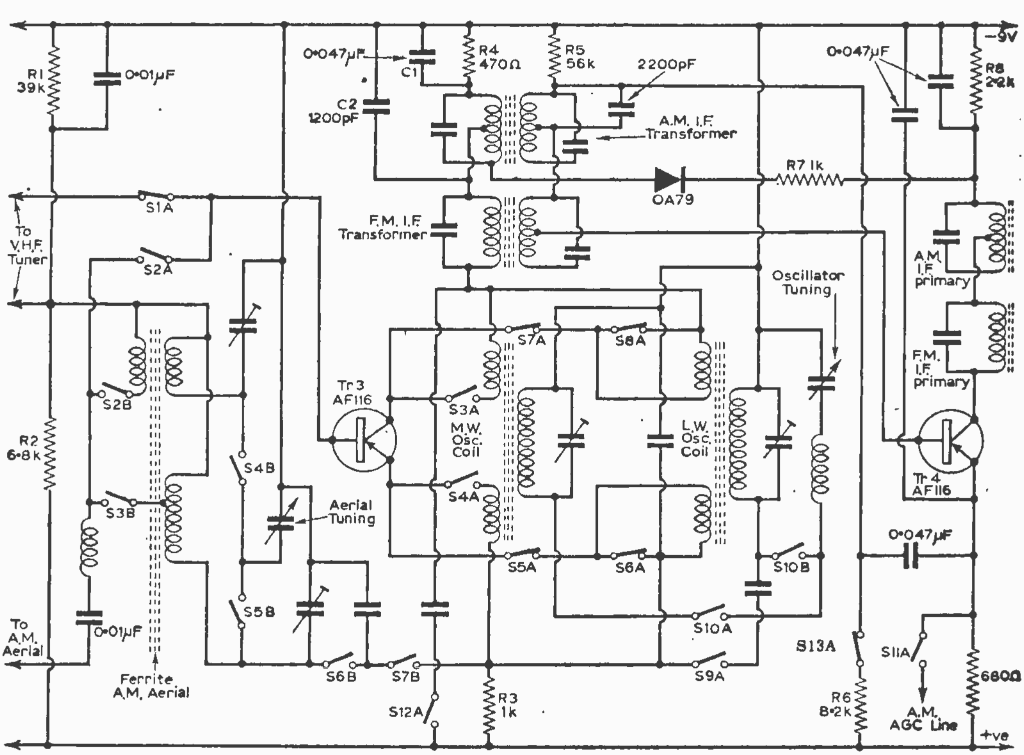
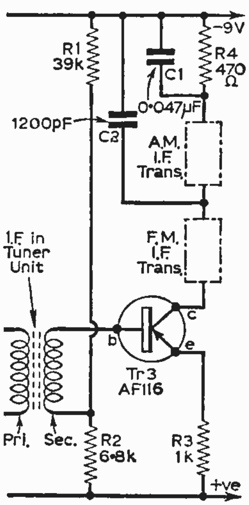


Fig. 13—The circuit diagram of the I.F. stages of a transistorised A.M./F.M. receiver.

of Tr3, via the closed S1A. The other side of the VHF tuner I.F. secondary winding is connected to the junction of R1 and R2, which forms the base potential-divider for Tr3. The A.M. aerial circuits are removed from the base of that transistor by S2A being open, and similarly, the A.M. local oscillator circuits are disconnected from the emitter and collector circuits by switches S3A and S4A being open.

Tr3 emitter continuity to battery positive, through emitter resistor R3, is achieved by switches S5A and S6A being closed, while collector continuity is maintained on "F.M." by switches S7A and S8A being closed. The collector switching puts the collector to the "live" side of the series-connected F.M. and A.M. I.F. transformer primaries. The low value resistor R4 is simply a collector decoupler, which works in conjunction with C1, while C2 provides a relatively low impedance path for the F.M. I.F. signals.

Fig. 14—The circuit of Tr3 stage when the receiver is switched to F.M.—Tr3 then operates as an I.F. amplifier.



The "F.M." operation of Tr3 is very simple, and resolves to the circuit shown in Fig. 14, which details the sum total of components employed, excluding the switching arrangements. It is a straightforward I.F. amplifier, using the "earthed-emitter" mode with the F.M. I.F. signals applied to the base. The biggest complication is the switching, and should both services fail, it is best to undertake fault diagnosis with the set switched to "F.M.".

Typical Tr3 readings on "F.M." are collector 7V, emitter 0·7V and base 0·85V, all relative to battery positive. The voltages will differ slightly when the set is switched to "A.M.", since then Tr3 is called upon to oscillate, but that section will be dealt with later.

As with the valve circuit, the F.M. I.F. signals are developed in the I.F. transformer which is tuned to 10·7Mc/s in the collector circuit (in the anode circuit when a valve is used). The A.M. I.F. transformer in series is almost like a short-circuit so far as the 10·7Mc/s signals are concerned, and this effect is increased by C2.

The I.F. signals in the secondary of the appropriate transformer are coupled to the base circuit of the second I.F. amplifier Tr4. The signals are usually fed from a tapping on the winding, as shown in Fig. 1, to facilitate matching to the low impedance base. The other side of the series-connected secondaries are returned to the junction of R5 and R6, which act as the base potential-divider for Tr4.

A point of interest here is the switch S8A in series with R6. This is closed on "F.M." operation, ensuring that Tr4 base is operated from a constant potential. On "A.M." operation, however, S13A opens and S11A closes. This returns the base to the A.M. AGC line, and thus gives AGC to Tr4.

The F.M. I.F. signals are developed in amplified form across the I.F. transformer in Tr4 collector circuit (note that the primaries only are shown in the circuit). from where the signals are coupled to the F.M. ratio detector. This latter section and the A.F. stages of the receiver will be dealt with in a subsequent article.

A.M. Operation

When the receiver is switched to "A.M." all the switches suffixed "A" change over. Such operation disconnects the VHF tuner and switches in the aerial circuits. In the circuit under discussion (Perdio Model 95) a ferrite rod aerial is used and the windings on this constitute the R.F. tuned circuits. Switches S2B, S3B, S4B and S5B are concerned with L.W. and M.W. switching.

The local oscillator tuned circuits and feedback are also brought into circuit by S3A, S4A and S12A closing. These functions cause Tr3 to work as a self-oscillating frequency changer, and the voltages therefore change as follows: collector 7·2V, emitter 0·8V and base 0.·9V. In essence, the base voltage rises, as also does the emitter voltage, due to the stage oscillating.

If the set is dead on "A.M." but normal on "F.M." a check of the emitter voltage when changing from F.M. to A.M. is sometimes sufficient to indicate whether or not failure of the local oscillator is responsible for the fault. A more definite change in emitter voltage can be obtained, however, by connecting an 0·1μF capacitor across the oscillator tuning gang with the set switched to "A.M.". An increase in voltage would indicate that the stage is oscillating.

The local oscillator "beating" with the incoming signal produces the A.M. I.F. of 470kc/s. This is developed across the A.M. I.F. transformer in the collector circuit of Tr3. The series-connected F.M. I.F. transformer has no significant effect on this, as the inductance is so small compared with that of the A.M. I.F. transformer.

Again, the output is coupled to the base of Tr4, as before. As already intimated, AGC is applied to Tr4 by S11A closing and S13A opening.

Overload Protection

A rather interesting feature on A.M. is the OA79 diode and resistor R7 connected between the primary of the first A.M. I.F. transformer and the junction of R8 and the primary of the second A.M. I.F. transformer. This network works as an overload protection on A.M. and is included as an alternative to AGC, which is extremely difficult to apply to a self-oscillating frequency changer stage.

The diode is normally non-conducting, but under conditions of strong signal, which may be sufficient to overload the frequency changer stage, the bias alters in such a way that conduction occurs through R7. This in effect then puts the resistor in shunt with the first A.M. I.F. transformer primary winding, and thus decreases the effective output of the stage.

(Continued on page 1050)

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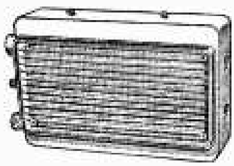

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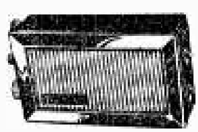

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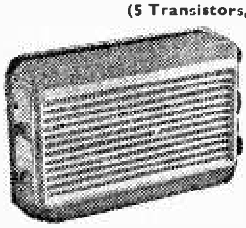

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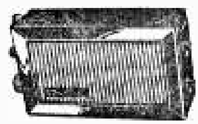
(MW/LW and TRAWLER BAND)

(5 Transistors, plus 2 Diodes)



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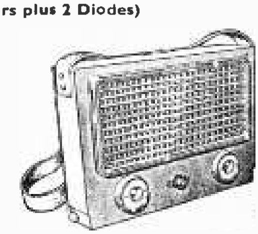

- ★ 3 R.F. STAGES.
- ★ Mullard and Surface Barrier Transistors.
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- ★ Use as domestic radio, car radio or fit with strap (not supplied) for carry-about.
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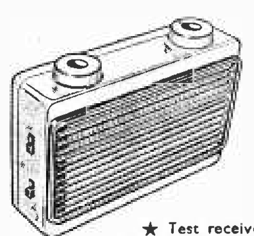

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Trade News

SIGNAL TRACER

THE Model 703 signal tracer, made by Lab-Craft, is essentially a two transistor transformer coupled amplifier providing adequate gain for signal tracing in the audio stages of a receiver. Provision is also made by the addition of a diode detector to trace signals in the I.F. and R.F. circuits of radio and television receivers.

When used in conjunction with Lab-Craft's radio and television signal probes—models 704 and 705 respectively—this instrument provides a complete circuit analyser for fault finding on radio or TV, by tracing the R.F. and A.F. signal from aerial to speaker.

A signal tracer made by Lab-Craft Ltd.

The output of this unit is 50mW and its overall power gain is 50dB.

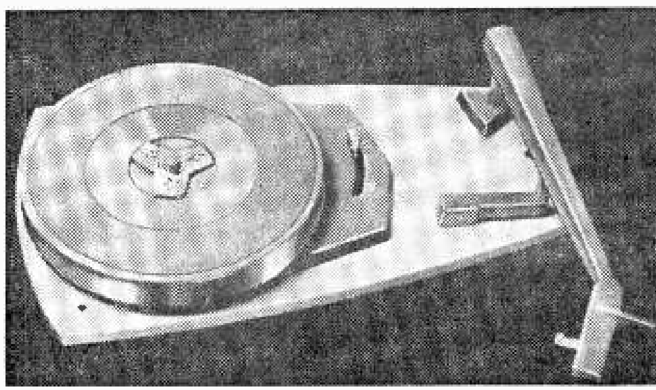
The signal tracer is manufactured by *Lab-Craft Ltd., 83 Ilford Lane, Ilford, Essex.*

BATTERY-OPERATED RECORD PLAYER UNIT

A NEW battery-operated record player unit has recently been introduced by Greencoat Industries Ltd. Compact and robust in design, the player will play all L.P. records from 7 to 12in. in diameter at 33⅓r.p.m. or 45r.p.m.

The record player is finished in two-tone grey and incorporates a ceramic cartridge. It provides reproduction free from audible "wow" and "rumble".

The unit consumes a low current which, during playing, is not higher than 23mA on the 9V version, and 38mA on the 6V version with the stylus in the outside groove of a 12in. record. The patented centrifugal governor ensures that turntable speed remains constant within ±0·8% over the voltage range. The voltage range for the 9V unit is 9·3 to 6·8 and that for the 6V unit is 6·3 to 4·5.


A new battery-operated record player unit from Greencoat Industries Ltd.

A switch automatically switches off the motor, which is started again by moving the arm away from the record, as is normal practice.

The record player is so designed that when not in use the tone arm support may be swung in towards the turntable and the tone arm positively locked on top of it.

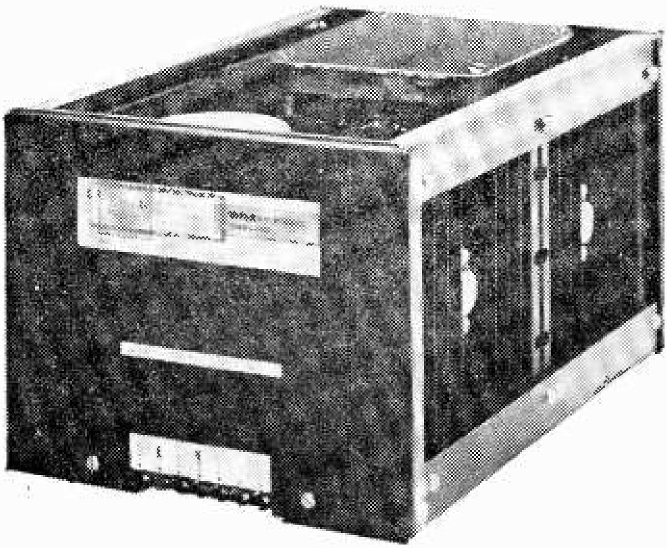
Robust construction is ensured by a metal chassis and the player will function correctly on non-horizontal surfaces up to angles of 25°.

Two standard types are available, one for operating from a 9V battery, Model No. KT 5/9, and the other unit is for operating from a 6V battery, Model No. KT 5/6.

The record player is made by *Greencoat Industries Ltd., Irwin House, 118 Southwark Street, London, S.E.1.*

TRANSISTORISED POWER SUB-UNITS

A NEW range of transistorised power supply sub-units has been announced by A.P.T. Electronic Industries Limited, and designated the TSU Series, and is intended both for laboratory use and for incorporation in customers' own equipment.



A transistorised power sub-unit by A.P.T. Electronic Industries Limited.

Features of the new units, apart from higher stabilisation and low output resistance, are their wide ambient temperature range, non-destructive overload protection, low temperature coefficient and small size.

The range comprises six units with maximum rated outputs of 0·5A, 1A, 2A, 3A, 5A and 10A; the unit illustrated is the 5A model, type TSU 500. The output voltage of each unit is set during manufacture to a specified fixed value in the range 6-30V, but can subsequently be reset to a different voltage in this range, if required.

All units operate from single phase A.C. mains of 200-250V. The output resistance (D.C.) in the 0·5A model is 0·1Ω, and in all other models it is less than 0·05Ω, the output impedance is less than 0·5Ω in all models and at all frequencies up to 500kc/s.

A non-destructive system of current overload protection is incorporated in all units, and is fully effective over the permissible range of ambient temperatures of −10 to +45°C.

The sizes of all units are small for their rated outputs. A factor contributing to the compact design, and one which also makes for ease of servicing, is the use of printed circuit-boards.

A.P.T. Electronic Industries Limited, Byfleet, Surrey.

SUB-MINIATURE HIGH STABILITY RESISTORS

A NEW "Resista" sub-miniature high stability composition film resistor, type Rsx1, is now available from GASP (G. A. Stanley Palmer, Ltd.).

This addition to the existing resistor stock range has been especially designed as a robust, long-life resistor with a high degree of service stability for use in such equipment as computers, data-processing, automation, telemetry, radiocommunications and so forth.

The resistor consists of a ceramic rod coated with a special composition film. It is capless with tinned axial wire terminations, and is finished with tropical lacquer.

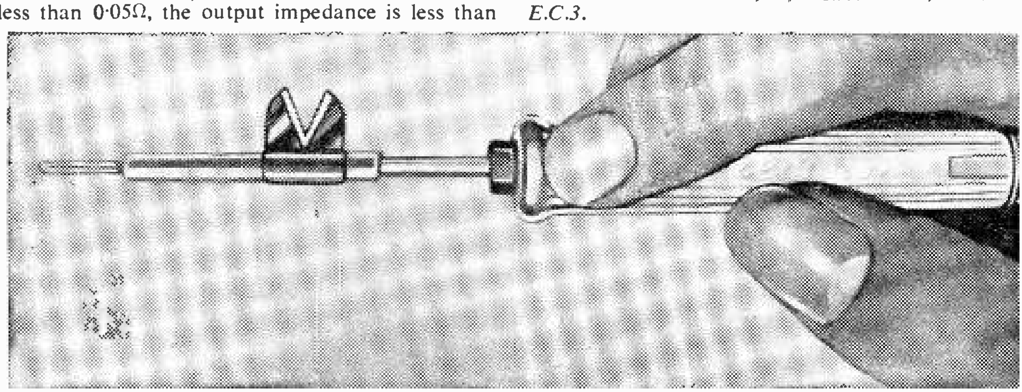
G. A. Stanley Palmer Ltd., Maxwell House, Arundel Street, London, W.C.2.

HEATED WIRE-STRIPPER

A WIRE-STRIPPER, designed to be mounted on to interchangeable soldering bits, has been announced by A.N.T.E.X. Ltd. The spare bit is attached—with the wire-stripper in place—to an ANTEX Precision soldering iron. With the iron "on" any wire drawn through the stripper will be stripped of any plastic covering — the heat of the iron melting the toughest of insulations.

The stripper is small enough to be left in place without any inconvenience when soldering.

A.N.T.E.X. Limited, 7/8 Idol Lane, London, E.C.3.



A new wire-stripping attachment by A.N.T.E.X. Ltd.

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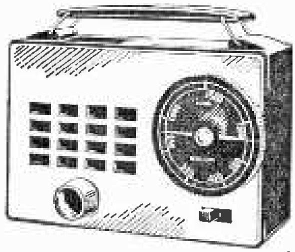

Circuit diagram 1/6, free if all parts bought.

All parts sold separately.

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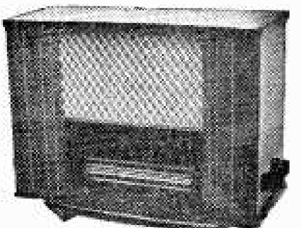

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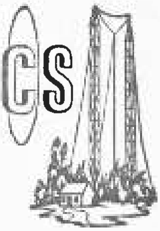

A CLASS "A" MODULATED MINIATURE VALVE TRANSMITTER

By Amateur Transmitter

(Continued from page 913 of the February issue)

IN last month's article most of the construction was dealt with and the circuit was described in detail. In this concluding article, final adjustments are made and the transmitter is tested.

A 100pF variable condenser is used for grid tuning, and this is mounted directly above the 6BW6 holder. (In Fig. 3—last month—the condenser is shown moved slightly to the right, to clarify wiring.) An extension spindle passes from this condenser, over the coil holder, and through the panel.

Connections in the oscillator and amplifier stages should be short and direct. Stout, direct leads are taken to the chassis, where indicated. In the oscillator section, an insulated tag serves as anchor point for the 22k resistor (R4)/(C5) and 1,000pF condenser. The lead to the neutralising condenser passes from this tag.

In front of the screen, a strip with three insulated tags forms connecting points for the choke and modulator leads. A smoothing choke may be used instead of the 100Ω resistor (R15) wired to the smoothing condenser tags. If a mains switch is required, it can be situated near the *Spot/Tune* switch.

Send/Receive Switch

Fig. 3 showed the *send/receive* switch as seen from behind, and this item is mounted on the chassis runner. The simplest way of providing for external connections is to use lengths of twin flex for the speaker circuits and separate flexible leads for aerial and receiver. These leads should not need to be more than about 2ft long, and in these circumstances no benefit was found to arise from using coaxial leads. But if the aerial coupler or receiver is designed for coaxial input, aerial and receiver leads may be of coaxial cable, with the outer conductor joined to the chassis.

Tuning Coils

The transmitter may be required for top band only, when a larger transmitter is operated on the other bands, where the same power limit does not apply. If so, the oscillator coil is tuned to the 160m band. For this purpose, a small medium wave coil, with single winding, as used in broadcast receivers, was found satisfactory. The effective parallel capacity is only about 50pF (100pF variable in series with 100pF fixed coupling condenser) and a small trimmer may be required across the coil, to reach 160m. When this trimmer, or the coil core, is suitably adjusted, the 100pF grid tuner will allow any final modification to tuning.

For 80m operation, 160m band crystals may remain in use. The oscillator coil can then consist of 45 turns of 32s.w.g. wire, occupying about ⅜in. winding length on a ½in. diameter former, with dust core. The core is adjusted until resonance can be obtained over the band.

The P.A. output coils were wound on plug-in formers, 1½in. over the ribs. For the 160m band, approximately 70 turns of 28s.w.g. DCC wire will be satisfactory. For the 80m band, 29 turns of 22s.w.g. bare wire, turns spaced to occupy about 2in., will be suitable. A notched former is most convenient for this coil, with a smooth ribbed former for the larger coil.

Meter Circuits

Surplus meters can be obtained at quite low cost, and it may be decided to use individual meters, as in Fig. 4. The anode current meter will be required to indicate about 50mA, so an instrument with a full scale deflection of about 100mA is convenient. Twisted twin leads pass from it to tags 1 and 3 in Fig. 3 (last month).

For grid current, an 0-5mA or similar meter may be used. It is wired to the points indicated in Fig. 3. A grid current of 1mA to 2mA will indicate a bias of about 25V to 50V on the 6BW6, and normal operation is well maintained between these limits.

Fig. 4 (on page 1050) shows a way of using a single meter. In this case it should be a 5mA or similar instrument, so that grid current may be read. The 1k resistor completes the grid circuit when the meter is switched out, and has no significant influence on either the meter reading or the grid current. When the meter is switched for anode current, the shunt reduces it to 100mA full-scale reading. The switch must be of a type which breaks one circuit before completing the other. Alternatively, a 3-position switch can be used, with the central position unconnected.

Fig. 1 (last month) showed the circuit positions of the grid meter M1 and anode meter M2 and it will be seen that the latter includes the 6BW6 g2 current also. Points 1, 2 and 3 in Fig. 1 correspond to the numbered tags in Fig. 3 (also last month).

Many surplus radio-frequency ammeters have a 2mA or similar movement, which can be used when the thermo-couple is disconnected. A new, linear scale may be drawn up for the converted meter, if preferred. The R.F. scale is non-linear, and no longer applies. Shunts may be found by trial. Alternatively, divide the movement resistance by a figure corresponding to one less than the number of times the scale is to be multiplied. The result will be the required shunt value, in Ohms.

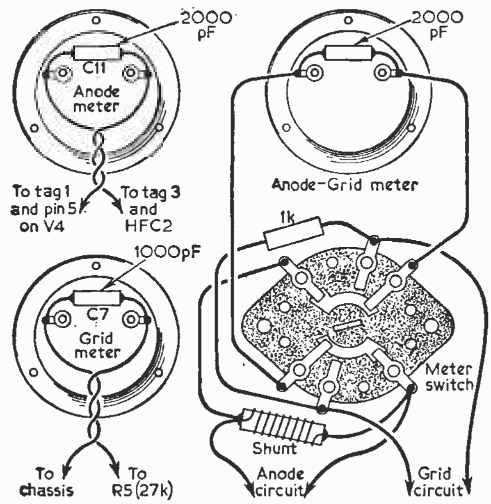

Fig. 4—The meter circuits.

Oscillator Adjustment

Initially, the *transmit/receive* switch should be at "receive". When the spot and tune switch is closed, some grid current should be indicated. This grid current should peak to a maximum when the 100pF grid tuner is rotated. If not, adjust the position of the coil core until this is so.

To neutralise the amplifier, unscrew the 30pF trimmer to minimum capacity. Close the 2-gang aerial loading condenser, and rotate the 200-300pF tuning condenser. As the circuit passes through resonance, a slight dip in grid current should be seen. Slowly screw down the 30pF trimmer, with an insulated rod, until this dip is no longer present. If the trimmer is turned too far, the dip will re-appear. This operation is done with the oscillator alone working, and when the best setting of the neutralising condenser is reached, little or no change in grid current should be seen, on tuning the anode circuit through resonance.

An initial test is best carried out with some form of artificial aerial. If the transmitter is to work into a relatively high impedance aerial, a 15W 250V household lamp will suffice. If a low impedance output will be used, a 12V 6W or similar lamp is more convenient. The lamp is joined from aerial lead to chassis.

Check that 1mA or more of grid current is obtainable, before turning the switch to transmit. The 2-gang condenser is closed, and the anode tuning condenser is rotated for minimum anode current. To load to the desired input, open the 2-gang condenser, meanwhile re-adjusting the anode condenser, until the anode current has reached the required figure. The 2-gang condenser will probably need to be almost closed, for a low impedance circuit but fairly well open for higher impedance.

To check modulation, either the station receiver may be used, or a simple monitor. The latter can consist of a coil and condenser tunable to the required band, with a crystal-diode detector, and phones. If a 500pF condenser is used, one coil will cover two bands. If the station receiver is used, remove the aerial, and reduce R.F. gain, to avoid overloading. Also keep the A.F. gain turned well down, and keep the microphone away from the loudspeaker.

Turn the audio gain control up until distortion just begins, then back slightly. If distortion remains, ensure that the receiver is not being overloaded. ■

FAULTS IN VHF/F.M. RECEIVERS *(Continued from page 1042)*

It will be understood, of course, that failure of A.M. and F.M. could point to a fault in the A.F. stages, but it is generally possible to obtain some idea of the operation of these sections simply by switching the set on. If an ear is held close to the speaker, a definite noise will be heard when the set is switched on (the sound is not so obvious when the set is switched off). This indicates, at least, that the output transistors and speaker are passing current.

The A.F. driver stage could still be at fault, however, but there is an equal chance that the trouble exists in stage Tr3 or Tr4 (the A.F. stages will be considered in the next article).

The best way of checking the I.F. stages is to switch the set to "F.M." and then inject a 10·7Mc/s I.F. signal, via an 0·1μF isolating capacitor, first to the base of Tr4 and next to the base of Tr3. If the signal passes through the set from Tr4 but not from Tr3, then the trouble obviously lies somewhere in Tr3 section. The transistor may be defective, or there may be trouble in an associated component, but a few voltage checks on the transistor electrodes, relative to battery positive, should reveal any obvious breakdown. Electrode voltages for that stage have already been given.

If the signal does not pass beyond Tr4, a check should first be made of the electrode voltages here. The base should be about 0·9V, the emitter 0·75V and the collector 5V.

If the voltages are fairly reasonable, a very strong 10·7Mc/s signal injected via an 0·1μF capacitor at the collector should produce an A.F. output. (In all F.M. tests, of course, the generator should be frequency-modulated.) If there is no trace of output signal, the A.F. stages should come under attention.

Failure of A.M. Reception

Here the trouble would almost certainly lie in stage Tr3. The transistor can be discounted, as also can the collector, emitter and base components. There is every possibility that a faulty switch is responsible or trouble in one of the A.M. oscillator coils or tuning elements.

Failure of F.M. Reception

This symptom was considered in Part 4 of this series, and would almost certainly result from a fault in the VHF tuner or tuner switching elements.

However, it sometimes happens that a fault occurs in one of the F.M. I.F. transformers or in one of the associated tuning capacitors.

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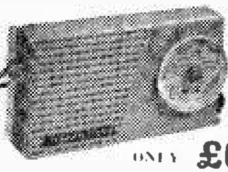

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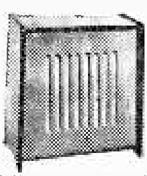

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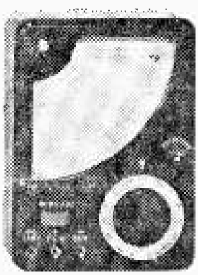

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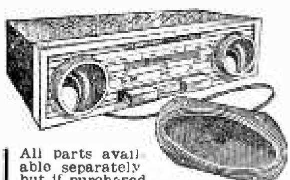

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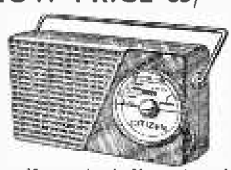

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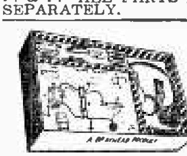

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All about CATHODE FOLLOWER circuits

By E. McLoughlin

PRINCIPLES AND USES OF THIS TYPE OF CIRCUIT

(Continued from page 921 of the February issue)

IN Fig. 12, last month, a valve White cathode follower circuit was shown. However, the direct transistor equivalent of the circuit which was shown in Fig. 13 (also last month), would give better performance, on account of the greater current carrying capacity of suitable transistors.

The principle of the White cathode follower is that a second valve is used as part of RK, in parallel with the external load forming the main RK. This second valve is driven at the grid from a small anode resistor in the cathode follower valve circuit, so that its resistance in parallel with RK changes to compensate any changes of output voltage. This circuit, employing a coupling condenser (C1) does not function as such at D.C. For frequencies below the cut-off of C1, R1, the circuit essentially behaves as an ordinary cathode follower.

Fig. 14 (right)—The base-input emitter-follower.

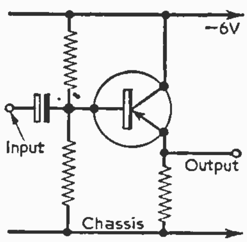
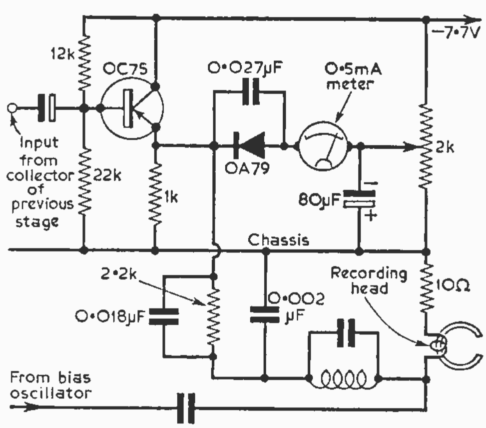


Fig. 15 (below)—The emitter-follower in a commercial tape recorder.



The Base-Input Emitter Follower

This circuit, shown in Fig. 14, is the direct transistor equivalent of the valve cathode follower. This circuit is capable of handling a signal almost equal to the collector supply voltage, as transistors are capable of running with very small emitter to collector voltages and base to collector voltages.

Using a parallel argument to the cathode follower mathematics, one finds here that the output impedance (internal impedance of the emitter output) is equal to the internal impedance of the generator feeding the base, divided by the current-gain of the transistor. The internal base-resistance of the transistor must, of course, be included in the effective internal resistance of the base-feed, for the above consideration. By the "current gain" is to be understood the ratio of increase of collector current to increase of base current producing this in the circuit, and is in the region of about 20 for very many typical transistors. A typical base-feed from the collector circuit of a preceding voltage amplifier will have, say, 5,000Ω impedance, so that the output impedance of the typical emitter follower will lie in the region of 250Ω. As in the case of the cathode follower, this value of load is then needed if maximum power is desired, whereas a load of several times this value is required if 1 : 1 voltage transfer is desired.

Fig. 15 shows a typical practical example of the use of a transistor emitter follower. It is the output circuit of the recording-amplifier in the Philips Transistor Portable Tape Recorder RK5. The low impedance output of the emitter follower supplies sufficient drive to operate the 500μA moving-coil meter serving as recording level indicator, via its rectifier. Also, at the same time, it drives the recording-head. Thus, the circuit is a genuine power output stage. Good use is made of the low impedance of the output in preventing distortion at the recording head in spite of the asymmetrical current in the meter on account of the rectifier diode. With an output circuit of higher impedance in a collector circuit, the meter rectifier would inevitably react back to distort the whole signal at the head.

Cascade

It is, of course, possible to use two or more emitter followers in cascade in which case the output impedance is about 10Ω at the second. This would enable an ordinary moving-coil speaker of 5Ω or 15Ω impedance to be connected direct as emitter-load of the second stage, and the power output would be excellent, provided a transistor of suitable current rating were used for the second stage. Using a 2A power transistor and a 6V

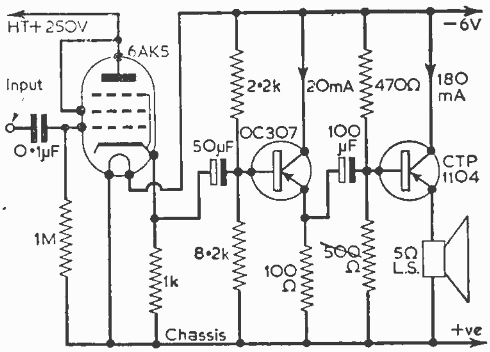


Fig. 16—An experimental circuit for a transformerless output stage for 5Ω or 15Ω loudspeakers. (To avoid D.C. in the speech coil, replace the loudspeaker by a resistor of 5Ω or 15Ω and feed the loudspeaker through a 1000µF 12VW electrolytic condenser between output emitter and chassis. This is necessary to avoid burning out miniature loudspeakers.)

collector supply, it is possible to feed a couple of watts into a moving-coil speaker of 15Ω, direct and without a transformer of any kind, by careful choice of component values in a circuit of this kind, to suit the particular transistor obtained.

A further possibility for lines of experiment for the ambitious experimenter would be to use a combination of a valve cathode follower and a power-transistor emitter follower, to operate a 15Ω moving-coil speaker at good power without a transformer. It would be possible to feed the transistor from a small bridge rectifier and smoothing running off the heater supply of the valve.

Fig. 16 shows a typical example of such a circuit tried out by the author, but, as transistors still vary greatly in their data, the experimenter will have to develop his own circuit for whatever transistor he can purchase. It is advisable to place a meter in the base and collector circuits during all experiments, to be able to see at all times that current ratings are not being exceeded.

Concluding Note

It is by no means maintained that the circuits sketched in this series represent the optimum attainable in all cases. These circuits are merely intended as sketches, to suggest to the reader his own experiments. The diagrams illustrate principles; precise component values must be tried out in the reader's own experiments. They will depend on the particular valves and transistors, etc., available. Whilst experimenting, particular attention should be given to trying various D.C. operating points, by returning grid leaks of cathode followers to various points on a H.T. bleeder, as indicated in many of the circuits. Meters should be included in circuit when experimenting, to show up at once any arrangement causing excessive current. ■

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TELEPHONE HANDSET, standard G.P.O. type. New 12/-, P. & P. 1/6.

VACUUM CONDENSER. 32,000 v. 50pF. 12/6. P. & P. 3/6.

AR 83's. Completely rebuilt with new PVC wiring. Type 'D' £75; Type 'L' F £70.

CARBON INSET MICROPHONE, G.P.O. Type 2/6. P. & P. 1/6.

BRAND NEW ORIGINAL SPARE PARTS FOR AR88 RECEIVERS

I.F. Transformers. 1st, 2nd, 3rd, 4th (for type D), **12/6** each or complete set of 6, **60/-.**

I.F. Transfs. Crystal Load, **12/6** each.

Plates escutcheons (for D and LF), **15/-** each.

Dials (for type D), **10/-** each.

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Filter Chokes (for D and LF), **22/6** each.

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Antenna Trimmers (LF and D), **2/6** each.

Filter Condenser 3 x 4µF, **£2.10.0.**

Condensers:
3 x .25µF (D and LF), **2/6** each.
3 x .01µF (D and LF), **2/6** each.

RF Antenna Inductors (D and LF), **7/6** each.

Mains Transformers (LF), **£3** each.

Small Trimming Tool, 7/-.

Small Mica Condensers, various values, **1/6** each.

Instruction Manual for AR88D. £1.

19 SET OWNERS. To increase output of your set 6 to 10 times use **RF Amplifier No. 2** with built-in rotary converter for 12 v. input. Four 807 valves output. Simple connection with transmitter. Fully tested condition, **£9.15.0,** including necessary connectors and instructions. Carriage and packing 15/-.

POWER SUPPLY UNIT. Input 200/250 v. A.C., 50 cycles. Output: 1, H.T.280/350 v. 300mA smoothed; 2, M.T. 150/200 v. 40mA (positive earthed); 3, L.T. 18/25 v. 4 amp. D.C. smoothed (negative earthed). 2 relay switching, H.T. & M.T., safety switch fuses on A.C. and all D.C. Two 5Z3 for H.T., one 6X5 for M.T., Selenium rectifier for L.T. Ideal for Ham transmitters. Weight 45 lb. Dimensions 14 x 8½ x 18in. Price **£12.10.0** including valves. P. & P. 25/.

R209 RECEPTION SET. A 10-valve High-Grade Super Heterodyne Receiver with facilities for receiving R/T (A.M. or F.M.) and C.W. Frequency 1-20 Mc/s. Hermetically sealed. Built on miniature valves and incorporating its own vibrator power supply unit driven by a 6 v. battery (2-point connector included). The set provides for reception from rod, open-wire or dipole aerial with built-in loudspeaker or phone output. Overall measurements: Length 12in., width 8in., depth 9in. Weight 23 lb. In as new, tested and guaranteed condition **£23.10.0,** including special headphones and supply leads. Carriage £1.

SUPPLY UNIT RECTIFIER No. 21. Fully sealed enabling all sets built for 6 v. (R209, R109, etc.) to work from A.C. mains. Input 90-260 v. A.C. (Taps at 10 v. intervals). Output excellently smoothed up to 10 amps with meter indicating exact output voltage. Measurements: 12 x 9 x 10in. Price **£8.** Carr. and p. 15/-.

FAMOUS T.17 CARBON MICROPHONES. **£2.5.0.** Post & packing 3/6.

P. C. RADIO LTD.
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Shepherds Bush 4946

Letters to the Editor

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

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 commerical 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 ~age iii of cover.

METAL CABINETS

SIR,—Your correspondent T. H. Hughes, who writes of his difficulty in obtaining metal cases to house his test gear (January issue), may be interested to learn that sheet steel boxes in a variety of sizes, from 3in. x 3in. x 1½in. to 12in. x 12in. x 4in. and possibly larger, are readily available as standard electrical hardware. They are usually referred to, in the electrical contracting trade, as "pressed steel adaptable boxes". These I have used with various small items of test gear etc., but one should however, be wary of using steel cases with instruments incorporating sensitive moving coil meters.

No doubt the firm from which Mr. Hughes purchases his components could obtain such boxes for him through the usual trade channels.—D. J. MORRIS (Birmingham).

CORRESPONDENTS WANTED

SIR,—I am interested in radio technology and have a radio service shop of my own. I would like to correspond with any radio serviceman from anywhere. All letters received will be answered promptly.—C. S. YEAR (61 Jln. Market, Bedong, Kedah, Malaya).

F.M. QUALITY

SIR,—Your correspondent Mr. Van der Syde's letter in the January issue regarding F.M. quality and his remarks regarding ratio detectors, prompts me to add that I have noticed several unusual effects with these transmissions, including that of the attenuation of the lower audio frequencies. Even allowing for the pre-emphasis of the system I feel that there are effects that are not easily explained.

I have enjoyed and constructed amateur radio apparatus for over 30 years and I will be the first to admit that there are difficulties in making and aligning I.F. transformers and ratio detectors of sufficient accuracy to make worthwhile F.M. receivers at home; the great point being to get the spot on zero at the centre of the I.F. passband. The effects which I have noticed are, however, apparently outside any explanation of this sort.

For instance, I have noticed that an A.M. detector will give a very good reproduction of VHF/F.M. on either side of the centre frequency. As a matter of fact I have discarded the ratio detector and am now using a normal single diode crystal detector. I would like to add that the results are superior to those formerly obtained with the ratio detector.

Another effect which I have noticed, and which may be connected with this aspect of the question, is that the VHF frequency modulated transmissions (from Wenvoe at least) can often be heard weak and distorted at points on the dial other than on the normal readings. This effect has been noticed on both the VHF/F.M. and on the TV transmissions, although it is more pronounced on the former.—T. G. DAVIES (Llantrisant, Glamorganshire).

VINTAGE MODELS

SIR,—I fully agree with all that Mr. J. Mansell says in the December issues of P.W. I have a truly magnificent receiver—an H.M.V. 442—which was built in 1934. I purchased this set in 1937 for £3 in working order and the only repairs I have had to pay for were a part rewind of the mains transformer and a MHD4 valve in 1940; and a PX4 valve in 1958.

The volume and bass response is still as good as ever and I intend to maintain this set in working order for as long as it is possible to do so.—P. J. PLATER (Wellington, Surrey).

Servicing Tape Recorders

(Continued from page 1038)

The alternating magnetic field created across the gap of the erase head serves to demagnetise the tape. An ordinary permanent magnet wiped along the tape would give more or less the same result, and some old machines employ permanent magnet erasure, but the "noise" background remaining on the tape is far less by the use of an alternating field than by a direct field. Again, since the "erasure" signal is above audible limits a tape so erased is completely cleared of signal.

The Basic Domestic Recorder

The record and replay functions are integrated in most domestic machines. Already it has been mentioned that the record head works also as the replay head and that the bias oscillator also serves as erase oscillator. In addition, sections of the replay amplifier are used for record.

This means that there is considerable switching on changing from record to replay and vice-versa. Moreover, the motor itself is invariably coupled in some way to the "record/replay" switch, as also is the tape drive capstan. In Fig. 4 is shown a simplified version of the record/replav change-over system.

(To be continued)

Club News

REPORTS OF CURRENT ACTIVITIES

AMATEUR RADIO MOBILE SOCIETY
Hon. Sec.: G3FPK, 79 Murchison Road, London, E.10.
On show on the society's stand at the Radio Hobbies Exhibition were a number of pieces of equipment, all loaned by members. The stand attracted a large number of visitors, and 59 new members were welcomed into the society.

BRADFORD RADIO SOCIETY
Hon. Sec.: M. T. G. Powell, G3NNO, 28 Gledhow Avenue, Roundhay, Leeds 8.
Instruction for junior members of the society is given at 7 p.m. before all meetings held at Cambridge House and morse classes are held when previously arranged.
Future Events:
February 13th—Field-day discussion and informal meeting.
February 27th—A display of members' equipment.
March 13th—Audio amplifier design and construction, by P. J. Barowitz.

DERBY AND DISTRICT AMATEUR RADIO SOCIETY
Hon. Sec.: F. C. Ward, G2CVV, 5 Uplands Avenue, Littleover, Derby.
On January 24th members exhibited home-made equipment, and on 31st the management committee meeting was held.
The society now has a membership of over 150 after the recent enrolment of ten new members.
The annual general meeting was held on February 7th.
Future Events:
February 11th—G5YY Trophy contest.
February 14th—A discussion on reflectors.
February 17th—The annual dinner at the Derbyshire Yeoman.

GUILDFORD AND DISTRICT RADIO SOCIETY
Hon. Sec.: J. Barker, G3PDX, 35 Banders Rise, Merrow, Guildford.
At the November 24th meeting, members saw the 1960 and 1961 films of the NFD's and G3NDF also showed a film about high speed photography.
Thick fog caused the car treasure hunt, which had been arranged for November 26th, to be abandoned. The Christmas draw was held on December 14th but the main subject for the meeting was a talk on recording, given by G2BBX. The first meeting in the New Year was held on January 11th.
It has been decided that for the 1962 National Field Day, the society will operate two stations, with G3FZC and G3IAF in charge of them.

HALIFAX AND DISTRICT AMATEUR RADIO SOCIETY
Hon. Sec.: G. Sunter, 24 Booth Fold, Luddendenfoot, Halifax.
Anyone interested in short-wave radio is invited to any of the society's meetings. Slow morse transmissions are now sent on 1900kc/s from 12.00 to 13.00GMT, every Sunday.
On December 5th, G3ADG gave a talk on efficiency modulation, and December 19th was a ragchew night.
On February 6th members attended the annual dinner.
Future Events:
February 20th—Ragchew.
March 6th—The conversion of surplus equipment by G3MAX.

MITCHAM AND DISTRICT RADIO SOCIETY
Hon. Sec.: M. Pharaoh, G3LCH, 1 Madeira Road, Mitcham.
G3VK recently gave a talk on the Radio Amateurs' Emergency Network, tracing the history and development of the movement in the Surrey area. The Christmas meeting was held on December 15th, which included the Christmas draw and constructional contest. The following meeting on December 29th was mainly devoted to an RSGB tape recorded lecture with the title, "The human machine as a radio operator" and which was illustrated with slides.
On January 12th, A. Gee gave a talk on amateur radio teleprinting.

NORTHERN HEIGHTS AMATEUR RADIO SOCIETY
Hon. Sec.: A. Robinson, G3MDW, Candy Cabin, Ogden, Halifax.
Recent activities of the society have included an informal evening and the Christmas dinner. On January 24th, T. Fawthrop gave a talk on tape recorders.

PLYMOUTH RADIO CLUB
Hon. Sec.: R. Hooper, 2 Chestnut Road, Peverell, Plymouth.
The competition on December 6th for the Ernie Hillyard trophy was won by J. Fallon. J. Share gave a talk on the erection of beam aerials at this meeting.
On February 7th members discussed preliminary arrangements for the National Field Day of 1962.

READING AMATEUR RADIO CLUB
Hon. Sec.: R. G. Nash, G3EJA, 9 Holybrook Road, Reading, Berkshire.
The November meeting was very well attended by short-wave enthusiasts.
National Field Day 1962 was the subject under discussion at the December meeting of the club. The Annual General Meeting was held on January 27th.
Future Event:
February 24th—G. Preston will give a talk on useful pieces of home-made equipment.

SPEN VALLEY AMATEUR RADIO SOCIETY
Hon. Sec.: N. Pride, 100 Raikes Lane, Birstall, Nr. Leeds.
On January 31st a Fire Prevention Officer from Bradford lectured members on the subject of "safety in the shack".
Future Events:
February 28th—Aerial problems, by A. R. Bailey.
March 14th—Radio astronomy, by L. Dougherty.

Experimenter's POWER PACK

(Continued from page 1030)

charging and transistor circuitry is taken off on the output side of the A.C. heater fuses, so that these serve to protect the D.C. circuitry as well. S5, a single-pole change-over toggle switch, selects 6V or 12V A.C. input to the half-wave copper oxide rectifier D4, and S6 functions as on/off switch for the D.C. circuit. C13 and C14, together with VR2, provide ample smoothing. The author has operated a sensitive transistorised tape-recorder from this supply, on record and playback, without any detectable hum whatsoever. VR2 serves to regulate output current and voltage on any particular load, and thus also serves as charging resistance for battery charging. The monitor meters can be switched in at will to read off the output voltage and current. If the on/off switch S6 is momentarily turned off whilst accumulators are charging, the charging current will cease, and the voltmeter will drop to the true voltage of the accumulators on charge, which is, among other things, a good indication of the extent of progress of charge of a healthy accumulator. Otherwise, the ammeter is more important for accumulator charging, but if the supply is used for heating battery valves, the voltmeter is normally more important. Once the heater voltage has been set correctly, the meters are free to be switched over to measure other outputs, e.g. to set the main stabilised H.T. at 120V, if we are dealing with battery valves. It is also perfectly permissible to "buffer" accumulators with this supply, i.e. to connect the power supply output and accumulators of the desired total voltage in parallel and with the same polarity to the consuming valve heaters or other load (see Fig. 8). If VR2 is then adjusted so that the monitor ammeter reads about the same current as the load consumption is known to be, then the accumulators will be neither charging nor discharging, but merely floating and acting as voltage stabilisers of very high efficiency. This is, in fact, the cheapest and simplest way of stabilising the low-voltage D.C. output.

(To be continued)

SURBITON PARK RADIO LTD

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F.M. TUNERS

JASON F.M. TUNER KITS

FMT1	Complete with valves	£6 17.6
	Deposit 27/6 and 6 monthly	£1.1.8
FMT2	Complete less power	£7.17.6
	Deposit 31/6 and 6 monthly	£1.4.4
FMT2	Complete with power	£9.15.0
	Deposit 39/- and 6 monthly	£1.9.4
FMT3	Complete less power	£9.12.6
	Deposit 38/6 and 6 monthly	£1.9.0
FMT6	Complete with power	£12.0.0
	Deposit 48/- and 8 monthly	£1.6.6
Power Pack Kit	ready drilled chassis	£2.12.6

The instruction book is included in all the above kits, but otherwise is 2/6

JTV/2	Switched, TV sound, powered	£14.15.0
	Deposit 60/- and 12 monthly	£1.1.6
Mercury 2	as above less power	£10.15.0
	Deposit 43/- and 8 monthly	£1.4.0

The instruction book is again included, but otherwise 3/6.

ARMSTRONG RADIO CHASSIS

T4B VHF Tuner, self powered	£23.0.0
Deposit £4.12.0 and 12 monthly	£1.13.8
ST/3 Mk.2 AM/FM Tuner, powered	£28.10.0
Deposit £5.14.0 and 12 monthly	£2.1.8
AF208 AM/FM Radio chassis, bass and treble controls, P.U. inputs, Single ended output stage	£23.15.0
Deposit £4.15.0 and 12 monthly	£1.14.10
Jubilee Mk.2 AM/FM Radio chassis with push-pull output stage	£31.15.0
Deposit £6.7.0 and 12 monthly	£2.6.6
Stereo 55 AM/FM Radio chassis, single ended output stage, on both channels. Separate tone and volume	£33.15.0
Deposit £6.15.0 and 12 monthly	£2.9.6
Stereo 12 Mk.2 AM/FM Radio chassis. Push-pull on both channels, separate controls	£44.15.0
Deposit £8.19.0 and 12 monthly	£3.5.6

Individual leaflets giving full description and technical specification available.

REQUIRED CHANNELS MUST BE SPECIFIED FOR ALL SWITCHED TUNERS

Argus	Transistor 2-wave band tuner kit, in attractive wooden case	£7.10.0
	Less transistors (OC44 and 2 OC45)	£6.10.0
	Book 3/6.	

READY BUILT TUNER

F.M. Tuner aligned and assembled, using Philips tuning head with ECC85, EF85, EF85, EZ81 and EM84 and two diodes. SELF POWERED. UNREPEATABLE BARGAIN.. £7.19.6

MARTIN RECORDAKITS

We are able to offer for the first time, a proprietary range of Recorders in kit or assembled form. This enables you to take advantage of mass production techniques and prices, should you wish to assemble yourself. The components used are the finest available, with BVA valves, and the decks are the latest having all the improvements B.S.R. and Collaro make from time to time, heads, etc.: The amplifiers are packed in special cartons with instructions which enable anyone to build. We are confident you will find these Recorders very good value, they have been built up to a standard and not down to a price.

B.S.R. TD3 Monardeck, latest model 5¾in. spools........CASH	£9.9.0
Hire purchase deposit £1.19.0 and 6 monthly	£1.8.4
Tape Amplifier for B.S.R. deck, printed circuit ready wired, with ECC83, ECL82, EM85 and EZ81. Complete with all plugs, sockets, panels, knobs, etc. The whole amplifier mounts on to the deck, making a self-contained unit...CASH PRICE	£8.8.0
Hire purchase deposit £1.14.0 and 6 monthly	£1.5.8
Cabinet for above including 7 x 4in. speaker	£4.4.0
Total kit as above....CASH	£22.0.0
Hire purchase deposit £4.10.0 and 12 monthly	£1.12.1
The above recorder can be supplied complete with Mic: tape assembled and tested for..........CASH PRICE	£25.0.0
Hire purchase deposit £5.0.0 and 12 monthly	£1.16.8
Collaro Studio Deck. Very latest model 3 speeds	£12.10.0
Hire purchase deposit £2.10.0 and 8 monthly	£1.7.6
Tape Amplifier for Studio Deck, with ready wired printed circuit, control and input panels, mains and output trans., complete with knobs, plans, screws, etc., EF86, ECC83, EM84, EZ81, OA81 and 2 EL84, 3 watts output. Magic eye, Radio and Mic. inputs. EX L/S socket. Tone control. Can be used as an amplifier..............COMPLETE CASH	£11.11.0
Hire purchase deposit £2.7.0 and 8 monthly	£1.5.6
Cabinet for above including 9 x 5in. speaker	£5.5.0
Total kit as above.... CASH	£29.0.0
Hire purchase deposit £6.0.0 and 12 monthly	£2.2.2
We can supply the above recorder, complete with tape and Mic., in a DE LUXE cabinet, assembled for	£35.0.0

THIS MACHINE IS LISTED £41.0.0 BY MAKERS AND IS A VERY GOOD BUY.

Hire purchase deposit £7.0.0 and 12 monthly	£2.11.4
Tape Pre-amplifier, for recording and playback, as above less output stage, with power supplies	£8.8.0
Hire purchase deposit £1.14.0 and 6 monthly	£1.5.8

Microphone for the above recorders. Acos MIC 40, 25/-, S/C plug 4/6.

Synchrotape	5in.	600ft.	15/-	5in.	900ft.	19/6
Finest	5¾in.	850ft.	19/6	5¾in.	1200ft.	22/6
Boxed	7in.	1200ft.	22/6	7in.	1800ft.	32/6

Tape Recorder Speaker Cabinet, corner, 20 x 10in. High class finish in two-tone Grey "Vynair"	£2.15.0
With 9 x 5in. high flux speaker	£4.0.0
Marriott Tape Heads, 4 track R/PB and Erase with mounting plate for Collaro deck............ PAIR COMPLETE	£4.4.0

List price for this set of heads is £8.14.0.

GRAMOPHONE EQUIPMENT

B.S.R. UA14 TC8/H cartridge	£7.15.0
Hire purchase deposit £1.11.0 and 6 monthly	£1.4.0
Collaro C60 Autochanger "O" cartridge	£8.15.0
Hire purchase deposit £1.15.0 and 6 monthly	£1.6.8
Garrard "Autoslim" 67/2 cartridge	£9.3.4
Hire purchase deposit £1.17.4 and 6 monthly	£1.7.8
Philips AG1016 New semi-auto player	£14.3.6
Hire purchase deposit £3.3.6 and 12 monthly	£1.0.2

MINI AMP P/W November issue. Resistors 6/-, V/C 6/-. Condensers 9/-, Transistors V6/R2 9/-, OC71 6/6, OC72 pr. 16/-. T/T3 13/-. T/T2 9/9. PP9 3/6. Press studs 1/-. Speaker 7 x 4in. 17/6, Group/b 2/9. All the above if ordered at one time. £4.15.0. Diagram may be obtained from "Practical Wireless", 5/-.

CITIZEN P.W. Transistor tuner, December issue. Resistors 5/-. Condensers 11/-, W/C 3/6, OA70 3/-, Group boards 2/9 ea.. Transistors 31/- set. Coil set 22/6, RA2W 12/6. J.B. 12/6 with trimmers.

TRANSISTORS

MULLARD HAVE REDUCED THE PRICE OF MANY TYPES TO OC44 11/-, OC45 10/-, OC70 6/6, OC71 6/6, OC72 8/-, OC75 8/-, OC76 8/-, OC78 8/-, OC81 8/-. ABOVE ARE THEIR NEW LIST PRICES. WHY BUY SURPLUS? MATCHED PAIRS ONLY. Mullard OC72 at 16/- pair.

— TRANSISTOR SUPERHET KITS —

"PRACTICAL WIRELESS" POCKET SUPERHET

OSMOR printed circuit version. Osmor Rod aerial 10/-. I.F.T.s and Osc. Coils. 22/6. Osmor Driver, 11/6. Osmor Output, 10/6. Set MULLARD transistors, 53/6. OA81 Diode, 3/-. J.B. Gang, 11/-. Trimmers, 2/8 pr. Set Condensers, 15/-. Set Resistors, 6/6. Ardente Vol. Control, 8/-. Ardente W/C, 3/6. Speaker, 19/10. Hardware, 4/6. Printed Circuit, 9/-. Case and Knob 12/6. Dial, 6d. Battery PP4, 2/-. Leaflet giving full illustrated details, 1/9. All the above components if purchased at one time £9.9.0. OSMOR undertake to align this receiver for a charge of 10/-. Modification Kit, 10/-. New contemporary case, 12/6, now included in kit.

"WEYRAD"

WEYMOUTH RADIO 6 Transistor Superhet using the P50 coils, as they advertise in this journal. P50/1AC Osc. Coil, 5/4. P50/2CC 1st and 2nd I.F.T.s, 5/7 ea. P50/3CC 3rd I.F.T., 6/-. RA2W Rod Aerial, 12/6. LFDT4 Driver, 9/6. PCA1 Printed Circuit, 9/6. Instruction Book, 2/-. Set Resistors, 7/6. Vol. Control D.P., 5/6. Set Condensers, 20/-. J.B. Gang, 11/-. Beehive Trimmers, 1/3 ea. W/C, 3/6. Dial and Knob, 3/6. Battery PP11, 5/6. OA81, 3/-. Set MULLARD transistors, 53/6. Car Aerial Coupling Coil, 1/-

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2 METER RECEIVER Type R1392(D) 95-155Mc/s. 15 valve Superhet. As New condition. Still used on many airways, D type being later model. Valve line up. 1st and 2nd RF AMP. EF54, 1st local osc. SP61, 2 osc. Multipliers EF54. 3 IF Amp. EF39, AGC6Q7. Output 6J5. Muting EA50. Noise Limiter EA50. BFO 6J7. Mixer EF54, DE Mod. 6Q7. Tuning meter, slow motion tuning. Normally crystal controlled or tunable over 95-155Mc/s. Power Reqd. 240, 80 mA, 6.3, 4 amps. Size 19 x 10 x 10in., £4.19.6, plus 7/6 carr., or as new, air tested, £6.19.6, plus 7/6 carr. Mains Power Supplys 1st class condition, £4.5.0, or 6 volt Power Unit 19 x 10 x 10in., new £3.10.0.

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200 MIXED Resistors, ½-14 watts, Pots, Trimmers, etc. 21/-. Post free. 3-4 Kingsbury Arcade, Kingsbury N.W.9.

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TUBES 6 mon. Guar. FITTED FREE 9-10-12in. 30/-. 14in. 40/-. 17in. 50/-.
VALVES. 50,000 in stock. 1,000 types. All set tested before despatch. Examples:

5UA	4/6	EBC41	6/-	N37	4/6
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6AF6	6/-	EB91	2/-	PCF80	4/6
6AQ5	4/6	ECC81	3/-	PCL83	7/6
6BA6	4/6	ECC82	4/6	PenA4	5/-
6BE6	4/6	ECC83	4/6	PL38	10/-
6BG6	10/-	ECC84	4/6	PL81	4/6
6BW6	4/6	ECC88	4/6	PL82	4/6
6DC6	17/6	ECC91	4/6	PL83	4/6
6CH6	4/6	ECH35	6/-	PY31	4/6
6O9	6/-	ECH42	6/-	PY80	4/6
6K25	7/6	ECF80	4/6	PY81	4/6
6L18	4/6	ECL80	4/6	PY82	4/6
6P25	4/-	EK90	4/6	PZ30	4/6
6V6	4/6	EF80	2/-	R19	7/6
6X4	4/6	EF92	4/6	MU14	5/-
7S7	4/6	EF95	4/6	SP61	2/-
7C5	4/6	EL38	4/6	U22	4/6
10C2	6/-	EL81	4/6	U24	7/6
10F1	3/-	EL90	4/6	U25	10/-
10P13	6/-	EY51	4/6	U37	12/6
12BH7	6/-	EY86	4/6	U31	4/6
20L1	6/-	FC4	5/-	U35	4/6
20P1	4/6	FC13	4/6	U191	7/6
20P3	6/-	KT36	4/6	U281	6/-
185BT	12/6	KT66	7/6	UL41	4/6
B36	4/6	KT81	4/6	UL44	6/-
DDT4	5/-	KT67	7/6	UU8	10/-

Most Pre-war 4, 5, 7 and 9 pin valves of British, European and American manufacture, 5/- each. Postage and packing 6d. per valve. Orders over £1—free.
NEW TRANSISTORS. Red Spot 2/6. OC45, OC72, OC76, 7/6, OC35 (1 watt power), OC201 (Silicon) 20/-. Postage 3d. each.
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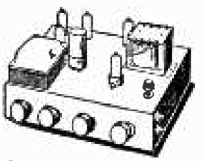

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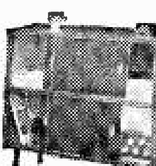

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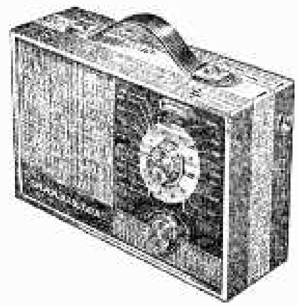

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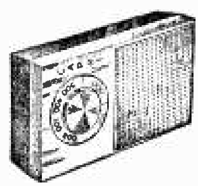

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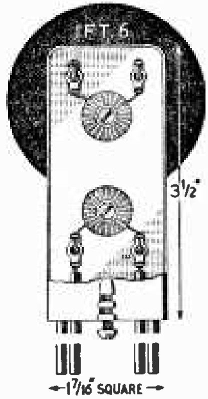

IFT. 11/465 Kc/s and 1.6 Mc/s.
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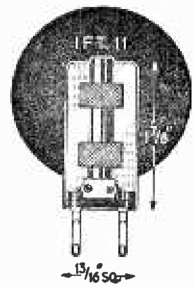

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Practical Wireless

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ALL OF these blueprints are drawn full-size and although the issues containing descriptions of these sets are now out of print, constructional details are available free with each blueprint except for the PW Monophonic Electronic Organ and the PW Roadfarer.

The index letters which precede the Blueprint Number indicate the periodical in which the description appeared. Thus PW refers to PRACTICAL WIRELESS; AW to *Amateur Wireless* and WM 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, London, W.C.2.

SPECIAL NOTE

THE following blueprints include some pre-war designs and are kept in circulation for those constructors who wish to make use of old components which they may have in their spares box. *The majority of the components for these receivers are no longer stocked by retailers.*

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Dual-wave Crystal Diode	PW95	2/6
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The PW Pocket Superhet	—	5/-
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The PW Monophonic Electronic Organ .. .. *(No constructional details are available with this blueprint)*	—	8/-
The PW Roadfarer .. .. *(No constructional details are available with this blueprint)*	—	5/-
TELEVISION		
The PT Band III converter ..	—	1/6

Title	*Number*	*Price*
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Experimenter's Short Wave ..	PW30a	2/6
Midget Short Wave Two	PW38a	2/6
Band-Spread Three (Battery) ..	PW68	2/6
Crystal Receiver	PW71	2/-
Signet Two (Battery)	PW76	2/6
Simple S.W. One-valver	PW88	2/6
Pyramid One-valver	PW93	2/6
BBC Special One-valver	AW387	2/6
A One-Valver for America ..	AW429	2/6
Short-Wave World Beater ..	AW436	3/6
Standard Four Valve S.W. ..	WM383	3/6
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Listener's 5-Watt Amplifier ..	WM392	3/6

QUERY COUPON

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PRACTICAL WIRELESS, MARCH, 1962

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A Three Transistor Three Diode Personal Radio for Medium Waves. Amateur top band and shipping. Quality output on 'phone. Fitted airspaced tone, vol. control, Mullard transistors, No aerial or earth. **Luxembourg guaranteed.**

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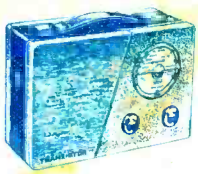

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A 5-Transistor and Diode, Printed Circuit, Medium and Long Wave Portable. Features 5in. speaker, Car aerial socket, Mullard transistors and carded components. Excellent results.

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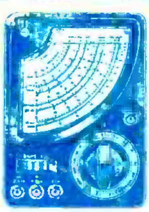

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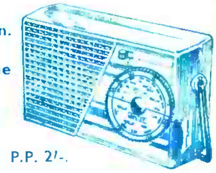

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With Test Leads, Battery and Instructions.

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