PRACTICAL WIRELESS

JUNE 1965

2/-

FREE INSIDE!

DOUBLE-SIDED

BLUEPRINT

TO BUILD THIS

ELECTRONIC HAWAIIAN GUITAR

BUILT-IN TRANSISTOR PREAMP / CONTROL UNIT

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

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

TOP SHROUDED DROP THROUGH

250-0-250v. 70mA. 6.3v. 2a, 0-5-6.3v. 2a	17/9
350-0-350v. 80mA. 6.3v. 2a, 0-5-6.3v. 2a	21/9
250-0-250v. 100mA. 6.3v. 2a. 6.3v. 1a ..	21/9
250-0-250v. 100mA. 6.3v. 3.5a. C.T. ..	19/9
250-0-250v. 100mA. 6.3v. 4a, 0-5-6.3v. 3a	28/9
300-0-300v. 130mA. 6.3v. 4a. 6.3v. 1a. for Mullard 510 Amplifier	35/9
300-0-300v. 100mA, 6.3v. 4a, 0-5-6.3v. 3a	28/9
350-0-350v. 100mA, 6.3v. 4a, 0-5-6.3v. 3a	28/9
350-0-350v. 150mA, 6.3v. 4a, 0-5-6.3v. 3a	37/9

FULLY SHROUDED UPRIGHT

250-0-250v. 60mA. 6.3v. 2a, 0-5-6.3v. 2a Midget type 2½ x 3 x 3in.	18/9
250-0-250v. 100mA. 6.3v. 4a, 0-5-6.3v. 3a	29/9
300-0-300v. 100mA. 6.3v. 4a, 5v. 3a. ..	29/9
300-0-300v. 130mA. 6.3v. 4a. C.T. 6.3v. 1a. for Mullard Amplifier	36/9
350-0-350v. 100mA. 6.3v. 4a, 0-5-6.3v. 3a	29/9
350-0-350v. 150mA. 6.3v. 4a, 0-5-6.3v. 3a	38/9

FILAMENT TRANSFORMERS

200-250v. 50 c/s primaries 6.3v. 1.5a, **5/9**; 6.3v. 2a, **7/6**; 12v. 1a, **7/11**; 6.3v. 3a, **8/11**; 6.3v. 6a, **17/6**; 12v. 1.5a, twice **17/6**.

OUTPUT TRANSFORMERS

Standard Pentode 5,000Ω to 3Ω ..	5/9
Standard Pentode 7,000Ω 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 to 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 Mullard 510 Ultra Linear ..	29/9
Push-Pull 20 watts, sectionally wound 6L, KT66, EL34, etc.	49/9

SMOOTHING CHOKES

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

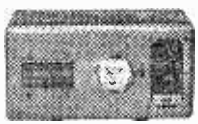
CHARGER TRANSFORMERS

All with 200-230-250v. 50 c/s Primaries: 0-9-15v. 1½a, **12/9**; 0-9-15v. 2a, **14/9**; 0-9-15v. 3a, **16/9**; 0-9-15v. 5a. **19/9**; 0-9-15v. 6a. **23/9**; 0-9-15v. 8a, **28/9**.

AUTO (Step up/Step down) TRANS. 0-110/120-230/250v. 50-60 watts, **13/9**; 250 watts, **49/9**; 150 watts. **27/9**. 500 watts **99/9**:

MICROPHONE TRANSFORMERS 120:1 high grade, clamped, **8/9**.

R.S.C. BATTERY CHARGER and KITS



for A.C. Mains 200/250v., 50c/s. *ASSEMBLED*, 4 amps 6/12v. Fitted Ammeter and variable charge rate selector. Also selector plug for 6v. or 12v. charging. Louvred steel case with stoved grey hammer finish. Fused and ready for use with mains and out- put leads and battery clips. **59/9** Carr. 4/6. Terms: Deposit 12/- and 5 monthly payments of 12/- (Total £3.12.0).

HEAVY DUTY CHARGER KIT 6/12 v. 6 amps., variable output. Mains transformer 0-200-230-250v. F.W. (Bridge) Selenium Rectifier, Ammeter, Variable Charge Rate Selector panels, Plugs, Fuses, Fuse-holder and circuit. **59/9.** Carriage 4/6.

SELENIUM RECTIFIERS

F.W. (BRIDGED) TYPES

6/12v. 1a.	3/11	6/12v. 6a.	15/3
6/12v. 2a.	6/11	6/12v. 10a.	26/9
6/12v. 3a.	9/9	6/12v. 15a.	35/9
6/12v. 4a.	12/3		

COMPLETE POWER PACK KIT

Consisting of Mains Trans., Metal Rectifier, Double electrolytic smoothing choke chassis and circuit. For 200-250 v. A.C. mains. Output 250v., 60mA, 6.3v., 2a. **19/11**

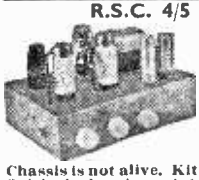
ARMSTRONG TRUVOX LEAK QUAD, ROGERS, LINEAR, W.B. FANE, WHARFEDALE, GOODMAN GARRARD, GOLDRING, GRAMPIAN, LUSTRAPHONE SHURE, RESLO

All items Cash or Terms.
Vast Range of components, etc.

SCOOP PURCHASE OF HIGH QUALITY RECORD CHANGERS

Brand new Garrard 3000 LM. Very latest model. Normal Retail price approx. £12.15.0. Heavy Turntable and light-weight pick-up arm. High fidelity Stereo/Mono cartridge. Fully guaranteed. **10 GNS.** Carr. 5/6

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 71 dB down 15 dB of Negative feedback is used, H.T. of 300v. 25 mA and L.T. of 6.3v. 1.5a, is available for the supply of a Radio Feeder Unit or Tape-Deck pre-amplifier. For A.C. mains 200-230-250v. 50 c/s. Output for 2-3 ohms speaker. Chassis is not alive. Kit is complete in every detail with fully punched Gold Hammer finished chassis, point-to-point wiring diagrams and instructions. Exceptional value £4.15.0, or assembled ready for use 25/- extra, plus 3/6 carr., deposit 22/6 and 5 monthly payments of 22/6 (Total £6.15.0) for assembled unit.

R.S.C. GRAM. AMPLIFIER KIT. 3 watts output. Negative feedback. Controls Vol., Tone and Switch. Mains operation 200-250v. A.C. Fully isolated chassis. Circuit, etc., supplied. Only 39/6. Carr. 3/9.

GEM MINIATURE 3-4 WATT GRAM AMPLIFIER. For use with any single or auto-change unit. Output for 2/3 ohm speaker. For 200-250v. A.C. mains. Size 11½ x 2½ x 2¼in. Controls: Vol. and Tone with Switch. Only **59/6**

R.S.C. 4 WATT GRAM. AMPLIFIER KIT. Complete set of parts to build a good quality compact unit suitable for use with any record playing unit. Mains isolated chassis separate Bass and Treble controls. Output for 2-3 ohm speaker. For 200-250v. A.C. **59/9**

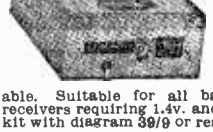
COMMUNICATION RECEIVERS

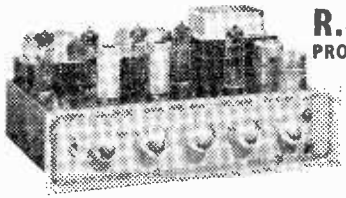
RX 60D2 LUXE 4 BAND

220/240v. 50/60 c.p.s. A.C. mains operation. Frequencies covered 1600 Kc/s to 30 Mc/s continuous. Incorporates 5in. speaker. Slide rule tuning dial 'S' meter. Internal ferrite aerial for medium wave. Telescopic whip aerial 58in. 10 section for short waves. Fitted sockets for optional outdoor aerial. Headphones, external speaker socket. Other features are electrical bandspread tuning, Noise limiter, A.V.C., B.F.O., stand by switch. Size approx. 12½ x 5½ x 8½in. Handsome crackle finished metal cabinet. Brand new with full instructions manual. Usual guarantee **19 Gns.** Carr. & pkg. 10/-.

R.S.C. BABY ALARM or INTER-COMM KIT. Complete set of parts with diagrams, etc. Housed in two polished walnut finished cabinets of pleasing design. High sensitivity. For 200-250v. A.C. mains. Fully isolated. Controllable at both units. An intercomm. of this class would normally cost £20-£30. Only **89/6**, carr. 5/- ready for use, **6 gns.**

R.S.C. BATTERY TO MAINS CONVERSION UNITS. Type BMI. An all-dry battery eliminator. Size 5½ x 4½x2in. approx. Completely replaces batteries supply 1.4v and 90v where A.C. mains 200-250v, 50 c/s is available. Suitable for all battery portable receivers requiring 1.4v. and 90v. Complete kit with diagram **39/9** or ready for use **48/9**





R.S.C. STEREO 20/HIGH FIDELITY AMPLIFIER

PROVIDING 10/14 WATTS ULTRA LINEAR PUSH-PULL OUTPUT ON EACH CHANNEL

SUITABLE for "MIKE", GRAM., RADIO OR TAPE. **INTENDED FOR THE HOME OR STUDIO BUT SUITABLE FOR LARGE HALLS OR CLUBS**

Features include:

- ★ Four-position tone and compensation Input Selector switch.
- ★ Stereo/Mono switch so that peak monaural output of 28 watts can be obtained.
- ★ Separate Bass "Lift" and "Cut" and treble "Lift" and "Cut" controls.
- ★ Neon panel indicator.
- ★ Handsome Perspex Frontplate

Send S.A.E. for illustrated leaflet. Carr. 10/-

13 Gns.

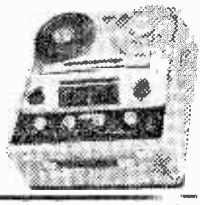
Based on a current Mullard design and employing valves ECC83, ECC83, ECL86, ECL86 ECL86, ECL86, EZ81. Output transformers are high quality sectionally wound to required specification. Output matchings for 3 and 15 ohm speakers on each channel.

Complete set of parts with point to point wiring diagrams and instructions, or Factory assembled, tested and supplied with our usual 12 months' guarantee for 18 gns, or DEPOSIT 2 gns. and nine monthly payments of 41/6 (Total £22.15.6.)

FREQUENCY RESPONSE ± 2dB. 30-20,000 c.p.s.
HUM LEVEL 65dB down.
SENSITIVITY: 15 millivolts maximum.
HARMONIC DISTORTION (each channel) 0.2%.
For operation on 200/250v. A.C. Mains.

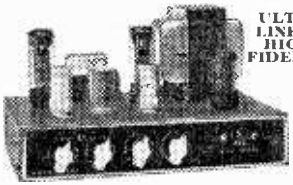
AUDIOTRINE HI-FI TAPE RECORDER KIT 25½ GNS. Carr. 17/6

REALISM AT INCREDIBLY LOW COST, CAN BE ASSEMBLED IN AN HOUR
Incorporating the latest Collaro Studio Tape Transcriptor. The Audiotrine High Quality Tape Amplifier with negative feedback equalisation for each of 3 speeds. High Flux P.M. Speaker, empty Tape Spool, a Reel of Best Quality Tape and a Handsome Portable Carrying Cabinet tastefully covered in two contrasting shades of Rexine and Vynair, Size 14½ x 15 x 8½in. high and circuit. Total cost if purchased individually approximately £40. Performance equal to units in the £60-£80 class. S.A.E. for leaflets. **TERMS. Deposit £3 and 12 monthly payments of 44/- (Total £28 Gns).**



ONLY 3 PAIRS OF SOLDERED JOINTS PLUS MAINS

R.S.C. A10 30 WATT AMPLIFIER



ULTRA LINEAR HIGH FIDELITY

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. 30-20,000 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, GZ34. 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; BASS, LEAD OR RHYTHM GUITAR, STRING BASS**, etc. For standard or long-playing records. **OUTPUT SOCKET PROVIDES** L.T. and H.T. for **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. 200-250 v. 50 c/s. A.C. Mains output for 3 and 15 ohm speakers. Complete Kit of parts with fully punched chassis and point-to-point wiring diagrams and instructions. Supplied factory built with EL34 output valves and 12 months' guarantee, for **14 Gns.** If required perforated cover with carrying handles can be supplied for **19/9.** Send S.A.E. for leaflet, also speaker.

11 Gns. Carr. 10/-

TERMS: DEPOSIT 34/6 and 9 monthly payments of **33/6. (Total 16 gns).**

12in. 10 WATT HIGH QUALITY LOUDSPEAKER

In walnut veneered cabinet. Gauss 12.000 lines. Speech coil 3 ohms or 15 ohms. Only Carr. 5/-

£4.19.6

Terms: Deposit 11/3 and 9 monthly payments of 11/3. (Total £5.12.6). 12in. 20 **WATT HI-FI LOUDSPEAKERS IN CABINETS.** Size 18 x 18 x 10in. Finish as above. Only **£7.18.6.** Terms: Deposit 17/9 and 9 monthly payments of 17/9 (Total £9.17.6). Carr. 8/6.

W.B. "STENTORIAN" HIGH FIDELITY P.M. SPEAKERS HF1012. 10 watts rating. Where a really good quality speaker at a low price is required, we highly recommend this unit with an amazing performance. **£4.12.0.** Please state whether 3 ohm or 15 ohm required.

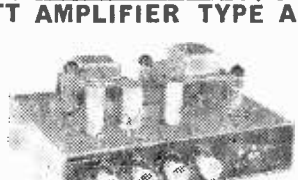
INTEREST CHARGES REFUNDED

on H.P. and CREDIT SALE Accounts settled in 6 months.

LINEAR TAPE PRE-AMPLIFIER. Type LP/1, Switched Equalisation. Positions for Recording at 1¼in., 3¾in., 7½in. per sec., and Playback, EM84 Recording Level Indicator. Designed primarily as the link between a Collaro Tape Transcriptor and a Hi-Fi amplifier, suitable almost any Tape Deck Only 9¾ gns. S.A.E. for leaflet.

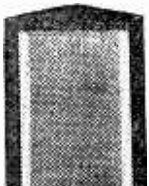
HIGH FIDELITY 12-14 WATT AMPLIFIER TYPE A11

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, EZ81. 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 dB 30-20,000 c/s. Six negative feedback loops. Hum level 60 dB 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, LEAD OR RHYTHM GUITARS**, etc. **OUTPUT SOCKET** with plug provides 300v. 30mA, and 6.3v. 1.5a. For supply of a **RADIO FEEDER UNIT.** Size approx. 12 x 9 x 7in. For A.C. mains 200-250v. 50 c.p.s. Output for 3 and 15 ohms speaker. 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 25/-** and 9 monthly payments of **25/-** (Total **£12.10.0**). Send S.A.E. for illustrated leaflet detailing Cabinets, Speakers, Mikes, etc.

R.S.C. STANDARD BASS REFLEX CABINET. For 12in. loudspeakers, acoustically lined and ported. Size 20 x 14 x 13in. Beautiful walnut veneer finish. Recommended for use with Audiotrine Speaker System. **£5.19.6. AUDIOTRINE CORNER CONSOLE CABINETS.** Strongly made. Beautiful polished walnut veneered finish. Pleasing design. **JUNIOR MODEL.** For up to 8in. speaker. Approx. 20x11x8in. **49/9 STANDARD MODEL.** To take up to 10in. speaker. Size 27 x 18 x 18in. **£4.11.9**

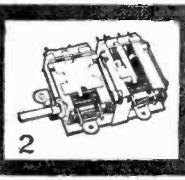


SENIOR MODEL. To take up to 12in. speaker and with Tweeter cut-out. size approx. 30 x 30 x 15in. (Recommended for use with Audiotrine speaker system). **7 gns.** or terms.

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 for "lift" and "cut". Provision is made for use as straight (monaural) 10-watt amplifier. Valve line-up ECC83, ECC83, EL84, 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/-
Or supplied factory assembled with 12 months' guarantee for **£11.7.6.**
Terms: Deposit **2 gns.** and 9 monthly payments of **24/2** (Total **£12.19.6.**).

AUDIOTRINE HI-FI SPEAKER SYSTEMS. Consisting of matched 12in. 12,000 line. 15 ohm high quality speaker; crossover unit (consisting of choke, condenser, etc.) and Tweeter. The smooth response and extended frequency range ensure surprisingly realistic reproduction. Standard 10 watt rating. **£4.19.9.** Carr. 5/-. Or Senior 20 watt. **£6.19.6.** Carr. 7/6.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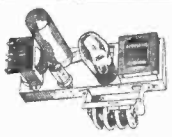
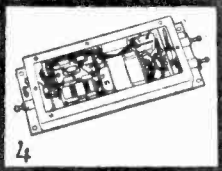

Comprising chassis 8½ x 2½ x 1in. Double wound mains transformer, output transformer, volume and tone controls, resistors, condensers etc. Valves 6V6, EC81 and metal rectifier. Circuit 1/6 free with kit. 29/6 plus 3/- P. & P.
3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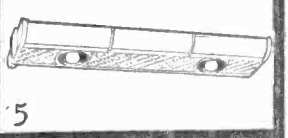
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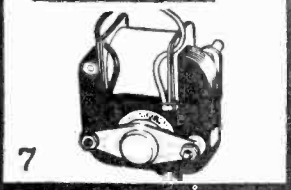
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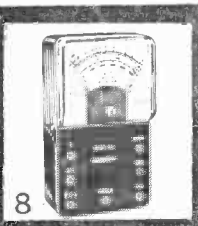
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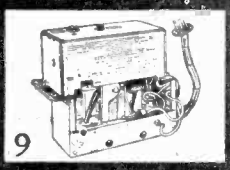
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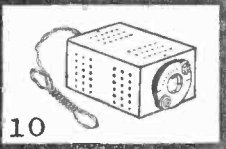
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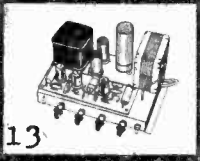
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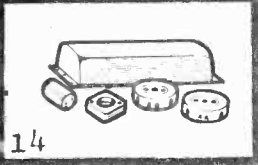
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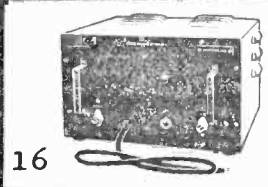
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1. **6 VALVE 15 WATT PUSH-PULL AMPLIFIER.** 15 x 7 x 1½in. A.C. Mains 200-250 volts. 4 inputs with controls for same and bass and treble lift controls. Tapped for 3 and 15 ohm speakers. Extra H.T. and L.T. for F.M. Tuner supplies etc. Built and tested. 7 gns. P. & P. 12/6.

2. **CYLDON A.M./F.M. PERMEABILITY TUNERS FOR ALL TRANSISTOR OPERATION.** Size 2½ x 2½in. approx. By famous manufacturer. A.M. I.F. 470 Kc/s. F.M. I.F. 10.7 Mc/s. A.M. coverage from 1620 Kc/s-525 Kc/s. F.M. coverage 108 Mc/s.-88 Mc/s. Circuit diagrams 2/6. **FREE** with Tuner, 1st, 2nd and 3rd A.M. I.F.'s, 1st, 2nd, 3rd and 4th F.M. I.F.'s V.H.F. Osc. choke, A.M. I.F. trap. All the above are the R.F. end of an A.M./F.M. receiver car radio etc. The above items, **£2.10.0.**

3. **AMPLIFIER KIT.** 3 to 4 watt Amplifier Kit.

4. **TRANSISTOR INVERTOR.** 50 v. D. C. Input. Output 240 v. A.C. 40 watts incorporating transformers, choke, condensers and 2 **GET573.** In solid 16 gauge aluminium case, size 15 x 6 x 2½in. by famous manufacturer, **19/6,** plus 6/- P. & P.

5. **FLUORESCENT LIGHT FITTING. Twin 40 watt** 200/250 v. less tubes **39/6.** P. & P. 6/-.

6. **SIGNAL GENERATORS:** Cash **£7.5.0.** & P. P. 6/6. 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 200/250v. Internal modulation of 400 c.p.s. to a depth of 30 per cent. Modulated or unmodulated R.F. output continuously variable 100 multivolts, C.W. and mod. switch, variable A.F. output. Magic eye as output indicator. Accuracy 2 per cent.

7. **A.C. MAINS MOTOR.** Can be used for a variety of purposes, silent running, satisfactory in every way. 230/250v. A.C., **9/6.** P. & P. 2/-.

8. **POCKET MULTI-METER.** Size 3½ x 2½ x 1½in. Meter size 2½ x 1½in. Sensitivity 1,000 O.P.V. on both A.C. and D.C. A.C. and D.C. volts. 0-15, 0-150, 0-1,000. D.C. current 0-150 mA. Resistance 0-100K Ω. Complete with test prods, battery and full instructions, **39/6.** P. & P. 2/6. **FREE GIFT** for limited period only. 30 watt Electric Soldering Iron value **15/-** to every purchaser of the Pocket Multi-Meter.

9. **CHANNEL TUNER I.F.** 16-19 Mc/s. Continuously tunable from 174-216 Mc/s. Valves required—**PCF80** and **PCC84** (in series). Cover **BBC** and **ITA** ranges. Also Police, Fire and Taxis, etc. Brand new by famous maker, **10/-.** P. & P. 3/-.

10. **POWER SUPPLY KIT** in metal case, size 3½ x 2½ x 2in. incorporating mains transformer, rectifier and condensers. 230/250 A.C. mains. Output: 9v. 100mA. 10/6 plus 2/6 P. & P.

11. **B.S.R. MONARCH UA14 WITH FULL 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 10½in. Space required above baseboard 4¾in., below baseboard 2¾in. Fitted with Full Fi turnover crystal head. **£5.19.6.** P. & P. 6/6.

12. **50 MICRO-AMP METER** movement by world famous manufacturer. Size 3 x 2½in., 25/-, plus 1/6 P. & P.

13. **8-WATT 5-VALVE PUSH-PULL AMPLIFIER & METAL RECTIFIER.** Size: 9 x 6 x 4½in. A.C. Mains, 200-250v. 5 valves. For use with Std. or L.P. records, musical instruments, all makes of pick-ups and mikes. Output 8 watts at 5 per cent total distortion. Separate bass and treble lift controls. Two inputs, with controls, for gram. and mike. Output transformer tapped for 3 and 15 ohms speech coils. Built and tested. **£3.19.6,** P. & P. 7/-.

14. **40W. FLUORESCENT LIGHT KIT** incorporating GEC Choke size 6½ x 1½ x 1¾in., 2 bi-pin holders, starter and starter holder, **11/6.** P. & P. 3/6.
Similar to above: **80W Fluorescent Light Kit** incorporating GEC choke size 11¾ x 1½ x 1¾in. 2 bi-pin holders, starter and starter holder **17/6.** P. & P. 4/6.

15. **FIRST QUALITY PVC TAPE.**

5⅞ in. Std. 850 ft.	..	9/-	5 in. D.P. 850 ft.	..	10/6
7 in. Std. 1200 ft.	..	11/6	3 in. T.P. 600 ft.	..	8/-
3 in. L.P. 240 ft.	..	4/-	5 in. T.P. 1800 ft.	..	20/6
5⅞ in. L.P. 1200 ft.	..	11/6	5⅞ in. T.P. 2400 ft.	..	27/6
7 in. L.P. 1800 ft.	..	18/6	7 in. T.P. 3600 ft.	..	37/6

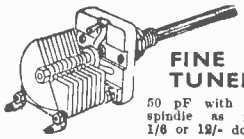
P. & P. on each 1/6, 4 or more Post Free.

16. **FIXED FREQUENCY SIGNAL GENERATOR.** Crystal controls in metal case, size 10 x 6 x 6in. Incorporating two **FC13** valves, mains transformer, metal rectifier, choke, indicator, lamp, crystal and numerous components. Modulated and unmodulated output socket. Originally used for I.T.V. frequencies. Brand new, 39/6, plus 6/- P. & P., A.C. mains 200-250 volts.

SILICON RECTIFIERS. 250v. P.I.V. 750 mA. Six for 7/6 post paid

FLOODLAMP CONTROL

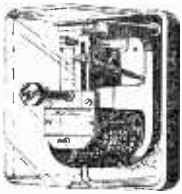
Dim and full switch for controlling photo floodlamps. Gives two lamps in series, two lamps full brilliance and lamps off. Similar control of other appliances. With circuit **3/6**, plus 9d. postage.



FINE TUNERS

50 pF with long spindle as illus. **1/6** or **12/-** dozen.

OVERCURRENT RELAY



Beautifully made by the famous American Westinghouse Company These are the surface mounting through panel type with clear Pyrex glass covers. They have coils for remote push-button resetting. Type A—calibrated for currents between 0.1 and 0.4 amps. Type B—calibrated for currents between 0.5 and 2 amps. Price, unused and perfect, **29/6** plus 3/6.

Microphone Inserts

American made. Dynamic type. Real bargain at **2/6**, plus 6d. postage.

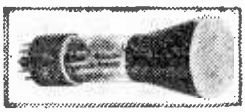
Fishing Rod from Dinghy Mast

Tubular aluminium not separate sections. extends like telescope from 15 ins. to 9 ft, **6/6** each.

Morganite Potentiometer

Single and 2-gang types available, standard size with good length spindle, all new. Single type, 1/- each, values available 5K, 10K, 25K, 50K, 100K, 250K, 1 meg., 2 meg. Gang type 3/- each—values available 5K + 5K, 100K + 100K, 1 meg. ± 1 meg., ½ meg. ± ½ meg.

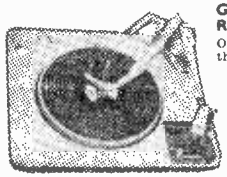
Building a 'Scope



5in. oscilloscope tube. American made type No. 3PP7, 6.3v. 0.6 amp. heater electrostatic deflection brand new and guaranteed with circuit diagram of 'scope **15/-** each. Plus 2/6 post and insurance.

Where postage is not definitely stated add 2/- all orders under £3.

AUTOCHANGER BARGAIN



Garrard Auto-Slim Record Changer

One of the nicest record changers that this famous company make—Automatic selection of records which may be mixed—may also be played manually. Finger tip adjustment of Stylus pressure. Fitted with monohead—but pick-up wired for stereo—suitable 200/250 A.C. mains cabinet space required 14½ x—12½in. with 4½in. above and 2½in. below. DON'T MISS THIS SPECIAL SNIP only **£5.15.0** (post and insurance, 6/6).

MULTI-METER BARGAIN

Model number EP10K. Extra wide scale fitted corner wise for compactness, extra accurate as it uses 1% components. Sensitivity 10,000 ohms per volt A.C. and D.C. ranges. D.C. voltage up to 1.2KV in 5 ranges. A.C. voltage up to 1.2KV 5 ranges. D.C. current up to 300mA 3 ranges. Resistance up to 2 meg. Capacities .005 to .15 mfd and decibels. Complete with full instructions and test prods and battery for ohms range. A real bargain not repeatable once stocks cleared. Price **69/6**. Carriage and insurance 5/-.

THIS MONTH'S SNIP

Cabinet & Pick-Up

Cabinet for battery record player. Size approx. 9 x 11 x 5in. allows for 7 x 4in. speaker and amplifier. Nicely covered two tone. Must have cost at least £2 to make. New and perfect. Offered while stocks last. ONLY **15/6** plus 4,6 post and insurance.

TAPE RECORDER

—that will play in your pocket

Undoubtedly one of the smallest precision tape recorders made. Entirely controlled by push buttons, you can record and play back with the instrument in your pocket. It is a full function machine using standard ¼in. tape and easy to replace batteries. Speaking and playing back is from the same (crystal) microphone. **Specification:** Dimensions 6¼ x 2¾ x 1¼in., weight 14 oz.; recording time, 12 mins.; rewinding time, 4 mins.; recording system, D.C. Bias: erasing system. Magnetic erasing; wow and flutter within 2% and frequency response, 500-1,200 c/s (within —6dB). Complete ready to work.

Price **£9.19.6** plus 3/6 post and insurance.

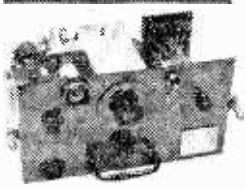
750 mW TRANSISTOR AMPLIFIER

4 transistors including two in push-pull input for crystal or magnetic microphone or pick-up—feed back loops—sensitivity 5 m/v.

Price 19/6

Post and insurance 2/6.

35 ohm Speaker, **12/6** extra.



Oscillating Unit 12A

This is a precision instrument covering the range 30 to 41 Mc/Sec. with tone switching for 700, 1150 and 1700 cycles per sec and magic eye tuning indicator. Unused in original transit cases with attenuator box. Limited quantity only **£5** each. carriage paid.

Speaker Bargain

12in. High-fidelity loudspeaker. High flux permanent magnet type with either 3 ohm or 15 ohm speech coil. Will handle up to 10 watts. Brand new by famous maker. Price **27/6** + 3/6 post and insurance.

Hi-Fi Speakers

Hi-Fi Speakers—E.M.I. Ceramic magnet 12,000 lines, size: 13 x 8in. (roughly equivalent to 12in. round speaker). Bass frequency 50-50 c/s. Handles up to 10 watts. Price **33/6** plus 5/- carriage and ins. State whether 15 ohm or 3 ohm.

Brayhead Turret Tuner

Complete with Band 1 and Band 3 coils. Less valves 10/- each or with valves **17/6** each. Post 2/6. Knobs 3/6 extra.

Waterproof Heater Wire

16 yds. length. 70 watts, self regulating temperature control. **10/-**. post free.

Cabinet Snip

This fine cabinet as illustrated but less control knobs is available this month at a special snip price of **12/6**, plus 3/6 post and insurance. Size is 13½in. x 9in. x 4in. and it is nicely covered in two tone L.C.I. fabric.

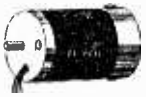
Siemens High Speed Relay

Twin 250 ohm coils adjustable tension change over contact—plat points **7/6**. Post 1/-.

Five Core Cable

Ideal for switching circuits, intercoms, P.A. runs etc. each core flex copper with rubber insulation, cores covered overall in tough rubber or P.V.C. **9d.** per yd. or 30 yds. length **15/-** plus 5/- post.

Making a Fan Heater

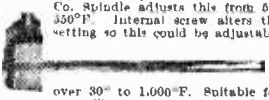


Miniature motor laminated poles. Operates off 20-30v. D.C. Original cost at least £3 each. **8/6** plus 1/6 postage and insurance. Mains model **9/6**, plus 2/6 postage and insurance.

THERMOSTATS

Type 'A' 15 amp. for controlling room heaters, greenhouse airing cupboard. Has spindle for pointer knob, quickly adjustable from 30-80°F. **9/6** plus 1/- post. Suitable box for wall mounting, 5/-. P. & P. 1/-.

Type 'B' 15 amp. This is a 17in. long rod type made by the famous Sunvic Co. Spindle adjusts this from 50-350°F. Internal screw alters the setting so this could be adjustable

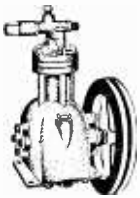


over 30° to 1,000°F. Suitable for controlling furnace, over kiln, immersion heater or to make flamestat or fire alarm. **8/6** plus 2/6 post and insurance.

BARGAINS GALORE—WAREHOUSE BEING CLEARED

FLEXIBLE COUPLINGS

These couplings extend as well as bend for joining shafts out of alignment and for sing tuning controls where the core has to come in and out. Price 10/- dozen.

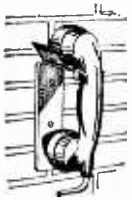


Compressor/ Vac. Pump

Fitted with outlet and inlet valve, suitable for paint spraying, refrigerator etc. Complete with V belt drive wheel. Price 27/6 plus 6/6 post and packing.

Sheet Paxolin

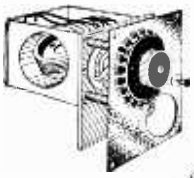
Ideal for transistor projects. Size 6 x 6in., 1/-; 12 x 8in., 2/-; 12 x 12in., 3/6; 24 x 12in., 6/-; 25% discount in dozen lots. Special offer, 12 panels 5 x 8in., 5/-.



SELF ENERGISED TELEPHONES

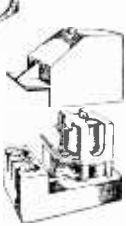
These require no batteries; in fact they have only to be connected by a pair of wires. They can thus be fitted into existing bell circuits. Results are extremely good and maintenance costs are nothing. Handsets only complete with wall mounting bracket as illustrated, 15/- each, post etc. 2/6. Two post tree.

Variometer Assembly



As illustrated this is useful for experimental circuits, crystal sets, etc. Price 3/9 ea.

RELAYS



Totally enclosed in bakelite, this relay has a 24v. coil but can of course be rewound for mains operation. Its contacts are suitable for breaking 20 amps. Price 2/6 each, 24/- doz.

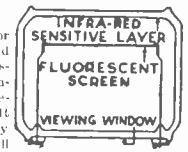
CATHODE RAY TUBES

Carr. and Ins.

VCR 517, 6in. (replaces VCR 97) new and unissued	9/6	8/6
VCR 139A, 2¼in. ..	27/6	4/6
VCR 138, 3¼in. ..	27/6	5/6
VCR 4/1, 3in.	32/6	4/6
VCR 112, 5in.	27/6	5 6
CV 996, 6in.	22/6	5/6
VCR 97, 6in.	42/6	8 6
CV 1140, 12in.	27/6	12/6
CV 1590, 12in.	27/6	12/6

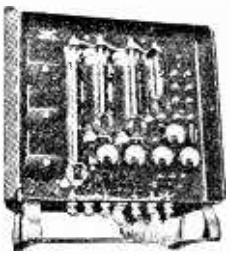
10 WAY CABLE ideal for interconnecting units and for remote switching circuits—each way has a flex copper core capable of carrying 5 amps. and insulated to 500v.—the cable is P.V.C. covered overall. Price 1/6 per yd. 10 yds. post free otherwise add 3/6 post.

SNIPERSCOPE



Famous wartime "cats eye" used for seeing in the dark. This is an infra-red image converter cell with a silver caesium screen which lights up (like a cathode ray tube) when the electrons released by the infra-red strike it. It follows that as light from an ordinary lamp is rich in infra-red these cells will work burglar alarms, counting circuits, smoke detectors and the hundred and one other devices as will the simpler type of photo cell. Here then is a golden opportunity for some interesting experiments, price 5/- each. Post 2/-. Data will be supplied if requested.

CHARGING SWITCHBOARD

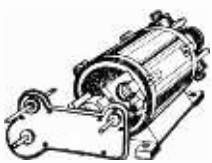


Type A. 350 w. 18 v.—contains three reverse current relays, one voltmeter rated 25 v. f.s.d. one main ammeter rate 40 amps. f.s.d., one secondary ammeter rated 15 amps. f.s.d., and two secondary meters rated 20 amps. f.s.d., one 2 ohm variable resistor, one 11 ohm variable resistor and two 1.2 ohm variable resistors. Complete in metal case 2ft. 6in. x 2ft. 8in. approx. Price £2.15.0. Carr. and Ins. 15/-.

Type B. 1260 w. 50 v. 12 amps. —contains one 14 ohm variable resistor and four 1 ohm variable resistors, one main ammeter, rated at 40 amps f.s.d., four secondary meters rated at 20 amps. f.s.d., and one voltmeter rated at 50 volts, and two reverse current relays. Complete in metal case—size approximately 2ft. 6in. x 2ft. 8in. Price £4.15.0. Carr. 15/-.

Hurry or you may be too late

See last two month's adverts. for more bargains but please note we are sold out of the following: **Ferranti Meters; Klystron Receivers; 25 amp Contactors; Motorised Rotary Switches.**



Multi-Speed Motors

You can adjust this motor to almost any speed you want it will work directly off A.C. mains, or if you require greater power or greater speed, work it through a metal rectifier. This motor is fitted with a gear box enabling speeds down as low as 1 r.p.m. to be obtained. Price 19/6, postage and packing 4/6 extra.

BUILDING AN AMPLIFIER

Here is a buy for you! Modulator Unit type 20. Contains parts ideal for building a large output amplifier and all ready set out in metal case. To name a few: Four high output valves Type KT44. Driver valve Type MH41. Iron cored choke for up to 200 milli-amps. Dozens of wire wound and carbon resistors, paper and mica condensers. Terminals and tag panels, etc., etc. Three other items of interest to everybody and well worth the price asked for the unit are: **1. Transformer Reference 10K/143.** This can act as auto-transformer to convert 230 to 110 or 240 to 460, and also as a filament transformer 230 to 6.3 or 230 to 12.6 volts. **2. Miniature Circuit Breaker.** For breaking 6.0 amps A.C. reset by pushing knob. **3. Steel Case.** With heavy gauge chassis, all ready cut out and fitted valve holders, etc. Price for complete unit is 12/6. Carriage 7/6.

INSTRUMENT COMPANY

Dept. P.W.

43 SILVERDALE ROAD, EASTBOURNE

CASH WITH ORDER

Mail order only from this address—goods may be seen by appointment in Oxfordshire.

If carriage is quoted this must be sent, otherwise if your order exceeds £2 no postage will be charged—under £2 add 2/-.

Something for Everybody

Toggle Panel Switch, 25/30 amp. single pole, 2/6. 24/- dozen.

Toggle Switch, 10 amp. double pole, 2/-, 18/- dozen.

Electric Lock. 24v. coil but rewindable to alter voltages. 4/6; 48/- dozen.

Dynamotor. American make, input 27v., output 285v. 20 watt. Totally enclosed 15/-, post etc., 2/6.

EHT Rectifier. CV111, 15 Kv. 350 M.A. (peaks), 6/-; £3 dozen.

Ceramic Holder for CV111 rectifier, 2/6; 24/- dozen.

Wafer Switch. 12 assorted types all very useful. 10/-, post 2/6.

Head Phones ideal for short wave listening etc. Low resistance, best makers. 6/-, post 2/6.

Sound Powered Inserts (D.L.R.5) as P.E. intercomm. as speakers or microphones, 5/6; 54/- dozen.

Hot Wire Meters. These measure 0-grams A.C. current at mains frequency, 2¼in. flush mounting 15/- each; 6 for £3.10.0.

½ Meg. Potentiometers. Sealed type by Morganite, among the best ever made. Standard ¼ spindle, 1in. long. 6/- dozen. 100K, ditto, 5/6 dozen. 50K. 5/- dozen.

MU Metal Screen for American 5 CPI etc. 6/6 pair for VCR97 and other 6in. tubes, 7/- complete. Jutto for 2-3in. tube, 5/- complete.

8-Way Connectors. Male and female to permit chassis units to be plugged into one another. 3/6 pair, 36/- dozen.

Screened Sleeving 6 MM. 6/- dozen yards.

Reverse Current Relays, 12 to 18v. 12/6 6 for 70/-.

P.M. Speaker Bargains. 8in. P.M. by Rola/Celestion fitted with standard Pentode output transformer, 12/6 plus 3/-. Ditto plus 6½in. 11/6 plus 3/-.

12 Volt Vibrator. 4-pin, standard for most car radios. 7/6; 36/- half dozen.

Vibrator Invertor. American made. D.C. input 24v. Two A.C. outputs. Each itiv. at 100 mA, 60 c.p.s., 15/-.

Vibrator Unit. British made. D.C. input 24v. gives 250v. D.C., 80 mA, using metal rectifier, 25/-.

Vibrator Unit. Canadian made. D.C. input 2v. gives 90-180v. D.C. at 35 mA, uses synchronous vibrator. Also gives 1.4 D.C. for filaments, 35/- plus 2/6.

Rotary Transformer for working 200.240v. D.C. or A.C./D.C. appliances from 12 volt car battery, output 200v. at 100 mA, 35/- plus 3.6.

Trimmer Bank. 5 x 50 pF compression trimmers mounted on metal strip 3¼in. long, ideal if making pre-set station receiver—ceramic/mica insulation, 2/- each; 18/- doz.

Air Spaced Trimmers. 0.50 pF with long preset type, 9/- dozen. Spindle type, 12/- dozen. Twin type with spindle, 18/- dozen.

Toughened Glass. Can be dropped, walked on etc. Unlikely to break unless struck on edge, then it turns into unharmful crystals, 5 panels each 10½ x 9½in., 5/- plus 5/- post and insurance.

Ignition Coil. 12v. suits most cars—useful for E.H.T. experiments, 12/6.

E.H.T. Smoothing Condenser. .1 mfd, 10 Kv., 6/-; £3 dozen.

Micro Switch by Burgess. Will open or close circuit, 2/6; 24/- dozen.

Miniature Relay. American make—630 ohm coil, 20-30 volt operation—two pole change over contacts, 2/6; 24/- dozen.

Electrical Rev. Counter Generator. This is a beautifully made generator supplied with flex-drive shaft. Simply take output of generator to voltmeter and calibrate this in r.p.m., 20/- plus 2/6.

Key Switch. Three position 3 c/o and 2 c/o, 5/- each; 48/- dozen.

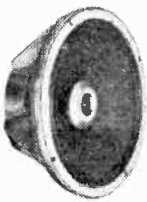
G.P.O. plug with lead, 2/6; 24/- dozen.

Press Button Switch. Multiple contacts on and off when pressed, 2/=; 18/- dozen.

RECTIFYING VALVES

VU29, 600 mA at 4,000v. htr. 4v. 9a., 7/6
866A, 240 mA at 10,000v. htr. 2.5v. 5a., 10/6.
872 1250 mA at 10,000v. htr. 5v. 7.5a., 17/6.
RZ1/150 150 mA at 1,000v. htr. 4v. 4a., 15/-.
VU 508 1,000 mA at 8,000v. htr. 4v. 3a., 15/-.
GU 21 3,500 mA at 11,000v. htr. 4v., 11a. 45/-.

LOUDSPEAKERS



We supply a completerange of Goodmans, Wharfedale, Stentorian, T&L Speaker Units and complete systems. A comprehensive leaflet is available on request this covers technical specifications and prices of nearly 50 types including:—

Celestion CX1512 (Illus.)	£11.10.0
Celestion Model CX2012,	£16.10.0
Stentorian HF 312 5 watts	£3.16.0
Stentorian HF1012 10 watts	£4.12.0
Goodmans Axiette 8, 6 watts	£5.10.11
Goodmans Axiom 10, 10 watts	£6.5.11
Goodmans Axiom 201. 15 watts	£10.17.4
Wharfedale Super 8/RS/12/DD 6 watts	£6.14.2
Wharfedale Golden RS/DD 8 watts	£7.17.5
Wharfedale RS/12/DD 15 watts	£11.10.0

Guitar Speakers include:—

Wharfedale W12EG 15 watts	£10.10.0
Wharfedale W15EG 20 watts	£17.10.0
Goodmans Audiom 51B 15 watts	£9.2.8
Goodmans Axiom 61B, 20 watts	£14.7.8

Carr. and Ins. extra

THE TRAVLER Mk. II CAR RADIO

★MEDIUM AND LONG WAVES
★12 VOLT POSITIVE EARTH
★Push Button Wave Change
★SIZE 7 x 2 x 7 inch
★TRANSISTORISED

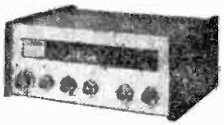
ONLY **9½ gns.** P. & P. 5/-

Ready built complete with 7 x 4in. speaker fitted to baffle, fixing brackets, filter unit, all nuts and bolts and fitting instructions.

Optional Extras: 3-section chromium plated weatherproof telescopic aerials. Type 1. 17in./44in. 19/6. Type 2. 2in./48in. 29/6. both plus P. & P. 2/6 if purchased separately.

The "HIGHWAYMAN" Car radio to build yourself. Similar in appearance to above but with on/off push button switch. Complete set of parts only £7.19.6. P. & P. 5/-.

TUNER UNITS



ARMSTRONG

Mono/Tuner Amp. Model 127M	£26.10.0
Stereo/Tuner Amp. 127 ..	£37.10.0
AM/FM Tuner 223 ..	£28.15.0
FM Tuner 224 ..	£22.10.0

Carr. and Ins. 7/6

STERN FIDELITY Mk. II VHF/FM
Built and vesyed .. £14.5.0
Carr. and Ins. 5/-.

JASON

FMT1 FM Tuner, Kit of Parts	£6.15.0
FMT2 FM Tuner. Kit of Parts	£10.12.6
FMT3 FM Tuner for Fringe areas. Kit of Parts	£12.5.0
FMT4 FM Tuner ..	£20.0.4
JTV2/FM/TV Sound. Kit of Parts	£15.15.0

Carr. and Ins. on above 5/- each.

TRIPLETONE

FM Tuner unpowered ..	£13.19.6
FM Tuner self-powered ..	£15.14.6

Carr. and Ins. 5/- each.

Descriptive leaflets free on request. Please state model required.

STERN-

GREAT BRITAIN'S GREATEST

STERN-CLYNE HI-FI EQUIPMENT
Ready Built or Kit of Parts

	Complete Kit of parts	Ready built and tested	Carr. and Ins.	Instruction book available separately
Stern Mono-Gram Amplifier 3 watts	£4 10 0	£6 0 0	3/6	2/6
Mullard 2 valve Audio Pre-Amplifier	£6 6 0	£9 10 0	5/-	2/-
Mullard 3 valve Audio Pre-Amplifier	£10 0 0	£13 13 0	5/-	3/6
Mullard "3-3" Amplifier with Tone Control Unit 33/RC 3 watts	£8 8 0	£11 10 0	6/6	2/-
Mullard "5-10" Main Amplifier Model 510/M. 10 watts	£10 0 0	£13 10 0	6/6	2/-
Mullard "5-10" Amplifier with Tone Control Unit, 10 watts	£12 0 0	£16 0 0	7/6	2/-
Stern Twin Three Stereo Amplifier, 3 watts per Channel	—	£9 0 0	5/-	—
Stern Twin Three Stereo Amplifier in Portable Case with Two Speakers and Leads	—	£16 10 0	10/-	—
Mullard "10+10" Stereo Amplifier, 10 watts per Channel	£16 0 0	£20 0 0	8/6	3/-
Mullard "10+10" Stereo Amplifier with Passive Control Unit	£20 0 0	£24 0 0	10/-	3/-
Mullard Dual Channel Pre-Amplifier	£12 10 0	£15 0 0	7/6	3/-
The above two items purchased together	£27 0 0	£34 0 0	15/-	—
HF/TR3 Tape Amplifier with Power Unit	£13 13 0	£19 0 0	7/6	3/-
Type "C" Tape Pre-Amplifier with Power Unit	£14 0 0	£19 10 0	7/6	3/6
STP-1 Tape Pre-amplifier with Power Unit, Mono and Stereo	£22 0 0	£28 0 0	8/6	5/-
CR3/8 Tape Recorder with Studio Deck	£33 8 0	—	15/-	3/-

INDIVIDUAL DESCRIPTIVE LEAFLETS GIVING TECHNICAL SPECIFICATIONS, DIMENSIONS, PRICES, TERMS ETC., FREE ON REQUEST

RECORD PLAYERS

Garrard SRP10 Single Player	£5.9.1
BSR UA25 4-speed changer	£5.19.6
Garrard Autoslim changer	£6.10.0
Garradr AT6 changer ..	£10.19.6
BSR Super Slim changer	£9.19.6
Garrard AT5 LM Auto-changer (8000LM) ..	£11.11.11
Philips AG1016 Stereo/Mono Record Player ..	£13.13.0

Carriage and Ins. 5/- on above.

Garrard 4HF Single Player	£16.17.6
Goldring Lenco Model 88 Transcription Turntable ..	£18.18.5
Garrard Laboratory Type "A" Autochanger ..	£19.16.0
Garrard 301 Strobe Transcription Turntable ..	£22.0.5
Goldring Lenco GL58 with 580 Cartridge	£21.19.0
Goldring Lenco GL70 less Pick-up Head	£27.9.4

Carr. and Ins. 7/6 on above.

Descriptive leaflet including prices with alternative cartridges, dimensions, terms etc. free on request.

MICROPHONES

Extensive range available. Send S.A.E. for illustrated brochure.

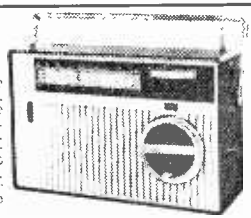
LASKY'S RADIO

Offer the Finest Value and HOME CONSTRUCTORS

We consider our construction parcels to be the finest value on the home constructor market. If on receipt you feel not competent to build the set, you may return it as received within 7 days when the sum paid will be refunded less postage.

THE "SKYROVER" RANGE

GENERAL SPECIFICATION



7 transistor plus 2 diode superhet, 6 waveband portable receiver. Operating from four 1.5 v. torch batteries. The SKYROVER and SKYROVER DE LUXE cover the full Medium Waveband and Short Waveband 31-94 M. and also 4 separate switched band-spread ranges, 13M, 16M, 19M and 25M, with Band Spread Tuning for accurate Station Selection. The coil pack and tuning heart is completely factory assembled, wired and tested. The remaining assembly can be completed in under three hours from our easy to follow stage by stage instructions.

A simple additional circuit provides coverage of the 1100 1950M. band (including 1500 M. Light programme). All components and detailed construction data. **Only 10/- extra** Post Free. This conversion is suitable for both models that have already been constructed.

Data for Receiver 2/6 extra. Refunded if you purchase the parcel. Four U2 batteries 3/4 extra. *All Components Available Separately.*

NEW—The SKYROVER Mk III

Now supplied with redesigned cabinet, edgewise controls, black and chrome plastic cabinet. Size 10 x 6½ x 3½ in. with carrying handle.

Can now be built for £8.19.6 Post 5/-.

H.P. Terms: 20/- dep. and 11 months at 16/6. Total H.P. Price £10.1.6.

The SKYROVER DE LUXE

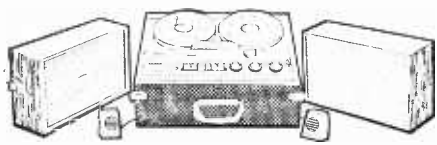
Tone Control Circuit is incorporated with separate Control. In a wood cabinet, size 11½ x 6½ x 3in. covered with a washable material with plastic trim and carrying handle. Car aerial socket fitted.

Can now be built for £10.19.6 Post 5/-. **H.P. Terms: 25/- dep. and 11 mths at 20/-. Total H.P.P. £12.5.0.**

We are pleased to announce the opening of our premises at
42 TOTTENHAM COURT ROAD, LONDON, W.1.
This branch, will be devoted exclusively to the quality High Fidelity equipment—Tape Recorders, Record Reproducers, Radios, Tuners, etc. Custom built installations will provide balanced comparisons of the best in Hi-Fi in ideal surroundings. Open all day Thursday, early closing Saturday.

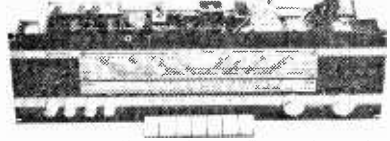
OUTSTANDING TAPE RECORDER OFFER

ELIZABETHAN TYPE LZ 511 STEREO RECORDER



A fully professional 4-track, 3-speed Stereophonic Tape Recorder—at almost half price! 4-track record and replay—Mono or Stereo. 3 speeds—7½, 3¾, 1⅞ i.p.s.—fast forward and rewind. Frequency response 40/16,000 c.p.s. at 7½ i.p.s. Output 3 watts per channel to two 8 x 5in. speakers in detachable enclosures which also form lid of the recorder (supplied with 8 ft. extension leads). 2 Vu record level meters; tape position indicator and auto tape stop; inputs for 2 microphones and 2 radio/pick-ups. Controls include; volume, treble monitor, bass, etc.—duplicated for each channel. Takes 7in. spools. For 200-250v. 50 c.p.s. Mains operation. Overall size (including speakers) 25 x 15 x 8in. **Makers original List Price 65 Gns.**

LASKY'S PRICE 39 GNS. Including 2 crystal microphones tape and spool. Carr. and Ins. 15/- extra.



THE NEW "KUBA" IMPORTED AM/FM STEREO RADIOGRAM CHASSIS

Long, medium and short waveband coverage plus VHF/FM. Piano key wave-change. Separate flywheel tuning on AM and FM. Bass, treble and balance controls. Magic-eye tuning indicator. Ferrite rod aerial. The very latest printed circuitry. Provision for multiplex-adaptor. 5 valves—line up: ECC85, ECH80, ECC83, ELL80, EAF801. Output 4 watts per channel at 3Ω imp. Full vision tuning scale, size 21 x 6in. Overall dimension: 21 x 6½ x 8in. Made to the very highest standards.

LASKY'S PRICE 29½ GNS. Carriage & Insurance 12/6 extra.

INTERNATIONAL TAPE

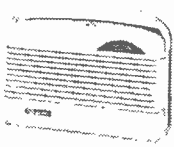
Famous American Brand—Fully Guaranteed

3in.	Message tape, 150ft.	3 6	5¾in.	Double play, 1,800 ft., Mylar base	22 6
3in.	Message tape, 225ft.	4 11	5¾in.	Long play, 1,200ft., Acetate base	12 6
3in.	Message tape, 300ft.	7 6	5¾in.	Standard play, 850ft., PVC base	11 6
3¾in.	Triple play, 600ft., Mylar base	15 0	5¾in.	Triple play, 2,400ft., Mylar base	45 0
4in.	Triple play, 900ft., Mylar base	17 6	7in.	Standard play, 1,200ft., Mylar base	12 6
5in.	Double play, 1,200ft., Mylar base	15 0	7in.	Long play, 1,800ft., Mylar base	19 6
5in.	Long play, 900ft., Acetate base	10 0	7in.	Double play, 2,400ft., Mylar base	25 0
5in.	Standard play, 600ft., PVC base	8 6	7in.	Long play, 1,800ft., Acetate base	15 0
5in.	Triple play, 1,800ft., Mylar base	35 0	7in.	Triple play, 3,600ft., Mylar base	58 6

P. & P. 1/- extra per reel; 4 reels and over Post Free.

The "REALISTIC" Seven

★ 7-transistor Superhet. ★ 350 milliwatt output into 4in. high flux speaker. ★ All components mounted on a single printed circuit board ★ Full medium and longwave cover. ★ Plastic cabinet with carrying handle, size 7 x 10 x 3½in., Blue/Grey or all Grey. ★ Socket for car aerial. ★ I.F. frequency 470 Kc/s. ★ Ferrite rod internal aerial. Operates from PP9 or similar battery. ★ Full data supplied. All coils and I.F.'s etc. fully wound ready for immediate assembly. An Outstanding Receiver.



Can be built for £5.19.6

Post 4/6. PP9 Batt. 3/9. Data and Instructions separately 2/6. Refunded if you purchase the parcel. All parts sold separately.

REALISTIC Seven DE LUXE

With the same specification as standard model—PLUS a superior wood cabinet in contemporary styling with full vision circular dial. ONLY **£1** EXTRA

NEW SINCLAIR SUPER MINIATURES

THE MICRO-6

Self-contained pocket radio. Size only 1⅞ x 1⅝ x ¾in. Amazing performance. Complete with earphone and detailed construction data. **Can be built for only 59/6** Mercury cell 1/11 extra. All parts sold separately.

THE SLIMLINE

The new 2-transistor pocket radio. Size only 2¼ x 1⅜ x 1¾in. Micro alloy transistorised and printed circuit. All components available separately. Easy to assemble.

CAN BE BUILT FOR 49/6

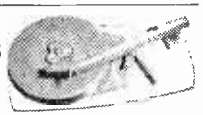
THE X10 AMPLIFIER

10 watt power amplifier fitted with integrated pre-amplifier. Requires only 1 mV. for an output of 10 watts. Only 6 x 3 x 1¾in.

KIT PRICE £5.19.6 Post Free.

AVAILABLE READY BUILT, TESTED AND GUARANTEED, £6.19.6. Post Free. 3 pots for Volume, Bass and Treble, **7/6** the 3 extra. Mains power pack, if required **54/-**

RECORD PLAYERS



45 r.p.m. 6 volt Batt. operated Complete with pick-up fitted crystal cartridge. Size only 7¼in. x 6in. Fitted auto stop and start. New and perfect.

45 r.p.m. Model 49/6 Post 2/6

2-speed model for 33 and 45 r.p.m. (as illustrated) **59/6** Post 2/6

GUITAR PICK-UPS

CGM3 Crystal-high imp. Size 1½ x ¾ x ½in. Clips to finger board. Complete with cable

LASKY'S PRICE 15/11 Post 1/-

CGM35. Fully adjustable pick-up position carrier. Separate tone and volume control. Pick-up size 3½ x 1¼in. Comp. with lead and plug.

LASKY'S PRICE 59/6 Post 1/6

LASKY'S FOR D.I.Y. CONSTRUCTION BARGAINS

L.K. ELECTRONICS

Under the personal direction of D. Miller, late C.B.S.

The Cheapest - The Best - The Quickest Service

SPRING SALE — Fantastic reductions for one month only

● **SCOOP! B.S.R. U.A. 25 Autochangers.** T.C. 8 Mono P.U. Brand new and boxed. Wired for stereo. Note **OUR** price **£5.10.0.** P.P. 5/6 The very very, latest model.

● **SCOOP! B.S.R. U.A. 14 Autochangers.** T.C. 8 Mono P.U. Brand new and boxed. Wired for stereo. Note **OUR** price **£5.10.0.** P.P. 5/6. Latest model.

● **SCOOP! Garrard Autoslim.** Mono P.U. Brand new and boxed. Wired for stereo. Latest model. Note **OUR** price **£6.0.0.** P.P. 6/-.

● **SCOOP! Garrard A.T.5.** Wired for stereo, inclusive of head and mono cartridge (A.T.5 is an auto transcriptor). The finest changer of them all. **OUR** price, brand new and boxed **£7.19.6** only. P.P. 6/6.

AUTOCHANGERS

Single Players

E.M.I. Autostop, Mono	£5.10.0 P.P. 5/6
Garrard S.R.P. 10, Mono	£5.10.0 P.P. 5/6
E.M.I. Separate Pick-up	£3.5.0 P.P. 4/6

Transcription Units	**Stereo Head**	**Mono**
Garrard 4 H.F. Stereo	£15.10.0 P.P. 7/6	
Philips A.G. 10/16 Stereo	£12.10.0 P.P. 7/6	
Garrard A.T.6. Stereo	£9.19.6 P.P. 7/6	
Garrard 301	£.2010.0 P.P. 7/6	

●**SCOOP! Record Player Cabinets.** Two-tone. de-luxe finish with cut-out board. These are brand new and product of very famous national manufacturers. **OUR** price **£3.5.0** only P.P. 5/6.

● **SCOOP! 3-watt Gramophone Amplifier.** Complete with 5in. Speaker. **49/6.** P.P. 5/6.

The amplifier is complete, on a fabric-covered baffle board. Output transformer included. Tone and volume controls and on/off switch. Ready to switch on and play. Terrific volume. Size 12½ x 6 x 3½in. back to front. For 200-250v. A.C. Output 3 watts.

WHY NOT BUILD A QUALITY RECORD PLAYER? THE ABOVE PRICES SAVE YOU POUNDS. We give you free a 12in. or 10in. L.P. Record of our choice (new) with every Auto-changer purchased.

● **SCOOP!** Diodes—over 1,000,000 in stock—ideal substitute O.A.81 vision detector.

Note **OUR** price **£1.0.0** per 500. P.P. 2/- (in 500 lots only).

● **SCOOP! Transistor Tape Recorder.** The best obtainable by very famous manufacturer. Brand new, boxed, guaranteed Reduced from 12 gns. **OUR** price **£7.10.0.** P. & P. 4/6. Complete with microphone, tape, batteries and operational booklet Features push-pull amplifier, two motors, single switch operation, pause speed, wind, rewind, record, play back. Can be used in any position, indoor or outdoor.

● **SCOOP! 5 valve Superhet Radio Chassis**—Brand new—fully aligned and tested. Valve line-up 35W4, 5OC5, 12BA6, 12BEG, 12AV6. Ferrite Rod Aerial, dial etc.

OUR price **6 guineas** only. P. & P. 5/6.

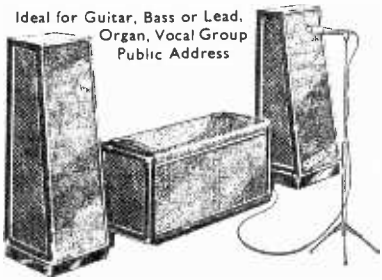
FREE while stocks last, attractive Plastic Cabinet in choice of pastel colours and matching Speaker to every purchaser.

● **SCOOP!** Tune your T.V. receiver from your armchair. Beautiful **Remote Control Units** by Ekco, Ferguson, etc. In manufaeturers sealed carton, original cost 3-4 guineas. **OUR** price **£1.1.0** only. P.P. 2/6. A thousand and one uses for this splendid equipment. Limited stocks only.

● **SCOOP! Radio Cabinets**—attractive pastel colours (plastic). Approx size 6 x 4 x 1in. **OUR** price **7/6** only. Limited stocks only.

● **SCOOP!** For 1 guinea only. P.P. 2/6. **Wavox Capacity Aerial.** The only aerial with additional short wave feed for hypersensitive reception on short and ultra-short waves with the Wavox A.1 performance on medium and long waves.

THE SIOUX 60 WATT MULTIPURPOSE AMPLIFIER



Ideal for Guitar, Bass or Lead, Organ, Vocal Group Public Address

ONLY 39GNS.

PACKING & CARR. EXTRA

Incorporating Two High Duty Speakers designed to handle efficiently the full output of Amplifier at frequencies down to 25 c.p.s. Heavily made Cabinet in two-tone Vynair. For 200-250 v. to 50 c.p.s. A.C. Mains operation. Four jack socket inputs and two independent volume controls for simultaneous connection of up to four instrument pick-ups or microphones. Level frequency response throughout the Audible Range. **OUR INCLUSIVE PRICE FOR AMPLIFIER MIKE, STAND, SPEAKERS, LEADS, ETC. ONLY 39 Gns. (REGRET NO H.P.)**

Now used by Leading Groups and Guitarists throughout the country. By request we will supply all units separately. **Cabinet 10 guineas.** P.P. 10/6. **Amplifier 20 guineas.** P.P. 5/6. **Speakers** (pair) **7 guineas.** P.P. 5/6. All leads supplied where applicable—complete assembly time under 30 minutes.

Sioux Junior Mk. II, 15 watts as above but incorporating one 12in. speaker. **£15.15.0.** P.P. 21/-.

● **SCOOP! Cartridges—Ceramic Diamond Stylii—Stereo—by Acos.** Limited number only at one quarter of original price—15/- only. P.P. 1/-. While stocks last.

TRANSISTOR SECTION

● **SCOOP!** A first-class **2 wave-band 8 transistor superhet chassis** by world famous manufacturer. Fully built, aligned, tested, guaranteed. Full coverage long and medium waves. Note **OUR** price only **£6.0.0.** P. & P. 2/6. Suitable speaker **10/6.** P. & P. 1/6. A few cabinets can be supplied at **22/6** each. P. & P. 2/6. **OUR** price for the package deal **£7.4.0** only, plus 4/6 P. & P. Ideal for Caroline.

S.A.E. enquiries please. Our Complete Lists 1/- only—credited against your order.

● **IF NOT ADVERTISED IT IS STILL IN STOCK.**

L.K. ELECTRONICS (Victoria) LTD.

★ **7-17 GILLINGHAM ROW, WILTON ROAD, LONDON, S.W.1** ★

All correspondence to Number 17

DESPATCH-TODAY?-PHONE-NOW!

DE LUXE RECORD PLAYER KITS

Autochange 2-tone Cabinets 17 x 16 x 8½in. High flux loudspeaker, 3 watt 2 valve 2 stage amplifier ready built. Quality output. Volume and tone controls. All items fit together perfectly. Special instructions enable assembly in 30 minutes. Only 5 wires to join. 12 months' written guarantee.

AUTOCHANGE KITS	Complete—as above.
B.S.R. Monarch	£19.10.0 P.P. 5/-
Garrard Autoslim	£10.19.6 P.P. 5/-
OR SEPARATELY	
Cabinet with board 14 x 13in.	£3.9.6 P.P. 3/6
Amplifier with speaker	£2.12.6 P.P. 3/6
AUTOCHANGERS (Stereo 15/- extra)	
B.S.R. UA35 Superslim	£5.19.6 P.P. 3/6
Garrard Autoslim Mono	£6.10.0 P.P. 3/6
SINGLE PLAYERS	
Garrard SRP10 auto stop	£4.17.6 P.P. 2/6
E.M.I. Auto Stop Model	£8.19.6 P.P. 2/6

Q MAX CHASSIS CUTTER

Complete die punch Allen screw and key.

¼in.	14/6	1 1/16in.	18/-	1¾in.	22/6
5/16in.	14/6	1⅛in.	18/-	2in.	34/3
⅜in.	15/6	1¼in.	18/6	2 3/16in.	37/9
7/16in.	15/9	1⅜in.	20/-	2½in.	44/9
½in.	18/-	1½in.	20/6	1in.sq.	31/6

CRYSTAL MIKE INSERTS

1¼in. dia. x ⅜in. 6/6; 1in. dia. x 7/16in. 7/6
ACOS MIC, insert 1¼in. dia. x ½in. 8/6

"6+1" TRANSISTOR RADIO

First class components to make a 6 transistor 2 waveband superhet chassis. Ideal for portable or table radio. All parts including BVA transistors, ferrite aerial, *with car aerial coil*, printed circuit, 8¼in. x 2¼in., but EXCLUDING Speaker and cabinet. Speakers, 35 ohms, 6 x 4in., 21/- **£4.5.0**

FULL WAVE BRIDGE SELENIUM RECTIFIERS: 2, 6 or 12 v., 1½ amp., 8/9; 2 a., 11/3; 4 a., 17/6. **CHARGER TRANSFORMERS.** Input 200/250v. 1½a 15/6; 2a, 17/6; 4a, 22/6. Circuit included.

MINIATURE PANEL METERS

Size 1¼in. sq. Precision jewelled 2%

1 mA	.. 27/6	50 μA	.. 39/6
5 mA	.. 27/6	500 μA	.. 32/6
300V	.. 27/6	"S" Meter	35/-

MOVING COIL MULTIMETER TK 20a 0-1000v. A.C./D.C., ohms .0-100k, etc., 49/6. **VALVE HOLDERS.** Int. Oct. or Mazda Oct., 6d. B7G, B8A, B8G, B9A, 9d.; B7G, B9A with can 1/6. Ceramic EF50, B7G, B9A, 1/-. Valve plugs B7G, B9A, Int. Oct. 2/3.

1965 RADIOGRAM CHASSIS

Three Wavebands. Five Valves ECH81, Long, Med., Short. EF89, EBC81, EL84, EZ80. 12-months guarantee. A.C. 200/250 v. Ferrite Aerial, 5 watts. 3 ohm. 13½in. x 7in. high x 5in. deep. Dial size 13 x 4in., horizontal working. Aligned, calibrated. Chassis isolated from mains.

BRAND NEW £9.15.6 Carr. 4/6
Matched speakers 8in. 17/6; 10in. 25/-; 12in. 30/-.

ARMSTRONG RADIOGRAM CHASSIS VHF-FM and Medium Wave model 127M £26.10.0 or Stereo £37.10.0

NEW ELECTROLYTICS FAMOUS MAKES

TUBULAR		TUBULAR		CAN TYPES	
1/350V	2/-	100/25V	2/-	8/600V	9/-
2/350V	2/3	250/25V	2/6	16/600V	12/-
4/350V	2/3	500/15V	2/6	16+16/500V	7/6
8/450V	2/3	1,000/15V	3/6	32+32/350V	5/6
16/450V	3/-	8+8/450V	3/6	32+32/450V	6/-
32/450V	3/9	8+16/450V	3/9	50+50/350V	7/-
25/25V	1/9	16+16/450V	4/3	64+120/350V	11/6
50/50V	2/-	32+32/350V	4/6	100+200/275V	12/6

PAPER TUBULARS

350v. 0.1 9d.; 0.5, 1/9. 1 mfd. 3/-.
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1,000v. 0.001 0.002, 0.005, 0.01, 0.02, 1/6; 0.05, 0.1 2/-; 0.25, 0.5 3/-.
2,000v. 0.005, 0.01 0.02 2/6; 0.05 3/6.

SILVER MICA (tolerance 1pF), 2.2 to 47pF, 1/-; ditto 1% 50 to .01 mfd. 1/-. 1,000 to 5,000pF. 1/9. Ceramic 500V. 1pF 9d. each.
TWIN GANG. "0-0" 208 pF + 176 pF. 10/6; 365 pF miniature, 10/-; 500 pF standard with trimmers, 9/6; midget, 7/6; midget with trimmers, 9/-; 500 pF, slow motion, standard, 9/-; small 3-gang 500 pF, 17/6. Single "0" 365 pF, 7/6 **SHORT WAVE.** Single 10 pF, 25 pF, 50 pF, 75 pF, 100 pF, 160 pF, 5/6 each. Can be ganged together. Couplers 9d. each.
TUNING AND REACTION. 100 pF, 300 pF, 500 pF, 3/6 each, solid dielectric. **TRIMMERS** Compression ceramic, 30, 50, 70 pF, 9d.; 100 pF, 150 pF, 1/3; 205 pF, 1/6; 300 pF, 750 pF, 1/9. Trimmer with knob 1000 pF 2/-.

MAINS TRANSFORMERS *Postage 2/- each.*	
STANDARD 250-0-250, 80mA. 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. 300-0-300, 70 mA. 6.3 v. 4 a.	.. 19/6
STD. 250-0-250 80 mA, 6.3 v. 3.5 a.	.. 17/6
HEATER TRANS., 6.3 v., 1½ a. 7/6; 4 a.	.. 10/6
Ditto, tapped 1.4, 2, 3, 4, 5, 6.3 v., 1½ a.	.. 8/6
GENERAL PURPOSE LOW VOLTAGE 2 amp. 3, 4, 5, 6, 9, 10, 12, 15, 18, 24 30 v.	22/6
AUTOTRANSFORMERS. 150 w.	.. 22/6
0, 115, 200, 230, 240 v. 500 w.	.. 82/6
MULLARD "510" Mains Transformer	.. 33/6

SURPLUS 2-VALVE GRAM. AMPLIFIERS. Valves: UY85 Rectifier and UCL82 Triode/Pentode giving 3½ watts output. Overall size 5in. high x 8½in. x 2in. deep. Each amplifier New and Tested supplied complete with valves 3 ohm output transformer, tone and volume on/off controls. **ONLY 37/6.** P.P. 2/6. Completely ready for use 200/250v. A.C.

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THE "INSTANT" BULK TAPE ERASER AND RECORD HEAD DEMAGNETIZER. 200/250 v. A.C. 35/-

TRANSISTOR MAINS ELIMINATOR 29/6

PP1-6v., PP9-9v **DOUBLES, 42/6** PP1+PP1, PP9+PP9, PP1 (4 + 4½). Same size as batteries.

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Ferrite aerial 12/6; Osc. P50/1AC 5/4; 1st and 2nd I.F. P50/2CC 5/7 each; 3rd I.F. P50/3CC 6/-. Spare Cores 6d.; Driver Trans —LFDT4 9/6; Printed Circuit 9/6; 35 ohm Speakers, 5in. 17/6; 6 x 4in. 21/-; J.B. Tuning Gang 10/6; Booklet 2/-.

NEW MULLARD TRANSISTORS

Holders 1/3; OC71, 8/-; OC72, 7/6; OA210, 9/6; OC81, 7/6; AF115, 10/6; AF114, 11/-; OC44, 8/-; OC45, 8/-; OC171, 9/-; OC170, 8/6; AF117, 9/6 OA81, 3/-; OC26, 12/6; BY100, 10/-. Min. Condensers 0.1 mFd., 30v. 1/3; 1, 2, 4, 5, 8, 16, 25, 30, 50, 100, 500, 1,000 mfd., 15 volt, 2/6.

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Linear or Log Tracks Long spindles. Midget 5 K ohms to 2 Meg. L.S., 3/-. D.P. 4/6.

Stereo L/S 10/6; DP. 14/- 1m log + 1m. A log. 7/6

80 ohm CABLE COAX

Semi-air spaced ¼in. 40 yds. 17/6. 6 yds. 25/-. **6d. yd.**

Ideal 625 lines. U.H.F. Low loss 5dB 100ft. 500 Mc/s **1/6 yd.**

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12in 15w. Stalwart. 3 or 15 ohms. 45-13,000 c.p.s., 12,000 lines .. 5 gns.
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12in. Standard H.D. 20w. 40-14,500 c.p.s. .. 7 gns.
12in. De Luxe 15w. 25-17,000 c.p.s. Foam 9 gns.
12in. Bass 25w. 20-18,000 c.p.s. 17,000 lines 12 gns.
15in. Auditorium, 35w., 20 c.p.s. to 12 kc/s. 18 gns
15in. 50W Guitar Model 20-10Kc/s .. .. 18 gns

C.R.T. BOOSTER TRANSFORMERS for heater cathode short circuit, or tubes with tailing emissions. Full instructions supplied, mains input. **Optional 25% and 50% boost 2v., 6.3v. or 12.6v. State voltage required. PRICE 15/6.**

LOUDSPEAKERS, P.M. 3 OHM FAMOUS MAKES. 2½in., 3in., 4in., 3in., 7 x 4in. 16/6 each; 8in., 17/6; 6½in., 16/6; 10in., 30/-; 12in. 30/- (15 ohms, 35-); 10 x 6in., 22/6; 8 x 5in., 21/-; 9 x 6in., 21/-. **E.M.I.** 13 x 8in. 10W, ceramic magnet 45/-. **WAVE-CHANGE SWITCHES.** 2 p. 2-way or 2 p. 6-way; 3 p. 3-way or 1 p. 12-way; 4 p. 2-way or 4 p. 3-way, 5/6 each; 8 p. 4-way, 2 wafer, 6/6. Wave change "**MAKITS**" available; 1 p. 12-way, 2p 6-way 3p. 4-way, 4p. 3-way, 6p. 2-way. Kit Prices 1 wafer 8/6; 2 wafer 12/6; 3 wafer 16/-. Extra wafers 3/6 each, extra long shafts 2/- extra. **TOGGLE SWITCHES**, s.p., 2/-; d.p., 3/6; d.p.d.t., 4/-

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Transistor Audio Amplifier Manual	6/-
Shortwave Transistor Receivers	.. 5/-
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Sub-miniature Transistor Receivers	5/-
Boys' Book of Crystal Sets	.. 2/6
"W.W." Radio Valve Data	.. 7/6
High Fidelity Speaker Enclosure	.. 5/-
TV Fault Finding	.. 6/-
Mullard Amplifier Manual	.. 3/6
Radio Valve Guide, Books 1, 2, 3, 4 or 5	.. 5/- each
Practical Radio Inside Out	.. 3/6
Valve Equivalents at a Glance	.. 3/6
Transistor Controlled Models	.. 7/6
International Radio Stations	.. 2/6

JACKS Standard open-circuit 2/6, closed circuit 4/6 Grundig type 3-pin 1/3; Standard Lead Type 6/-. Phono Plugs 1/-. Socket 1/-. Banana Plugs 1/- **JACK PLUGS.** Screened 8/-. Grundig 3-pin 3/6 **BULGIN NON-REV PLUGS and SOCKETS** P74, 2-pin 4/3; P73 3-pin 4/6; P194 6-pin 6/6; P466 12/6 **RESISTORS.** Preferred values. 10 ohms to 10 meg. ¼ w., ⅓ w., 1 w., 20% 4d.; 1½ w., 8d.; 2 w., 1/-. **HIGH STABILITY** ¼ w., 1%, 2/-. Preferred values 10 ohms to 10 meg. Ditto 5%. 10 ohms to 22 meg., 9d.

5 watt, 10 watt, 15 watt **WIRE-WOUND RESISTORS** 10 ohms—6,800 ohms 1/6, 2/-, 3/-

10 K., 15 K., 25 K., 10 w.

MAINS DROPPERS Midget. With sliders. 0.3a., 1 K., 0.2a. 1.2 K., 0.15 a., 1.5 K., 0.1a., 2 K., 6/- each. Line Cord 100 ohms ft. 3-way, 1/- ft.
Wirewound Ext. Speaker Controls 10 Ω 3/-; 25 Ω 6/6. WIRE-WOUND POTS 3 WATT Pre-set Min., TV Types. All values 10 ohms to 25 K., 3/- each. 30K., 4/-. (Carbon 30K to 2 meg., 3/-).
WIRE-WOUND 4 WATTS. Pots. Long Spindle. Value 50 ohms to 50 K., 6/6; 100 K., 7/6.
SPEAKER FRET Tygan various colours, 52in. wide from 10/- ft.; 26in. wide from 5/- ft. Samples S.A.E. **EXPANDED METAL** Gold 12 x 12, 6/-.
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D3034 1.5:1 C.T. Push-pull Driver	11/-
D3068 11.5:1 Output to 3 ohms, etc.	11/-
D239 4.5:1. Driver. 11/6; D240, 8.5:1 Driver	11/6
TRANSISTOR POTS 6 K Switched VC1545	5/3
SUB-MIN EARPIECE Xtal or magnetic	7/6
SUB-MIN JACK AND PLUG 2.5 or 3.5 mm.,	3/6 pr.

B.T.H. TAPE MOTORS 115 v. A.C. 28 w. 12/6 pair, for 200/250 v. (in series).

Blank Aluminium Chassis, 18 s.w.g. 4 sides, riveted corners, lattice fixing holes, 2¼in. sides, 7 x 4in., 5/6; 9 x 7in. 6/6; 11 x 7in., 7/6; 13 x 9in., 9/6; 14 x 11in., 12/6; 15 x 14in., 15/-; 11 x 3in. 6/6. Panels.

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5 WAVEBAND PORTABLE OR CAR RADIO

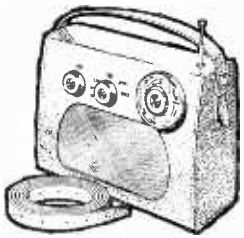
Amazing performance and specification ★ *Now with PHILCO MICRO-ALLOY R.F. TRANSISTORS*

● **9 stages—7 transistors and 2 diodes**

Covers Medium and Long Waves, Trawler Band and two Short Waves to approx. 15 metres. Push-pull output for room filling volume from rich toned heavy "Celestion" speaker. Air spaced ganged tuning condenser. Ferrite rod aerial for M & L waves and telescopic aerial for S Waves. Real leather look case with gilt trim and shoulder and hand straps. Size 9 x 7 x 4in. approx. **The perfect portable and the ideal car radio.** (Uses PP7 battery available anywhere).

Total cost of parts now only **£5.19.6** P. & P. 5/6

Parts Price List and easy build plans 3/-

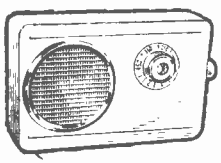


". . . amazed at volume and performance . . . has really come up to my expectations." S. G. Stockton-on-Tees.

New TRANSONA FIVE

"Home, Light, A.F.N., Lux, all at good volume". G. P. Durham.

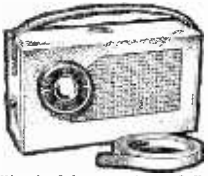
● **7 stages—5 transistors and 2 diodes**



Fully tunable over Medium and Long Waves and Trawler Band. Incorporates Ferrite rod aerial, tuning condenser, volume control, new type fine tone super dynamic 2½in. speaker etc. Attractive case. Size 6½ x 4½ x 1¼in. with red speaker grille. (Uses 1289 battery available anywhere.)

Total cost of all parts now only **42/6** P. & P. 3/6. *Parts Price List and easy build plans 2/-.*

MELODY SIX



● **8 stages—6 transistors and 2 diodes**

Our latest completely portable transistor radio covering medium and long waves. Incorporates pre-tagged circuit board, 3in. heavy duty speaker, top grade transistors, volume control, tuning condenser, wave change slide switch, sensitive 6in. ferrite rod aerial. Push-pull output. Wonderful reception of B.B.C. Home and Light, 208 and many Continental stations. Handsome leather-look pocket size case, only 6¾ x 3¼ x 1¼in. approx. with gilt speaker grille and supplied with hand and shoulder straps.

Parts Price List and easy build plans 2/- Total cost of all parts now only **£3.9.6** P. & P. 3/6

TRANSONA SIX

● **8 stages—6 transistors and 2 diodes**

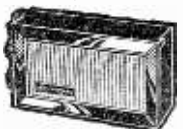
This is a top performance receiver covering full Medium and Long Waves and Trawler Band. High-grade approx. 3in. speaker makes listening a pleasure. Ferrite rod aerial. Many stations listed in one evening including Luxembourg loud and clear. Attractive case in grey with red grille. Size 6½ x 4½ x 1¼in. (Uses PP4 battery available anywhere.) Carrying strap 1/- extra.

Total cost of all parts now only **59/6** P. & P 3/6.

Parts Price List and easy build plans 1/6.

POCKET FIVE

● **7 stages—5 transistors and 2 diodes**



Covers Medium and Long Waves and Trawler Band, a feature usually found in only the most expensive radios. On test Home, Light, Luxembourg and many Continental stations were received loud and clear. Designed round supersensitive Ferrite Rod Aerial and fine tone 2½in. moving coil speaker, built into attractive black case with red speaker grille. Size 5½ x 1½ x 3½in. (Uses 1289 battery available anywhere).

Parts Price List and easy build plans 1/6.

Total cost of all parts now only **42/6** P. & P. 3/-.

SUPER SEVEN

● **9 stages—7 transistors and 2 diodes**

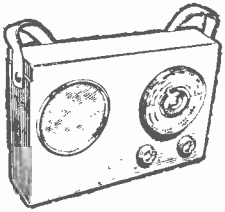
Covers Medium and Long Waves and Trawler Band. The ideal radio for home, car, or can be fitted with carrying strap for outdoor use. Completely portable—has built-in Ferrite rod aerial for wonderful reception. Special circuit incorporating 2 R.F. Stages, push-pull output, 3in. speaker (will drive large speaker). Size 7½ x 5½ x 1¼in. (Uses 9v battery, available anywhere.)

Total cost of all parts now only **£3.19.6** P. & P. 3/6 *Parts Price List and easy build plans 2/-.*

ROAMER SIX *NEW!!*

NOW WITH PHILCO MICRO-ALLOY R.F. TRANSISTORS

● **6 WAVEBAND!!**



● **8 stages—6 transistors and 2 diodes**

Listen to stations half a world away with this 6 waveband portable. Tuneable on Medium and Long waves, Trawler band and two Short Waves. Sensitive ferrite rod aerial and telescopic aerial for short waves. Top grade transistors, 3-inch speaker, handsome case with gilt fittings. Size 7½ x 5½ x 1¼in. Carrying strap 1/6 extra.

★ **EXTRA BAND FOR EASIER TUNING OF LUX, ETC.**

Parts Price List and easy build plans 2/- Total cost of all parts now only **£3.19.6** P. & P. 3/6

All components used in our receivers may be purchased separately if desired. Parts price lists and easy build plans available separately at fixed prices stated. Overseas post 10/-.

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PRACTICAL WIRELESS

JUNE 1965
VOL 41 NO 700

SELF-SUFFICIENCY

RECENT letters from readers tread on the thorny subject of the competence, or otherwise, of the radio enthusiast. There are so many opinions, that it is virtually impossible to generalise. Nevertheless, we are tempted to make a few observations which may bring more tolerance—or add fuel to the flames!

Competence is a somewhat intangible element; a variable definition. What is considered to be competent by one person in a given context, may be considered highly incompetent by another. The dictionary tells us that competence means "suitableness", "adequateness", "sufficiency".

Who can, therefore, say exactly what *is* competence? A piece of equipment built by A could be looked upon with awe by B (who is a novice) but sneered at by C (who is a professional). The horizon shifts according to ones own ability or personal criterion. If a man builds a set which works perfectly but looks untidy, is he competent? Is a highly experienced amateur considered incompetent if he cannot build a computor yet competent if he can construct a simple crystal set? Where does competence begin and end?

We have a sneaking feeling that there might be an element of inflated self-importance in those who go out of their way to make too much of a noise about how good they are and how bad others may be. There is a certain regular reader who cheerfully admits that nothing he builds ever works well, if at all, and more often than not produces bizarre results which would drive the designer grey with despair. This does not deter him; on the contrary, it seems to feed his appetite for more.

To the purist, this reader is hopelessly incompetent but, for him, his erratic constructional efforts have an "adequateness" and a "sufficiency". He may be no genius, but he probably gets more fun out of radio than many self-styled perfectionist!

CONTENTS

All correspondence intended for the Editor should be addressed to: The Editor, "Practical Wireless", George Newnes Ltd., Tower House, Southampton Street, London, W.C.2. Phone: TEMple Bar 4363. Telegrams: Newnes Rand London. Subscription rates, including postage: 29s. per year to any part of the world.

THE JULY ISSUE WILL BE PUBLISHED ON JUNE 3RD.

Ground Communication

I WAS interested in C. R. Bradley's article on ground communication (P.W. Feb., 1965) and after reading N. W. Roberts' letter in the April issue, I had some new ideas on the subject.

A power cathode follower could be used as an output stage, being driven hard so that the output stage only conducts for a fraction of the time, as in "Class C" output stages.

A line output valve could be used to give quite a lot of power, thus greatly increasing the range. If the carrier frequency was high enough, certain communications receivers could tune to it, thereby greatly increasing the sensitivity of the receiving end. I would suggest that a CR100 (B28) communications receiver is used, as it will tune down to just under 60kc/s.

Huw Lewis.

Swansea,
Glamorgan.

D.F. Aerial

WITH reference to the article "A Ferrite Rod D.F. Aerial for 1·5—3Mc/s" (P.W. January, 1965). The reference to "d.f. below 3Mc/s" should have read "d.f. above 3Mc/s", since we are dealing with frequency and not wavelength. Also, the reference to "adding 10° to compass bearing" on page 838, should have read "subtract 10°" although the present magnetic variation is about 6·8°.

F. C. Judd.

South Woodford,
London, E.18.

Can Anyone Help?

I AM thinking of building the "Ten Five" described in P.W. October, 1964, but I am having great difficulty in obtaining some of the parts in my country. I would be extremely grateful, therefore, to any reader who would send me the variable capacitors, coils and transformers employed in this circuit. In return, I will send anything of the same value from my country.

Rudolph Lobo.

236 Godavari Hostel,
Indian Institute of Technology,
Madras—36,
India.

NEWS AND..

GOONHILLY PREPARED FOR "EARLY BIRD" . . .

Now that the world's first commercial communications satellite 'Early Bird' is in a stationary orbit somewhere over the Atlantic and inter-continental telephone calls via satellite are destined to become everyday occurrences, the GPO's tracking station at Goonhilly has been completely modified to cope with the expected volume of traffic.

Modifications have included a new, shallower reflector surface for the aerial dish, which has brought its performance up to, if not ahead of the American and French horn type aerials. The control system too, which steers the aerial, has been modified, for although the satellite is practically stationary in relation to the Earth, there will be some movement. Weak signals received at the aerial will be amplified by travelling wave masers newly designed by Mullard Limited.

Satellite 'Early Bird' in conjunction with Goonhilly or either the French or German ground stations, will eventually provide up to 240 telephone circuits between the North American continent and a network of European countries.

. . .AND G6AG CONTACTS "OSCAR III"

Mr. C. J. McClelland (G6AG) of Chalfont St. Peter, Bucks., seen here in his shack, has the distinction of being the first amateur operator to receive reports from the U.S. of trans-Atlantic v.h.f. reception of transmissions he made via the communications satellite Oscar III. Other reception reports arrived from Czechoslovakia, France, Belgium and many English stations, while actual contacts were made with amateurs in Germany, Switzerland and Sweden.

Mr. McClelland, who is a Chief Engineer at Ultra Electronics Ltd., used a home-made transmitter operating at 1kW on 144·1Mc/s for these contacts, the satellite equipment converting and re-transmitting the signals on 145·9Mc/s ±25kc/s.

TRANSISTOR TESTER KIT

Just £24 18s. will buy one of Heathkit's latest test equipment kits, the IM-30U transistor tester. Available also in assembled form at £35 10s., this new instrument from Daystrom Ltd., Gloucester, will provide complete d.c. analysis of p-n-p and n-p-n transistors and permit direct read-off of d.c. gain (alpha, beta). Facilities for many other tests including diode or collector-to-emitter and collector-to-base leakage, collector current and voltage, etc., make the model IM-30U a really comprehensive piece of equipment.

.. COMMENT

SMALLER AND SMALLER

The Japanese radio manufacturers Standard have recently added three new pocket-sized receivers to their range. The most inexpensive of the three, the G433, is also the tiniest, measuring less than 1¾in. x 2in. x ⅞in. Inside this minute case Standard have packed a 7-transistor circuit, a 1½in. speaker, a ferrite rod aerial and two mercury cells. Denham and Morley Ltd., are the UK agents for this radio which costs £9 19s. 6d., and all other Standard receivers.

THE "PIRATE" DANGER TO SHIPPING

During February this year an urgent radio report from a lightship to a shore base was held up for 30 minutes because both frequencies normally available were blocked, one by a pirate broadcasting station. This was only one instance of shipping communications bands being blocked by pirate operations, but it clearly illustrates the very real danger they present.

In a written answer to a parliamentary question recently, the Postmaster-General, listed 19 specific instances when transmissions from pirate radio stations had caused interference to ship to shore communications, seven of these instances singling out 'Radio Caroline' as the offender.

A NEW WAY TO VARY RESISTANCE

A new device which permits completely noise-free resistance control, has been introduced by Mullard. In appearance it is a plastic block measuring 17mm x 17·5mm x 22mm, with just four lead-out pins. Enclosed in this block are a cadmium sulphide cell and a 12V filament lamp. Varying the brightness of the lamp causes changes in the resistance of the cell and control over at least three decades (typically 100 to 10,000Ω) can be achieved with complete lack of noise.

A JUKE-BOX FOR YOUR HOME

Now for the first time, for anyone who wants it, KB (Footscray, Kent) offer four hours of continuous 7in. record playing (or 7½ hours on e.p's) with their new Discomatic portable juke-box.

The Discomatic houses forty 45 r.p.m. records and will automatically select and play any of the 80 sides in order selected by push buttons. The output from its transistorised amplifier is 2½W and additional speakers and amplifier may be connected.

The price you pay for having a juke-box in your home is 69 guineas, but then, unlike commercial machines, you don't have to put any money into it once you've bought it.

more News and Comment **on page 148**

Overseas Ham

I AM happy to inform you that I recently passed the R.A.E. and obtained my ticket (9M2FF).

I have just built the Beginner's 10W Transmitter (P.W. Dec. '63), which I will use as a top band and standby transmitter.

Over the years I have built many constructional projects from PRACTICAL WIRELESS designs, and they all work very well. Thank you for a most interesting magazine.

Mohd. Yusoff Bin Mohamed.
Mersing, Johore, Malaya.

Considering the difficulties overseas readers often face in obtaining components, it is always gratifying to hear of the perseverance with which they pursue their hobby.—Editor.

Bottling Acid

IN the May, 1965, issue you printed an article by F. L. Thurston, a continuation of "Cabinet and Chassis Techniques". Mr. Thurston describes processes involving certain chemicals and towards the end of the process advocates that "all chemicals involved should be well stoppered up in glass containers".

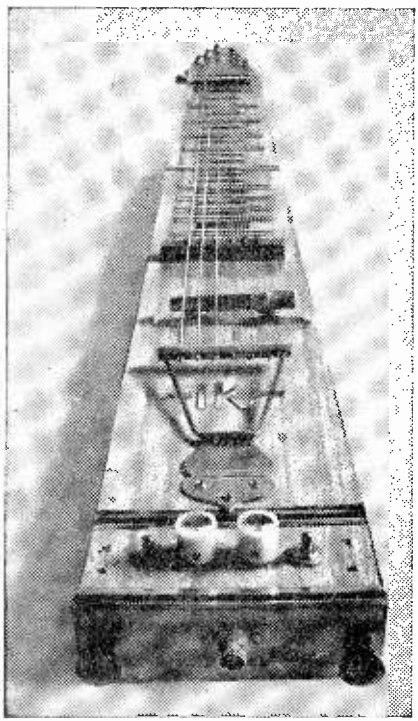
I would point out, however, that one of the chemicals is hydrofluoric acid, which attacks glass and should thus be kept in bottles made of wax or guttapercha.

Ian Gregory. Boreham Wood, Herts.

Excellent Design

MY thanks to P.W. and Mr. Groome for the excellent pulse-counter f.m. tuner design in the April issue. I made up the simpler, single limiter version and quality has proved at least equal to that from a very well known tuner selling at more than £25. By the way, I found the greater gain of an EF183 frame grid pentode, instead of the EF80 specified for the first stage, helpful in this fairly weak reception area.

H. E. Owens. Hornsey, London, N.8.



AN ELECTRONIC Hawaiian Guitar

COVER SUBJECT

by I. J. Kampel

THE conventional electric guitar today enjoys an immense popularity, but not so much is heard of the Hawaiian guitar, an instrument capable, in the right hands, of producing most enjoyable music, its very construction making the need for an electronic tremolo non-existent.

The body of the guitar is made from a solid plank of soft wood which, when completed, will be completely covered with Formica. A gloss grained Formica is used to give the benefits in appearance of polished wood. Although a channel and a hollow pocket must be cut out of the wood, no difficult shaping is required.

The article will describe two designs for pick-up heads which may be constructed quite cheaply as compared with manufactured heads, the cheapest of which is little under £2. This is where the chief part of the metalwork comes, hence if the constructor has neither the tools, facilities nor abilities to tackle it, a head might be purchased.

The pre-amp and control circuit must be very carefully constructed, as only absolute minimum volume has been allowed for these—little over six cubic inches!

Principle

Just as a tape-head responds to varying strength magnetic fields, as produced by the magnetic tape passing the head, so the pick-up head of the electric guitar responds to varying magnetic fields.

Fig. 10a (on the Blueprint) indicates three bar magnets placed side by side. Every magnet has two poles—which are known as north (N) and south (S) poles. It is a well known fact that unlike poles attract and like poles repel. Hence, a N and S pole attract each other where a N and N or a S and S tend to repel each other. Fig. 10a indicates unlike poles placed side by side, and the dotted lines, representing the magnetic fields, indicate that they are attracted to each other where, alongside, Fig. 10b, where we have three like poles, they are seen to repel. North poles are indicated, but the effect would be exactly similar if they were south poles (as of course they are at the other end of the magnets).

Now consider Fig. 10c. This corresponds to Fig. 10a, but now we have above the first two an oscillating steel string which effects the magnetic fields. As the poles attract, the left-hand magnet's field is effected by the string directly above it, but as its field strays across towards the other magnet, not only does it affect the neighbour's magnetic field by its own changes due to the first oscillating wire, but also it is effected by the neighbouring oscillating wire.

It will be seen in Fig. 10d, with like poles, that the influence of one pole upon its neighbour is not nearly so great and that each magnet is more free to 'consider' the frequency of the oscillating wire above it.

Gain, tone and a rhythm switch are provided as well as the necessary on/off switch. It is, however, a simple matter to eliminate the rhythm switch if desired, but more of this later. The output may be fed to a guitar amplifier or any high-gain amplifier.

Construction of Guitar Body

The *minimum* dimensions of the piece of timber required for the body (planed) are 3ft. 6in. x 5in. x 1⅛in., though 6in. is perhaps an easier width. Firstly square one end and draw clearly a central line up the timber, taking measurements from either side of this except where stated. Mark 2½in. off at either side and then 1⅛in. on either side 35¾in. from the base. This gives the taper where symmetrical. Then mark the taper of one side

(see Fig. 6) to a point ½in. from the central line, 6in. further along. Extend the original taper on the other side for a further 1½in. before taking it to its top point ½in. from central line. The basic outline may then be cut.

A step is then cut out of the upper portion of the wood, leaving only ½in. width, to take the two treble key units. These should be purchased from a music shop, and the type with the winding knob set at right-angles to the metal pin, three per plate, should be used. These must be staggered to allow room for the two on opposite sides. Position these with care before drilling the holes through which pass the pins. Screws in the plate on the reverse side secure the two base plates of these keys. The pins usually have a small point on their top, just enough to mark clearly central indentations if a piece of card is pressed on top of them, or more practically if they are pressed on to a piece of card. Thus a template can easily be constructed. It is important that these holes are positioned accurately or the plates will not push home or may cause the pins to bend. If large, it might be necessary to cut the corner off one of the base plates to fit in the space provided. See that the pins line up with the slope of the taper.

Now we may move on to the further end of the instrument, the business end. As Fig. 6 shows, a 3½in. x 2in. rectangle is cut from the base to make room for the electronics, leaving two wooden sidepieces tapering from ¾in. A number of saw cuts in the portion of wood to be removed will ease the chiselling operation. When the rectangle has been removed and the edges tidied up, from the top and the bottom of the wooden sidepieces, saw or chisel enough to just allow a sheet of aluminium to sit across the sidepieces flush to the other wood.

When this has been completed a ¾in. channel about ¼in. deep must be cut down the central line to the point 10½in. along where a channel across the grain is cut to take the underside of the pick-up head. Bevel the channel down where it enters the end pockets.

Other than the pre-amp a battery has to be contained within the instrument to power it. The battery, housed in a hollow near to the pre-amp, accessible from the underside. A compartment is cut out just large enough for the battery and is covered by either a plywood lid (it will not be seen) or a block of the same wood as that of the instrument, $\frac{5}{16}$in. thick. The compartment is cut in from the side of the wood as the Formica covering will hide the gaping hole thus made, at right angles to the tapering side, for if it is cut in relation to the central line we have an unsuitable shape. The battery itself, leaving room for contacts, requires a volume of 3in. x 2½in. x ⅞in. *below* the underside of its covering lid which screws into place with two countersunk screws, one in either side of the ¼in. wide supporting ledge, just deep enough to make lid flush with base of instrument. This compartment will just break through at the back to the central channel. If you use a metal plate as a battery cover, or some very thin material, and do not break through to the channel, it will be necessary to drill a hole through to the channel, as the power supply wires run along this channel to the pre-amp.

Construction of Preamp Chassis

Firstly a tapering plate of aluminium is cut to fit on the underside of the instrument, 2½in. long, the width of the guitar (tapering from 5in). Holes are countersunk for four screws, and this may be screwed in place. Take next another piece of aluminium, scribe a line 2½in. in from one side, and then cut a 5in. width of aluminium about 4½in long, tapering it from the scribe to match the taper of the base of the instrument. Before bending mark out and drill for the two switches and two potentiometers. Provided that small carbon potentiometers are used, when placed side by side with the switches, *touching*, there will be *just* enough room, but there is no room for mistakes or spacing between these components. The holes should be drilled on a central line across i.e. 1¼in. from base. As dimensions of different makes may differ slightly these measurements are not given. There is just, without any breathing space, enough room for two small carbon potentiometers plus two toggle switches.

When the holes for these components have been drilled, fold the aluminium at a right angle to fit round the top and end. Drill next for a chassis-mount type coax socket, and when this has been done fold over a small lip to just rest on the lower base plate, already affixed to the instrument. Before folding this over, however, two further holes should be drilled if it is wished to store the instrument on end. These are to take either kettle knobs, bolted to the inside of the chassis, or small cupboard doorknobs, passing through a hole in the aluminium to screw into the base of the wooden sidepieces. Holes are also drilled, four in number, on the topside of the metal, to take two securing screws in either sidepiece. N.B.: Doorknobs screwed into base of sidepieces will not be sufficient to hold on chassis. Chromium-plated, round-headed screws, ¾in. long, say No. 4's should be used for the top. To give full screening to the pre-amp, the three remaining sides of the pre-amp compartment may be lined with very thin tin-plate or aluminium, making sure that all are electrically linked, but it will be necessary of course to cut out a section in the one across the width to expose the channel. See Fig. 3.

Fitting the Formica

After checking that the sides of the instrument are square lay the shaped timber the correct way up on to the top surface of the Formica to be used, and pencil round the outline.

When the outline has been marked in pencil, and checked, enlarged by a Formica's width all the way round, scribe the line to be cut. Remember that if grained wood, the grain should run down the instrument rather than across.

Position the holes for the pins at the top end carefully, drilling the Formica, from the top surface, holes just large enough for the pins to pass through. *Always* work Formica from the top surface to prevent chipping. Saw across the Formica at the bottom end slightly less than the 2½in. the plate covers. From the shop where the Formica is purchased may also be obtained a selection of edging, though expensive (4d. per ft.), enhances the finished appearance greatly. A ½in.

width of gold strip with a central black line was selected by the author, this edging being quite thin, flat and easily cut with scissors. This was also used to break the monotony of the sides, as well as mark the frets (see Fig. 7). If a piece of edging is fitted on the top of the Formica that is stuck to the top of the chassis, at the base and across the join, overlapping slightly, keeping the controls on the centre line between the edgings, the edging overlaps the Formica join and make it indistinguishable. The chassis section of course is held to the main body of the instrument only by the screws and is thus easily detatchable.

A rectangle 2⅜in. x ⅜in. must be cut to fit exactly over the cross-ways channel designed to take the pick-up head. This may be chiselled, but if so it is advisable not to use a good chisel. If fret-sawed the side cut will still have to be chiselled unless the blade will turn through 90°.

The next step is to measure 4in. towards the base of the instrument from the centre of the cross-ways channel. This is the position for the bridge. Then, using Fig. 6 and the Table, the positions for the frets may be marked. The distance from the bridge (B) to the 12th fret should be the same distance as that from the 12th to the top bridge (T.B.), in this case 12⅛in. Mark this out initially, and then mark off the key frets—3, 5, 9 etc. When this has been done then drill holes along the central line where these key frets cross, and also at the two bridges, just large enough to take small ¼in. to ⅜in. screws, countersinking them. Screw two or three in to hold the Formica in place.

Cut strips of Formica to go along the sides, ensuring that the grain runs the length of the instrument. The top Formica should overlap the side Formica, and the top Formica may be planed flush. Finally cut and shape pieces of Formica to fit the underside of the top cut out, drilling through where necessary to allow the fixing screws for the key plates to pass through, and also cut a piece for the base of the instrument, drilled as the aluminium for the coaxial socket. It is best to fold the aluminium, stick the Formica to it and to then drill all necessary holes in one operation.

A combined bridge and tailpiece may be used for the instrument if you find it possible to obtain one, but this may be difficult. If one is obtainable, however, the instrument may be made shorter. The tailpiece used in the prototype was designed to fit over the end of an instrument, being bent at a right-angle. This was straightened out to fit flat on the surface. Some length could be taken off if the furthest end of the tailpiece was cut off and new screw holes drilled. This was not done as the tailpiece shaping looked better as it was.

Position the tailpiece on the central line between the bridge position and the edging put across above the controls. Its position is not critical. Mark the positions of the screw holes and then drill them. Any central ones will unfortunately fall in the central channel and hence only a false screw through into a small block of wood may be put or a bolt if one is found to match the screws. At least two screws should go through to solid wood. To prevent this the channel could be offset. There is, however, a reason why at least one screw in the channel could be of use (explained later).

The stage has now been reached when the Formica may be stuck down. The most suitable adhesive is Evo-Stik. When the two sides have been stuck—leave after impact for ten minutes—plane off the edge of top piece of Formica if this has not already been done and unscrew. This is then stuck on before placing screws all the way down. If these screws are not put through the surface Formica there is a danger that the tension of the strings—pulling at one end on the pins, which in turn pull on the Formica, and at the other end the tailpiece, which through its screw has a similar effect—might cause the whole length to buckle upwards.

You may now mark out the additional frets, sticking edging across the marks as the final marking. Where on an ordinary guitar the frets project upwards and the fingers press the strings down on to these frets, on the Hawaiian guitar the strings never touch the frets and the fingers themselves do not play such an important role. A metal bar is used on the strings, sliding it up and down, quick oscillating movements about a point causing a tremolo effect.

The key frets, those marked initially, must be distinguishable from the other frets and this can be done in two ways. In ordinary guitars a spot is commonly placed by the fret to indicate it, for in the ordinary guitar the finger presses the wire in the spaces between frets rather than hovering above the frets as does the bar with a Hawaiian guitar. The second method, and seemingly more suitable for this type of guitar, is to make the key frets different to the other frets. The author did this with the black and gold edging, using the full width for key frets, so covering the countersunk screw heads and only the cut-out central black line of the edging for the other frets. All frets except the most important fret, the 12th, were made the same length, the 12th much longer as Fig. 7 indicates.

With the two plates of keys screwed in place at the top and the tailpiece near the bottom, the Formica on and edging where desired and indicating the frets, it only remains to complete the electronics and make a pick-up head.

N.B.—It would be most unwise to construct the body of the guitar as a light plywood frame as the extreme tension of the strings combined with the warping quality of plywood would make it a most unsound proposition.

Preamplifier and Control Unit

The circuit is as indicated in Fig. 1, the pick-up head is in series with the first transistor's emitter in the grounded-base low-impedance configuration. The output is taken from Tr3 collector via a coupling capacitor. The output is coupled via VR1, the gain or volume control, and is then fed through the filter or tone control, using screened leads, and finally through the rhythm switch to the output socket.

It will be seen that when S1 is closed R7 is shorted out and gain is determined solely by VR1. If, however, the switch is open R1 is included in the output circuitry, so reducing the volume slightly. This means that it is not necessary to adjust the gain control to drop volume briefly and

when dropped it is a simple matter to flick back to original volume. It will also be seen that with this method the reduced volume introduced by the rhythm switch being open drops the volume to a lower level, proportional to that of the original gain setting and not simply to a lower pre-selected level determined by a resistor, regardless of original setting, as many do.

If the level obtained with this rhythm switch is not quite what is required it is varied by simply changing the value of R7. Increase this resistor to about 3·3kΩ and the rhythm level will be even lower. Obviously if the resistor is decreased, say to just above 1kΩ, then the level will not drop as much.

As will be seen, the circuit incorporates a facility for shorting the output socket and hence the amplifier input when connected. This is only to be used where the instrument is plugged into a socket that has a shorting-jack, i.e. shorts out input at amplifier when no plug is inserted. This is to prevent pick-up when instrument is connected to amplifier but not switched on. Before adding this facility *be sure that the input you intend to use should be shorted before doing this, and if more than one amplifier may be used do not add this facility. If in doubt leave it out.*

The circuit is powered by a 4·5V battery. This type has two brass spring clips projecting out of the top, one longer than the other. *Note that the shorter one is positive.* When the battery seal has been broken it is usual to then remove a thin piece of slitted cardboard to reveal the contacts completely. For this use it is best to leave this cardboard in as it prevents the longer contact shorting against the other if pressed in. There is just room at either end to make contacts and *miniature* bulldog or crocodile clips may be used for this purpose. Contacts may be soldered on but this, to say the least, is inconvenient. Tinned looped wires will serve if the small contact is bent and the card removed to just slide the loop over the longer clip.

Components are mounted on the paxolin side of a 2 x 2in. section of Veroboard.

Fig. 4 shows the copper side of the board and Fig. 5 indicates the circuit layout. The other components are best left flying as this means less wires to and from the circuit board. It will be seen that there are only three breaks (Fig. 4) at the reference points D1, G2 and D8.

Fit all components on to the board by bending the wires on the reverse side, then check the circuit before soldering. When soldering, heat shunt transistor leads on the upper side and remember that it is always advisable to slip sleeving over them to prevent shorting. This applies especially to Tr2 collector and Tr3 emitter, which pass very close to each other, not to mention all leads on Tr1. A7 to A8 is simply a wire linking tracks 7 and 8 (links only section of track 8). Cut off wires *after* the component has been soldered.

Fig. 2 indicates the wiring of pots and switches on the chassis.

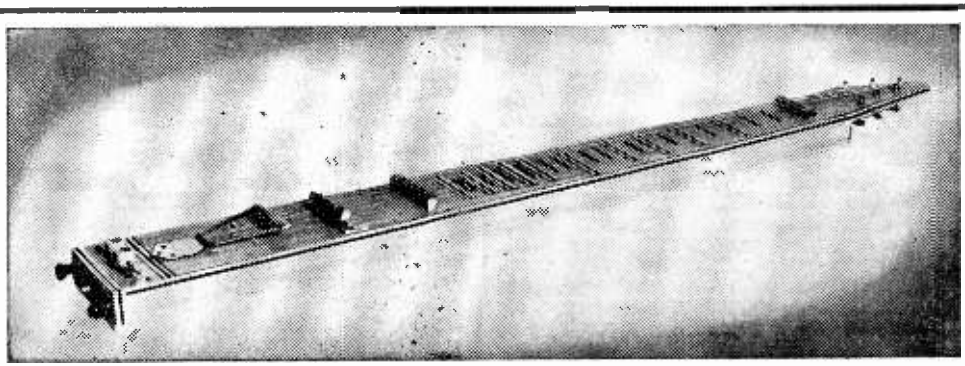
The circuit board will sit most comfortably beneath the two potentiometers if these are of the miniature type.

Use microphone coax. from the pick-up head to the circuit board and also from circuit board to VR7 and all along the output line to socket, earthing all screening to chassis.

Because of the extreme compactness of the unit it will not really be necessary to anchor the Veroboard as there will be just no room for it to move! A very thin insulator—mica, card, tape, paxolin—should be placed on the baseplate and then the board laid upon this. This is to prevent the aluminium shorting to the copper tracks. When wiring see that components are pulled firmly and tightly on to the board and see that the transistors lie down flat also. It is advisable to place another flexible insulating sheet over the components then, sandwiching them, as the contacts of the controls approach very close.

An Alternative Circuit Board

If for reasons of economy or unavailability Veroboard cannot be used, a printed circuit can be made fairly easily, using the copper-clad laminated board more commonly available. Mark out this in strips as in Fig. 4, making small holes where the holes are indicated, then etching away



The prototype instrument is finished in wood-grain Formica and gold-and-black edging material, and is seen here complete and ready for playing.

the copper not required. The square should be just under 2in.

Other Guitar Requirements

A metal bridge will be required and it is better to obtain this from a music shop than attempt to make one. This should be held in position by the tension of the strings alone. It is placed directly over the lowest exposed countersunk screw head if previous directions were followed carefully, as does the upper guide bridge, standing over the upper exposed screw head. The upper one may be pinned or glued in place. It may be found necessary to slightly raise the upper bridge if wires are not taut across it. A small wooden block or even one or more layers of Formica will do this quite easily.

You then require only the bar that is slid up and down the strings or "steel" as it is known, 5s. at a music shop and not worth the effort making (a polished surface must be offered to the strings) and a plectrum. Three of these are used by many players of a type that pushes on to the end of the thumb or finger.

Lastly but, of course, by no means least the key part of the whole instrument, you require a pick-up head.

Construction of the High-quality Pick-up Head

These, except for the inferior crystal-mike type, tend to be rather expensive. However, an excellent head may be constructed for a few shillings with a little care which gives an extremely good performance. This design is shown on the front cover and on this month's free blueprint. This requires some careful drilling and the facilities to do so. If this presents no problem there should be no difficulty.

The magnets diameter is not critical but should be around $\frac{3}{16}$in. diameter and length about $\frac{3}{4}$ to 1in. These magnets are embedded in a brass block as this metal is non-magnetic, dimensions being $3\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2}$in.

Mark the centre point on one side of the brass block—$1\frac{3}{4}$in. from either end—and then on the central line mark 0·5cm on either side of this central point with two more marks on either side spaced 1cm from those marked lastly, i.e. six points 1cm apart. These six points should be carefully centre-punched ready for drilling. Also centre-punch for a hole at either side to take securing screws for the head. The change of units —inches to centimetres—was necessary due to the fact that 1cm expresses the distance better than a fraction of an inch.

Drill the holes at either end for the securing screws, countersunk on one side. Drill holes through block at the remaining six points just large enough to allow the magnets to be used to push in tightly. An experiment with an odd piece of metal would be be wise before drilling the block. When these holes have been drilled, on the opposite side of the block to that which was countersunk for securing screws, drill to a depth not exceeding $\frac{1}{8}$in., holes to take diameter of windings on magnets, not exceeding $\frac{5}{16}$in. See Fig. 8.

Magnets are not the easiest of items to obtain and if you have difficulty in obtaining rod magnets suitable it should be possible to order through your local electronic spares stockist the following magnet manufactured by Mullard Ltd.:

5·3 mm diameter, 20mm long Magnadur 1, rod magnet, No. FD196.

Six magnets will be required, of course, and the type mentioned have their north poles indicated by a white spot. If the poles of the magnets to be used are not marked it is necessary to at least determine like poles. Take any two magnets and bring them together end to end. If they attract they are unlike poles and if they repel they are like poles. It will be obvious that if they attract, turning one magnet round will cause them to repel. Mark the ends that repel. Place one magnet to one side and then compare one of the marked magnets with an unmarked to determine which pole repels the pole marked. The one that does is like, may be marked, and hence by this method like poles determined for all six magnets.

Take a scrap piece of wood and drill six holes about 1cm apart just large enough for the base of the magnets to wedge in. Stand the six magnets in the holes, the marked poles in the wood (the only reason for this is that then the end of the magnets to be seen projecting through the head will not be marked).

A length of 36s.w.g. enamelled copper wire is then taken and wound on to the magnets in series, starting with the left-hand magnet, finishing at the right. Close-wind on the centre of each magnet, in turn, 50 turns of wire, taping or by some method securing the winds when completed. Lift the magnets out of the wood in turn to wind, replacing when secured, and go on to the next. Keep the length of wire from one magnet to the next as short as possible, taking the two final ends of wire at either end and cutting off, leaving enough length to stretch to the far end.

Fit the magnets into the brass block, ensuring that they go in the right way up, and then, if at all loose, secure by dropping a resin such as Araldite or Epophen down from the reverse side. Bostik or Durofix will serve if the above mentioned are not at hand. If necessary surround magnets on top of head but keep quantity of resin or adhesive to absolute minimum. Finally take the two ends of wire to the centre and twist together to hold in place, scraping off the enamel for electrical connections, cutting short if necessary.

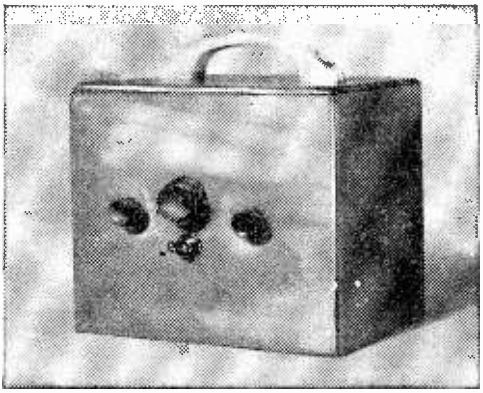
The magnets should be as close to the strings as possible without the danger of them actually touching; $\frac{1}{4}$in. should be quite safe. Before completing the head it is advisable to fit one string on to the guitar and to measure the space between it and the top surface at the point where the head will go. Deducting $\frac{1}{4}$in. for the brass bar, and a further $\frac{1}{8}$in. for spacing, the remaining is the amount the magnets should project through the block.

Microphone-type coaxial cable should be soldered to the ends of the wires at the head and fed up the central channel back to the preamplifier compartment. When holes have been drilled in the Formica at either side of the head's recess to allow the securing screws to pass through, the head may be screwed into place with countersunk brass-coloured screws to match the head.

NEXT MONTH A SIMPLER PICKUP HEAD IS DESCRIBED

FOR THE BEGINNER

Simple Two-Transistor Set



by P. Taylor

THE theoretical circuit is shown in Fig. 1. The external aerial is coupled to the receiver either via C1 or TC1, depending on the position of the wavechange switch S1. TC1 has been made variable so that optimum results may be obtained on the crowded medium wave band. As will be seen from diagrams, the tuning coils have been wound on a 5½in. x ¼in. piece of ferrite rod, wound on a 5½in. x ¼in. piece of ferrite rod, the type that is commonly available from any good radio component stockist. This method results in the aerial coils having a very high "Q" which improves sensitivity and selectivity.

The r.f. signal which appears across the aerial circuit (which is tuned by VC1) is passed to the detector D1, a germanium diode.

The audio signal is then passed to the base of Tr1, the first audio amplifier. Amplified signals from the collector of Tr1 are then passed, via C2, to the base of Tr2, the audio output stage. R2/R3 are emitter biasing components and transformer T1 is the loudspeaker matching transformer. Potentiometer VR1 acts as a volume control.

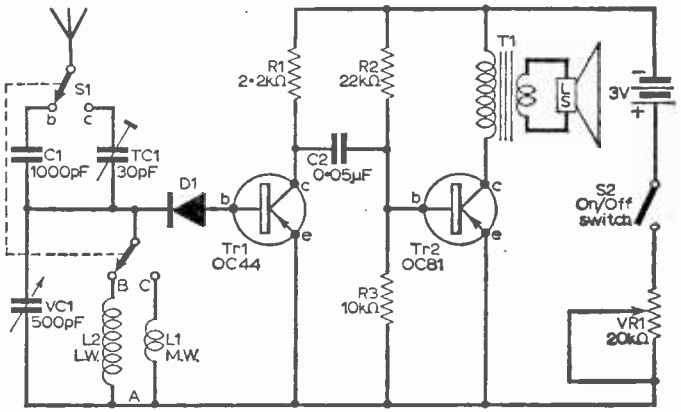


Fig. 1: The simple circuit of the receiver. D1 can be practically any crystal diode, and T1 is a transistor output transformer.

Constructional Details

The chassis was made from a 6in. x 5in. x ½in. piece of deal with small brass carpentry nails or pins (½in. long) placed in the positions shown in Fig. 2. These are driven in to a depth of approximately ¼in. These form the tagpoints for

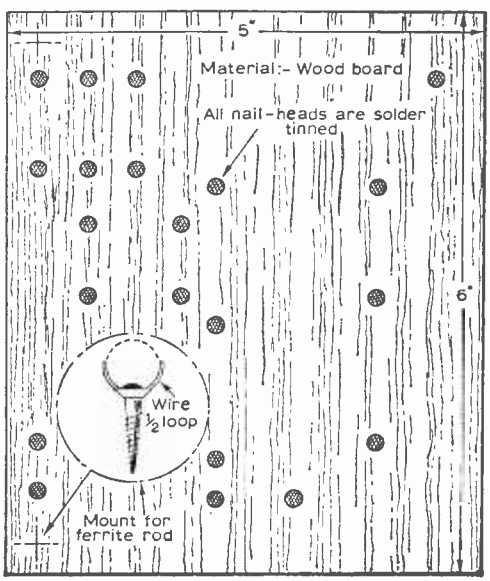


Fig. 2: The wooden base-board which acts as a "chassis", components being soldered to heads of nails driven into the wood.

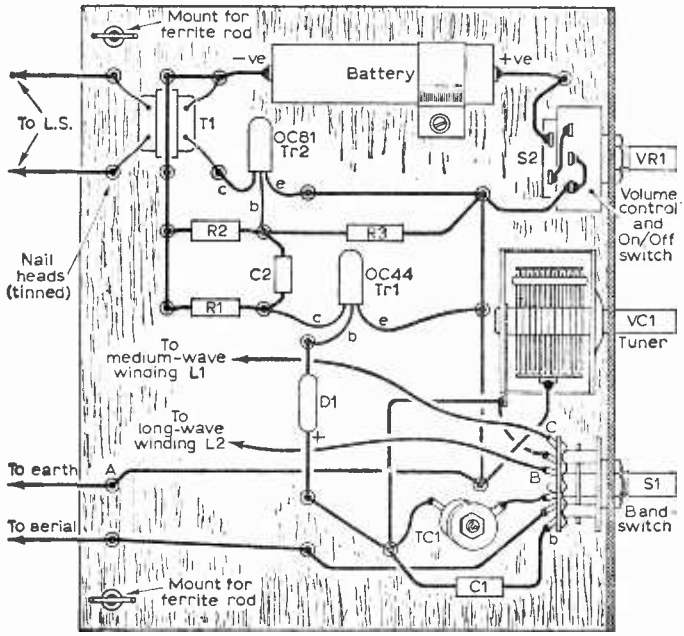


Fig. 3: This shows the components wired on to the board. The battery is an Ever Ready No. 8 type. VR1, VC1 and S1 are mounted on a vertical panel. TC1 is a 30 pF "beehive" trimmer.

components and wiring. The heads of all the pins should be tinned with solder.

The front panel was a 6in. x 5in. section of ¼in. plywood. As an alternative aluminium sheet or Formica can be used.

Holes are drilled in the panel to take the four controls in the position shown in the photograph. The front panel is held in position on one edge of the chassis baseboard with small wood screws.

Mount all the large components first, using small wood screws to hold the tuning capacitor VC1 in position. Four terminals should be fitted in the position shown for the aerial, earth and loudspeaker connections. When mounting the ferrite rod aerial coil make sure that the ends of the small wire clips do not meet (see inset to Fig. 2). It is most important that these "mounting clips" do not form a "closed loop" around the rod.

Coil Winding

L1 is the medium wave aerial coil and consists of 50 turns of 20s.w.g. enamelled wire wound in a single layer as shown in Fig. 4. L2, the long wave aerial coil, consists of 160 turns of 26s.w.g. enamelled wire wound in two sections. Both sections (80 turns each) may be pile wound. The coils should be wound on paper or thin cardboard sleves to facilitate final adjustment.

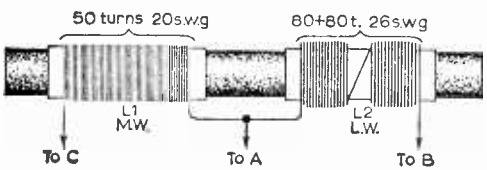


Fig. 4: Winding details of the aerial. The two coils are wound on paper sleeves.

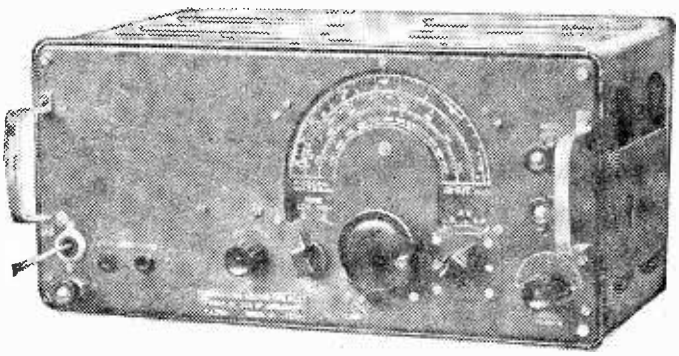
Testing the Receiver

Connect a 3Ω loudspeaker to the receiver, plus an aerial and earth. Switch on and turn the volume control to maximum with the wavechange switch in the long wave position. Set the tuning capacitor to approximately mid-tuning position. Adjust the position on the ferrite rod of L2, the long wave aerial coil, until the BBC Light Programme transmitter is heard at full volume. Switch to medium wave with tuning capacitor nearly *halfway* open. Adjust position of L1 on the ferrite rod for BBC Home Service. Finally fix coil in position with a dab of adhesive cement or piece of Sellotape.

The total current consumption from the battery is approximately 2mA.

The finished receiver is contained within a simple plywood cabinet with a cut-out for the loudspeaker. ■

PCR MODS



BY W. V. WOODS

Improving the PCR, PCR2 and PCR3 ex-government communications receivers.

LARGE numbers of the PCR communications receivers are now available on the surplus market covering the following frequencies:
PCR, LW, MW, SW 15—50m, internal speaker.
PCR2, LW, MW, SW 13—50m, external „
PCR3, MW, SW1 120—43M.
SW2 43—13m, „ „

While these receivers generally have quite a good performance it is obvious that they have a number of shortcomings which, after all, is only to be expected, since most of the PCR's are approximately 20 years old and great progress has been made in the development of radio receivers since the 1940's.

The PCR's were originally designed to work off a 12V d.c. supply with the h.t. (250V) provided by a vibrator pack. One of the first jobs therefore is to provide a mains power supply.

The valve heaters are wired in series parallel to operate from 12V, so these must first be rewired in parallel to work off 6·3V: a suitable power supply is shown in Fig. 1. The choke (L1) is usually already fitted to the PCR.

There is ample room for the mains transformer (T1) to be mounted on top of the chassis, but in order to leave space for any further additions it may prove necessary to move L1. On the PCR2 and 3 L1 can be placed between the front panel and the output transformer, the mains transformer (T1) is then mounted in the space formerly occupied by L1. On the PCR the loudspeaker prevents the re-mounting of L1. This may be overcome by fitting a physically smaller choke in place of L1; the new choke could be mounted under the chassis. If no other additions are envisaged L1 may be left in its original position and T1 mounted in the remaining space between L1 and the front panel. Care should be taken to place the cores of L1 and T1 at right-angles to one another, otherwise mains hum may be induced into the h.t. line.

The valves normally fitted to the PCR's are:

V1	R.F. amplifier,	EF39.
V2	Frequency changer,	ECH35.
V3	First i.f. amplifier,	EF39.
V4	Second i.f. „	EF39.
V5	First af, avc, det,	EBC33.
V6	Audio output,	EL32 or 6V6G.

An improvement in r.f. gain can be achieved by replacing V1 with a 6SG7 or its miniature equivalent the 6BA6. The 6SG7 requires least mechanical work since it fits the same octal socket as the EF39 and only requires rewiring of the socket and the reduction of the cathode bias resistor to 68Ω; the 6BA6 requires a B7G socket and mounting plate.

These two modifications considerably improve the PCR's performance and are intended for constructors who do not want to disturb the original wiring too much. However, for those who wish to make more extensive modifications and additions there are a number of other circuit changes that can be made.

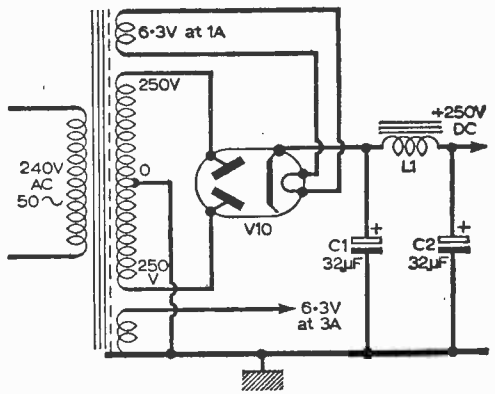


Fig. 1: A simple power supply circuit designed to replace the vibrator unit fitted to the original.

COMPONENTS LIST

C1, C2	32+32μF electolytic 350V
V10	EZ81, EZ80, 6V4, 6X5GT, 6X4
T1	Mains transformer. Secondaries: 250-0-250V, 70mA; 6·3V, 3A; 6·3V, 1A
L1	10H 70mA l.f. choke

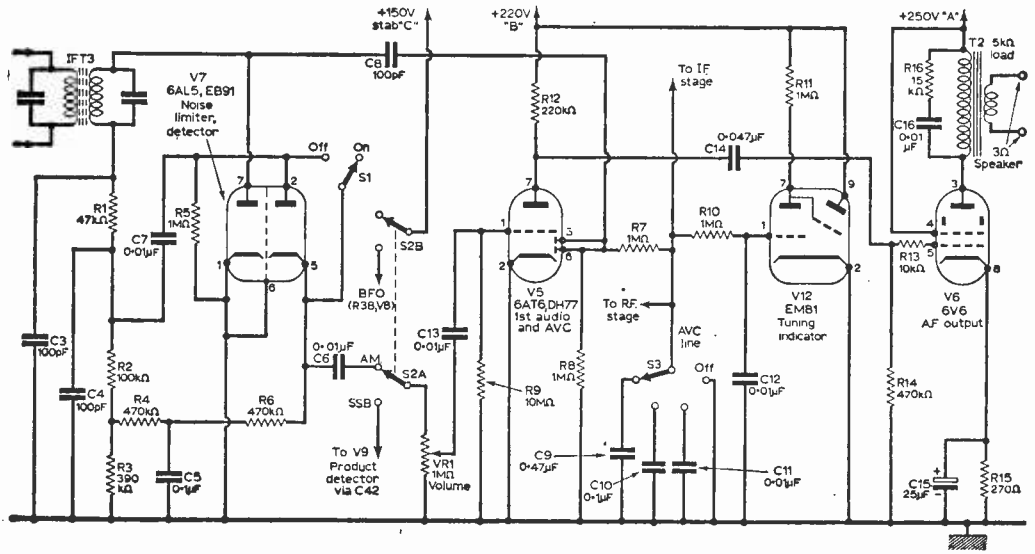


Fig. 2: A rearranged a.g.c. line as shown here permits increased i.f. gain without the risk of overloading the receiver. In this circuit, S1 is the noise limiter on/off switch; S2A, B is the a.m./s.s.b. switch, and S3 the a.g.c. time constant control.

COMPONENTS LIST

Resistors:

R1	47kΩ	R9	10MΩ
R2	100kΩ	R10	1MΩ
R3	390kΩ	R11	1MΩ
R4	470kΩ	R12	220kΩ
R5	1MΩ	R13	10kΩ
R6	470kΩ	R14	470kΩ
R7	1MΩ	R15	270Ω 1W
R8	1MΩ	R16	15kΩ

All 10% ½W carbon, unless otherwise stated
VR1 1MΩ potentiometer

Switches:

S1 Single-pole on/off
S2A,B Double-pole change-over
S3 Single-pole 4-way

Transformers:

T2 Output transformer: 5kΩ: 3Ω turns ratio

Capacitors:

C3	100pF ceramic 350V
C4	100pF ceramic 350V
C5	0·1µF paper tubular 350V
C6	0·01µF paper tubular 350V
C7	0·01µF paper tubular 350V
C8	100pF ceramic 350V
C9	0·47µF paper tubular 350V
C10	0·1µF paper tubular 350V
C11	0·01µF paper tubular 350V
C12	0·01µF paper tubular 350V
C13	0·01µF paper tubular 350V
C14	0·047µF paper tubular 350V
C15	25µF electrolytic 25V
C16	0·01µF paper tubular 350V

Valves:

V5	6H6GT/G	V7	6AL5 or EB91
V6	6U6GT/G	V12	EM81

A.G.C. and Noise Limiter

In the PCR's original form a.g.c. was applied to the r.f. and first i.f. stages only. Since there was no manual r.f. gain control it was possible to overload the set on strong signals and to overcome this the gain of the i.f. stages (V3 and V4) was limited by using larger than normal cathode bias resistors.

By rearranging the a.g.c. line (Fig. 2) so that V1, 3 and 4 are all controlled by the a.g.c, we can increase the i.f. gain without the risk of overloading. The cathode resistors of V3 and V4 should be reduced to 330Ω and 220Ω respectively. A.G.C. is not applied to V2, thus enabling it to work at maximum gain.

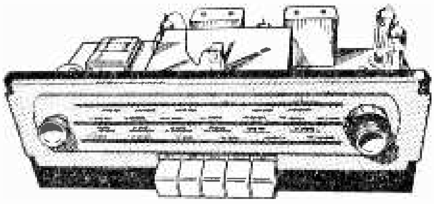
This alternate a.g.c. system has the advantage that we can alter the a.g.c. time constant by switching in different valve by-pass capacitors; this can be very useful for combating various types of fading on distant short wave stations.

By substituting a 6AT6 or 6SQ7-GT for V5 we can simplify the audio and detector circuits considerably and make the circuit more suitable for the addition of a noise limiter, a most valuable addition to the receiver! The 6AT6 or 6SQ7 also increases the audio gain.

By removing the 8µF electrolytic (next to V6) from the chassis and using wire-ended capacitors in the power supply we now have an extra hole in the chassis.

Work should commence by stripping out all wiring surrounding V5 and V6, including the tone control switch and bracket. An octal socket for V6 is now placed in the hole originally occupied

BRAND NEW AM/FM (V.H.F.) RADIO GRAM CHASSIS AT £13.13.0 (Carriage Paid)



Chassis size 15 x 6 x 5½in. high. New manufacture. Dial 14½ x 4in. in 2 colours, predominantly cream. 200-250v. A.C. only.
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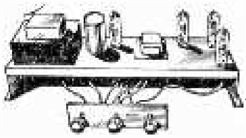

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(6/- Carr.)

Brand new 200-240 A.C. mains Bass, treble and vol. controls. with valves EZ80, ECC83 and 2-EL84's giving full 8 w. Chassis 12 x 3½ x 3¾in. With o.p. trans for 2-3 ohm speaker. Front panel (normally screwed to chassis) may be removed and used as "flying panel."

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Chassis as above. Valves EZ80 2 x EL84, 6 BR8. Output for 3 and 15 ohms Bass, treble and volume controls. On/off. Input 200/240v A.C. Also suitable for pick-up radio etc.

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4in.	Triple play 900ft. Mylar base	17/6
5in.	Double play, 1,200ft. Mylar base	15/-
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5in.	Triple play, 1,800ft. Mylar base	35/-
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5¾in.	Double play, 1,800ft. Mylar base	22/6
5¾in.	Long play, 1,200ft. Acetate base	12/6
5¾in.	Standard play, 850ft. P.V.C. base	11/6
5¾in.	Triple play, 2,400ft. Mylar base	45/-
7in	Standard play, 1,200ft. Mylar base	12/6
7in.	Long play 1,800ft. Mylar base	19/6
7in.	Double play, 2,400ft. Mylar base	25/-
7in.	Long play 1,800ft. Acetate base	15/-
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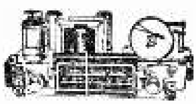

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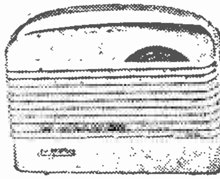

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PRINTED CIRCUIT. 4in. x 2¾in. x 1¼in. over transformers. Output for 3-ohm speaker. Suitable for microphone, record player, guitar and intercom. 9 volt battery required. Frequency range 100 cps. to 25 cps. Push-pull output class B. Instruction sheet provided. Fully wired ready for use. Two types, 200mW 35/-; 500mW, 41/-. (P. & P. 2/6 each).

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Only £4.16.6. (P. & P. 6/-). Suitable for record player, radio, tape after equalisation. Double wound mains transformer. Fully built. For A.C. mains of 200-250v. 14 db. neg. feedback. Controls are volume (on/off), treble and bass. Contact cooled metal rectifier (bridge); ECC83 and EL84 valves. Output for 3 ohm speaker. Chassis size 6¾ x 6in. (over spindle) overall height, including valves, 5¾in. High and low input by Phono sockets.
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Three ohm. Ceramic magnet of latest type. BRAND NEW. (Post 3/6).

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by the 8μF capacitor; V5 will now occupy V6's original position; the remaining space between i.f.t.3 and V5 is now used for the noise limiter detector valve V7. This may be a 6AL5/EB91, 6H6-GT or EB34; alternatively two OA202 silicon diodes could be used in place of V7 or an EABC80 could be used in place of V5 and V7.

Fig. 2 also shows how a tuning indicator can be fitted if required: any type with characteristics similar to the EM81 may be used, the latter was chosen mainly for physical convenience.

The R.F. and F.C. Stages (Fig. 3)

To bring the "front end" up to modern standards substitution of an EF183 for V1 and an ECH81 for V2 is recommended.

These changes can be executed without disturbing the main coil and switch wiring. V1 and V2's sockets will have to be replaced by B9A sockets mounted on small aluminium plates. It is advisable to have a source of stabilised h.t. for the oscillator anode and mixer screen, so the power supply of Fig. 4 is recommended.

VR2 is the r.f. gain control varying the bias on V1. A small two-lug tagstrip is mounted under the retaining bolt for the oscillator trimmer bank, thus making a junction point for R23, R25 and the 150V stabilised h.t. line. A short piece of 80Ω coaxial cable is used between the wavechange switch and pin 2 (control grid) of V2 because this lead is rather long owing to the orientation of the valve holder to give short leads to the oscillator section.

The original V1 and V3 had a common screen supply. The new V1 now has its own separate

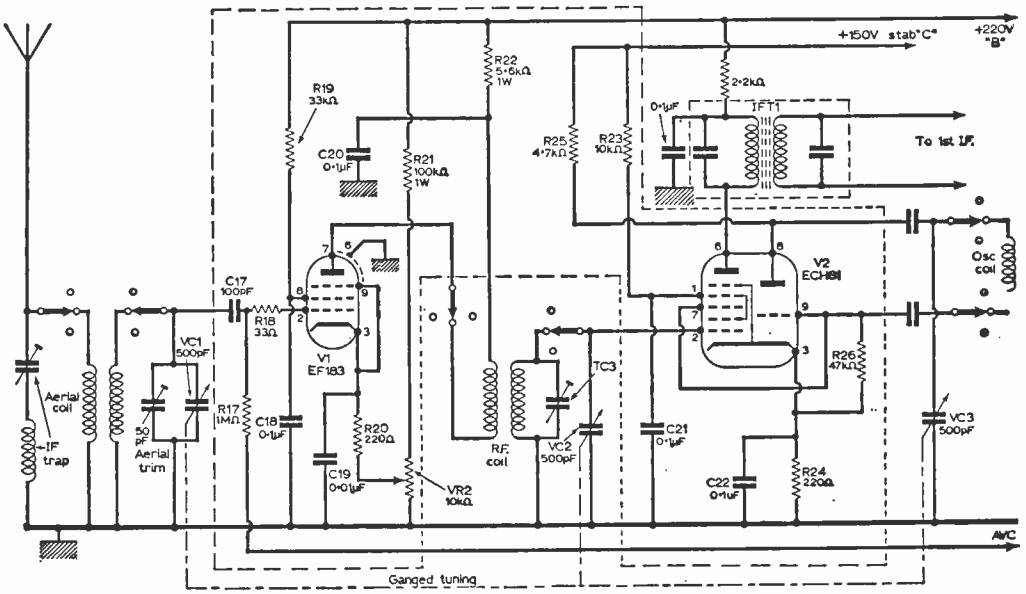


Fig. 3a: The modified r.f. and f.c. stages of the circuit. Sections of the circuit outside the dotted box remain unchanged

COMPONENTS LIST

Resistors:

R17	1MΩ	R22	5·6kΩ 1W
R18	33Ω	R23	10kΩ
R19	33kΩ	R24	220Ω
R20	220Ω	R25	4·7kΩ
R21	100kΩ 1W	R26	47kΩ

All 10% ½W carbon, unless otherwise stated
VR2 10kΩ w.w. potentiometer

Capacitors:

C17	100pF silver mica 350V
C18	0·1μF paper 350V
C19	0·01μF paper 350V
C20	0·1μF paper 350V
C21	0·1μF paper 350V
C22	0·1μF paper 350V

Valves:

V1	EF183	V2	ECH81

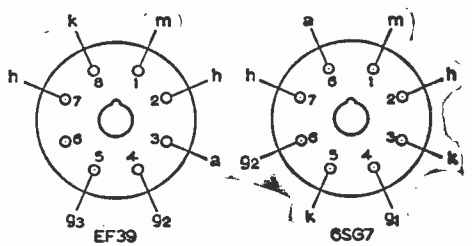


Fig. 3b: Pin connections for alternative r.f. amplifier valves (V1). The first grid of the EF39 is a top cap connection.

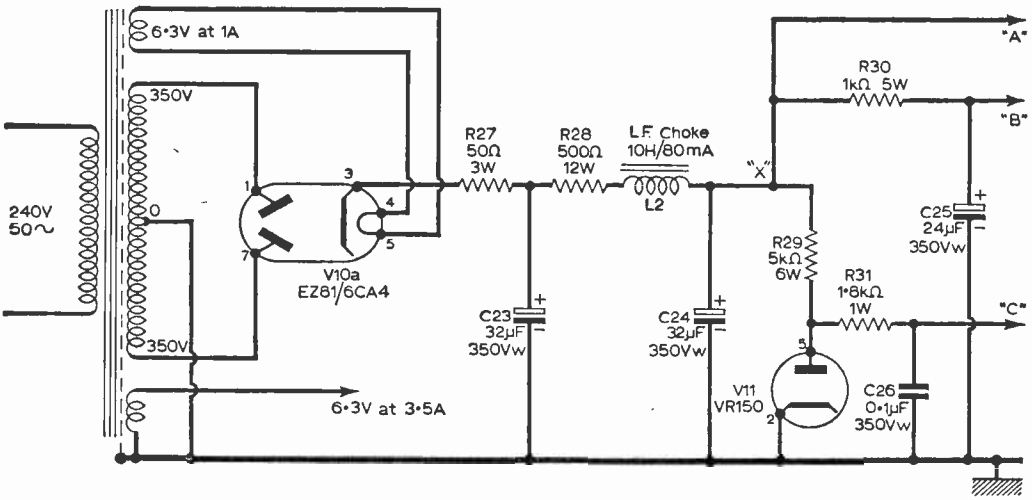


Fig. 4: An alternative regulated power supply. R27 and R28 may be omitted with a mains transformer rated at 250-0-250V, 80mA. R28 is normally fitted to those sets obtained from disposal sources. Voltage outputs are "A" 250V to V6 (Fig. 2); "B" 220V to V12 (Fig. 2), V3 and V4 (Fig. 5) V1 and V2 (Fig. 3) and V9 (Fig. 6); "C" 150V to S2B (Fig. 2) and V2 (Fig. 3a). The Douglas MT.2AT mains transformer used in the original has an 0-5-6·3V rectifier winding which permits the use of 5Z4GT/G, a 5V4G or a 5Y3GT/G in the place of V10a. With the 5Y3, C23, C24 and C25 must be rated at 475V. With the transformer specified in the Components List, alternatives for V10a are EZ80/6V4, and 6AX5GT.

COMPONENTS LIST

Resistors:

R27	50Ω 3W	R30	1kΩ 5W
R28	500Ω 12W	R31	1·8kΩ 1W
R29	5kΩ 6W		

Capacitors:

C23	32μF electrolytic 350V
C24	32μF electrolytic 350V
C25	24μF electrolytic 350V
C26	0·1μF paper 350V

Miscellaneous:

V10a	EZ81 or 6CA4 (see also caption Fig. 4)
V11	VR150
T3	Mains transformer. Secondaries: 350-0-350V, 80mA; 6·3V, 1A; 6·3V, 3·5A. (See also caption Fig. 4)
L2	10H 80mA l.f. choke

COMPONENTS LIST

Resistors:

R32	100kΩ
R33	330Ω
R34	12kΩ 1W
R35	100kΩ 1W
R36	2·2kΩ
R37	220Ω

All 10% ½W carbon, unless otherwise stated

Capacitors:

C27	0·1μF paper 350V
C28	0·1μF paper 350V
C29	0·1μF paper 350V
C30	0·1μF paper 350V
C31	0·1μF paper 350V

Miscellaneous:

V3 6K7G V4 6K7G

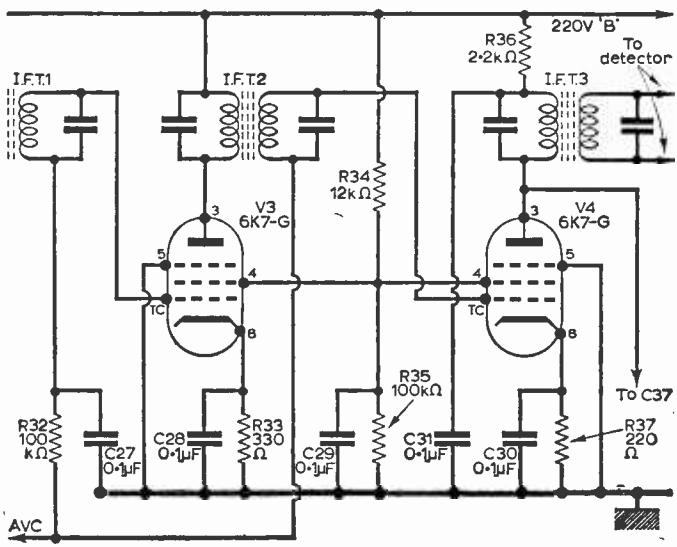


Fig. 5: Modified l.f. stages of the circuit.

supply, so V3 now requires a source of supply. The simplest way to do this is to make a common supply for V3 and V4 (Fig. 5).

Fig. 5 shows 6K7-Gs for V3 and V4 in place of the original EF39s; these were used because they were on hand, in practice EF39s, CK7s, 6U7s, 6SS7s or 6SK7s could be used without any circuit changes, although 6SS7s and 6SK7s have different connections to the other types.

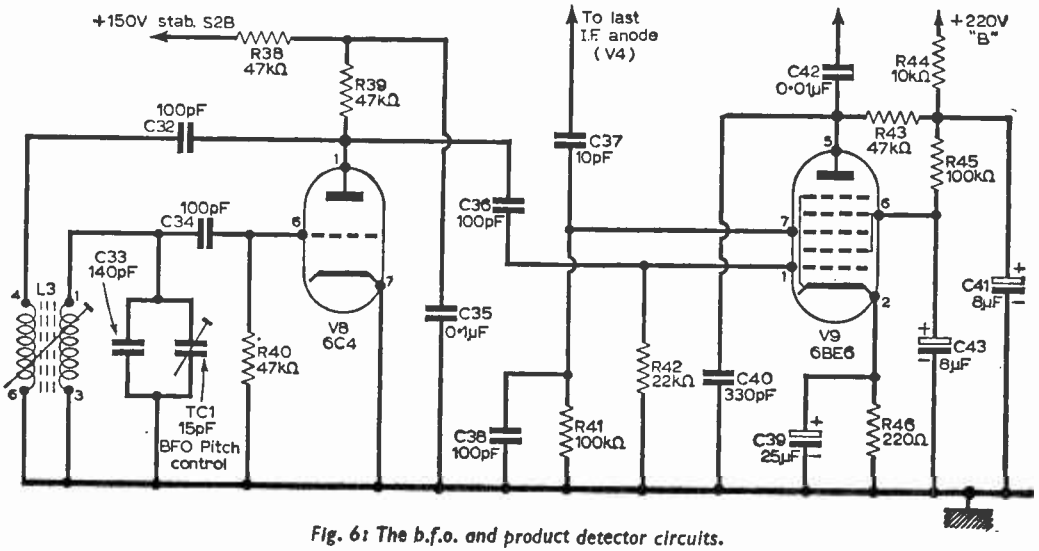
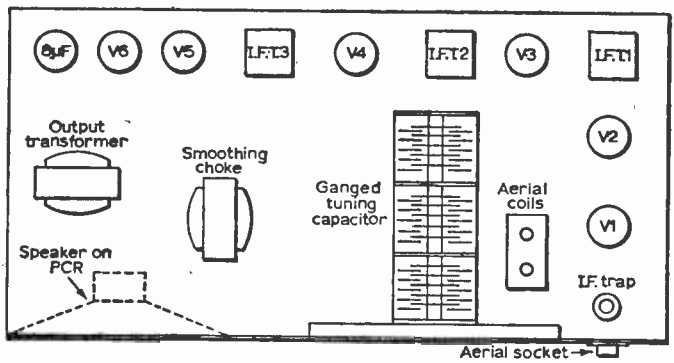
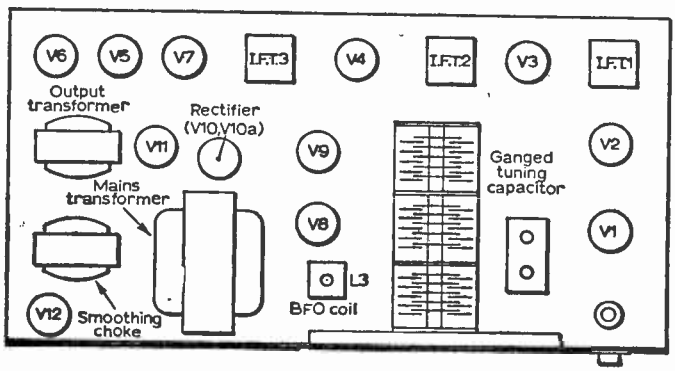


Fig. 6: The b.f.o. and product detector circuits.





COMPONENTS LIST

Resistors:

R38	47kΩ	R43	47kΩ
R39	47kΩ	R44	10kΩ
R40	47kΩ	R45	100kΩ
R41	100kΩ	R46	220Ω
R42	22kΩ		

All 10% ½W carbon

Capacitors

C32	100pF silver mica 350V
C33	140pF silver mica 350V
C34	100pF silver mica 350V
C35	0·1μF paper 350V
C36	100pF silver mica 350V
C37	10pF silver mica 350V
C38	100pF silver mica 350V
C39	25μF electrolytic 25V
C40	330pF silver mica 350V
C41	8μF electrolytic 275V
C42	0·01μF paper 350V
C43	8μF electrolytic 275V

Miscellaneous:

V8	6C4	V9	6BE6
TC1	15pF variable capacitor		
L3	B.F.O. coil (Denco BFO2/465)		

Fig. 7a (top): The original layout of the chassis. The loudspeaker is only included on the PCR model.

Fig. 7b (bottom): The completely remodelled chassis layout. The valve-holder for V1 should be orientated (by pointing its location pip—see Fig. 3b) to face the left, and V2 similarly orientated to face upwards.

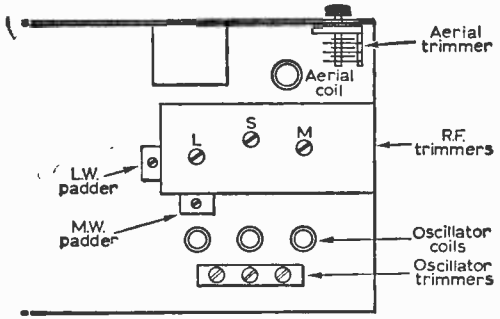


Fig. 8a: The arrangement of the trimmers and padders which is common to the PCR and PCR2 models.

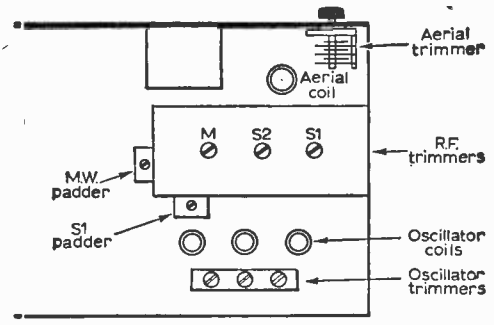


Fig. 8b: The trimmer and padder arrangement for the model PCR3.

Product Detector and B.F.O. (Fig. 6)

The addition of the product detector enables the demodulation of single sideband signals, a system of transmission favoured by many amateurs of today.

V8 (6C4) is the beat frequency oscillator which takes its h.t. supply from the stabilised 150V line; any medium mu triode or triode connected pentode could be used for V8. V9 is the product detector, a 6BE6 or its octal equivalent the 6SA7-GT.

There is ample space for L3, V8 and V9 on the chassis between the power supply and the three-gang tuning capacitor. New holes will have to be punched for these components.

Should all these modifications be carried out the PCR will have been transformed into an extremely useful communications receiver with the following valve line-up:

V1	R.F. amplifier,	EF183.
V2	F.C.,	ECH81.
V3	First i.f. amplifier,	6K7G.
V4	Second i.f. amplifier,	6K7G.
V5	A.F., a.g.c.,	6AT6 or 6SQ7.
V6	Output,	6V6-GT/G.
V7	Noise limiter/detector,	6AL5 or 6H6.
V8	B.F.O.,	6C4.
V9	Product detector,	6BE6 or 6SA7.
V10	Rectifier,	EZ81/6CA4.
V11	V. Reg.,	VR150.
V12	Tuning indicator,	EM81.

Because of the rewiring of V1 and V2 realignment will be necessary; this will require a modulated r.f. signal generator covering the i.f. and r.f. ranges of the receiver and suitable tools to adjust the i.f.t. cores and the trimmers.

Both signal generator and receiver should be switched on for about five minutes to let them reach their correct operating temperature. The receiver should, of course, be checked to make sure that it is functioning correctly on all bands.

I.F. Alignment (PCR, PCR2 and PCR3)

Set generator to 465kc/s.

Switch receiver to medium wave (tuning capacitor fully closed).

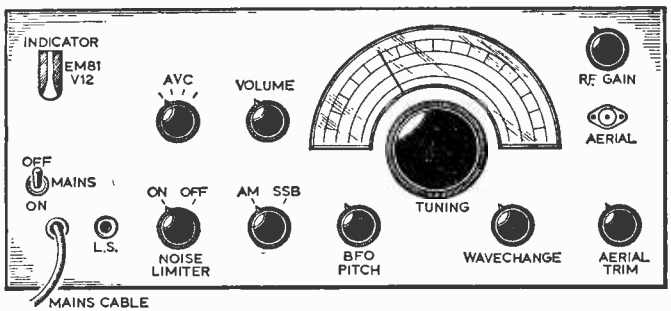


Fig. 9: The front panel layout of the PCR2 and PCR3 after modification.

Inject signal into control grid (pin 2) of V2, peak i.f.t.3, 2 and 1 in that order, starting with secondary of i.f.t.3, working up to primary of i.f.t.1. The EM81, if fitted, can be used as an output indicator. The generator output should be reduced as the circuits are peaked; this prevents the a.v.c. broadening the response.

R.F. Alignment

Positions of trimmers and padders are shown in Fig. 8. Generator signal is applied to the aerial terminal.

All trimming and padding adjustments should be repeated until one has no effect on the other.

When properly aligned the short wave performance is excellent—stations in Europe, Canada, U.S.A., Cuba, Windward Islands (using only 5kW), India, Pakistan, etc., etc., have been received and Radio Australia is heard loud and clear using only an indoor aerial 15ft long. ■

designing a MULTIMETER

by K. Berry

Theory, Design and Construction of Simple Instruments

CONTINUED FROM PAGE 32 OF THE MAY ISSUE

THE second multimeter, Design No. 2, enables measurements to be made of d.c. voltage, d.c. current and resistance. The meter employs switching but because there is no a.c. facility it is of the simplest nature and should deter no constructor. The circuit is shown in Fig. 7.

Specification

Voltage	D.C. only current	Resistance
0—5	0—1mA	1,500Ω mid scale
0—10	0—10mA	
0—50	0—100mA	
0—100	0—1A	
0—500		
0—1,000		

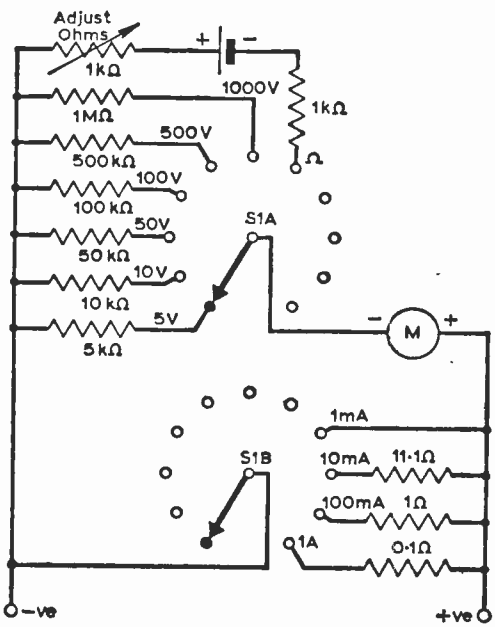


Fig. 7: Design circuit No. 2. This instrument will measure d.c. volts, d.c. amps and resistance.

The basic movement is a 2½in. round 1mA meter scaled 0—100. As in the case of design No. 1 the voltage ranges have been chosen so as to facilitate reading from the meter scale. The resistance of the meter used in the prototype was 100Ω and the values quoted for the shunts are based on this value. If a meter having a lower resistance than this is used a resistor can be connected in series with the meter so that the combined resistance of the meter plus series resistor is 100Ω. If a meter having a resistance higher than 100Ω is used, then the resistance of the shunts required can be calculated from the expression given in the section on current measurement.

COMPONENTS LIST FOR DESIGN NO. 2

Multipliers

5V	5kΩ	¼W.
10V	10kΩ	
50V	50kΩ	
100V	100kΩ	
500V	500kΩ	½W.
1,000V	1,000kΩ	1W.

Shunts

10mA	11·1Ω (3 x 33Ω in parallel).	
100mA	1Ω	approx.
1A	0·1Ω	

Miscellaneous

M moving coil meter 0—1mA f.s.d.
S1 1 pole, 11 position, 2 bank.
Terminals.
Dry cell 1·5V.
Potentiometer 1kΩ.
Resistor 1kΩ ¼W.

Once again high-stability 1% or 5% resistors are recommended for use as multipliers. For the shunts it is necessary for the 100mA and 1A ranges to make one's own. This will necessitate the acquisition of some resistance wire; unfortunately this is not usually available in very small quantities from the normal suppliers but a wire suitable for the purpose can readily be obtained from most electrical dealers. This is the wire contained in the spiral elements sold for replacements on " bowl "-type electric fires.

To determine the amount of wire required for the 100mA shunt connect the meter (switched to its 10mA range) in series with a 3V battery and a 500 or 1,000Ω rheostat. Adjust the rheostat until the meter reads exactly full scale. Disconnect the battery and set the meter to its 100mA range. Connect one end of the resistance wire to one of the meter terminals and connect a length of normal copper wire to the other meter terminal. Tap the copper wire on to the resistance wire at a point, say, 6in. from the meter terminal and reconnect the battery. Now slide the copper wire along the resistance wire until the meter reads $\frac{1}{10}$ full scale (i.e. 10mA). The length of wire required as a shunt is thus determined. This should be cut from the remainder of the wire and insulated with sleeving. It can then be wound into a coil for easy insertion into the meter circuit.

It must be pointed out that the current in the circuit must not vary whilst the shunt is being found, i.e. the battery voltage must stay constant during that time. As a check the meter should be

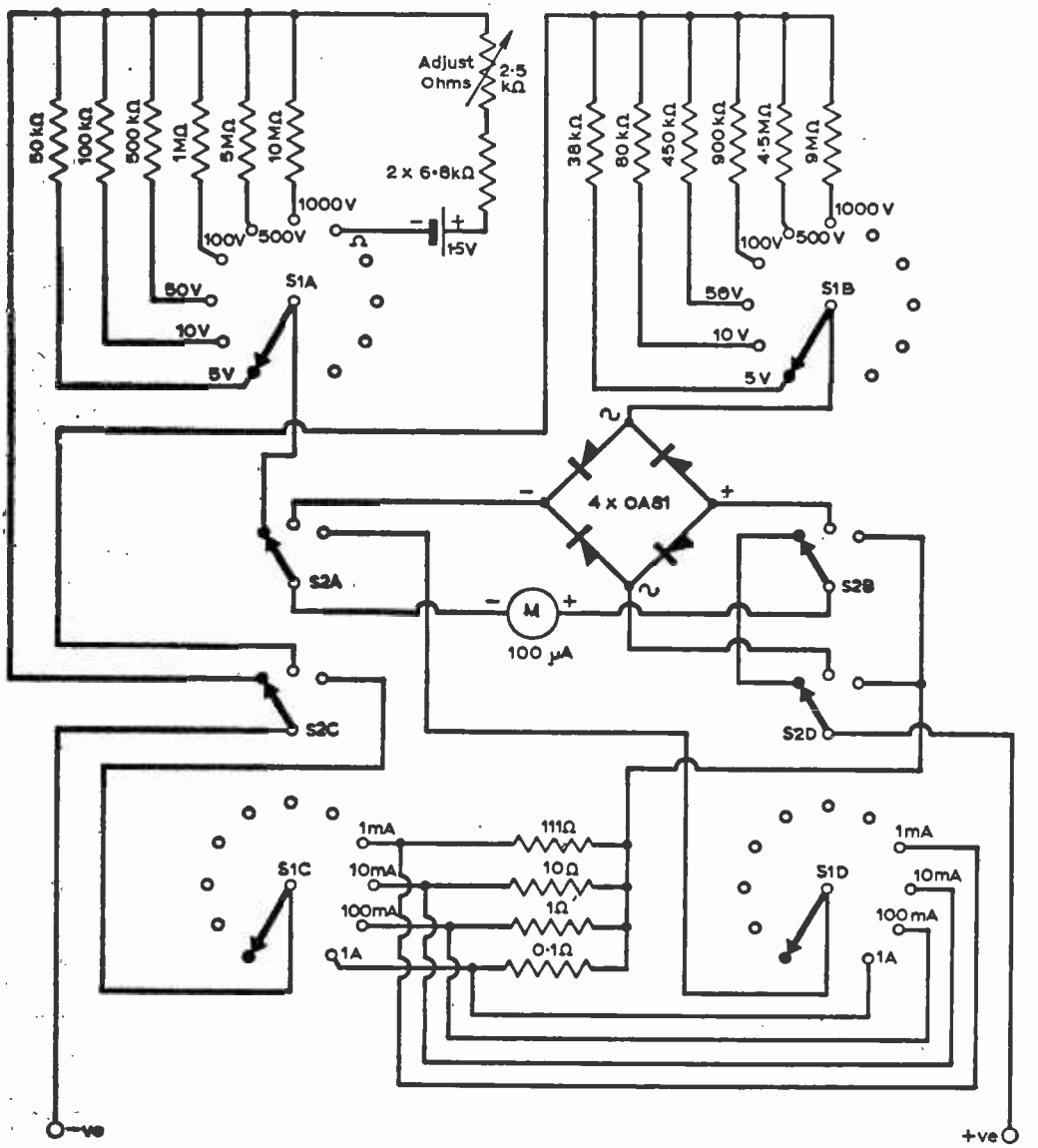
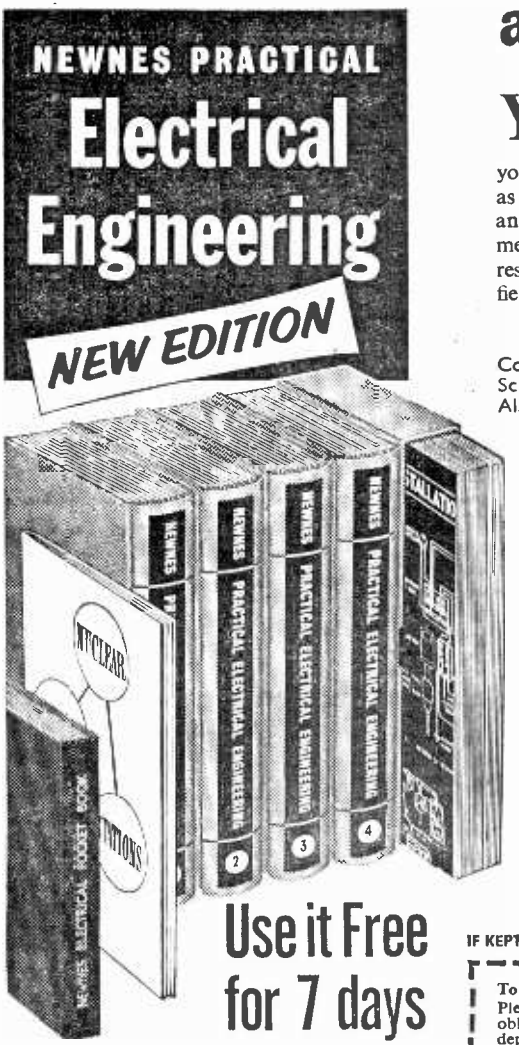


Fig. 8: Design No. 3—the most comprehensive, with facilities for measuring a.c. and d.c. volts, d.c. amps and ohms.

87 Experts guide you to advancement and higher rewards



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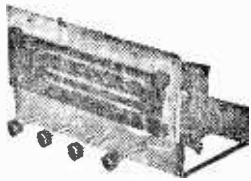
7 VALVE AM/FM RADIOGRAM CHASSIS



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7in.	1200ft.	17/6	1800ft.	22/6	2400ft.	42/6

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EMPTY TAPE REELS (Plastic): 3in., 1/3; 4in., 2/-; 5in., 2/-; 5½in., 2/-; 7in., 2/3.
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2-tone Cabinet and 7in. x 4in. Speaker. Size 14 x 3 x 7¾in.	£3. 5.0 Carr. 5/-
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EF80	7/6	PL81 9/6
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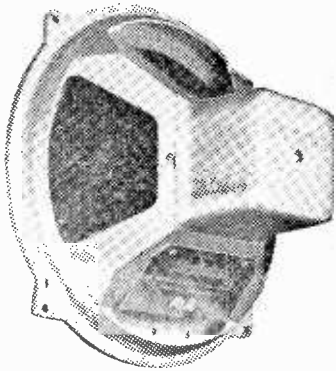
W B Stentorian

MODEL H.F. 1016 'MAJOR'



This unit makes use of the high flux density available in the magnet system of the previous H.F.1016 unit. A curved diaphragm is used with a rigid centre section coupled to the voice coil. The rigid coupling and the design of the cone termination give a balanced response over the whole audio range. The unit is specially suitable for use in the smaller type of enclosure having a volume of approximately 1½ cubic feet.

Other Stentorian speakers:

Type	Flux Density	Price	Type	Flux Density	Price
8" H.F.816*	16,000 gauss	£6.6.0	T.816	16,000 gauss	£5.19.3
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8" H.F.810	10,000 gauss	£2.17.0	T.10 tweeter	14,000 gauss	£4.12.9
6" H.F.610	10,000 gauss	£2.7.3 Steel £2.9.3.diecast	T.359 tweeter	9,000 gauss	£1.12.3

**These two speakers incorporate a universal impedance speech coil.*

Specification:

Chassis—die cast aluminium

Cone—graded pulp cambric surround; Cone dia.—10 ins.,

Pole dia.—1 in.; Flux density —16,000 gauss; Total flux— 64,000 maxwells; Impedance —15 ohms.

Price: £9.8.6 (inc. tax)

WHITELEY ELECTRICAL RADIO CO. LTD. MANSFIELD, NOTTS.

Telephone: MANSFIELD 1762-5 London Office: 109 Kingsway, W.C.2

WA3

switched back to its 10mA range, when it should read exactly full scale.

This procedure is then repeated for the 1A range. Some difficulty may be experienced in soldering the resistance wire, since it is sometimes difficult to tin. Satisfactory results should, however, be obtained if the wire is cleaned carefully with a piece of fine emery cloth. The use of one of the proprietary non-corrosive fluxes can also be of assistance. If, however, the wire refuses to be tinned it should be wrapped round a small screw, say 6BA, sandwiched between a washer and a soldering tag. A nut is then threaded on the screw and the assembly tightened. The connection is obtained by soldering on to the solder tag.

Design No. 3

This, the last design, is the most comprehensive of the three. Facilities are included for measuring a.c. and d.c. voltages, resistance and d.c. current. This meter should prove suitable for nearly all measurements which are likely to arise. The circuit is given in Fig. 8.

Specification

Voltage A.C. and D.C.	Resistance	Current D.C.
0—5	15,000Ω mid scale	0—1mA
0—10		0—10mA
0—50		0—100mA
0—100		0—1A
0—500		
0—1,000		

The basic movement is a 3½in. round 100μA meter scaled 0—100. The circuit employed (Fig. 8) uses two switches. The main meter range switch SW1 is an 11-position four-bank switch, whilst the second switch SW2 selects either a.c. or d.c. volts and current. It would be possible to eliminate SW2 by increasing the number of banks on SW1 but this was thought to be undesirable on the grounds of cost and size.

A feature of this design is the use of an additional switch bank (SW1D) to safeguard the meter when it is used to measure current. The use of this switch ensures that the meter reads only when it is connected across a shunt and if a switch contact connecting that shunt into circuit becomes high resistance or open circuit then no current flows in the meter. If the meter were permanently connected into circuit and the necessary shunts were switched across it then failure of the switch could result in damage to the meter.

Examination of the circuit for design No. 2 (Fig. 7) will show what is meant. If SW1B becomes defective the full load current will flow through the meter. The addition of an extra switch bank would eliminate this possibility.

The meter used in the prototype had a resistance of 1,000Ω and the values quoted for the shunts are based on this value. As in the case of design No. 2 these must be adjusted to suit the particular meter used. The values quoted for the a.c. multipliers are approximate and the precise value required should be found by the method given in design No. 1.

COMPONENTS LIST FOR DESIGN NO. 3

Multipliers (all ¼W)

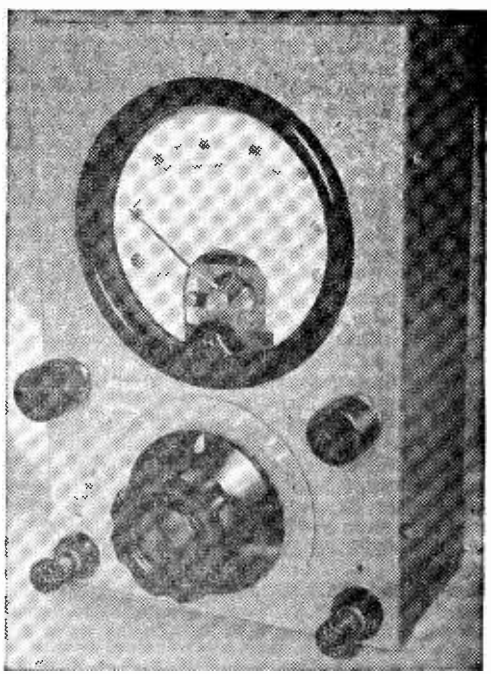
	A.C.	D.C.
5V	38kΩ	50kΩ
10V	80kΩ	100kΩ
50V	450kΩ	500kΩ
100V	900kΩ	1MΩ
500V	4·5MΩ	5MΩ
1,000V	9MΩ	10MΩ

Shunts

1mA	111Ω (29Ω+82Ω)
10mA	10Ω
100mA	1Ω
1A	0·1Ω

Miscellaneous

M moving coil meter 0—100μA f.s.d.
S1, 1 pole, 11 position, 4 bank.
S2, 4 pole, 3 position, 1 bank.
4 OA81 germanium diodes.
Terminals
Dry cell 1·5V.
Potentiometer 2·5kΩ.
2 resistors 6·8kΩ ¼W.



The appearance of Design No. 3 when made up.

The construction of this meter should present no difficulties. As in the case of the previous designs no details of construction have been given but a suitable metal or plastic case will no doubt be easy to obtain. The version of this meter made by the author is shown in the photograph. ■

on the Short Waves

MONTHLY NEWS FOR DX LISTENERS

All times are in G.M.T. All frequences are in kc/s.

The Broadcast Bands—by John Guttridge

NEWS first of all this month from the Caribbean area. W. Smith (West Bromwich) reports the Windward Islands Broadcasting Service, St. George's, Grenada, and *Radio Habana*, (Apt. Postal 7026, Habana, Cuba). W.I.B.S. has now returned to 15,085 from 11.895 for its evening transmission, whilst *Radio Habana* is using 11,735 for its 2010—2140 English transmission to Europe. (This is confirmed by Roy Patrick, Derby). Paul Harris, of Elgin, has heard Habana in Spanish from 1900—2000 on 9,655.

A schedule and card have been received from *Trans World Radio*, Bonaire, Netherlands Antilles. The card is a big disappointment, giving no QSL details and no exact frequencies. English is carried from 1030—1230 (—1430 Sundays), and 0200—0430 on 800 medium wave and in the 31m band. Other transmissions are Spanish 1000—1030 31m., 0130 (0100 Sunday)—0200 19m., Dutch 2200—2215 19m., Portuguese 0930—1000, 2300—2330, 0030—0100 19m., German 2300—2315 Thursday, 0000—0030 19m., Russian 2330—2400 19m.b., French 2145—2200 19m., and Cantonese (not Sunday) 2200—2215 19m. Many of these transmissions are also carried on 800kc/s medium wave which is still well heard during the night in the U.K. Judging from the World Radio Handbook, likely short wave frequencies are 9.675/9,755/15.265.

Both Ian Taylor of Slough and R. Nelson of Castleton, mention *La Voz de los Andes*, HCJB, (Cas.691, Quito, Ecuador). The present QSL card gives no verification details. English is used from 1900—2030 on 17,890/15.115/11,755.

Moving Eastwards, Paul Harris mentions *Radio South Africa* (P.O. Box 8606, Johannesburg), which has full verification details on its QSL, and *Radio-diffusion du Senegal* (B.P. 1756, Dakar, Senegal), which he still hears on 9,675. He has also had a report acknowledged by the outlet of *Radio Nacional de Espana* in the Canary Isles. The schedule is given as 1400—1600 on 9,660 to Europe and 0000—0300 on 11,800 to South America. All in Spanish.

One of the most popular European stations at present appears to be *Radio Tirana* (Rue Ismail Quemal, Tirana, Albania). Ian Taylor gives the English schedule as 2000—2030, 2130—2200 on 7,090/9,715, whilst W. Smith says 1,088 medium wave is used additionally for the 2130 transmission. Both have had cards from the station—one with no date and one with no verification details. Alan Jones, of Chertsey, reports very strong signals at 0645 on 7,088 in an unidentified language.

Coming right home, devotees of the BBC should note that the General Overseas Service is to be renamed the World Service.

Items have come in about the two stations at Monaco. First *Radio Monte Carlo* (16 Boulevard Princesse Charlotte, Monte Carlo). W. Smith reports a QSL consisting of a piece of paper giving the date, time and metre band, and Paul Harris had a verification giving the date only. Paul also reports *Trans World Radio* (Rue de la Poste, P.O. Box 141, Monte Carlo) with a Norwegian broadcast from 1700—1730 on 9,630.

Full details are given on the card issued by *Radio Norway*, Oslo, Norway. Amongst transmissions affected by frequency changes recently are 0745—0815 on 11,850/15,175/17,825/21,730/6,130 and 1700—1830 on 11,850/15,175/17,825/21,730/6,130.

According to W. Smith coloured QSL's giving full details are now being issued by *Vatican Radio*, Vatican City, Vatican State.

New times and extensive frequency changes are features of the summer schedule of the Overseas Service of Swiss Broadcasting Corporation, Berne. The new English times are: 1200—1300 on 7,110/9,665; 1845—2015 on 9,665/6.055; 0115—0245 on 9,655/9,535/6,120; 0415—0515 on 9,655/9,535; 1315—1445 on 15.320/15.305/15,255/17,845; 1500/1630 on 17.830/15,305/15,255/11,865; 2100—2230 on 11,865/9,545; 0830—1000 on 17.830/15,305/15.225.

An Asian station heard recently by Paul Harris is *Radio Republik Indonesia* (P.O. Box 157, Djkarta). German, he says, is now aired by this station on Tuesdays and Fridays from 1700—1730 on 9.865/11,715.

Roy Patrick reports new frequencies for the transmission in English to Europe from 1945—2030 by *Radio Pakistan* (71 Garden Road, Karachi 3). They are 6,250/7.135.

With the gradual improvement in reception conditions as solar activity increases, *Radio Japan*, Tokyo, Japan, has announced that it hopes to resume evening transmissions to Europe in the spring next year. Burmese is now transmitted in the South-east Asian service with the result that it has been extended by half an hour to run from 1230—1600. Frequencies are 9,675/11,705/11,875. The Hawaiian service on 15,235/17,725 has moved to the new time of 0600—0700. Other services affected by frequency changes are the African (1900—2000) on 9,670/11,780 and the North and Latin American (0200—0400) on 11,780/15,135/15,235. Three General Service transmissions have been extended to a full hour. These are at 1000 and 1400 on 9,505/9,740/11,815 and 2300 on 6,140/15,105/15,425. The 1800—1830 and 1900—1930 transmissions are now on 9,505/9,605/9,740.

The Amateur Bands—by David Gibson G3JDG

ONCE upon a time, a scribe was foolish enough to suggest a contest for stations using as an antenna an end-fed coathanger and a pair of base-loaded cuff links. Reader **H. S. Stevens** of Aylesbury bravely (?) took up the challenge and here are some extracts from his log (this antennae were taken via a pi-coupler into an S640 receiver). All on a.m. 16in. Wire Coathanger Antenna: 28Mc/s—9J2DT, ZC4KW, ZC4MO. 21Mc/s—UB1BL, PY2CH, PY9WL, PY5AQM, CT3XM, CR4AJ, ZS8C, CR6CG, CR4AI, CR6DL, PY9HL, YV1PF, YV1BM, ZE7JR, UB5BH. 14Mc/s—EA4, DL9,11,PAØ and SP5. 3in. Gold Plated Cuff Links Antenna; 1½in. lead to pi-coupler: 21Mc/s—5A1TK, 5A4TI, WA4WVD, 9Q5RB, PY5AQM. 14Mc/s—UB2KAB, K2CAK, W4ZYS, K2HLB, SM5BL, W8NGO, W1JFG, SP5AR, WB2APG.

Well done, Mr. Stevens—the outright winner (and only entrant)!

21Mc/s

"My favourite band," say more and more readers. This band is challenging 14Mc/s in DX popularity.

Stephen Beal (London) collected these on his P.W. t.r.f. and 66ft. longwire: W1ROU, 2ZX, 2AWD, 2RGU, 2SJM, 3MSK, 8HRV, 8WYT, K2HV, 3MBF, UB5BX, EA8EA. All a.m.

Bernard Hughes (Worcester) got these between 1300—1700 on his 840C+Codar preselector and dipole: CR5SP, CT3AQ, HI8WSR, IT1CFN, KV4CX, VE8BZ (Baffin Is.), VO1GX, WØZYM, ZS8G, ZC4MO, ZC4TJ, XE3AF, 9Q5DL, 9Q5RB.

John Fitzgerald (Gt. Missenden) says 15m has been wide open betweèn 1100-1900. His unusual rig is Hitachi WH837 8-transistor superhet plus a 20m dipole—CO3CO, CR4BC, 5SP, 6DL, 7FR: CT3AM, EA8EN, ET3USA, K7JDX, 9WEZ; LU5AQ, SVØWCV, TN8BK, YV4KT, ZB1RM, 2AK; ZC4HK, ZS2AR, 6ADF, 8C, 8G; 7X2MD, 9J2BK, 9L1WN, 9Q5A1, 9Q5HP. All a.m.

Martin Briscoe (Bolton) uses a VR66 and PR30 preselector, with a folded dipole, and logged: CR7FC, ET3USA, IT1CF, KZ5TD, MP4DAA, OD5CY, SV1DL, ZB1RM, ZC4MO, ZS1AB, 5A1TK, 5A5TE, 9Q5RB, 9J2DT, 9X5RZ.

BRS26171 (Lowestoft) found a new ground plane was better than his 264ft. longwire and dipole. This, with his Cr100 and a.y.u., produced these:—CP1LN, CT3AQ, ET3USA, KP4AXC, MP4TAA *(or DAA?)*, OD5EC, OD5DU, PY4BOP, PY6OPY, PY1AXP, ZB1CE, ZB4MO *(surely* 1MO?), ZE7JR, 4X4AB, 9G1SS, 9G5AB.

J. Cowley (Lancs) has an HA63 and a joystick on a 20ft. pole, aided by an old 19 Set a.t.u. He found—CR6EI, HK7UL, KP4ASN, KR6MB, OA4NQ, PY1FH, PZ1CM, UL7NH, VK2EW, VR6TC (Pitcairn Is.), W7KVT, WAØHHX, ZS5KI, 9J2FB. All these were on c.w.

14Mc/s

Staying open later and packed with DX. A sample is the colossal log received from **R. Garvey** (Cheltenham) using an S640 and 90ft. longwire. We have selected the cream, as follows—AP5HQ, CN8BU, HM5BF, JA4BJO, JA6PN, KR6MH, UL7KSB, UM8AP, XW8BA, ZL2BG, 5R8AN, WA6HLU. All on c.w.

Paul Bernard (Birmingham) sent this log: EA8EA, HA8WH, K1DHG, K2CAK, OZ7NK, SM6CKS, UA1KBE, UA1KUD, W2AXH, W2SFP, W3OJX, YO2BB, 4X4RD. The receiver was a one-valver! Aerial was 69ft. longwire.

Alan Dailey (Leeds) uses an R107 with pre-selector and comments on an amazing improvement by raising his 90ft. longwire from a height of 8-10ft. to 20ft. Proof of the pudding:—BV1USG, CO8MN, CX8AX, DU1AA, FK8AU, HC1MX, HC8FM (Galapagos Is.), HK3AVE, HP1AA, HS1X, HV1CN, HZ3TA, JA1BRD, K1LMV/VE8 (Baffin Is.), KA5DG, KR6DL KA7DB, LU5DBS, MP4MAM, PY4AS, TG9EL, VK6XX, VK9TL (Norfolk Is.), VP2LS, VP2GTA, VS9AWR, ZD3C, ZD5R, ZD8WR, (Ascension Is.), 6Y5UC, 7X3CT, 9M4MB, 9M8EB. Some very fine DX there, Alan.

W. Clarke (Devon) has an AR88 and inverted dipole. He pulled in these on s.s.b.—AP1AD, ET3MEN, DU7GB, FM7AEL, HR1SR, KC4OA, KG4AN, KP4CL, KL7DR, KX6BQ, OA1SU, VK3AM, VK4RH, VK5MS, VP2LF, VP4KD, VP9CP, XE1ME, XE1YO, YA3BMC, YV5FTS, ZL2KL, ZL2DU, ZL3FA, ZL3UY, 4X4HW, 4X4BL.

Norman Ponsford, also of Devon, uses a t.r.f. (CR45) with a 60ft. longwire. These were heard on a.m. on one day between 1600-1730—F8SC, HV1CN, K1DIR, K1HVV, OH2TI, SP9ANH, SM4CHM, UQ2KFG, UA2KAK, W2GBC, W3ZVA, W3MSK, W7ESK, W8BF, WØNVZ, 5A1TT. On a Sunday between 1725-1840 he found: EL3C, HB9DO, OE1KRB, K2UYT, SM5AWL, UB5KSP, VE2ADL, VE1AGD, W8UFG, YV5BBU, 5A4TK.

P. Whelan finds the band lively on his CR300/2 and reports CE7BV, CP5EZ, CX2CO, HK3KY, LA4EJ/P (Jan Meyen Is.), LU4DM, LU4ACJ, OD5CY, PY2ON, VP7NY, YV5AXA. His ariel is 50ft. of wire stretched between the lifeboats, and the log above was received "somewhere off the Kent coast." Does this make him P. Whelan/MM?

L.F. Bands

The only report of a non-G station this month was of OK1KLX. This is surprising since DX has been about (W6, VP3, VE, etc.)—maybe it's because the DX is on c.w.

One or two have braved the QRM and G side-band nets to winkle out the interesting ones. **Gilles Whylie** (Renfrewshire) got OHØNC, TI2JIC, VE3CW, ZL2AAG, ZL4LM, all on s.s.b. **Alan Dailey** got HBØAFM/M, HBØAFM, PJ2AA, VE3AXU/M. **D. Foster** (Essex) raised VE1IE, VO1HI and W2ZTL.

One or two have taken up the challenge of DX on 7Mc/s, including **M. Woollin** (Leeds), who found WB2GWY, K1LTZ, K2ODC, KV4CI and

—continued on page 162

HAM FEATURE

Automatic Control Systems

A system of fully automatic change-over from send to receive and vice-versa, with only two relays.

by A. D. Taylor, G8PG/GW8PG

AUTOMATIC changeover on telegraphy or "push-to-talk" operation on telephony is a great operating convenience in the amateur station. It allows the operator to monitor the frequency during an "over", thus reducing the effects of interference, changes contacts between stations from monologues into conversations and considerably reduces fatigue during long operating sessions. The relay control system described in this article allows "listening through" between words on c.w. and also at any time on telephony by merely releasing the "press-to-talk" switch. The delay time can be adjusted, between a few milliseconds and about one second, by means of a potentiometer. As the transmitter v.f.o. is held on continuously while sending words the problem of "chirp" on c.w. is eliminated. The system has been operated on the various bands with a transmitter running at powers up to 60W.

Circuit Description

The circuit is shown in Fig. 1. Transformer T1, rectifier MR1 and capacitor C1 together provide a 24V 0·5A supply for operating the relays. This supply energises the relay coils when the morse key or "push-to-talk" switch is operated. Both relays then operate immediately, the current which operates RC/5 flowing through rectifier MR2. As soon as contacts RC1 close, C2 charges up from the 24V supply and the potential across this capacitor is sufficient to hold RC/5 operated for a time which can be varied by altering the value of VR1. When the morse key is released for the space between symbols the keying relay, RK/1, releases immediately, but RC/5 coil is isolated owing to the removal of the forward bias on MR2; this relay therefore remains operated. When the operator presses the key for the next symbol RK/1 operates immediately and the loss of charge on C2 is made good by conduction through MR2. If the operator makes a longer pause, such as that between words, C2 discharges sufficiently for RC/5 to release and return the station to the "receive" condition. The provision of MR2 and relay contacts RC1 are key factors in the operation of the circuit. If MR2 were not fitted the charge on C2 would hold both relays operated and keying would be impossible.

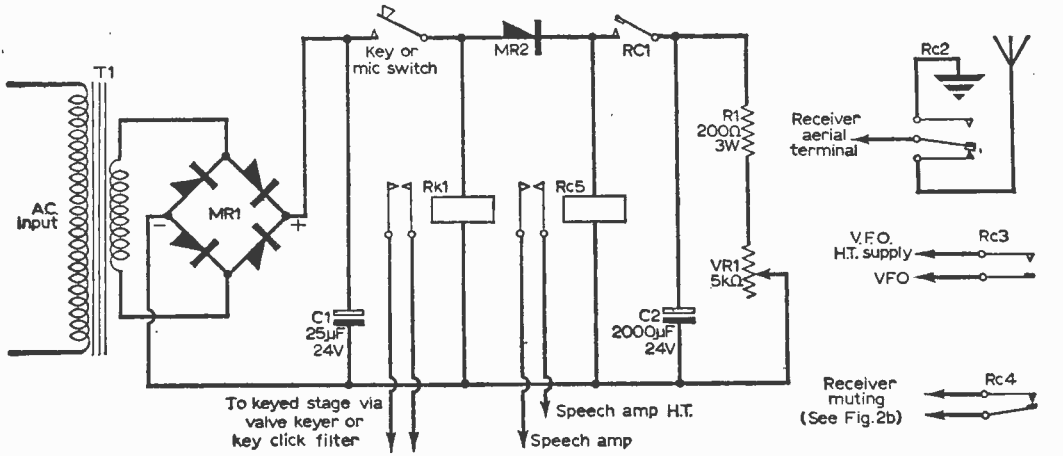


Fig. 1: The transmitter control circuit. T1 should be a general-purpose low voltage transformer. MR1 and MR2 should be 24V 0·5A components (e.g. GEC X541 B.I.P.I. or surplus 1A bridge for MR1).

If C2 were connected directly across the coil of RC/5 instead of via RC1 the relay would be slow-to-operate as well as slow-to-release, thus interfering with the operation of the system.

The use of the remaining contacts on RC/5 is self-explanatory except for the method of connecting the aerial to the receiver via contact RC2, which is unconventional as will be seen from examination of Fig. 2a. On receive the receiver aerial connection is "tapped in" to the inner conductor of the coaxial cable used to connect the transmitter output to the aerial coupler. This method eliminates the need for a heavy-duty aerial changeover relay and, provided the precautions mentioned later are taken, it works very well and has no effect on the transmitter output or the s.w.r. on the cable.

Receiver muting is achieved by connecting a variable resistor in series with the earth return from the existing r.f. gain control and shorting it out on "receive" by means of contacts RC4 as shown in Fig. 2b. This method has the advantage that it is only necessary to unsolder one wire in the receiver when installing it.

Choice of Relays

Relay RK/1 is one of the small, ex-Government high-speed relays often described as "Siemens high-speed relays". These are available from a number of sources and any model (there are five different types) should be suitable. Relay RC/5 can be any 24V relay which mounts the necessary contact assemblies and has a coil resistance of 800Ω or more. If a very high resistance relay is used (say 10,000Ω coil) the value of RV1 should be increased to 100kΩ.

Transmitter Requirements

Owing to the type of aerial connection to the receiver the p.a. should use fixed bias or a clamper valve if RK/1 is used to key an intermediate stage. Unless this provision is made there is a possibility that during reception the p.a. valve may radiate noise which will be picked up in the receiver. In the prototype installation no noise was picked up from a p.a. using a simple clamper valve, keying being in a buffer/doubler stage preceding the p.a.

Construction

The unit can be built on any suitable chassis or in a wooden box. The relays are fairly quiet in operation but it is suggested that they be mounted on a piece of sound-absorbent material to reduce noise to a minimum. The aerial sockets, SK1 and SK2 in Fig. 2a, should be mounted as close to each other as possible, and relay RC/5 should be placed so that the lead from contacts RC2 to the sockets does not exceed 1in. in length. The frames of the two sockets must also be bonded together carefully. The layout of the remaining components is not critical. The receiver aerial connection is made via a terminal, the key connection is via a jack and the remaining control leads are connected via an international octal plug and socket.

Setting-up Adjustments

The first tests should be made with the international octal plug withdrawn. The mains should be connected and the 24V output from the power supply checked. The key should then be connected and when it is pressed relays RK/1 and RC/5 should operate immediately. When the key is raised RK/1 should release immediately and RC/5 after a delay period. It should be possible to vary this delay period by adjusting VR1. The operation of contacts RK1 and RC2 to 5 should then be checked with the aid of an ohmmeter to ensure that they make and break correctly. The unit can then be connected to the transmitter and receiver, after which VR1 is adjusted to give the desired delay and VR2 (Fig. 2b) to give the desired level of sidetone from the receiver. ■

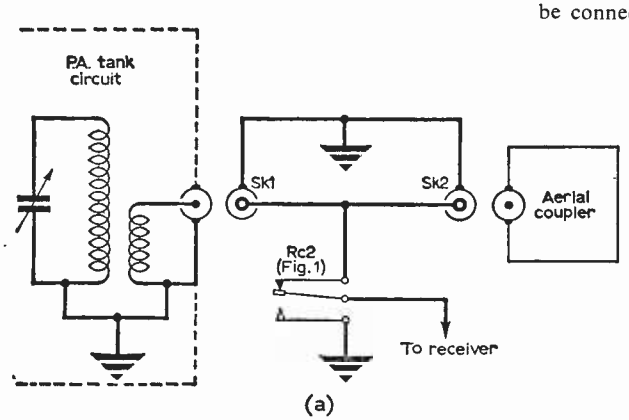
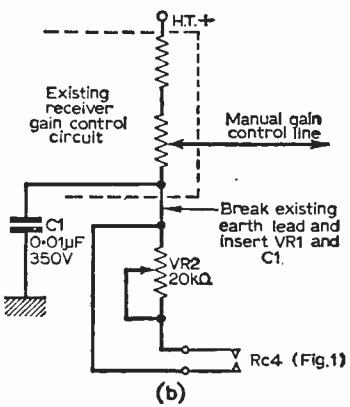
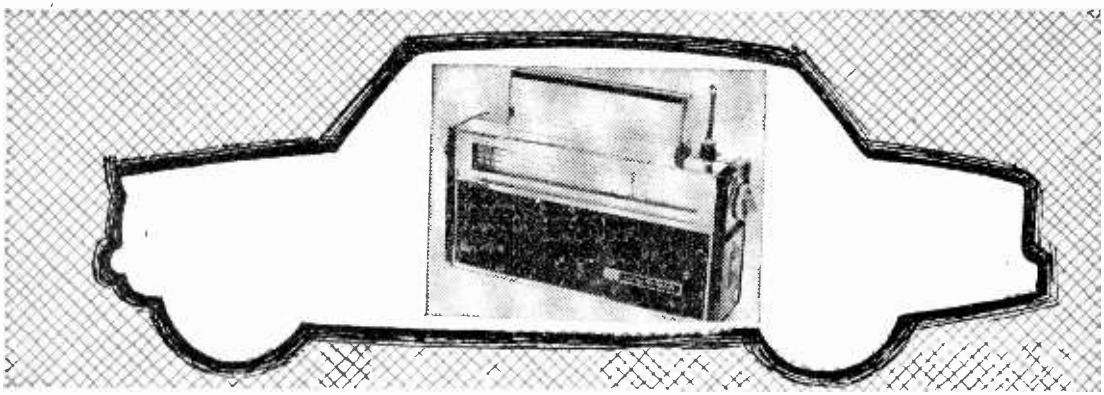


Fig. 2a (left): The receiver aerial connection.

Fig. 2b (below): The circuit arrangement for muting the receiver.





OWING to the great popularity of the transistor portable, it is understandable that many car owners have endeavoured to employ this possession in the car as well as in the home, office, on the bench and so forth. One advantage of the use of a portable in a car is that a separate car radio licence is not required. That is, provided the radio is not a fixture and does not run from the car battery.

It is generally possible to embrace the portable within the household licence covering the domestic radio and TV set. Note, however, that if the portable is used by a different family, even in the same house, then a licence may be required specifically for the portable. The Post Office will advise on these matters.

Unfortunately, the portable does not work very well in the car by itself. This is because it relies upon its internal ferrite rod aerial for picking up the signals, and signals do not pass very easily through the metal body of a car. There is some signal present inside the body of a car, of course, as some is bound to get in through the windows, and a certain amount even through the metal panels. Thus, by turning the volume control pretty well full on reasonable reception *may* be possible provided the set is orientated so that the internal ferrite rod aerial picks up as much as possible of the little signal there is available in the car.

Under this condition the set is highly sensitive. The background noise is often fairly high, this being in the form of a "hiss" when the required station is tuned in. Provided this was the major disadvantage, the set could probably be used in 40 per cent of the cases on the local stations with reasonable entertainment value.

However, the trouble really starts when the engine is turning. Since the set is now pulling really hard to catch on to as much signal as possible, it responds strongly to the smallest amount of interference. And inside a car with the engine running exists a high level of ignition interference, even when the engine is moderately suppressed.

Superimposed upon the weak signal, therefore, is the continuous, staccato crackle characteristic of ignition interference. Unless the tuned station is producing a relatively high signal field in the area, the interference generally outweighs the signal inside the car and the set has to be switched off.

POOR S/I RATIO

This arises, of course, from the poor signal/interference ratio, as shown in Fig. 1. Here we have the strong outside signal S_o giving rise to the weak inside signal S_i due to the screening of the car. Also inside the car is the strong interference signal I. The signal/interference ratio is thus S_i/I.

At S/I ratios below 100-to-1 (40dB) the interference can be heard in the background. When the ratio rises above 100-to-1 the interference is pushed well into the background and is not heard.

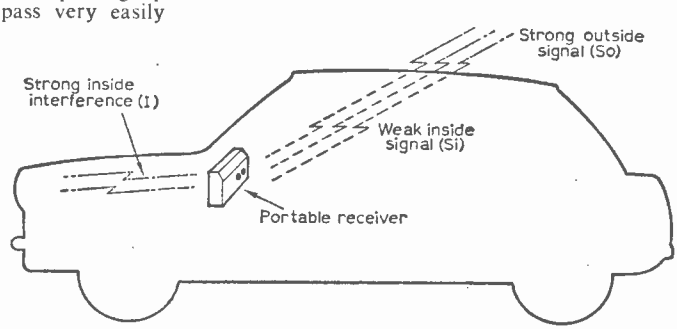
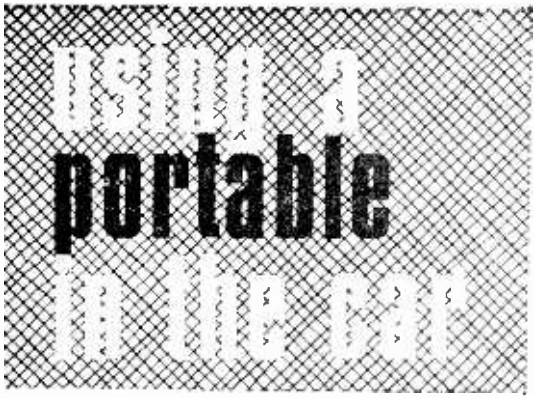


Fig. 1: Poor signal/interference ratio and signal fading are factors associated with using an ordinary transistor portable inside a car. Here the signal/interference ratio is given by S_i I.

At ratios below about 50-to-1 the interference can be so disturbing that the portable just cannot provide reception of entertainment value in the car.

The problem is considerably aggravated due to the directivity characteristic of the portable's ferrite rod aerial. Thus, if the set is carefully orientated in the car for the best signal/interference ratio with the car travelling in one direction, the ratio is worsened when the car alters course.

To retain the best signal/interference ratio while travelling in a car, therefore, it is necessary to turn the set correspondingly each time the car alters course. This is highly undesirable and not particu-



G. J. KING

larly safe so far as the lone rider is concerned.

It is possible to improve the signal/interference ratio by placing the receiver in line with one of the windows of the car. This overcomes the screening effects of the metal car body to some extent and the signal/interference ratio may then rise to $S_0/1$. On fairly strong stations this may be sufficient with correct orientation of the set to produce a ratio better than 40dB.

Unfortunately, however, the directivity problem still exists and complete fade-outs can occur when the car turns a corner. Moreover, it is not usually very convenient to have a portable perched up near one of the windows.

Transistor portable manufacturers, realising the need to do something about these problems, now almost universally fit a car aerial socket on their sets. This allows a car aerial to be employed with the set, the theory being that a signal of value S_0 (Fig. 1) is brought into the set.

MARGINAL IMPROVEMENT

The theory is good, but in practice the results are very marginal and sometimes there is virtually no improvement at all with the car aerial connected. There are two reasons for this.

One is that transistor portable manufacturers are in a very competitive field and so obviously they are not in a position to spend a great deal of extra money to introduce additional facilities for a minority market.

The other is that the extra signal picked up by a simple car-type aerial is hardly worth bothering about if one compares the efficiency of the ferrite aerial in the set with that of the car aerial. The former is many times more efficient than the latter.

Over the past two years the author has been making a special study of the subject and has reached the conclusion that one solution is to improve the overall efficiency of the simple car-type aerial so that it is at least as efficient as the set's ferrite rod aerial without being directional. Another solution is to "radiate" inside the car a signal field over the whole of the long and medium wave bands at least equal to that of the signal field outside the car. The resulting designs are the subject of British Patent App. No. 4097/64.

Set manufacturers have also now introduced the "hybrid" portable/car radio set. This is basically a transistor portable with facilities for switching out the internal ferrite rod aerial and switching in circuits for accepting the signals picked up on a car-type aerial. This type of set has considerable advantage over the ordinary portable used in the car with an aerial plugged into the car aerial socket because the aerial circuits are designed for optimum matching to a car-type aerial.

One of the reasons why an ordinary portable fails to react so well with a car-type aerial is that the matching and coupling efficiency between the car-type aerial and the aerial socket is not generally very good. Then, of course, there is the disadvantage of the ferrite rod aerial remaining in circuit as we have seen.

It is not easily possible for the owner of an ordinary portable to introduce modifications so that the ferrite rod can be switched out of circuit when the set is used in a car with a car aerial. This is because the ferrite rod aerial acts as the aerial coils as well as the "collector" of signals.

RE-RADIATION INSIDE CAR

The author has tackled the problem from the aspect of the existing type of ordinary portable whose owner may wish to take it out in the car without introducing any modifications whatever. The "radiation" principle is of interest.

In this system a wideband amplifier feeds into a push-pull wideband power amplifier, using transistors, as shown in Fig. 2. Here a wideband medium frequency amplifier is supplied with signals from a car aerial and the signals at the output of this amplifier are coupled to the power amplifier by T1. The collectors of the output transistors are then loaded to a ferrite loop radiator which is located at a convenient site inside the car.

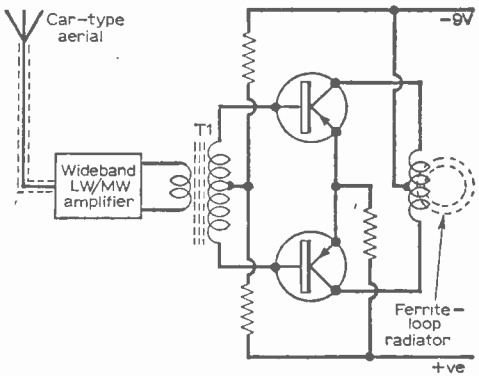


Fig. 2: A wideband amplifier driving a push-pull r.f. power amplifier can be employed to "radiate" strong signals, at least equal in strength to those outside the car, inside the car.

All the signals thus picked up by the car-type aerial are re-radiated inside the car at a strength at least equal to that outside the car as shown in Fig. 3. The signal/interference ratio then becomes $S_1=S_0/1$ and, provided ordinary ignition interference suppression precautions are taken, the ratio is generally better than 40dB on all but very distant stations.

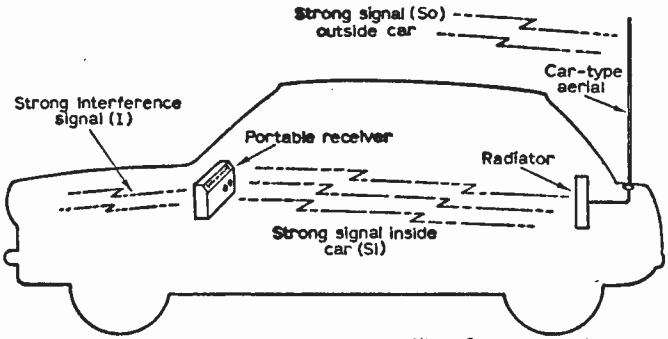


Fig. 3: The resulting improvement in the signal/interference ratio by the use of the "radiator" is shown here as S_i—S_oI. Directivity troubles are also eliminated.

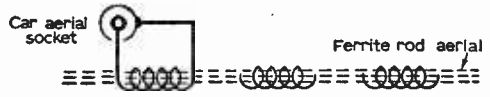


Fig. 4: Most transistor portables feature a "car aerial" socket connected to the ferrite rod aerial by means of a small coil, as this diagram shows.

EFFECT OF A.G.C.

The amount of interference produced by a portable operating in an interference environment is affected not only by the signal/interference ratio but also by the strength of the wanted station irrespective of that of the interference.

This is because the greater the strength of the signal picked up by the portable the greater will be the effect of the automatic gain control (a.g.c.) circuits inside the set and the less will be the sensitivity of the set to interfering signals anyway!

This means that the effect of interference resulting from a given signal/interference ratio will be less the greater the strength of the signal proper. As an illustration the signal/interference ratio is 10 to 1 with a wanted signal of 100μV and an interference signal of 10μV. The interference would be considerably troublesome under these conditions because 100μV of wanted signal would be barely sufficient to push the set into a.g.c.

However, with a wanted signal of 1mV and an interference signal of 100μV (still 10 to 1 ratio) the interference effect would be less, since 1mV of wanted signal would push the set well into a.g.c. action and thus diminish its sensitivity to the interference. A.G.C. action thus tends to improve the effective signal/interference ratio.

It will be appreciated, of course, that the set-up in Fig. 3 completely destroys the directional properties of the transistor portable when it is used in the car, for the portable and/or radiator is positioned for the most convenience and the optimum signal/interference ratio. Neither the set nor the radiator moves relative to each other, so this optimum will be maintained whatever station tuned.

In practice it has been discovered that the complications and expense of re-radiation can be deleted without detracting from the overall effect by utilising the aerial coupling loop provided by the set manufacturer. This loop comprises a number of turns of wire wound round the ferrite rod and terminated across the car aerial socket as shown in Fig. 4.

DIRECT BOOST

By using this we can do away with the push-pull output stage shown in Fig. 2 and employ only the wideband amplifier by connecting the output of the amplifier direct to the car aerial socket. This arrangement is shown in Fig. 5, from which it will be seen that the outside signal now present in proximity to the set's ferrite rod aerial is S_o x A, where A is the gain of the wideband amplifier.

If the amplifier has a gain of ten times then the signal focused around the set's ferrite rod is 10 x S_o, which could be considerable. The signal/interference ratio now rises approximately to S_o x A/I. In general the signal/interference ratio is improved by at least ten times relative to the interference actually inside the car.

This can be easily demonstrated by running the portable inside the car with the engine running and the amplifier switched off, noting the background noise and interference crackles, and then switching the amplifier on. When the arrangement is correctly employed both the interference and the background noise disappear completely or very significantly.

The success of the arrangement is not only due to the boost that the amplifier provides to the signal, thereby improving the signal/interference ratio directly and also by pushing the set's a.g.c.

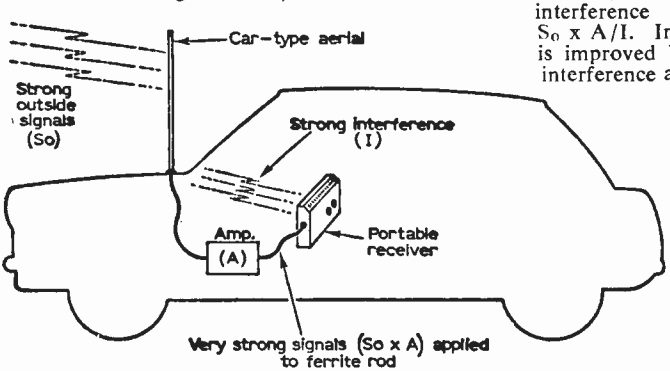


Fig. 5: By use of a wideband amplifier with gain A the signal/interference ratio is improved approximately to S_o — A/I. Thus, the ratio is improved by the numerical gain of the amplifier.

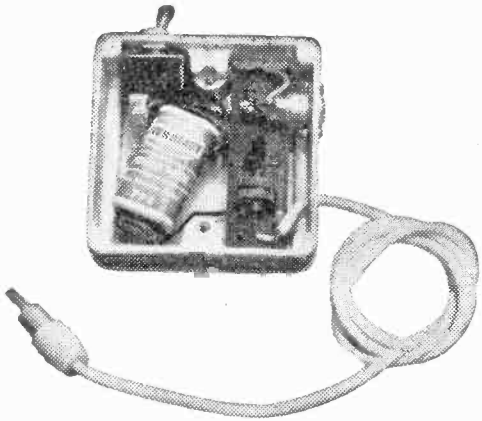


Fig. 6: Inside view of commercial wideband amplifier for use with transistor portables inside cars.

hard on, but by the improvement in matching that can be secured between the car-type aerial and the set's aerial socket. The amplifier can thus be designed to match at its input a simple type of car radio aerial and at its output the aerial circuit of the set.

In that way optimum signal transfer results from the aerial to the set which, as has already been intimated, rarely occurs when a car-type aerial is plugged straight into the set. As with the "radiation" arrangement the direct boost also kills the directivity of the ferrite rod and, in fact, the aerial/amplifier combination easily matches the efficiency of the set's ferrite rod aerial, which was the original target of the exercise.

There are one or two points that should be remembered when these arrangements are adopted. One is that the signal/interference ratio improvement relates to the interference actually inside the car and not to interference outside the car. This means that ordinary suppression of the ignition and electrical system is required as when any radio is used in a car. Another is that if the amplifier is made with too great a gain unsuppressed passing traffic can cause trouble. Excessive gain is unnecessary since it just cannot be used on a main road. The same applies to an amplifier whose response extends beyond about 2Mc/s.

EXTRA L.W. BOOST

Above that frequency local car interference starts showing up really badly, so it is as well to curtail the response of this type of amplifier at about 1·5Mc/s. It is generally desirable to give a lift of around 40dB at 1,500m, for the Light Programme is pretty poor in some parts of the country, and this now makes a handy station for late night car travellers since the recent extension of popular music.

To determine the maximum amount of gain that can be accommodated under practical conditions

Continued on page 170

Incompetence

RARELY have I seen a correspondent so completely "off the beam" as R. A. Packer (May issue). Not only is he under the impression that an 807 is an I.O. based valve (all the 807s that I have used during the past 20 years have come supplied with five-pin U.X. bases) but he is addicted to making sweeping and completely false generalisations.

He obviously never peruses the advertisement sections of P.W. because a quick glance through any recent issue would show him that many manufacturers are still making and selling a large variety of kits and completed units using the ever-popular I.O. valves.

His remarks regarding "Competent Constructors" are not only illogical but show great intolerance—a "constructor" is one who constructs, a "designer" is one who designs.

Moreover, *most* amateurs I have met do not enjoy the obviously ample financial sources of Mr. Packer; 6K8s and 6V6s at a bob a time are a far more attractive proposition to the typically financially embarrassed amateur than ECH81s and ECL86s at several shillings each.

Finally, in case Mr. Packer thinks that I am a "Radio Square", let me hasten to add that for years I have regularly (and quite competently) constructed equipment using everything from Jumbo valves to miniature deaf-aid components.

J. D. Methven.

Crawley,
Sussex.

Correspondents

I WOULD like to correspond with anyone who is interested in radio and of my own age (13).

Richard Edeson,
32 Crewe Avenue,
Ferrybridge,
Knottingley,
Yorks.

I AM a radio experimenter and keen reader of P.W. I would like to correspond with anyone who shares an interest in the same field. I am 26 years of age.

Kenneth Smith.
7 Luyan Hill,
Belmont,
Port of Spain,
Trinidad.

NEWS AND..

STEREO HEADPHONES FOR DEAF CHILDREN

The little girl on the left is wearing a hi-fi stereo headset manufactured by Standard Telephones and Cables Limited and designed to rather special requirements. The microphone on the boom feeds the child's speech through a small amplifier back to the phones at increased volume. In fact the headsets have been designed to help deaf children learn to speak by enabling them to listen to their first efforts of forming sounds and words.

These specifications required the phones to handle, without distortion, sounds exceeding the threshold of pain level for normal hearing, and for each earpiece to have individual volume control.

RECORD DECKS AT THE FAIR

The 1965 Audio Fair was recently held in London, and naturally enough, record decks and players were well represented by a number of British and overseas manufacturers.

Garrard Engineering Ltd. (Newcastle Street, Swindon) had a wide range of decks on display, from inexpensive auto-changers to high performance transcription units and including three which had not previously been seen in the UK. One of these, type A.70, incorporates a new record-changing mechanism which, with a sloping centre spindle and a pusher platform at one corner of the deck, provides a gentler disc release than the conventional arrangement.

One of the foreign manufacturers represented at the Show by their UK agents Denham and Morley Ltd. (173 Cleveland St., London, W.1) were the Scandinavian Radio and Television Company of Denmark. Two S.R.T. transcription decks and a record player were displayed, the transcription decks both featuring belt driven turnable and variable speed control.

The German firm of Telefunken were represented by their agents Welmec Corporation Ltd. (27 Chancery Lane, London, W.C.2), who had on show two Telefunken sound systems comprising record deck, amplifier and speaker units. One of these featured a belt driven deck and a 12-valve amplifier.

SOME NEW MICROPHONES ON THE MARKET

Vitavox Ltd., Westmoreland Road, London, N.W.9 have recently introduced a new dynamic microphone (Multi-Zed M100) with four alternative output impedances. Impedances of 25Ω, 200Ω, 10kΩ and 'high', are available from the mic. which incorporates a tapped ratio line transformer. Frequency response is from 50c/s to 15kc/s ±3dB.

Another new microphone is the model 4126 capacitor from STC. This professional instrument measures only two inches plus, yet it incorporates the unusual feature of an integral field-effect-transistor head amplifier. Another unusual feature is the price—around £120.

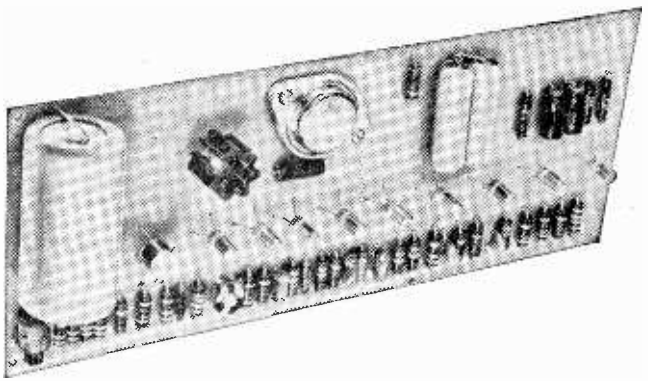
Another recent addition to the STC range of microphones is their model 4119 ribbon mic. This is a high quality tubular microphone with a narrow cardioid directional sound pick-up. Especially suitable for pop singers, the microphone costs £25.

..COMMENT

PMG TO GRANT LICENCES TO VISITING AMATEURS

Good news for overseas amateurs visiting the UK. is the recent announcement of the Postmaster-General that in future they can expect to be granted licences to operate transmitting equipment whilst in this country. This concession will apply to all foreign amateurs whose own country are prepared to grant similar facilities to UK licensed operators.

NEW TRANSISTOR AMPLIFIER KIT



This is a 12-transistor amplifier with a 20W r.m.s. music power output (40W peak) claimed by its makers. It is Sinclair Radionics' new X-20 unit which combines preamp and power amplifier on a panel measuring only 8¼in. x 3¼in. x 1in. Tone and volume controls for mono or stereo can be added to suit practically any requirements, and any type of pick-up, as well as outputs from f.m. tuners and tape preamps, can be connected to it. Frequency response of the amplifier is 20c/s to 20kc/s ±1dB, input sensitivity 1mV into 5kΩ and signal to noise ratio is better than 70dB. Power requirements are 36V d.c. at 700 mA.

In kit form the X-20 will cost you £7 19s. 6d., or built and tested the price is £9 19s. 6d. from Sinclair Radionics Ltd., Comberton, Cambridge.

POLICE TO GET POCKET TRANSCEIVERS

Police forces throughout the country will soon be using pocket-sized radio transmitter/receivers manufactured by G.E.C. (Electronics) Ltd. 400 of these sets have been ordered by the Home Office, following a period of 12 months' operational use by the Lancashire Constabulary.

G.E.C.'s transceiver is the smallest v.h.f. pocket set to be granted G.P.O. and Home Office approval and already many arrests have been attributed to its use.

STEREO TRANSMISSIONS: NEW TIMES

The experimental pilot-tone stereophonic transmissions from Wrotham, which have until recent weeks been taking place three afternoons a week on the Third Network Music Programme, are now forming part of the Music Programme transmissions from Wrotham on 91·3Mc/s on Mondays from 2.30 to 3 p.m. and on Thursdays from 11 to 11.30 a.m.

These transmissions will also be radiated by the Swingate station near Dover, on 92·4Mc/s.

BECAUSE OF THE LARGE NUMBER OF OUTSTANDING "SELL OR LOAN" REQUESTS NOW HELD BY US, WE REGRET THAT FOR THE NEXT FEW MONTHS WE WILL NOT BE ABLE TO ACCEPT ANY LETTERS FOR THIS COLUMN.

Sir, I would be grateful if any reader could sell or loan me . . .

. . . details on the power unit No. 2 for the 19 Set, and any other information on the 19 Set.—J. Watts, 103 Strathnairn St., Roath, Cardiff, S. Wales.

. . . conversion details of v.h.f. receiver R126 (a) to include a.v.c., (b) to all 6V valves.—F. S. Murphy, Old Abbey, Drogheda, Ireland.

. . . operating manual etc. on aircraft receiver RU19 model, type CW-460-480, made by Western Electric.—P. Etterley, The Ingle, Granby, Notts.

. . . details of a four transistor superhet receiver.—Shahid Mumtaz, 791-F Satellite Town, Rawalpindi, West Pakistan.

. . . an instruction manual for the R107 and any details on this receiver.—T. Nolan, 50 Albert Road, Gurnard, Isle of Wight.

. . . any information on where to buy an Ekco car radio CR/61A.—E. Amadasu, 6 Idahosa St., Benin City, Nigeria.

. . . a circuit diagram and operating manual for a No. 38 Mk. 3 set.—G. A. Mackay, 32 Ty-Wern Ave., Rhiwbina, Cardiff, Glamorgan, S. Wales.

. . . circuit and service details on the Pye domestic receiver, model 39J/H, made about 1950.—Desmond Walsh, Ballylynch, Carrick-on-Suir, Co. Tipperary, Ireland.

. . . a manual or service gen. on ex-army receiver R107. The h.t. is weak and will not oscillate.—W. Brewer, 174 Tynemouth Road, Heaton, Newcastle upon Tyne 6.

. . . any information, layout, circuit diagrams etc., on ex-Admiralty receiver, B28.—W. Hillman, 42 Gertrude Street, Abercynon, Mountain Ash, Glamorgan, S. Wales.

. . . surplus valves 5V4 and 6C5 cheaply. I am 12 years old but am a very keen radio fan.—E. King, 14 Windmill Road, Cookham Rise, Berkshire.

. . . the circuit diagram and conversion details for reception set R220 Mk. 2.—C. R. Pearson, 3 North View Avenue, Bideford, Devon.

. . . circuit diagram and manual for the Eddystone S640. Also any modifications for s.s.b. reception.—R. Garvey, 181 Arle Road, Cheltenham, Glos.

. . . the circuit diagram of a Philips AG8106 tape recorder.—C. Jones, Tenby House, High Street, Newchapel, Stoke-on-Trent.

. . . circuit diagram and service details of walkie talkie set 38 Mk. 3, manufactured by Minimitter Ltd.—H. F. Hynd, NASA Switching Centre, Room 1, Annexe, Electra House, Victoria Embankment, London, W.C.2.

. . . any information and circuit diagram on the No. 19 Mk. 2 "B" set.—M. Franklin, 17 Hitherwood Drive, London, S.E.19.

. . . service sheet on dual standard TV set (17in.) made by British Radio Corp. The only mark on the chassis is PA77.—P. Gormley, 2 Francis Street, Londonderry, N. Ireland.

. . . the handbook of the Armstrong chassis No. F.C.48.—T. Renfrew, 6 Wellington Terrace, Birkenhead, Cheshire.

A Stabilised Nine Volts

A compact unit to power transistor receivers from the mains.

BY P. G. THOMSON

THIS power unit was originally constructed to form part of a mains-battery transistor portable radio. In the light of experience gained from building and operating similar power supplies, it was felt that a stabilised type with ample power rating was to be preferred. Further in designing this power unit particular attention was paid to economy, compactness and hum level.

Circuit Design

To give an ample current rating about 350mA is needed. The output voltage varies from 9·3V without load, to 8·7V with a load of 350mA (See Fig. 1.). Different output voltages may be attained for individual needs, by using a different zener diode.

The operation of the circuit is as follows. The secondary voltage from mains transformer T1, is rectified by a full wave rectifier consisting of D1, D2, D3 and D4, capacitor C1 being used to smooth the output from these rectifiers. Resistor R1 allows current to flow through the zener diode D5, so setting the base reference voltage for transistor Tr1. The transistor de-amplifies the large voltage variations on its collector side, so that they appear as only very small variations on its emitter side. Decoupling and extra smoothing are achieved by capacitor C2. Fuses F1 and F2 are included to protect the power unit and any equipment it may be connected to.

Other output voltages and current ratings can be obtained using the same circuit, with modified component values. The main design considerations for this circuit are:—

(1) The mains transformer:—

$$\text{Current Rating} > (I_M + I_Z)$$

$$\text{Voltage Rating} = \frac{V_C}{\sqrt{2}}$$

Where:—

I_M = Maximum current taken by load.

I_Z = Current taken by diode to establish zener voltage.

V_C = Maximum voltage at collector of Tr1.

V_Z = Zener voltage.

V_C is given by:—

$V_C = \sqrt{2} \times$ Transformer secondary voltage.

The higher the secondary voltage (i.e. the greater the voltage allowed across Tr1) and current rating of the transformer, the better the regulation.

(2) The current ratings for each of the full wave rectifier diodes should be:—

$$\tfrac{1}{2}(I_M + I_Z)$$

The voltage ratings for each of the rectifier diodes will depend upon the transformer secondary voltage, which will in turn depend upon the output voltage, and the voltage it is decided to allow across the transistor. The voltage rating for each of the diodes will be:—

$$\tfrac{1}{4}(V_C)$$

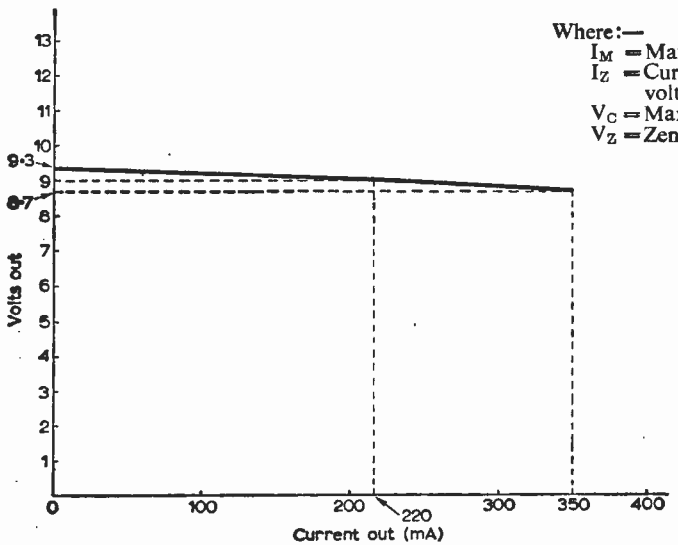


Fig. 1: This graph illustrates the reduction of output voltage from the unit, with increased current load.

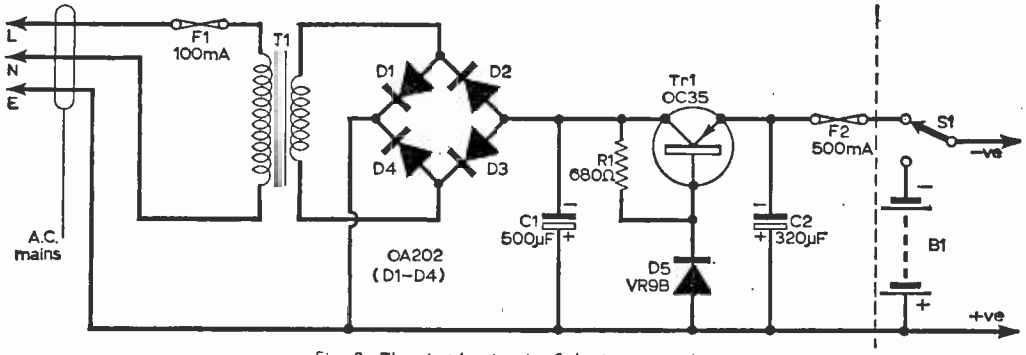


Fig. 2: The simple circuit of the power pack.

(3) The value of R is given by:—

$$R = \frac{V'_C - V_Z}{I_Z}$$

Since the voltage at the collector will vary with the load, it is advisable to use the lowest value of collector voltage (V'_C), or else it is possible that the zener diode may operate in the wrong portion of its characteristic. It should also be ascertained that the maximum power rating of the diode is not exceeded. The power dissipated in the diode is given by the expression:—

$$P_Z = \frac{V_Z \times (V_C - V_Z)}{R}.$$

(4) The dissipation in Tr1 varies with the load current, however it may be taken to be:—

$$PTr1 = (V_C - V_Z) \times I_M$$

As well as not exceeding the maximum power rating of the transistor, the maximum collector emitter voltage rating should not be exceeded either. For the power unit built by the author, the maximum power dissipated in Tr1 was about 4 watts, as the maximum permissible dissipation was 11 watts only a small heat sink was required, which enabled the size of the unit to be reduced. Indeed it is possibly better to employ a higher rating transistor working at far less than its maximum dissipation, simply for the economy in space.

COMPONENTS LIST

Tr1	OC35 or any other power transistor of 10W or higher rating
D1, 2, 3, 4	OA202 miniature silicon rectifiers or similar
D5	VR9B 9V 2·25W zener diode 5%, or similar 9V zener diode
T1	Small bell transformer, or similar, with 12V 1A output
R1	680 Ω ¼W carbon
C1	500μF miniature electrolytic 25V
C2	320μF miniature electrolytic 10V
F1	100mA fuse
F2	500mA fuse
B1	Optional—see text
S1	Optional—single-pole, 2-way switch

Two fuseholders. 3-pin mains input socket (T.S.L.) and plug to match. Aluminium for chassis. Piece of Veroboard for sub-chassis.

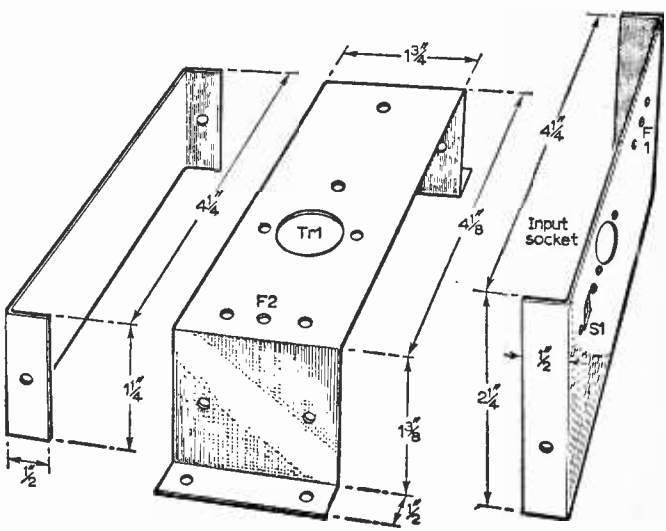


Fig. 3: An exploded view of the aluminium chassis. The right-hand panel extends above the top of the chassis to carry the mains socket, switch S1 and the fuseholder for F1.

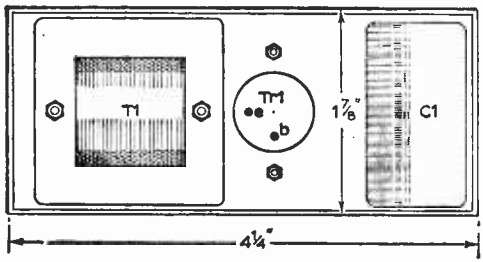


Fig. 4a: A view from underneath the chassis.

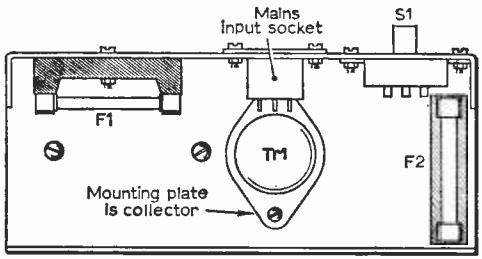


Fig. 4b: Looking down from above the chassis, F1, S1 and the input socket are shown to be fitted to the front panel.

Construction

The aluminium chassis is made in three parts. The chassis dimensions and the position of the fixing holes are shown in Fig. 3. The exact dimensions and relative positions of the holes are not shown since they will depend upon the particular components used by the constructor.

The position of the larger components is shown in Fig. 4. The rest of the components are assembled together on a sub-chassis made of *Veroboard* (this consists of a perforated board of insulating material with strips of copper laid across it, Fig. 5). However these components could equally well have been assembled together on a piece of perspex, or similar material and connected by means of conventional wiring.

The procedure when wiring is as follows. First mount the principal components (those shown in Fig. 4) to the chassis and connect them up. Then wire the sub-chassis and when complete, connect to the components already mounted on the main chassis. The sub-chassis is held in position by means of the wire connections made from it to the chassis.

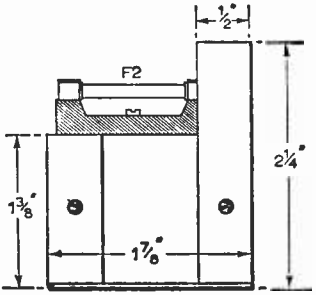


Fig. 4c: An end-on view showing how the two vertical panels wrap round the end of the centre piece.

The would-be constructor is advised to look through radio magazines to find the most reasonably priced components.

The completed unit is capable of powering most types of transistor portable radios and record players. It will be appreciated that the output ratings and construction configuration of the unit may be easily modified to suit individual requirements. ■

Operation

It will be seen from the theoretical circuit (Fig. 2) that switch S1 and a battery B1 have been included in the circuit. As previously mentioned the unit was designed to be incorporated in a transistor radio, B1 and S1 facilitate mains-battery operation, whether or not they are included in the constructor's version will depend upon the function the power supply is put to.

The hum level of this power supply is exceptionally low. The prototype was used to feed a one-watt transistor amplifier driving an 8 × 5in. loudspeaker, at a load of 220mA (12mA quiescent into the amplifier, the remainder into a resistive load). Hum was only discernable 6in. away from the loudspeaker, the hum level increased at 350mA but was still barely audible. At higher loads the hum level increased appreciably.

It is important to realise that since the transistor is bolted to the aluminium chassis, the whole of the chassis is at collector potential and thus must *not* be earthed.

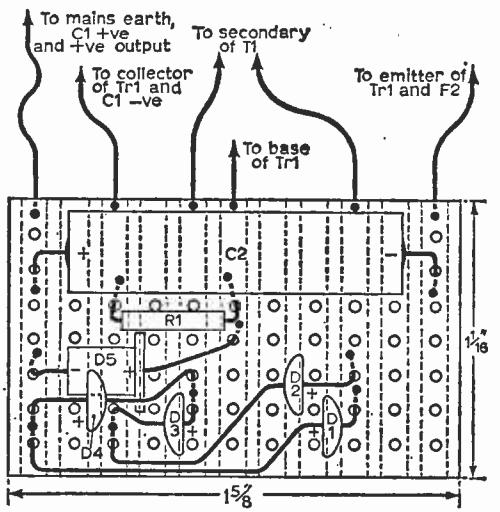


Fig. 5: The component layout and wiring details of the Veroboard-based sub-chassis.

Conclusion

The total cost to the author was about £2, which is less than other similar units, and has been achieved without sacrificing voltage regulation and smoothing.

SURPLUS HANDBOOKS

19 set Instruction Handbook 3/6 each, P.P. 6d.
1155 Instruction Handbook 3/6 each, P.P. 6d.
H.R.O. Instruction Handbook 3/6 each, P.P. 6d.
Frequency Meter, BC 221 Instruction Handbook 3/6 each, P.P. 6d.
46 Trans/Receiver Details and Notes 3/6 each, P.P. 6d.
38 set A.F.V. Inst. Handbook 3/6 each, P.P. 6d.
R.F. unit 24 circuit diagram and details 1/6 each, P.P. 3d.
R.F. unit 25 circuit diagram and details 1/6 each, P.P. 3d.
R.F. unit 26 circuit diagram and details 1/6 each, P.P. 3d.
Receiver R1355 circuit diagram and details 1/6 each, P.P. 3d.
Receiver R1224A circuit diagram and details 1/6 each. P.P. 3d.
R.1116/A circuit diagram and details 1/9 each, P.P. 3d.

MORSE KEYS

Morse key assembly. Key with base cover and terminals. Complete with lead. 6/11, P. & P. 2/-. 2 Morse Keys for 12/6 post free.

19 TRANS. REC. MAINS POWER PACK

Operate your 19 set receiver straight off the mains. Ready built power unit complete with modification and fitting instructions. Price 59/6, P. & P. 3/6. Please state model Mk.II or Mk.III.

TANK AERIALS

Fully interlocking copper rods. One foot sections. Ideal for car or scooter aerials. Will make excellent dipoles. Six sections complete with canvas carrying case 3/6, P. & P. 1/6. Additional sections 6d. each. Please send sufficient postage.

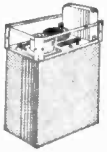
PAXOLIN SHEETS

Strong, high quality paxolin sheets. Size 10½ x 8¼ x 1/10in., 3 for 5/-. P. & P. 1/-. 6 for 10/-. Post free.

DOUBLE THROAT MIKES

Double throat mikes. Can be adapted for use with musical instruments. 5/11, P. & P. 9d.

WIRELESS SET No. 38 AFV



A lightweight walkie talkie with transmitting range 3 to 5 miles and frequency coverage 7.4 to 9 m/cs. Operates from 12 and 120 v. external dry batteries. Large, clearly numbered tuning control, with tuning lock. In good condition. Price £4 per pair, post free.

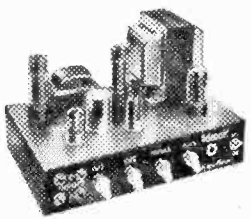
DYNAMOTOR

Run all your mains A.C./D.C. equipment from your car battery. 6 v. input gives 250 v. output, or 12 v. input gives 500 v. output at 30 watts. Very low battery drain. Size only 5¼in. x 3¼in. A must for the caravanner. ONLY 25/-. P. & P. 3/6.

Portable Mains Soldering Iron. 30 watt version. Features removable handle that covers tip and barrel. Complete with lead and plug. Only 10/6, P. & P. 1/6.

TWO-WAY RADIOS

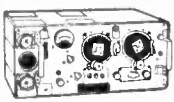
A compact V.H.F. Trans./rec. that can be held in the hand. Size approx. 15 x 3 x 3in. Range up to three miles under favourable conditions. Utilises three miniature valves and self-contained standard batteries. Easy to operate and economical to run. Ideal for authorised fixed or mobile operation. British manufacture. Limited number left. Price 12 gns. per pair, post free.



THE GOLDENAIR "THIRTY" HI-FI AMPLIFIER

A high quality 30-watt amplifier developed for use in large halls and clubs, etc. Ideal for bass, lead or rhythm guitars, schools, dance halls, theatres and public address. Suitable for any type of mike or pick-up. Valve line-up: two EF86; one ECC83; one GZ34; two KL34. Four separate inputs are provided with two volume controls. Bass and Treble controls are incorporated. Amplifier operates on standard 50 c/s mains. 3 ohm and 15 ohm speakers may be used. Perforated cover with carrying handles can be provided if required, price now 25/-. Customers are invited to see and hear this amplifier at our shop premises in Lambert's Arcade. Send S.A.E. for illustrated leaflet. Cash price 16 gns. Carriage 15/-, to be sent with order.

TYPE 19 SHORT WAVE RECEIVING SET



Works straight off the mains. An excellent short wave receiver, requires only phones for immediate operation. Price £5.19.6. P. & P. 10/-.

During an evening's testing of this excellent receiver, we obtained clear reception from scores of stations, many of them thousands of miles distant, including ship stations, Government transmission, maritime broadcasts and also the short wave radio Luxembourg broadcasts.

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New shop open at
97 WALMGATE, YORK
Open weekdays 9 a.m.–5.30 p.m.
Sats. 9 a.m.–6 p.m.
Half-day Wednesday.
Callers welcome.

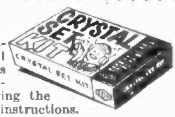
High Impedance Personal Listening Earpiece. Suitable for all types of crystal sets and transistor sets. Complete with lead and plug. Price 4/11, P. & P. 6d.

Valve Sale. 2/6 each, P. & P. 9d. 2 for 5/-, post free. 6V6, 807, 6H6, 6K7, 6B8G, EF50, ILA.

Monster Parcel No. 3. Six crocodile clips. One portable mains soldering iron, 6 phono plugs, 6 coils of multi cored solder 6 valves, 3 T.V. aerial plugs. 12 British octal valve holders. 12 wafers. 3 car aerial plugs, 3 sheets of 10 x 6in. paxolin, 6ft. copper rod aerial. 3 sturdily made panel mounting fuse holders. 24 new resistors. 6 assorted pots. 1 operators unit, a very useful piece of equipment. All this for only 25/-, P. & P. 3/6.

M.A.T. Transistors. M.A.T. 100, 7/9; M.A.T. 120, 7/9; M.A.T. 121, 8/6; Ferrite slab aerials suitable for Transistor sets, 3/-, P. & P. 6d.

CRYSTAL SET



A wonderful educational kit for all children. Provides hours of amusement while following the easy step by step instructions. It is powered entirely by wireless waves, eliminating the expense of batteries. No soldering required. Receives all main stations. Includes super sensitive personal listening device. Price now 25/-. P. & P. 2/6.

SENSITIVE MULTIMETER

20,000 ohms per volt 1% resistance used throughout. Single control system for all ranges. Compact and lightweight. Highly accurate. P. & P. 3/-. **£5.10.0**

VEHICLE RADIO TELEPHONE

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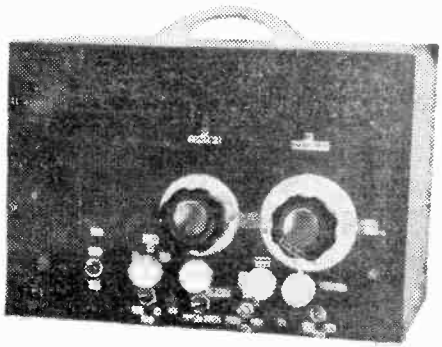
AF/RF SIGNAL GENERATOR

C. MARSHALL

CONTINUED FROM PAGE 73 OF THE MAY ISSUE

THE power pack described here is suitable for powering both audio and r.f. units of the generator. A chassis similar to that for the audio generator described last month is used. First mark the positions for the fixing holes of the transformer, capacitors, tag strip, switch, warning light and valveholder on the chassis. A suggested layout of the major components is given in Fig. 6. Securely bolt all components to the chassis, placing a slip-proof washer under each nut. The theoretical circuit is given in Fig. 5 and no difficulty should be experienced in wiring up the power supply.

When all wiring is complete it should be carefully checked for incorrect connections and short-circuits. If all appears to be correct, the unit should be switched on and the h.t. and l.t. outputs tested with a multimeter. The open circuit h.t. voltages should be about 300V and the l.t. should be 6·3V. If all appears in working order the unit may be put safely to one side until the audio oscillator is ready for testing.



The RF Oscillator Circuit

The oscillator is basically a cathode-coupled Hartley oscillator. The four switched coils are tuned by a 500pF tuning capacitor and a range of about 175kc/s—22Mc/s is obtained. A fifth range covering the higher frequencies was tried but great difficulty was experienced in getting the valve (an ECC81) to oscillate at these frequencies. If such a band is needed, other valves (such as ECC84 or ECC85) should be tried.

The r.f. signal may also be modulated by a fixed tone of about 440c/s obtained from a simple transformer-coupled oscillator stage (V4a). Modulation is switched off by shorting the grid of the modulator oscillator to chassis.

The output is taken from the anode of the r.f. oscillator V4b to a cathode-follower output stage. This is found to be quite adequate for normal use as r.f. and i.f. stages are usually of high gain and followed by the audio section. The output coupling capacitor C24 should be of 1,000V working for absolute safety.

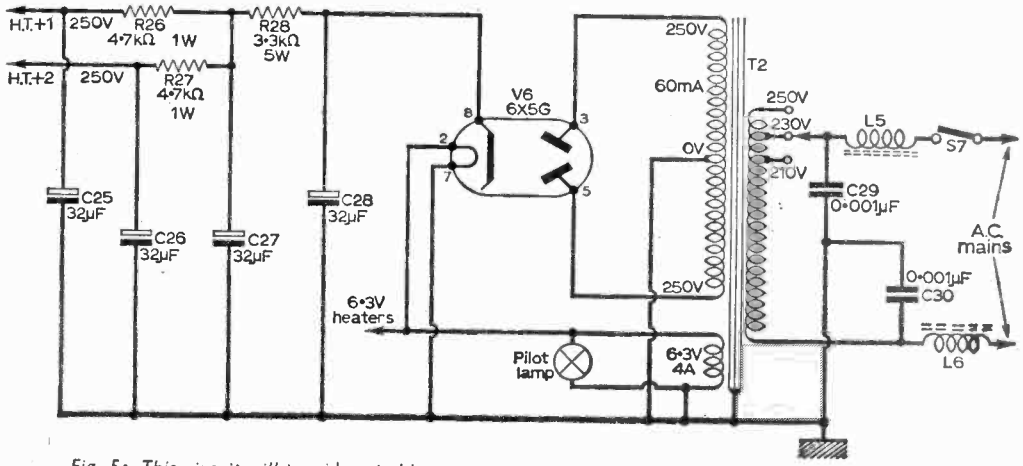


Fig. 5: This circuit will provide suitable power outputs for both the audio and r.f. oscillator units.

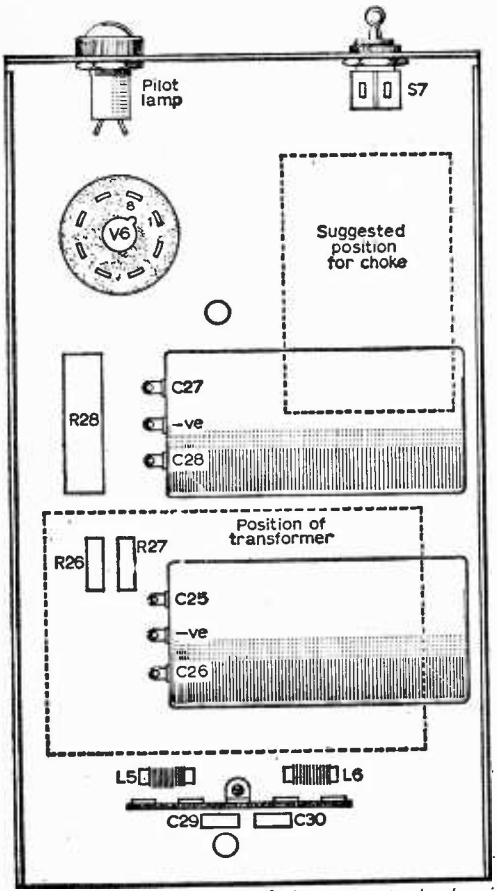


Fig. 6: Component layout of the power pack chassis.

POWER SUPPLY COMPONENTS LIST

Resistors:

R26	4·7kΩ ½W	R28	3·3kΩ 5W
R27	4·7kΩ ½W		

Capacitors:

C25	32μF electrolytic 350V
C26	32μF electrolytic 350V
C27	32μF electrolytic 350V
C28	32μF electrolytic 350V
C29	0·001μF paper
C30	0·001μF paper

Miscellaneous:

V6	6X5
S7	On/off toggle switch
T2	Mains transformer. Primaries: 210/230/250V. Secondaries: 250/0/250V, 60mA; 6·3V, 4A
L5, 6	R.F. chokes

6·3V indicator lamp and lampholder. One International Octal valveholder.

Construction

This unit is built in a similar manner to the other two units. In order that better connections can be made to the chassis at high frequencies it would be better if a tinplate chassis was available as wires can then be soldered directly to the chassis.

The switch and valve holes should be cut and the transformer fixing holes and the grommet holes drilled. Holes should also be drilled to take the coil formers and tuning capacitor brackets.

The wiring should now be completed except for the coils. All wiring must be short and direct and either ceramic or mica capacitors should be used at r.f. The leads to the range switch should be wired. The coil for range 1 (L1) can now be wound.

Take the 2 x $\frac{5}{16}$in. former and put a small dab of plastic cement about $\frac{3}{8}$in. from the base. Fasten one end of the 30s.w.g. enamelled copper wire in the cement, leaving about 6in. free. Pile-wind 350 turns spaced to $\frac{1}{4}$in. on the former, then twist a 6in. loop in the wire to form the centre tap. Wind another 350 turns in the same direction in the $\frac{1}{4}$in. above the centre tap. Fasten the end temporarily with a small knot.

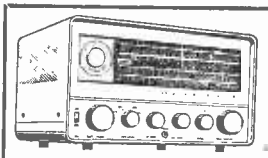
Connect the coil to the circuit. Test the oscillator by applying the output to a receiver tuned to the long waves via a 10pF capacitor. The range of the coil should be adjusted by means of a ferrite slug until it covers about 600—175kc/s. In order to match up with Band II the coil should be adjusted to oscillate at 600kc/s (500m) with the vanes of the capacitor about 5° enmeshed.

The coil for range 2 (L2) is wound in a similar manner, there being two pile windings of 90 turns each over $\frac{3}{4}$in. with a centre tap between them. This coil should be connected into circuit and the coverage adjusted by means of the ferrite slug so that it resonates at 600kc/s with the vanes about 5° from fully enmeshed. The highest frequency can be found with a s.w. receiver and will be about 2·5Mc/s (120m).

Range 3 coil (L3) has a total of 80 turns with a tape in the centre, but this coil is wound in a single layer. When connected its minimum frequency should be adjusted to about 2·5Mc/s with the condenser 5° from enmeshed. If the maximum frequency of range 2 is nowhere near 2·5Mc/s then range 3 should be adjusted to overlap at a convenient frequency.

Range 4 (L4) coil has a total of 14 turns, centre tapped. In the author's prototype oscillation was not obtained over the whole band but only over the higher frequency half (the 90° with lower capacity in the tuning capacitor). The minimum oscillation frequency should be adjusted to give a suitable overlap with range 3. As the frequency on this band is very dependent on stray capacities no two units will be alike and constructors should be prepared to experiment with this coil.

The number of turns on the coils given above is only a guide. If the correct range cannot be obtained with the slug the number of turns should be adjusted. If adjustment seems to need the ferrite slug to be driven further in increase the number of turns; if it needs to come further out decrease them. When adjusting the coils remember



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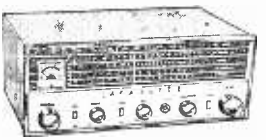

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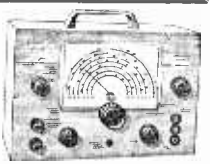

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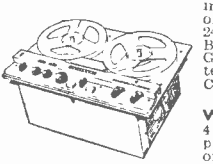

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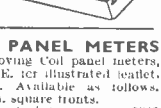

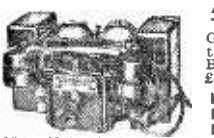

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150mA	..	22/6	300V. DC	..	22/6
200mA	..	22/6	500V. DC	..	22/6
300mA	..	22/6	750V. DC	..	22/6
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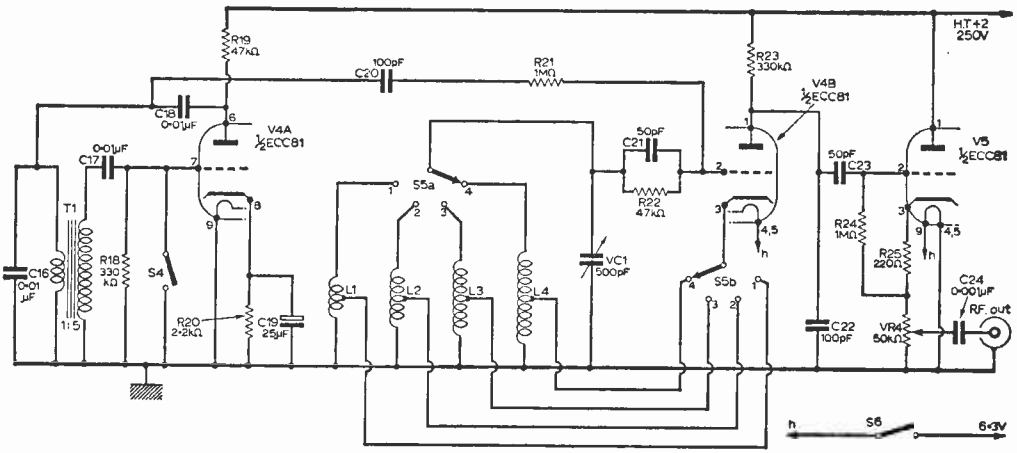


Fig. 7: The r.f. oscillator circuit.

R.F. OSCILLATOR COMPONENTS LIST

Resistors:

R18	330kΩ	R22	47kΩ
R19	47kΩ	R23	330kΩ
R20	2·2kΩ	R24	1MΩ
R21	1MΩ	R25	220Ω

All 10% ½W carbon
VR4 50kΩ potentiometer

Capacitors:

C16 0·01μF paper
C17 0·01μF paper
C18 0·01μF paper
C19 25μF electrolytic 25V
C20 100pF mica
C21 50pF mica
C22 100pF mica
C23 50pF mica
C24 0·001μF mica
VC1 500pF variable

Miscellaneous:

V4 ECC81 V5 ½ECC81
S4 On/off toggle switch
S5 2-pole, 4-way rotary switch
S6 On/off toggle switch
T1 Valve inter-stage transformer; 5 : 1 ratio
L1, 2, 3, 4 See text
Aluminium for chassis. Coaxial output socket.
Two B9A noval valveholders.

to keep the centre tap exactly in the centre of the coil. When all the coils are adjusted to the constructor's satisfaction the winding should be fixed in position with polystyrene cement.

The modulating frequency is altered by changing C16. It should be about 440c/s (a middle C on the piano) for standard work, but this is not critical.

When the unit is completed satisfactorily it may be fixed in the case and calibrated.

Calibrating the r.f.

There are many ways of calibrating an r.f. oscillator, some more accurate and complicated than others. Such methods include the use of crystal markers or very accurate oscillators. The same restrictions were enforced in the calibration of this oscillator as with the audio and the following method was evolved. The only equipment necessary is a reasonably accurately calibrated receiver covering the required range. The R1155 receiver will cover up to 18Mc/s and many "domestic" sets will cover 18-25Mc/s.

Switch the signal generator and receiver on and leave them to warm up for at least 15 minutes. Tune the receiver to 200kc/s. This is the standard for the whole calibration and must be done accurately. Turn the generator to Band I and tune to the most powerful heterodyne. This corresponds to 200kc/s and a note should be made of the dial reading (the dial is fitted with a temporary scale marked 0—180°). Tune the receiver to about 400kc/s to find the second harmonic of 200kc/s. Tune the oscillator to 400kc/s and note this reading. Return the oscillator to 200kc/s.

Repeat this procedure over the whole of Band I and over as much of Band II as possible (until the harmonics are too weak. This will be at about 1·4Mc/s). You will then have a series of 200kc/s marker points.

In order to draw an accurate graph of Band I more points are needed. Tune the receiver to 1Mc/s. When the oscillator is tuned to about midway between 400 and 600kc/s the second harmonic of 500kc/s will be received. Repeat this at 600kc/s on the receiver to get the 300kc/s mark. Fill in as many of these odd 100kc/s marks as is possible by using the known frequencies (i.e. third harmonic of 300kc/s gives 900kc/s).

The oscillator should be tuned to 500kc/s and 500kc/s marks made as far up the band as possible. If extra points are needed for range 2 250kc/s marks can be made; 1Mc/s marks are adequate for range 4.

When sufficient checkpoints have been made four graphs can be accurately drawn showing the

relationship between dial reading and frequency for each band. A permanent dial can then be made from the graphs and firmly fixed to the knob. To check that the dial is in the correct position it is only necessary to check its position at 200kc/s.

Although this method is certainly not the most accurate it is sufficiently so for most amateur purposes and it is quite simple.

With all three chassis included the constructor now possesses a signal generator of reasonably high quality and accuracy, suitable for any purpose for which the average amateur may need it, at a price such that they cannot afford to be without it. The author built his generator from scratch for under £4 and it has served him well for some years now.

The cabinet constructed by the author was made from plywood which was lined completely with tinfoil to provide screening. Alternatively a cabinet may be constructed from 20s.w.g. aluminium sheet. ■

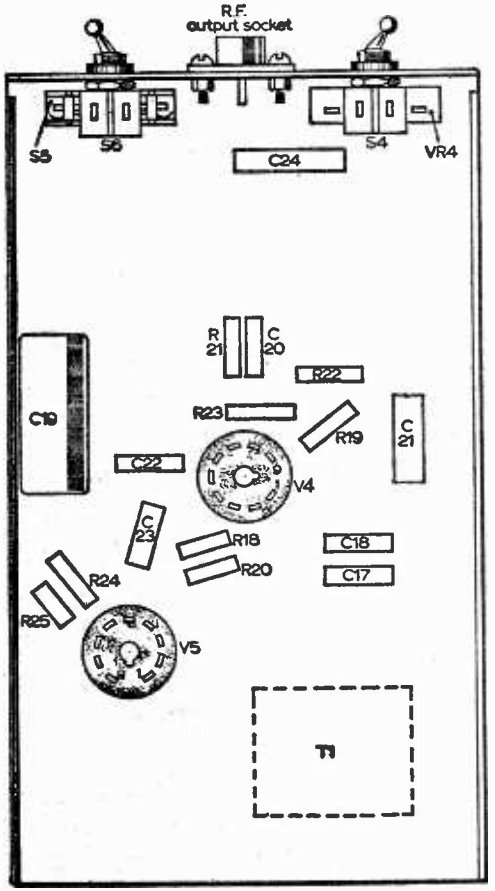


Fig. 8: An underchassis view of the r.f. unit. Dimensions for this chassis are 7in. x 4in. with a 2½in. front panel and ½in. flanges.

ON THE SHORT WAVES

—continued from page 141

6W8BF on c.w., together with hordes of Europeans and U's.

S. W. L. Jolley (Staffs) uses a 66ft. longwire and a 19 Set sans a.t.u. and preselector and found this lot between 2330-0030, all on c.w.—HA5KFR, IT1AGA, OE6MZG, SP8AQK, UA3AN, UA1KCU, VE1OU, W1HGT, WA1UKS, W2CA, WB2DU, W2CJC, W3DVO, W3FKB and 5K4ALE. If anyone knows which planet the last one comes from we would be pleased to know. Another interesting one was G3AM/TR, using only 500mW and working ON5PA.

28Mc/s

Ten metres almost, but not quite, deserted. **D. H. Foster** (Essex) using an HRO with "very much bent' 132ft. longwire found CR4AE on c.w. at 1830 in QSO with CO2OM. Also OD5BU and LU4DM on phone. **L. Morrison** (Suffolk) found ZE8IH and ZE5JS on phone around 1130. **Wilfred Smith** (Staffs) reports several G's active and logged ZE1JE and 9J2DT. At G3JDG a 28Mc/s ground plane has sneaked skywards and great things are expected.

General Snippets

P. Collins informs us that FH8CD is active on Comoros Island on 14 and 21Mc/s s.s.b., Malta will probably be changing to 9H1 (at the moment it's ZB1), and PY7BAL/O is on 7012kc/s, and is situated on Fernando de Noronha.

A new one for Chatham Island is ZL3AWJ/3, and the pre-fix for Portuguese Guinea will probably now change to CR3.

ISWL/G11570 says that three W's will operate CEØXA on San Felix and San Ambrosi Islands for about one week from around April 20th. Anyone hear them? Alan Dailey says the MP4MAH operates from a caravan in Oman. ZB1JM is on Gozo Island, north-west of Malta. VS9OC is on Masirah Island and is active on 20 and 40 c.w. AC5H on 14035kc/s and XW8AX and XW8AZ are both active on 20 s.s.b.

GM3LXI left for St. Helena on the 1st April, and another call already on the island will be ZD7IP. G3JDG is active on 28Mc/s Sunday mornings (real DX).

Contest enthusiasts have a quiet time for May. On the 3rd, 144Mc/s portable contest; 8-9th, USSR DX c.w.; 15-16th, Second 70Mc/s Open Contest; 29-30th, first 432Mc/s, contest. June 4-7th, CHC/FHC/HTH QSO party. Finally, June 12-13th is National Field Day.

In future please submit your logs in alphabetical order of prefix.

CATALOGUE RECEIVED

We have recently received the latest illustrated catalogue of Messrs. Henry's Radio Ltd. (303 Edgware Road, London, W.2). This latest edition which has been completely brought up to date to include many new lines, contains 90 pages detailing hundreds of components and may be obtained from Henry's for 2s. 6d. post paid.

PREPARING FOR THE R.A.E

BRIAN ROBINSON.

8. AMPLIFIERS, FREQUENCY CHANGERS AND DETECTORS

8.1 The Triode as an Amplifier

IT will be remembered from Article 6 that the triode valve can be used as an *amplifier* and also that the *amplification factor*, μ, was given by the ratio of the change in Va to that of Vg when both were causing the same change in Ia. The three types of amplification generally met are Class A, Class B and Class C amplification.

Class A—the valve is operated on the straight line portion of the Ia/Vg curve.

Class B—the valve is operated on the curved portion of the Ia/Vg curve.

Class C—the valve is biased beyond the cut-off value.

8.2 Class A Amplification

Assume that an alternating voltage is applied to the grid of a triode and that this voltage has a peak value of 2V. If the negative bias applied to the grid is −3V then it can be seen that the actual negative voltage applied to the grid can vary between −5 and −1V (i.e. −3−2=−5V and −3+2=−1V).

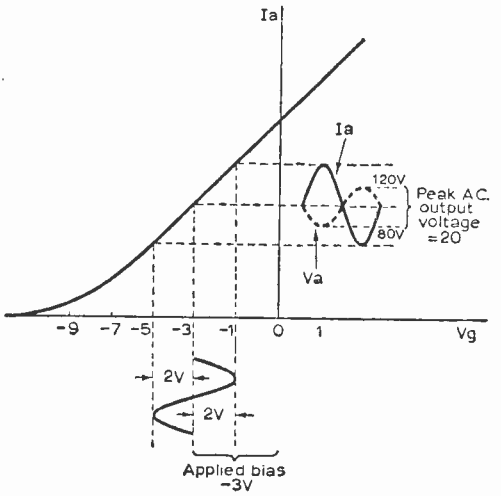


Fig. 67: Typical conditions for Class A amplification.

It can be seen from Fig. 67 that the alternating voltage applied to the grid causes an alternating current to appear in the anode circuit. The alternation of Ia does, of course, cause an alternating component to occur in Va, this is shown dotted in Fig. 67. The peak a.c. output voltage is 20V as shown, and therefore the change in grid voltage of 2V has caused a change in anode voltage of 20V. (For the *same* change in Ia.) The amplification factor is 20/2 or 10.

For Class A amplification the valve must be operated on the straight line portion of the Ia/Vg curve otherwise distortion of the signal will occur. The effect on the output caused by operating the valve used in Fig. 67 with an applied bias of −6V is shown in Fig. 68. It can be seen that distortion of the output signal occurs. This type of distortion is called *harmonic distortion* and is most undesirable in a Class A amplifier.

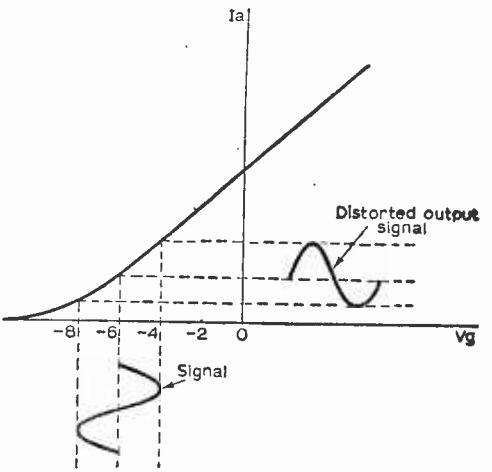


Fig. 68: Class A distortion due to over-biasing.

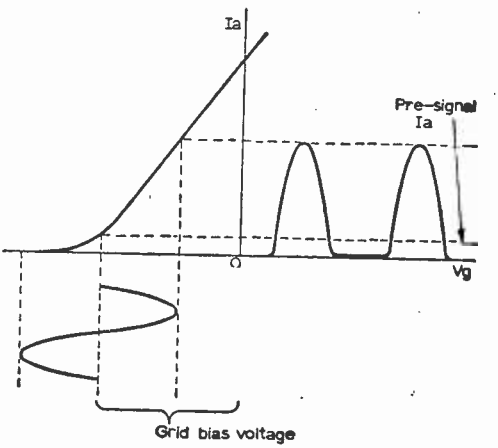


Fig. 69: Typical conditions for Class B amplification.

8.3 Class B Amplification

In Class B amplification the valve is biased near to its cut-off value. In Fig. 69 a graph showing typical operating conditions is given. The output signal is virtually only a half cycle. This output is therefore distorted as no anode current flows on almost half a cycle. The Class B amplifier is much more efficient than the Class A amplifier but the distortion of the output signal is a serious problem.

If the input signal is connected to two valves connected in *push-pull*, as shown in Fig. 70, then the problem of distortion is overcome. The signal is applied to the valves through a centre tapped transformer and the output is also taken from a centre tapped transformer. If the valves have identical characteristics the output from the secondary of the output transformer will be a sine wave. In the circuit as drawn anode current does not flow in either valve for the duration of the dotted part of the cycle.

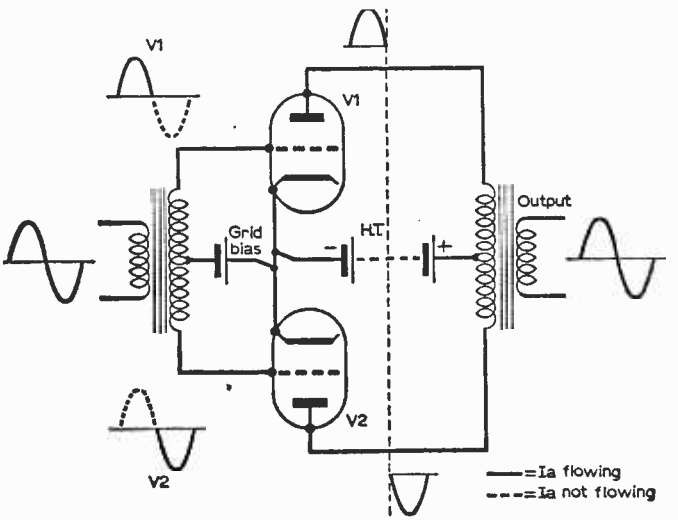


Fig. 70: A Class B push-pull amplifier circuit.

8.4 Class C Amplification

For this type of amplification the valve is biased beyond its cut-off value. In this case then no anode current will flow for the greater part of the cycle. Class C amplifiers are generally used for radio frequencies when the tuned circuits which are used are sufficiently selective to filter out the harmonics which occur as a result of distortion. The Class C amplifier is the most efficient of the three and is frequently used in transmitter circuits where large power outputs are required.

8.5 Frequency Changers

In the *superheterodyne receiver* (or "superhet", which will be dealt with later) the incoming signal, which could be say a broadcast station, is not amplified and then rectified (or *detected*) at its original frequency but is first of all converted to a lower frequency. This converting of a signal from one frequency to another is called *frequency changing*. The frequency to which the signal is changed is called the *intermediate frequency*. The advantages of lowering the frequency at which the signal is to be amplified are as follows—

1 The receiver becomes more *selective*, i.e. signals of stations with very close frequencies can be more easily separated.
2 Strong signals will not "block" the receiver.
3 Amplification is more efficient at a lower frequency, i.e. the Intermediate Frequency or i.f.

The frequency changer works in the following way. Two separate valves are required (both may however be in the same envelope), one being called the *mixer* and the other the *oscillator*. As can be seen from the block diagram in Fig. 72 it is assumed that the incoming signal is at a frequency of 5Mc/s. If an oscillator generates a signal at 5·5Mc/s then a tuned circuit at 5·5−5=0·5Mc/s can be placed in the anode circuit of the mixer valve. The incoming signal has therefore been converted from a frequency of 5Mc/s to one of 0.5Mc/s which is the Intermediate Frequency.

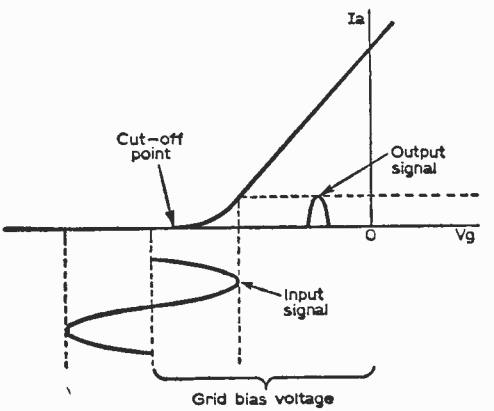


Fig. 71: Typical conditions for Class C amplification.

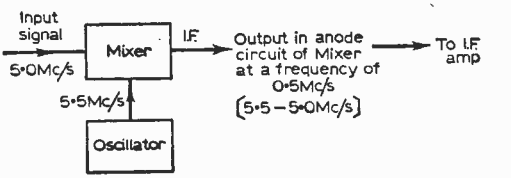


Fig. 72: A block diagram illustrating the principle of the mixer.

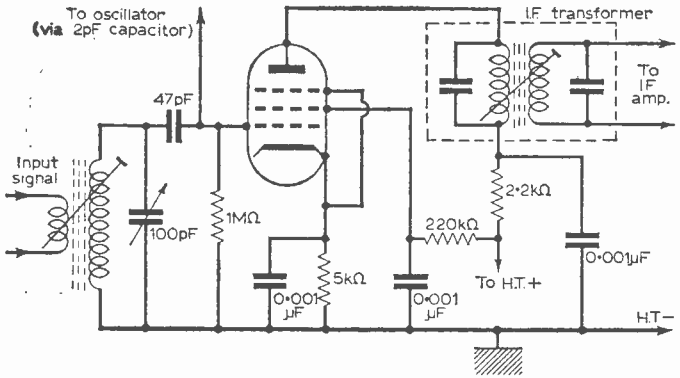
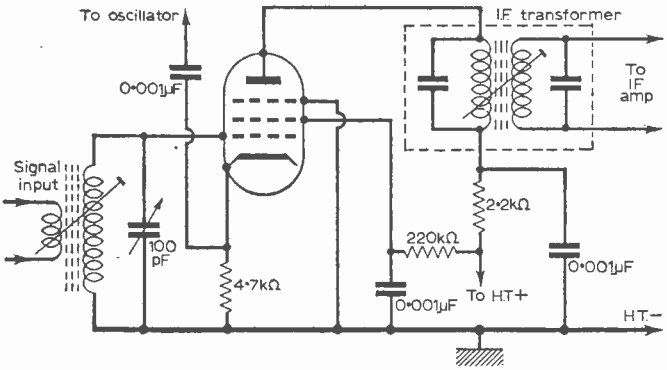


Fig. 73a (above) and b (below): Two typical mixer circuits.



The i.f. would still be 0·5Mc/s if the oscillator frequency were 4·5Mc/s, i.e. 5—4·5=0·5Mc/s. (In Fig. 72 it would, of course, also be possible to have an i.f. of 10Mc/s, i.e. 5+5·5=10Mc/s, but this would destroy the object of the frequency changing!) The output from a mixer at the Intermediate Frequency is taken through an Intermediate Frequency transformer. Two mixer circuits are shown in Fig. 73a and b. The main difference between the circuits is the way in which the oscillator voltage is *injected* into the mixer.

8.6 Detectors

The simplest type of detector simply uses a diode valve. (Or a Germanium or Silicon Diode.) Generally a simple *half wave detector will be used and this is* very similar to the diode rectifier dealt with in Article 5. It is assumed that the r.f. signal received by the detector is *modulated*, i.e. speech or some other sound is superimposed on the r.f. signal. The modulated r.f. signal is of the form shown in Fig. 74a. This is applied to the anode circuit of the detector and anode current only flows on the positive half cycle, the rectified signal is then of the form shown in Fig. 74b. The rectified signal is then passed through a capacitance and resistance connected in parallel, and these filter out the r.f. component which remains in the rectified signal: the resulting waveform is as shown in Fig. 74c. The signal will then be passed to an *audio frequency (a.f.) amplifier* through a coupling capacitor, and as the capacitor only transmits variations of voltage the voltage which reaches the a.f. amplifier will be of the form shown in Fig. 74d.

A simple diode detector is shown in Fig. 75.

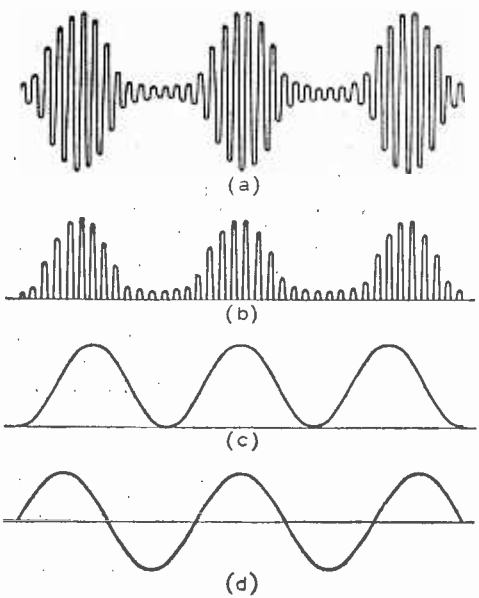


Fig. 74 (left): Illustrating the action of the diode as a detector.

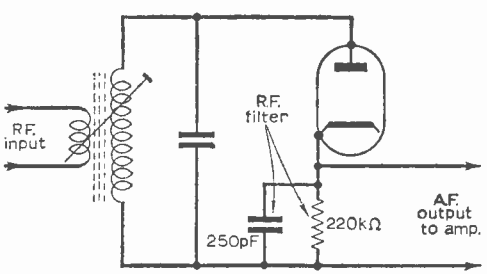


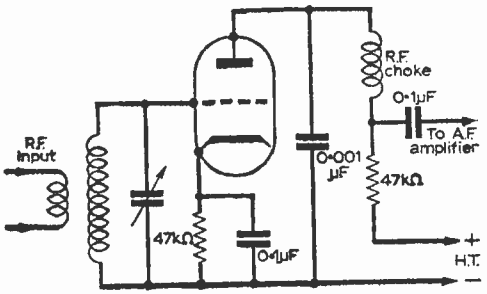
Fig. 75: A simple diode rectifier circuit.

The diode detector can handle large signals and its linearity is good. It does consume power from the circuit, however, and the "Q" of the tuned circuit will therefore be lowered, the sensitivity of the diode is also low.

8.7 The Anode Detector

If a triode is biased almost to cut-off point then a change in the grid voltage will cause a corresponding change in the anode current (average). This change of anode current will follow the changes of grid voltage and the result is that rectification will take place in the anode circuit. A typical circuit for an anode detector is given in Fig. 76 (below). The anode detector takes no power from the tuned circuit and some amplification of the signal takes place. It will not handle signals as large as the diode will however, and its linearity is not quite so good.

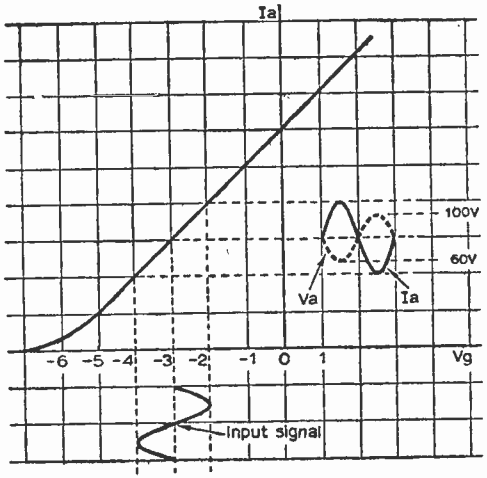
Another popular detector using the triode is the *grid leak detector* and the reader is advised to look up details of this in one of the recommended text books.



Question

In Fig. 77 (below)

a What is the applied grid bias?
b What is the peak input signal voltage?
c What is the peak change in anode voltage?
d What is the amplification factor?
e What type of amplifier is depicted?



Answer to Last Month's Question

This answer is given in Fig. 78 a and b.

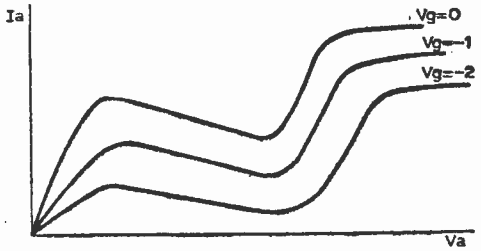
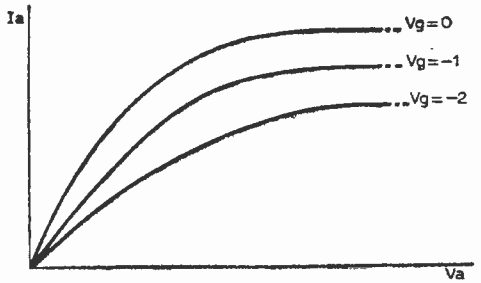


Fig. 78a (above) and b (below): Graphs the same as, or similar to these should have been obtained from the data given in last month's question.



USING A PORTABLE IN THE CAR

—continued from page 147

a prototype amplifier using an OC171 in a wideband circuit extending to about 3Mc/s was produced. The gain was measured at about 36dB at the top end of the m.w. band. An ordinary portable was set up at sea level on the South Devon coast and tuned round the frequency of Radio Caroline. There was no trace of the station.

The above-mentioned amplifier was then connected to the portable and to an ordinary, clip-on car radio aerial. Radio Caroline was then received loud and clear at full volume. The only trouble was that the combination picked up almost every source of interference for yards around. It seems that the most useful gain is 20dB provided good matching is maintained at both the input and the output of the amplifier and that the response does not rise much above 2Mc/s.

Negative feedback can be adopted in the design both to equalise the response over the required spectrum and to secure the best input matching to the car-type aerial. The author has had a great deal of success with single transistor common-emitter amplifiers with a wideband ferrite transformer or choke in the collector circuit and with controlled negative feedback. Commercial representation of the author's design is shown in Fig. 6. ■

A COMMENTARY BY HENRY

PRACTICALLY WIRELESS

No. 10 Some Odd Audio

THOSE of the faithful who managed a visit to the Russell Hotel for this year's International Audio Festival and Fair may well be wondering just where the search for realism is leading us.

Stop-at-homes, who rely on the reports they read in magazines such as this, are quite sure. The road to fidelity runs right off the edge of a cliff. Before it gets to the brink, it performs that curious optical confidence trick of vanishing to a perspective point. As we get nearer and nearer what we believe to be the ultimate, there is less and less difference between the steps we take. Improvements, to quote a reviewer, are "marginal".

Last year, the gimmick was Multiplex Stereo. This year, with the radio powers-that-be still living in the age of Morse, with international committees wrangling over standards while countries go their diverse ways, even the most optimistic amplifier maker was reluctant to make Multiplex a prime selling point—despite the Quad decoder.

There were numerous "refinements". Among these, the loudspeaker with no moving parts, and the pickup with almost as inertialess a virtue. Now that Fane appear to have got rid of the QRM bug that beset Plessey in the earlier Ionophone, and Decca the transverse pick-up stresses, we must surely be a pace more along that vanishing road?

Tell a chap he is seeing double ....

The optical illusion metaphor is apt. Tell a chap he is seeing double and he'll shrug it off as a bit of a joke. But tell him that the pop disc that "sends" him has sounds the composer never scribbled, that the backing group did not put there, and which the vocalist could not produce, even with *that* twisted larynx, and he'll call you a purist. Worse, if you show him scientifically that half of what went in the microphone fails to come out of the loudspeaker, moving parts or no, he is likely to write you off as some sort of big-headed necromancer.

The old sneer about the audiophile who listens to the decibels rather than the music is still to be heard, even in the discreetly carpeted corridors of our exhibition hotels.

Some of the charges are justifiable. After all, who wants the London Symphony Orchestra in the lounge? They would only knock over the ornaments. On the other hand, if we consider that good listening is elusive, who is to tell the hearer whether he is getting all that the composer intended?

Using this subjectivity argument we can muse on whether the composer actually intended what we hear under "normal", or even "ideal" concert conditions. Consider the latest Festival Hall assisted resonance. Helmoholtz resonators mounted above the ceiling, microphones and loudspeakers tuned to spot frequencies from 70 to 340c/s (with the 100c/s spot missing—ask Messrs Moir and Parkin why; don't complain to Henry). In all, 89 channels, with amplifiers adjusting reverberation time of each individually. All cunningly installed and adjusted unknown to us blissful concert-goers over a period of weeks.

The coughs and sniffs of a Hanoverian court.

The point is, what of the later Beethoven? Did he, hand cupped to ear, imagine his symphonies as acoustically pure as the London County Council is endeavouring to make them? More likely, he would have considered himself in a vacuum without the coughs and sniffs of the Hanoverian Court.

It does not seem to matter so much with some modern music, where even the orchestra leader is not sure if the score is upside down. It should matter even less with a beat group. Perhaps it is at this point that the two cultures meet, so let's get back to the electronics and leave the musicians to wrangle among themselves.

Electronics—that's a laugh. What about the baby grand piano at the Paris Festival du Son, which contained tape recorder, record player, amplifiers, F.M. tuner, and, crowning insult, keyboard of an electronic organ under the lid.

A parting mention, to get your audio teeth into. Patent 982,934 describes a hearing aid with the microphone coupled to a short range radio transmitter, and its receiver fitted in a hollow tooth so that the rectified signal tickles up the exposed nerve endings.

Ouch!

Long Wave Convertor

This unit will very simply add l.w. Light Programme to any medium wave-only receiver.

BY JAMES BRETT

THE BBC medium wave Light Programme on 1,214kc/s is prone to selective fading and interference from Continental stations during the evening, and this is very much worse in the south and east of England. The long wave Light Programme on 200kc/s does not suffer these disadvantages but, however, there are a considerable number of both valve and transistor receivers which will only receive medium wave. The purpose here is to describe a self-contained simple unit not requiring any modification to the existing receiver that will convert the 200kc/s Light Programme to a convenient point on the medium wave band.

Description

The circuit (Fig. 1) consists of two stages, Tr1 being a mixer amplifier and Tr2 a local oscillator.

The 200kc/s signal is received on the ferrite rod aerial and tuned by TC1/C1. It is then amplified and converted to a medium wave frequency by Tr1. The output is taken direct from the collector load resistor via the blocking capacitor C4 and does not require a tuned circuit as the receiver to which it is connected will provide the necessary selectivity. No earth connection is needed provided the unit and the receiver are connected by only a short wire, the capacity between them providing the earth coupling.

The local oscillator which will determine the medium wave output frequency is tuned by TC2 and L3 and coupled by the winding L4 to the base of the mixer.

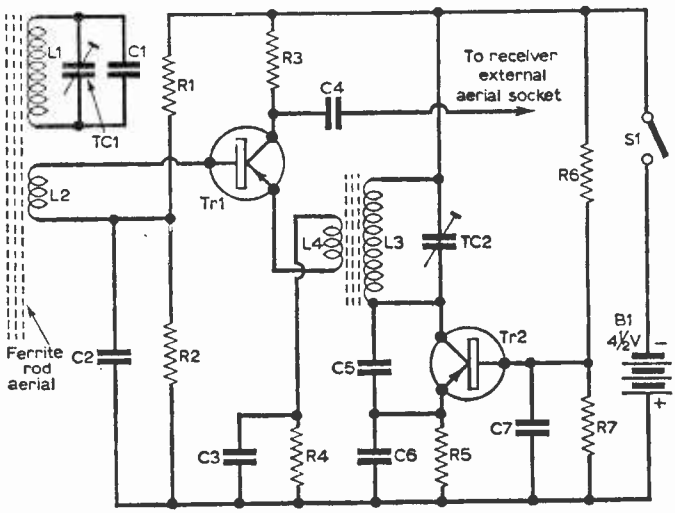


Fig. 1: The two-stage transistor circuit.

COMPONENTS LIST

Resistors:

R1	39kΩ	R5	4·7kΩ
R2	6·8kΩ	R6	39kΩ
R3	10kΩ	R7	6·8kΩ
R4	4·7kΩ	All ½W carbon	

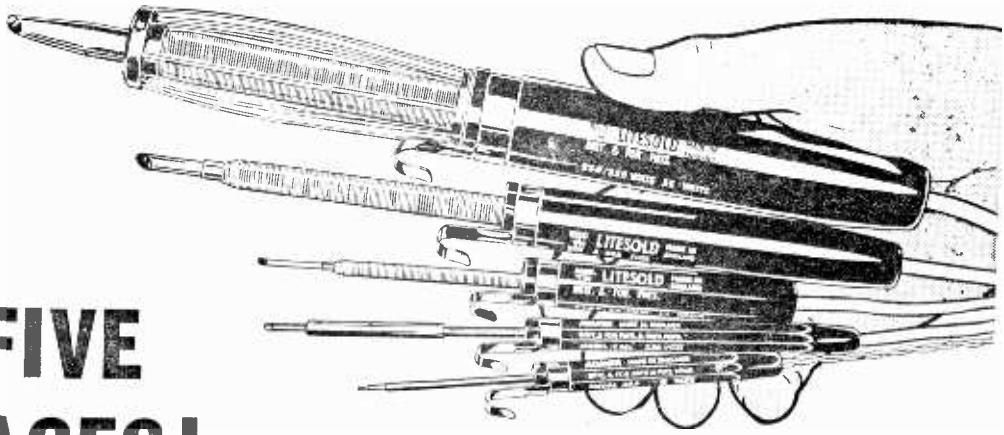
Miscellaneous:

L1,2	Aerial coil	see text
L3,4	Oscillator coil	see text
Tr1,2	OC44 or similar	
B1	4·5V battery	
S1	On/off toggle switch	

Capacitors:

C1	See text	
C2	0·1μF	miniature ceramic
C3	0·1μF	miniature ceramic
C4	0·1μF	miniature ceramic
C5	33pF	miniature ceramic
C6	470pF	miniature ceramic
C7	0·1μF	miniature ceramic
TC1	Trimmer see text	
TC2	450pF compression trimmer (Clydon type 26/3).	

4½in. length of ¼in. diameter ferrite rod. Piece of paxolin for sub-panel. Plastic or wooden box. 5/16in. diameter former, with iron dust core and screening can (Aladdin). Knob, grommet, wire, etc.



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10 WATT MONO AMPLIFIER. Complete with built in pre-amplifier in metal case, plastic veneer covered 6 inputs, 3 each level. With equalisation each input. 1 input switch selected each level with separate vol. control for mixing. Wide range tone controls. Separate Bass and Treble. For use on 220-250v. A.C. mains. Case isolated from mains. ECL86 valves in output for low distortion. Suitable all high impedance Microphones and pick-ups. Size overall including plastic feet: Height 4¾in., Width 11in., Depth 9¼in.
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3W+3W STEREO AMPLIFIER. As above amplifier but 2 separate amplifiers giving full 3 watts each channel controls. 1 Mono-Stereo 2 Balance, 3 Left Vol., 4 Right Vol., 5 Bass, 6 Treble, Input and output sockets at rear. A.C. mains, 220-250v. Case isolated.
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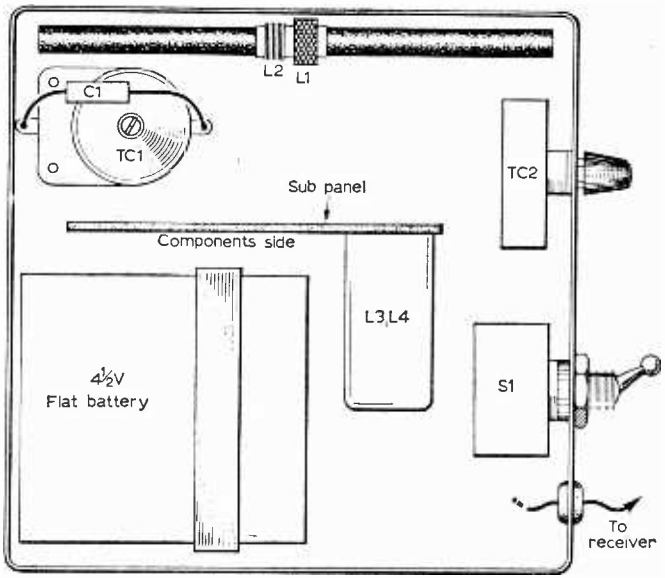


Fig. 2: This component layout was found satisfactory for the plastic case used for the prototype. The methods of mounting the components is largely a matter of convenience, but thick elastic bands can be recommended for holding the ferrite rod and battery.

The bias of both transistors is conventional and the values chosen will provide suitable operation conditions for a wide range of popular r.f. transistors such as OC44, etc.

Coils and Variable Capacitors

The tuning may be achieved by using proprietary coils or winding one's own.

If proprietary coils are chosen a suitable ferrite aerial is the Repanco FS4. This covers long wave only and has a suitable coupling winding L2. The local oscillator transformer is any medium wave coil with a coupling winding and screened, a suitable one being the Repanco XMA16.

To wind one's own coils the details are as follows: L1 200 turns 36s.w.g. pile wound. L2 20 turns 28s.w.g. close wound and adjacent to L1. Both wound near the centre of a 4½in. piece of ¼in. diameter ferrite rod. L3 80 turns 36s.w.g. pile wound. L4 20 turns 36s.w.g. close wound. Both wound on a $\frac{5}{16}$in. diameter former fitted with a dust slug and screening can, a suitable one being the Aladdin former and screening can.

Since the tuning of L1 is to be fixed at 200kc/s a low-value trimmer TC1 may be used and the total capacity made up to approximately 300pF by C1.

If the compression trimmer TC2 specified is not readily available a small variable capacitor with solid dielectric such as the type sold with crystal sets may be used.

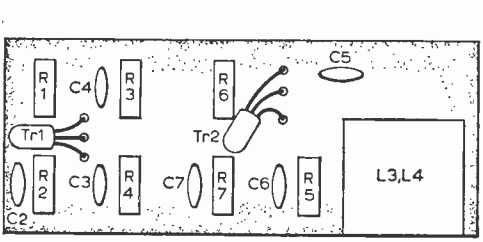


Fig. 3: Layout of components on the paxolin sub-panel.

Construction

The unit is built in a box approximately 5in. x 5in. x 1½in., there being plenty to choose from, sold as sandwich boxes. A wooden box can also be constructed but a metal box *must not* be used as it would screen the aerial.

The parts may be positioned in the box as shown in Fig. 2 and fixing holes marked out. The battery is held against the box by bolting to the box a piece of broad elestic band. The ferrite rod may be held in place in the same way.

The component sub-panel (Fig. 3) is a piece of paxolin drilled with a fine drill to support the lead wires of the components and the inter-connecting of the components done on the reverse side, using the component lead wires. Where wires cross, a piece of sleeving should be slipped over.

The sub-panel is held on to the box by a small angle bracket.

Alignment

The unit is connected to the receiver and the receiver switched on and tuned to a quiet part of the medium wave band. Note this frequency then move the receiver tuning by 200kc/s as indicated by the receiver dial. Switch on the converter and adjust its oscillator tuning (TC2) until the receiver produces a change in background noise showing that the converter oscillator is on the frequency indicated by the receiver. Reset the receiver tuning to its original setting and the 200kc/s Light Programme should be heard. A slight adjustment of the converter tuning TC2 may be required due to inaccuracies in the receiver dial alignment. Adjust TC1 for maximum signal and the unit is aligned.

To assist in the initial alignment a long wire aerial may be attached to the base of Tr1 via a 220pF capacitor, but on removal a slight adjustment of TC1 will be necessary.

If it is thought that the quietest point has not been found on the medium wave band a small adjustment to the receiver tuning may be made, followed by a readjustment of TC2 to regain the Light Programme. In this way the Light Programme may be brought up almost anywhere on the medium wave band.

CLUB NEWS

ACTON, BRENTFORD AND CHISWICK RADIO CLUB
Hon. Sec.: W. G. Dyer, G3GEH, 188 Gunnersbury Avenue, Acton, London, W.13.

At the meeting held 18th May there was a talk and discussion on "Antennae". The Club meeting place is 66 High Road, Chiswick, and meetings start at 7.30 p.m.

BRADFORD RADIO SOCIETY
Hon. Sec.: E. G. Barker, G3OTO, 63 Woodcot Road, Baildon, Nr. Shipley, Yorkshire.

On 29th April, there was a visit to the Spen Valley A.R.S., where there was a talk on Manned Space Flight.

BROMSGROVE AND DISTRICT AMATEUR RADIO CLUB
Hon. Sec.: J. K. Harvey, 22 Elm Grove, Bromsgrove, Worcestershire.

G6WI will give a lecture on 14th May, entitled "14Mc/s Operation and Conditions".

Meetings are held on the second Friday each month at the Co-op. Rooms, High Street, Bromsgrove.

CHESTER AND DISTRICT AMATEUR RADIO SOCIETY
Hon. Sec.: P. J. Holland, G3TZO, Field House, 19 Kingsley Road, Gt. Boughton, Chester.

There will be a surplus sale on 11th May and G3DRB will present a film show.

Meetings are every Tuesday except the first in the month, at 8 p.m. in the Y.M.C.A., Chester.

DERBY AND DISTRICT AMATEUR RADIO SOCIETY
Hon. Sec.: F. C. Ward, G2CVV, 5 Uplands Avenue, Littleover, Derby.

On 1st and 2nd May, there was the 144Mc/s Contest (portable event) and on 29th May there will be the first 432Mc/s Contest.

GOSPORT AND DISTRICT AMATEUR RADIO SOCIETY
Hon. Sec.: J. T. Nightingale, 21 Pier Street, Lee-on-the-Solent, Hants.

Recent activities have included a talk and demonstration on Mobile 4 metre operation, and a visit to the Radio Museum of *H.M.S. Collingwood.*

HALIFAX AND DISTRICT AMATEUR RADIO SOCIETY
Hon. Sec.: J. Ingham, G3RMQ, Lambert House, Greetland, Halifax, Yorkshire.

On 25th May there will be a 2 Metre evening at the QTH of G3IGW, Rose Dene, Wood Lane, Hipperholme, Halifax.

HUDDERSFIELD AMATEUR RADIO SOCIETY
Hon. Sec.: R. Higton, 5 Brian Avenue, Dalton, Huddersfield, Yorkshire.

The Club recently had a visit from members of the Spen Valley Club. A favourable QTH has been taken over by the Club, so the Club station will be on the air under the callsign G3HOV.

ISLE OF WIGHT RADIO SOCIETY
Hon. Sec.: M. Pettit, 18 Berry Hill, Lake, Sandown, I.O.W.

The Society is running an R.A.E. course every Monday evening. Normal meetings are held every Friday evening, and include lectures, a construction course and film shows. All meetings are held at the Club's H.Q. at Unity Hall, Wootton Bridge, Nr. Ryde, I.O.W.

MELTON MOWBRAY AMATEUR RADIO SOCIETY
Hon. Sec.: D. W. Lilley, G3FDF, 23 Melton Road, Ashfordby Hill, Melton Mowbray, Leics.

On 27th May there will be a visit to the shack of Mr. D. Fisher.

All meetings are held in the St. John Ambulance Hall, Ashfordby Hill, Melton Mowbray.

MID-WARWICKSHIRE AMATEUR RADIO SOCIETY
Hon. Sec.: H. C. Loxley, 5 Guy Street, Warwick.

At the meeting on 3rd May, there was a talk on S.S.B. Reception, and on the 17th J. Beam Aerials Ltd., will give a talk about Amateur Aerial Arrays.

NORTHERN HEIGHTS AMATEUR RADIO SOCIETY, G2SU
Hon. Sec.: A. Robinson, G3MDW, Candy Cabin, Ogden, Halifax.

The Club has recently obtained a licence (callsign G2SU) which is a re-issue of one of the founder member's callsign.

The meetings are held at the Sportsman Inn, Ogden, Nr. Halifax, at 7.30 p.m.

On 12th May there will be a visit to Manchester airport and on 26th May, there will be a recorded lecture by the late G2SU on Microphones.

READING AMATEUR RADIO SOCIETY
Hon. Sec.: N. C. Taylor, G3TOQ, 83 Stoneham Close, Tilehurst, Reading, Berks.

The next meeting of the Club will be on 29th May. The meeting will take the form of a full scale rehearsal for NFD and will be held at the QTH of G5HZ, commencing at 2.30 p.m.

ROYAL NAVAL AMATEUR RADIO SOCIETY, G3BZU
M. J. Matthews, H.Q., H.M.S. Mercury, Leydene, Petersfield, Hants.

The Society is holding a Mobile Rally at H.M. Signal School, *H.M.S. Mercury*, to celebrate their 5th year in existence.

Mobiles equipped for amateur operation will be able to get a "Talk-in" through GB3RN operating on 1880kc/s, 70·26Mc/s and 144·2Mc/s. G3BZU will be operating on 3720kc/s for mobiles equipped for S.S.B. reception on that band.

SALTASH AND DISTRICT AMATEUR RADIO SOCIETY
Hon. Sec.: D. Bowers, 95 Grenfell Avenue, Saltash, Cornwall.

On 7th May, there will be an R.S.G.B. tape lecture, "Hints on Mobile Operation".

SLADE RADIO SOCIETY
Publicity Officer: R. L. Jenkins, 42 Warwick Road, Warley, Birmingham 32.

On 24th May there will be a lecture by Mr. D. Collins on Logic and Digital Circuits.

SOUTH BIRMINGHAM RADIO SOCIETY
Hon. Sec.: J. Rowley, GTQO, 195 Castle Lane, Solihull.

On 20th May, there will be the half-yearly Junk and Surplus Sale and on 17th June there will be a demonstration and display of Heathkit Products.

SOUTHGATE, FINCHLEY AND DISTRICT GROUP OF THE R.S.G.B.
Hon. Sec.: R. Wilkinson, G3TXA, 23 Ashridge Gardens, Palmers Green, N.13.

On 13th May there will be a talk by Truvox Ltd., postponed from some months back.

SPEN VALLEY AMATEUR RADIO SOCIETY
Hon. Sec.: N. Pride, 100 Raikes Lane, Birstall, Nr. Leeds.

There was a talk on Manned Space Flight on 29th April, and on 13th May there will be a visit to Wharfedale Wireless Works, at Idle, Bradford.

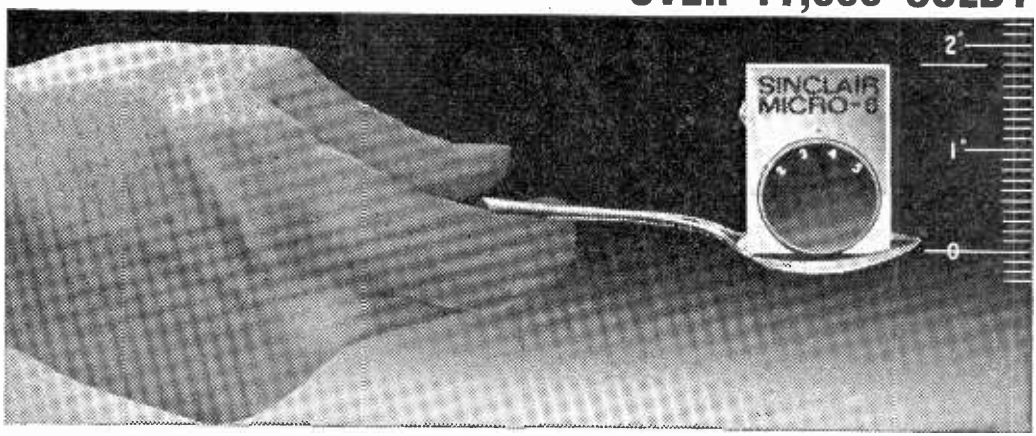
WEST KENT AMATEUR RADIO SOCIETY
Hon. Sec.: H. F. Richards, 17 Reynolds Lane, Tunbridge Wells, Kent.

On 23rd April there was an Exchange and Mart evening. On the 14th May final arrangements will be made for the NFD.

WIRRAL AMATEUR RADIO SOCIETY
Hon. Sec.: A. Seed, G3FOO, 31 Withert Avenue, Bebington, Wirral, Cheshire.

On 30th April there was an "expedition" covering top band 4 and 2 metres.

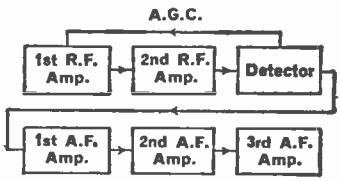
OVER 17,000 SOLD!



Smaller than any set in the world

FASCINATING TO BUILD MARVELLOUS TO USE

No set in the history of radio has ever captured the public's enthusiasm as has the world famous Sinclair Micro-6 Never was a set so small, never so efficient and powerful. Smaller than a matchbox, the Micro-6 brings in stations from all over Europe for your pleasure and entertainment (unless you use it in the U.S.A. or Australia, for example). It performs with fantastic efficiency in cars, buses, trains as well as steel-framed buildings, yet everything to do with this set except the lightweight earpiece is contained in the minute white, gold and black base which is small enough to be held in a teaspoon! The many attractive features of the Micro-6 include an unusual and original 6-stage circuit, powerful A.G.C., bandspread for easy Luxembourg reception, vernier-type tuning and three special M.A.T. Transistors. Tunes over the medium wave-band. The instructions make building easy.



BLOCK DIAGRAM OF MICRO-6

Three special Sinclair Micro-Alloy transistors (MAT) are used to provide two stages of R.F. amplification, followed by an efficient double diode detector which drives a high-gain 3-stage A.F. amplifier, Powerful A.G.C. applied to the first R.F. stage ensures fade-free reception from the most distant stations tuned in and the set measures only $1\frac{3}{8} \times 1^{3}/_{16} \times \frac{1}{2}$ *inch.*

All parts including transistors, case, dial lightweight earpiece and instructions come to **59/6**

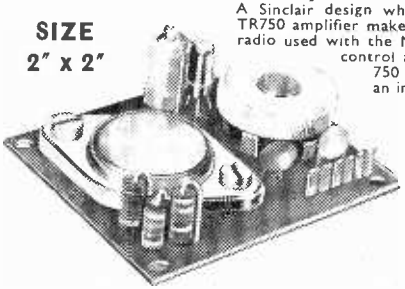
MALLORY ZM.312 MERCURY CELL (2 required) each **1/11**
Pack of 6 ZM.312 cells **10/6**
TRANSRISTA nylon wrist strap for wearing Micro-6 on wrist **7/6**

SINCLAIR MICRO-6

SINCLAIR TR750 AMPLIFIER

Designed specially for use with Micro-6

SIZE 2" x 2"



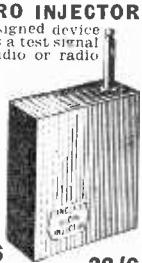
A Sinclair design which enjoys enormous popularity. The TR750 amplifier makes a powerful car, portable or domestic radio used with the Micro-6. With its own built in volume control and on-off switch, the TR750 has a full 750 milliwatt transformerless output for an input of 10mV into 10K ohms. Frequency response from 30 to 20,000 c/s ± 1dB. For standard 25-35 ohm speakers. Also makes a record reproducer.

All parts with instructions come to **39/6**

Ready built and tested **45/-**

SINCLAIR MICRO INJECTOR

This ingeniously designed device generates and injects a test signal into any part of audio or radio equipment at any frequency from 1 kc/s to 30 Mc/s by means of which it becomes easy to locate faults rapidly and accurately. Measures $1^{3}/_{8} \times 1^{3}/_{16}$ x $\frac{1}{2}$in. excluding probe. With full instructions.



No constructor should be without a Micro-Injector.

Parts for building come to **27/6**

Ready built and tested **32/6**

X-20

See next page

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X-20

20 WATT COMBINED AMPLIFIER AND PRE-AMP

Complete Kit of parts and X-20 Manual

£7.19.6

Built and tested **£9.19.6**

X-20 power unit **£4.19.6**

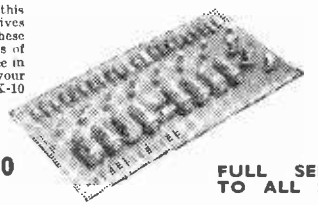
New design - New power!

First to bring P.W.M. to constructors, Sinclair now take amplifier design even further ahead with the Sinclair X-20. This elegantly styled amplifier has all the qualities demanded of the costliest hi-fi equipment, but it costs many times less, and is far more efficient. With a maximum output of 20 watts R.M.S. (British rating) the X-20 gives you power and power to spare. It provides unsurpassed quality too, and is so designed that for very little outlay, you can add the tone and volume control system of your choice to the pre-amp stage included in the X-20. This is the ideal amplifier for stereo reproduction, and the X-20 manual included with this amplifier gives full details of how to make a stereo assembly. The X-20 measures only 8¼" x 3¼" x 1"—dimensions which will inspire constructors to build to entirely new concepts of design and layout.

- No. of transistors—12
- Output stage uses newest silicon epitaxial planar transistors and requires no heat sink.
- Frequency response—20 to 20,000 c/s ± 1dB
- Total harmonic distortion—0.1% at 10 watts R.M.S.
- Input sensitivity—1mV into 5 K ohms
- Signal to noise ratio better than 70dB
- **OUTPUT INTO 7.5 ohms**
  20 watts R.M.S. music power
  15 watts R.M.S. continuous
- **OUTPUT INTO 15 ohms**
  15 watts R.M.S. music power
  12 watts R.M.S. continuous
- Low pass filter in output stage
- Power requirements—36Vdc at 700 mA
- P.R.F. 65–75 kc/s
- Overall size—8¼" x 3¼" x 1"
- Total weight—4½ ozs.

and the X-10 for those requiring a less powerful P.W.M amplifier

Although the X-10 has been superseded in power by the X-20 this superb Sinclair integrated P.W.M. Amplifier and Pre-amp. gives you all the advantages of quality and efficiency which makes these Sinclair designs so outstanding in every way. Many thousands of X-10's are already in use and this unit will go on giving service in those cases where its power is likely to be best suited to your listening conditions. Prices too are particularly attractive. An X-10 manual is available, 1/-.



The complete kit costs only **£5.19.6**

Ready built **£6.19.6** *X-10 Power supply unit* **£2.14.0**

For 12-15V operation. Tone control system is added to choice. Power output 5 watts R.M.S., 10 watts peak.

FULL SERVICE FACILITIES AVAILABLE TO ALL SINCLAIR CUSTOMERS

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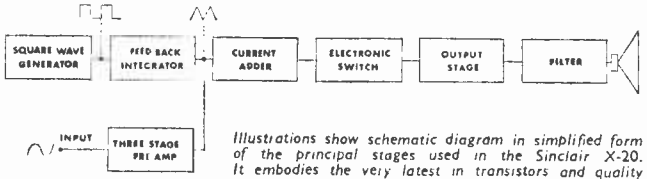
SINCLAIR RADIONICS LTD.
COMBERTON CAMBRIDGE *Telephone COMBERTON 682*

WHAT YOU SHOULD KNOW ABOUT THIS BRILLIANT NEW SINCLAIR DESIGN



Illustrations show schematic diagram in simplified form of the principal stages used in the Sinclair X-20. It embodies the very latest in transistors and quality components.

The Sinclair X-20 integrated Pulse Width Modulated Amplifier and Pre-amp marks a further important advance by Sinclair in the development of entirely new and original amplifier designs. Many months of research and development have gone into its production and units have been subjected to impossibly severe working conditions with sensationally satisfactory results. The X-20 has even been run flat out continuously and at the end has still shown no signs of strain or distress.

WHY P.W.M. WAS CHOSEN

This advanced form of Pulse Width Modulation used by Sinclair in the X-20 offers many important advantages over conventionally designed amplifiers. These can be summarised briefly as follows:

1. Completely faithful reproduction of the signal fed into the pre-amp. stage.
2. Brilliant transient response.
3. Absolutely flat frequency response at all power levels.
4. 95% energy conversion factor—power is not dissipated in unwanted heat.
5. Fantastically compact size in relation to power output.
6. Prices that make it possible for everyone to enjoy hi-fi at its very best.

PULSE REPETITION FREQUENCY

In the interests of quality the P.R.F. must be as high as possible without extending into the region of radio frequencies. In the X-20, the pulse repetition frequency is between 65 and 75 Kc/s, a value which is found to satisfy the most stringent demands likely to be made upon it in terms of uncompromising quality. This frequency is generated within the circuitry of the X-20 itself and the output has rise-fall times of less than 0.2 micro-seconds, a value sufficient to ensure maximum efficiency in energy conversion to the loudspeaker with perfect reproduction of the audio signal itself.

OUTPUT STAGE—95% EFFICIENT

Rise and fall times of less than 0.2 micro-seconds are achieved by using silicon epitaxial planar output transistors which makes the efficiency of the output stage at least 95%. Thus only 1 watt is dissipated in each of the output transistors when the amplifier is giving an output of 20 watts.
The complete linearity of the integrater and careful modulator design ensure absolutely negligible distortion right up to the maximum output.

LOW-PASS FILTER

A low-pass filter cutting off above 20 Kc/s built into the output of the X-20 ensures that the output transistors always "see" a high impedance at the P.R.F., making the amplifier widely tolerant of the type of load to which it is connected.

PRE-AMPLIFIER

This consists of three transistors with two negative feed back loops which define the gain and ensure an absolutely flat frequency response. The sensitivity is sufficient for all types of pick-ups. Provision is also made for connecting high-output devices such as F.M. Tuners and Tape Pre-amps.

TONE CONTROL SYSTEMS

The Manual included with the X-20 Amplifier details a variety of tone and volume control systems, any one of which may be added to the amplifier for very little outlay. Full information on stereo operation is also provided, of course.

POWER SUPPLY

A special A.C. Mains operated power supply unit is available for the X-20, delivering 36 volts D.C. Full-wave rectification is used, and the unit is supplied ready built in a completely enclosed steel case.

Complete Kit of Parts including Transistors and X-20 Manual **£7.19.6**

Ready built and tested **£9.19.6**

AC Mains Power unit for up to two X-20's **£4.19.6**

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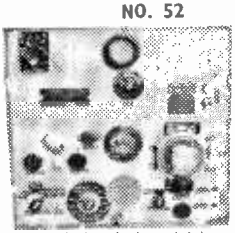

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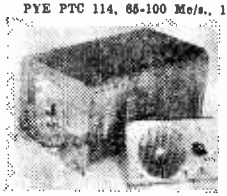

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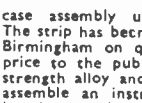

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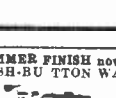

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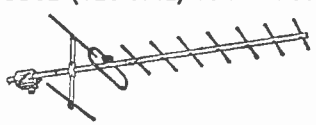

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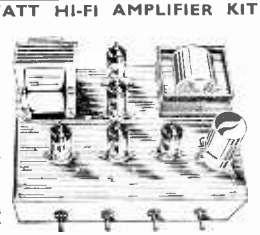
10-14 WATT HI-FI AMPLIFIER KIT



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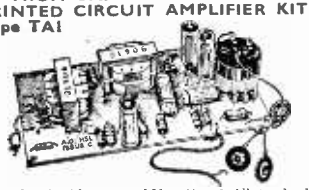

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Also ready built and tested. 52/6. P. & P. 3/-.

A pair of TA1's are ideal for stereo.

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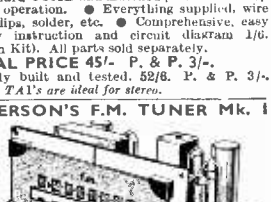

● F.M. tuning head by famous maker. ● Guaranteed non-drift ● Permeability tuning. ● Frequency coverage 88-100 Mc/s. ● Balanced diode output. ● Two I.F. stages and discriminator. ● Attractive maroon and gold dial (7 x 3in. glass). ● Self-powered, using a good quality mains transformer and valve rectifier. ● Valves used ECC85, two EF80's and EZ80 (rectifier). ● Fully drilled chassis. ● Size of completed tuner 8 x 6 x 5¼in. ● All parts sold separately. Set of parts if purchased at one time £5.19.6, plus 8/6 P. & P. and ins. Circuit diagram and instructions 1/6 post free. **Mark II Version** as above but complete with magic eye, front panel and brackets, £6.12.6. P. & P. 8/6.

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UNREPEATABLE OFFER AT 89/6 Carr. 5/6

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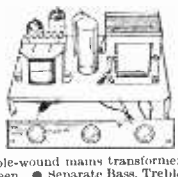

A really excellent all purpose A.C. mains 200/240v. **AMPLIFIER KIT TYPE HSL 'FOUR' 3 VALVE. 4 WATT USING ECC83 EL84, EZ80 VALVES**

Special features include:

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7in. metal turntable Low flutter performance. 200/250 v. shaded pole motor with 90 v. tap for valve heaters. High gain crystal pick-up with turnover LP/78 head complete with sapphire stylii.

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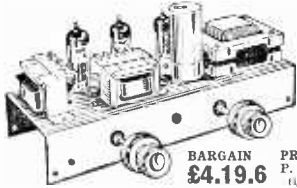

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3	6500	80	9/6
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3½	9500	3	10/6
3¾	9500	3	10/6
4	7000	25	11/6
4	6000	35	10/6
4	7000	35	11/-
4	7500	5	9/6
4	9000	50	11/6
4	9500	35	11/6
4	9500	15	12/-
4½	9500	3	10/6
5	9500	3	10/6
5	9500	15	12/6
5	8500	25	10/6
5	9500	35	11/6
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5 × 3	9000	3	8/6
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6 × 4	6000	3	8/6
6 × 4	7000	3	9/-
6 × 4	8500	3	9/6
6 × 4	9500	3	10/-
6 × 4	9500	35	12/-
7 × 3⅝	7000	3	9/6
7 × 3⅝	9500	3	10/6
7 × 4	9500	3	11/-
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