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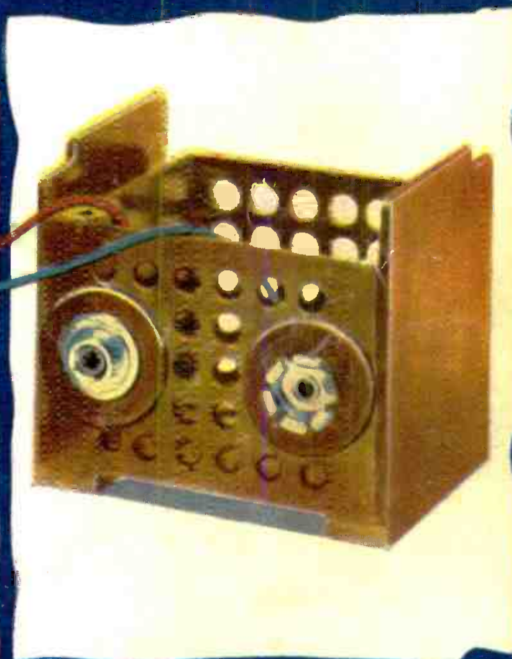

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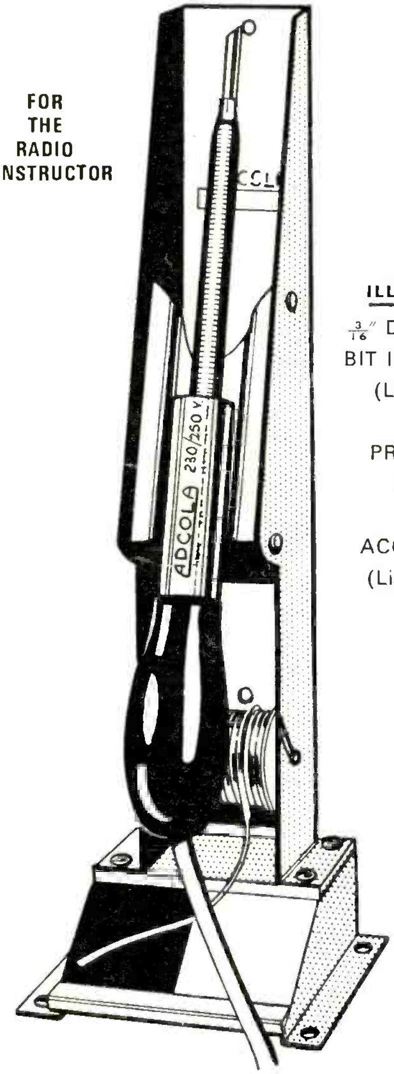

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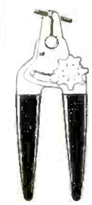

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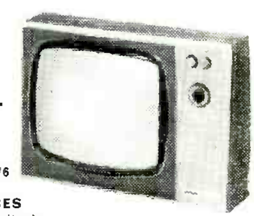

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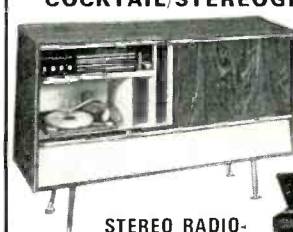

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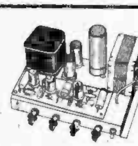
8-watt 4-valve PUSH-PULL AMPLIFIER & METAL RECTIFIER



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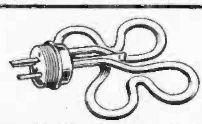

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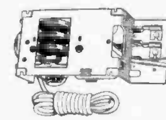

comprising Mullard 2AC128, 20C75 and 2 AA129 separate bass and treble volume controls. Complete with Power Supply AC mains 240 v. Size 7½" × 3¾" × 2". Price **50/-** plus 2/6 P. & P.

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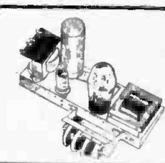

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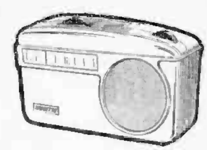

★ 2½" Speaker. ★ 6 Transistor Superhet Output 200mW. ★ Plastic Cabinet in red, size 4⅞" x 3" x 1⅞" and gold speaker louvre. ★ Horizontal Tuning Scale. ★ Ferrite Rod Internal Aerial. ★ IF 460 kc/s. ★ All components Ferrite Rod and Tuning Assembly mount on printed board. ★ Operated from PP3 Battery. ★ Fully comprehensive instructions and point-to-point wiring diagram. ★ Printed Circuit Board. ★ Tunable over medium and long waveband. ★ Car aerial and earpiece socket.

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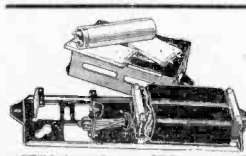

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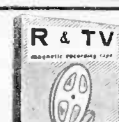

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5¾" D.P.	1800ft.	18/6	4" T.P.	900ft.	15/-

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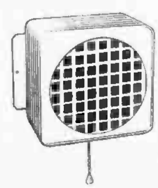

AC Mains 230/250 v. complete with pull switch. Size 6" x 6" x 4". Price **27/6** plus 5/- P. & P.

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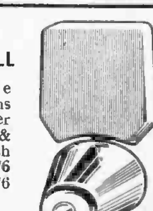

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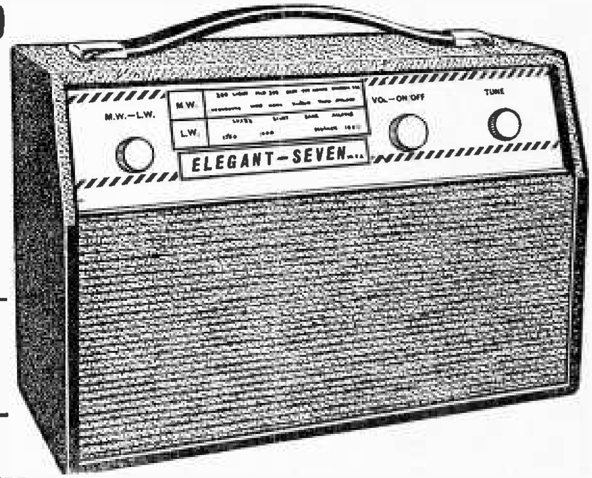

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- ★ High 'Q' ferrite rod aerial.
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ONLY £4.4.0

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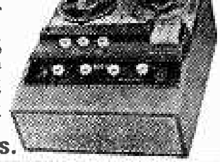

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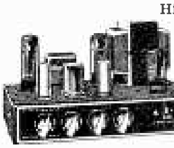
R.S.C. A10 30 WATT ULTRA LINEAR HI-FI AMPLIFIER



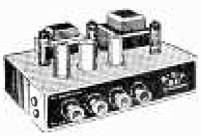
Highly sensitive. Push-Pull high output, with Pre-amp./Tone Control Stages. Performance figures equal to most expensive amplifiers available. Hum level —70dB. Frequency response ±3dB 30-20,000c/s. Specially designed sectionally wound ultra linear output transformer with 807 output valves. All first grade components. Valves EF86. EF86. ECC83. 807. 807. GZ34. Separate Bass and Treble Controls. Sensitivity 12 millivolts so that **any kind of Microphone or Pick-up is suitable.** Designed for **Clubs, Schools, Theatres, Dance Halls** or **Outdoor Functions,** etc. For use with **Electronic Organ, Guitar, String Bass,** etc. Gram. Radio or Tape. Reserve L.T. and H.T. for **Radio Tuner.** Two inputs with associated volume controls so that two separate inputs such as Gram and "Mike" can be mixed. 200-250v. 50c/s A.C. mains. For 3 and 15 ohm speakers. Complete kit of parts fully punched chassis. point-to-point wiring diagrams and instructions. **12 Gns.** Carr. 12/6

Supplied factory built with **EL34** output valves. 12 months guarantee for **15 gns.** If required perforated cover with carrying handles can be supplied for **21/-.** Send s.a.e. for leaflet. **TERMS: Deposit 48/-** and 9 monthly payments of **33/7** (Total **£17.10.3**).

LOUDSPEAKER CORNER CONSOLE CABINETS

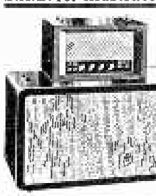
Attractive design With polished walnut finish. Model M for 10" speaker Size 28 x 19 x 12in. **59/11** Model S for 12" speaker and tweeter. Size 31½ x 22½ x 14in. **5 Gns.**

R.S.C. A11 HIGH FIDELITY 12-14 WATT AMPLIFIER



PUSH-PULL ULTRA LINEAR OUTPUT "BUILT-IN" TONE CONTROL PRE-AMP Two input sockets with associated controls allow mixing of "mike" and gram. etc.. etc. High sensitivity. 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. Frequency response ±3dB 30-20,000c/s. Six negative feedback loops. Hum level —60dB. SENSITIVITY 23 millivolts. Suitable for Crystal or Ceramic P.U.s, all types "mikes". Comparable with the very best designs. For **Musical Instruments** such as **String Bass, Electronic Guitars,** etc. **Reserve Power** provides 300v. 30mA. and 6.3v. 1.5a. for **Radio Tuner** or **Tape Pre-Amp.** Size approx. 12 x 9 x 7in. For A.C. mains 200-250v. 50 c.p.s. Output for 4 and 15 ohm speakers. Kit complete to last nut. Chassis fully punched. Full instructions and point-to-point wiring diagrams (or factory built **£11.15.0**). Metal cover with 2 handles available for **21/-. TERMS ON ASSEMBLED UNITS: Deposit 36/6** and 9 monthly payments of **25/9** (Total **£13.8.3**). Send S.A.E. for illustrated leaflet of Cabinets, Speakers, Mikes, etc. **£8.15.0** Carr. 11/6

R.S.C. BASS-REGENT 50 WATT AMPLIFIER



AN EXCEPTIONALLY POWERFUL HIGH QUALITY ALL-PURPOSE UNIT For lead, rhythm, bass guitar and all other musical instruments. For vocalists, gram, radio, tape, and general public address.

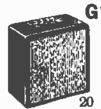
★ UNUSUALLY POWERFUL LOUDSPEAKER COMBINATION consisting of a FANE HIGH FLUX 12in. 30 watt unit PLUS a FANE 12in. 20 watt unit with extended frequency response. ★ 4 Jack Inputs and two Volume Controls for simultaneous use of up to 4 pick-ups or "mikes". ★ Cabinets covered in two-tone Rexine/Vynair with gold trimming. Fitted carrying handles. ★ Separate Bass and Treble Controls giving "lift" and "cut".

49½ Gns. Carr. 30/- Send S.A.E. for leaflet. Or call at one of our many branches and compare the Bass-Regent with units at three times the cost. Or deposit **£7.17.6** and 9 monthly payments of **£5.10.10.** (Total **55 gns.**)

B20 MULTI-PURPOSE AMPLIFIER especially suitable for Bass Guitar

Incorporating massive 15in. high flux loudspeaker. Rating 25 watts. Individual bass and treble controls. Two jack inputs separately controlled. Substantial cabinet attractively finished in Rexine and Vynair. Size approx. 24 x 21 x 11in. Send S.A.E. for leaflet. Or Deposit **£4.14.6** and 9 monthly payments of **66/-.** (Total **£34.8.6**). Carr. 17/6. **29½ Gns.**

G15 15 WATT AMPLIFIER for Lead or Rhythm Guitar, Vocal Groups, etc.



High-fidelity output. Separate bass and treble controls. Twin separately controlled inputs so that two instruments or "mike" and pick-ups can be used at the same time. Heavy Duty 12in. 20 watt Speaker. Cabinet covered in attractive Rexine/Vynair. Size 18 x 18 x 8in. Deposit 3 gns. **19½ Gns.** Carr. 15/- and 9 monthly payments of **43/7** (Total **£22.15.3**). S.A.E. for leaflet.

G80 80 WATT AMPLIFIER

2 Channels, 6 inputs. Tremolo, 2 Columns and 1 Bass Speaker unit with two 15in. H.D. Speakers. **99 Gns.** Carr. £3

SELENIUM RECTIFIERS F.W. (Bridged)

All 6/12v. D.C. output. Max. A.C. input 18v. 1a. 3/11. 2a. 6/11. 3a. 9/9. 4a. 12/9. 6a. 15/9.

HEAVY DUTY SELENIUM RECTIFIERS

12v. 15 amps. F.W. (Bridged). Only **19/9**

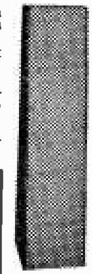
R.S.C. BATTERY/MAINS CONVERSION UNITS

Type BM1. An all-dry battery eliminator. Size 5½ x 4½ x 2in. approx. Completely replaces batteries supplying 1.5v. and 90v. where A.C. mains 200/250v. 50c/s is available. Complete kit with diagram 47/9 or ready for use 59/11.

POWER PACK KIT

Consisting of Mains transformer. Metal Rectifier. Electrolytics. smoothing choke. chassis and circuit. 200/250v. A.C. mains. Output 250v. 60mA 6.3v. 2a. Supplied with case in lieu of chassis **26/11.** Or assembled **39/11.** **22/11**

R.S.C. COLUMN SPEAKERS

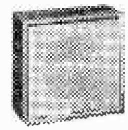


Covered in two-tone Rexine/Vynair. ideal for vocalists and Public Address. 15 ohm matching.
Type C58, 15-20 watts. Fitted five 8in. high flux speakers. Overall size approx. 42 x 10 x 5in. Or deposit **44/-** and 9 mthly pmts **34/9** (Total **£18.1.6**) **15 Gns.** Carr. 10/-
Type C42, 40 watts. Fitted four 12in. 12,000 line 10 watt speakers. Overall size 56 x 14 x 9in. approx. Carr. 15/- **22 Gns.** Or Deposit **£3.13.0** and 9 monthly payments of **50/-** (Total **£26.3.0**).

30 WATT HI-FI AMPLIFIER for Guitar, Vocal or Instrumental Group

A 4 Input, 2 volume control Hi-Fi unit with Separate Bass and Treble controls. Latest valves. Strong Rexine covered cabinet with carrying handles. Attractive black/gold perspex facia. For 200-250v. A.C. mains. For 3 or 15 ohm speakers. Send S.A.E. for leaflet. **17 Gns.** Carr. 12/6 Deposit **£3** and 9 monthly payments of **37/5** (Total **£19.16.9**).

12in. HIGH QUALITY L'SPEAKERS



In teak veneered cabinets.
10 Watt Model. Gauss 12,000 lines. 3 or 15 ohms. Carr. 7/6 **5 Gns.**
20 Watt Model. 15 ohm. Size 18x18x10in. Gauss 12,000 lines. **8 Gns.** Rexine covered £1 extra. Carr. 10/6
Terms available on both.

FANE HEAVY DUTY HI-FI SPEAKERS

122/10A Dual Cone. 12in. 20 watt. 15 ohms. Frequency range 40 to 18,000 c.p.s. Carr. 5/9 **£5.11.9**

LOUDSPEAKERS

Limited number at fraction of list price 15 ohms impedance. Brand new, guaranteed. Terms available.

12in. HEAVY DUTY 30 watts **£7.19.9** Carr. 10/- Normally £13 approx.

15in. EXTRA HEAVY DUTY 40 watts **12 GNS.** Carr. 15/-

Massive units. Gauss 17,000 lines. Usually app. **£19.**

HIGH FIDELITY 12in. 10 WATT SPEAKERS

Flux Density 12,000 lines. Impedance 3 or 15 ohms. **59/11**

R.S.C. GRAM AMPLIFIER KIT. 4 watts output. Negative feedback. Controls: Vol.. Tone and Switch. Mains operation 200-250v. A.C. Fully isolated chassis. Circuit. etc. supplied. Only **49/11.**

TRANSISTOR SALE

Mullard OC71, OC72, OC81, 2/11, OC44, OC45, 3/11, OC75, 7/9. AF117 6/9. Post 6d. for 3.

JASON VHF/FM TUNER

Complete kit with valves. **£6.19.11**

INTEREST CHARGES REFUNDED

on H.P. and Credit Sale Accounts settled in 3 months.

MOVING COIL AMMETERS

Sangamo thermo-couple type 0-3.5a. Dia. 2⅝in. Each **8/9**

R.S.C. MAINS TRANSFORMERS

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

MIDGET CLAMPED TYPE 2⅜ × 2⅜ × 2½in.
250v., 60mA, 6.3v. 2a 14/11
250-0-250v., 60mA. 6.3v. 2a 15/11

FULLY SHROUDED UPRIGHT MOUNTING
250-0-250v. 60mA, 6.3v. 2a, 0-5-6.3v. 2a 19/9
250-0-250v. 100mA, 6.3v. 4a, 0-5-6.3v. 3a. .. 33/9
300-0-300v. 100mA, 6.3v. 4a, 0-5-6.3v. 3a. .. 33/9
300-0-300v. 130mA, 6.3v. 4a. c.t., 6.3v. 1a. For Mullard 510 Amplifier 41/9
350-0-350v. 100mA, 6.3v. 4a, 0-5-6.3v. 3a. .. 33/9
350-0-350v. 150mA, 6.3v. 4a, 0-5-6.3v. 3a. .. 42/9
425-0-425v. 200mA, 6.3v. 4a, c.t., 5v. 3a..... 67/9
425-0-425v. 200mA, 6.3v. 4a, 6.3v. 4a, 5v. 3a 69/9
450-0-450v. 250mA, 6.3v. 4a, c.t., 5v. 3a..... 79/9

TOP SHROUDED DROP-THROUGH TYPE
250-0-250v. 70mA, 6.3v. 2a, 0-5-6.3v. 2a. ... 19/9
250-0-250v. 100mA, 6.3v. 3.5a........ 21/9
250-0-250v. 100mA, 6.3v. 2a. 6.3v. 1a. 22/9
350-0-350v. 80mA, 6.3v. 2a, 0-5-6.3v. 2a..... 23/9
250-0-250v. 100mA, 6.3v. 4a, 0-5-6.3v. 3a. .. 32/9
300-0-300v. 100mA, 6.3v. 4a, 0-5-6.3v. 3a. .. 32/9
300-0-300v. 130mA, 6.3v. 4a, 0-5-6.3v. 1a. Suitable for Mullard 510 Amplifier 39/9
350-0-350v. 100mA, 6.3v. 4a, 0-5-6.3v. 3a ... 32/9
350-0-350v. 150mA, 6.3v. 4a, 0-5-6.3v. 3a. .. 39/11

FILAMENT or TRANSISTOR POWER PACK Types 6.3v. 1.5a 6/9, 6.3v. 2a 7/9, 6.3v. 3a 9/9, 6.3v. 6a 19/9. 12v. 1a 8/9, 12v. 3a or 24v. 1.5a 19/9. 0-9-18v. 1½a. 15/9. 0-12-25-42v. 2a 27/9.

CHARGER TRANSFORMERS 0-9-15v. 1½a, 13/11 2½a, 16/11, 3a, 18/11, 5a, 21/11, 6a, 25/11, 8a, 31/11

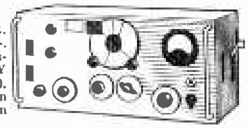
AUTO (Step UP/Step DOWN) TRANSFORMERS 0-110/120v.-200-230-250v. 50-80 watts, 14/9 150 watts, 29/11, 250 watts, 49/9, 500 watts, 99/9

OUTPUT TRANSFORMERS
Standard Pentode 5,000 Ω or 7,000 Ω to 3 Ω 7/9
Push-Pull 8 watts EL84 to 3 Ω or 15 Ω 11/9
Push-Pull 10 watts 6V6 ECL86 to 3, 5, 8 or 15 Ω 21/9
Push-Pull EL84 to 3 or 15 Ω 10-12 watts..... 19/9
Push-Pull Ultra Linear for Mullard 510, etc. 35/9
Push-Pull 15-18 watts, sectionally wound 6L6, KT66. etc., for 3 or 15 Ω 29/9
Push-Pull 20 watt high quality sectionally wound, EL34, 6L6, KT66, etc., to 3 or 15 Ω fully shrouded 55/9

SMOOTHING CHOKES
150mA, 7-10H, 250 Ω 12/9.
100mA, 10H, 200 Ω 9/11.
80mA, 10H, 350 Ω 7/9.
60mA, 10H, 400 Ω 4/11.

R·S·C HI-FI CENTRES LTD.

MARCONI TEST EQUIPMENT



TF.144G STANDARD SIGNAL GENERATOR. 85 Kc/s.-25 Mc/s. 200/250 v. A.C. £25. Carr. 30/-. TF.329G "Q" METER Brand new with all accessories £75. T.F. 195M. BEAT FREQUENCY OSCILLATOR. 0-40 Kc/s. 200/250 v. A.C. £20. Carr. 30/-. All above offered in excellent condition fully tested and checked and offered at a fraction of original cost.

2-WAY RADIOS

Super quality. Brand new and guaranteed.

3 transistor	£6.15.0 pr.
4 transistor	£7.19.6 pr.
5 transistor	£8.4.0 pr.
6 transistor	£9.19.6 pr.
6 transistor De Luxe	£17.10.0 pr.
10 transistor	£22.10.0 pr.
13 transistor 500 MW	£31.10.0 pr.
13 Trans. 1W	£35.0.0 pr.

Post extra.

These cannot be operated in U.K.

SINCLAIR TRANSISTOR AMPLIFIERS

Z12 Amplifier 89/6; Z12 Power Pack 79/6; Stereo 25 Pre-Amplifier £9.19.6; Micro FM Radio Kits £5.19.6; Micro 6 Radio Kit 59/6; Micromatic Radio Kit 59/5; Ready built 79/6. Post paid.

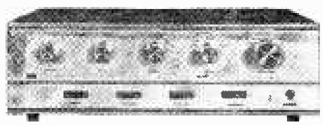
COSSOR 1035 Mk II DOUBLE BEAM OSCILLOSCOPES

Latest model using miniature valves. Perfect condition. £45. Carr. 30/-.

GARRARD RECORD PLAYERS

SRP22 Player mono £4.4.0; 1000 changer mono or stereo £5.15.6; 2000 changer mono or stereo £6.19.6; 3000 Changer mono or stereo £7.19.6; SP25 Player mono or stereo £9.19.6; SP25 with cast turntable £10.19.6; AT60 Changer mono or stereo £10.10.0; AT60 Mk II less cartridge £11.19.6; A70 less cartridge £19.19.0; LAB80 Mk II Stereo £25.0.0; 401 Transcription 26 gns. Brand new and guaranteed. All plus post and packing 5/-.

LAFAYETTE HI-FIDELITY SOLID STATE STEREO AMPLIFIERS

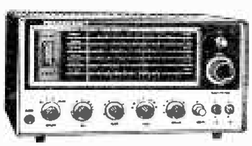


Latest 1967 models now available. Outstanding performance from modern semi conductors. Provision for all types of inputs and outputs and comprehensive tone controls. Attractive metal cased free standing units.

Model LA-224T 30 watt £25. Carr. 7/6. Model LA-60T 60 watt £37.10.0. Carr. 7/6.

DETAILS ON REQUEST

LAFAYETTE MODEL HA-500 SSB/AM/CW 80 THROUGH 6 METRE RECEIVER

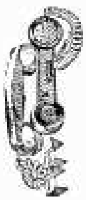


New outstanding Ham Bands only receiver covering the 80/40/20/15/10/6 metre bands. Incorporates 10 valves product detector two mechanical filters S Meter dual conversion on all bands crystal calibrator B.F.O. noise limiter aerial trimmer. I.F's 2·608 Mc/s and 455 Kc/s. Output 8 ohms and 500 ohms. Operations 220/240 volt. A.C. Supplied brand new and guaranteed with handbook. 42 gns. Carr. 10/-. 100 Kc/s crystal 35/-.

★ TRANSISTORISED FM TUNER ★

6 TRANSISTOR HIGH QUALITY TUNER. SIZE ONLY 6in. × 4in. × 2¼in. 3 I.F. stages. Double tuned discriminator. Ample output to feed most amplifiers. Operates on 9 volt battery. Coverage 88-108 Mc/s. Ready built ready for use. Fantastic value for money. £6.17.6. P. & P. 2/6.

TRANSISTORISED TWO-WAY TELEPHONE INTERCOM.



Operative over amazingly long distances. Separate call and press to talk buttons, 2-wire connection. 1000's of applications. Beautifully finished in ebony. Supplied complete with batteries and wall brackets. £5.19.6. P. & P. 3/6.

R.107 RECEIVERS

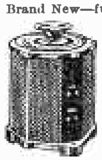
1·7–17·5 Mc/s. Mains or 12 volt D.C. operation. Perfect condition. £15. Carr. 30/-.

TYPE 13 DOUBLE BEAM OSCILLOSCOPES

5·5 Mc/s Bandwidth Perfect condition. £22.10.0. Carr. 30/-.

VARIABLE VOLTAGE TRANSFORMERS

Brand New—fully Shrouded. Input 230v. 50/60 c/s. Output 0·260 Volts.



1 Amp	£4.10.0
2·5 Amp	£5.17.6
5 Amp	£9.0.0
8 Amp	£13.10.0
10 Amp	£17.0.0
12 Amp	£19.10.0
20 Amp	£32.10.0

Post extra.

AMERICAN TAPE

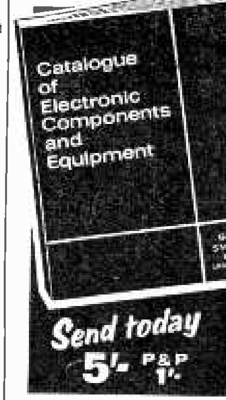
First grade quality American tapes Brand new. Discounts for quantities.

3in., 225ft. L.P. acetate	4/-
3¾in. 600ft. T.P. mylar	10/-
5in., 600ft. std. plastic	8/6
5in., 900ft. L.P. acetate	10/-
5in., 1,200ft. D.P. mylar..........	15/-
5in., 1,800ft. T.P. mylar	35/-
5¾in., 1,200ft. L.P. acetate	12/6
5¾in., 1,800ft D.P. mylar.........	22/6
5¾in., 2,400ft. T.P. mylar	45/-
7in., 1,200ft. std. acetate	12/6
7in., 1,800ft. L.P. acetate	15/-
7in., 1,800ft. L.P. mylar	20/-
7in., 2,400ft. D.P. mylar..........	25/-
7in., 3,600ft. T.P. mylar	58/6

Postage 2/-. Over £3 post paid.

CALLERS WELCOME!

Open 9 a.m. to 6 p.m. every day Monday to Saturday. Trade supplied. All items available as previously advertised.



CATALOGUE

★ ELECTRONIC COMPONENTS
★ TEST EQUIPMENT
★ COMMUNICATIONS EQUIPMENT
★ HI-FI EQUIPMENT

We are proud to introduce our first comprehensive catalogue of Electronic Components and equipment. Over 150 pages fully illustrated, listing thousands of items many at bargain prices. Free discount coupons with every catalogue. Everyone in electronics should have a copy.

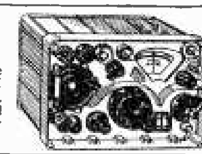
CLEAR PLASTIC PANEL METERS

First grade quality Moving Coil panel meters available ex-stock. S.A.E. for illustrated leaflet. Discounts for quantity. Available as follows: Type MR 38P, 1 21/32in. square fronts.

50µA	32/6	100-0-100µA	27/6	200mA ...	22/6	100V D.C....	22/6
100µA	29/6	500-0-500µA	22/6	300mA ...	22/6	150V D.C....	22/6
200µA	27/6	1-0-1mA ..	22/6	500mA ...	22/6	300V D.C....	22/6
500µA	25/-	1mA	22/6	750mA ...	22/6	500V D.C....	22/6
50-0-50µA ..	29/6	2mA......	22/6	1A D.C....	22/6	750V D.C....	22/6
		5mA	22/6	2A D.C....	22/6	15V A.C.....	22/6
		10mA	22/6	5A D.C....	22/6	50V A.C.....	22/6
		20mA	22/6	3V D.C....	22/6	150V A.C....	22/6
		50mA	22/6	10V D.C...	22/6	300V A.C....	22/6
		100mA ...	22/6	20V D.C...	22/6	500V A.C....	22/6
		150mA ...	22/6	50V D.C...	22/6	'S' Meter 1mA	29/6

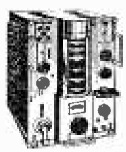
POST EXTRA. Larger sizes available—send for lists.

R209 MK. II COMMUNICATION RECEIVER



11 valve high grade communication receiver suitable for tropical use. 1·20 Mc/s. on 4 bands. AM/CW/FM operation. Incorporates precision vernier driver, BFO. Aerial trimmer, internal speaker and 12v. D.C. internal power supply. Supplied in excellent condition, fully tested and checked. £15.0.0. Carr. 20/-.

ADMIRALTY B.40 RECEIVERS

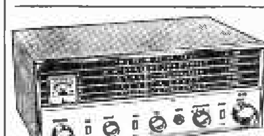


Just released by the Ministry. High quality 10 valve receiver manufactured by Murphy. Coverage in 5 bands 650 Kc/s.-30 Mc/s. I/F. 500 Kc/s. Incorporates 2 R.F. and 3 I.F. stages, crystal bandpass filter, noise limiter, crystal controlled B.F.O., calibrator, I.F. output, etc. Built-in speaker, output for phones. Operation 150/230 volt A.C. Size 19½ x 13½in. x 16in. Wght. 114 lbs. Offered in good working condition, £22.10.0. Carr. 30/-. With circuit diagrams. Also available B.41 L.F. version of above. 15 Kc/s.-700 Kc/s., £17.10.0., carr. 30/-.

LAFAYETTE KT-340 COMMUNICATION RECEIVER SEMI-KIT

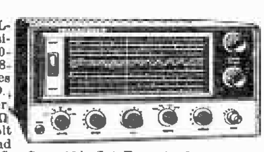
Build this wonderful receiver and save pounds. Supplied semi completed, main components ready mounted, R.F. section already wired and aligned. Full and precise instructions supplied. Specification:— 8 valves+rectifier. 4 bands covering 550 kc/s.-30 Mc/s. Incorporates 1 R.F. and 2 I.F. stages, 'Q' multiplier, B.F.O., A.N.L., 'S' meter, bandspread, aerial trimmer etc. Operation 115/230 V. A.C. Price 25 gns. Carr. 10/-.

HAM-1, 4 BAND COMMUNICATION RECEIVER



4 wavebands covering 535 kc/s. to 30 Mc/s. 5 valve superhet circuit. Incorporates S meter B.F.O., BANDSPREAD TUNING, BUILT-IN 4in. SPEAKER, FERRITE AERIAL AND EXTERNAL TELESCOPIC AERIAL. Operation 220/240 v. A.C. Supplied brand new with handbook. £16.16.0. Carr. 10/-.

NEW LAFAYETTE MODEL HA-700 AM/CW/SSB AMATEUR COMMUNICATION RECEIVER



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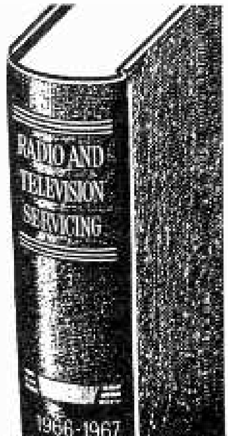

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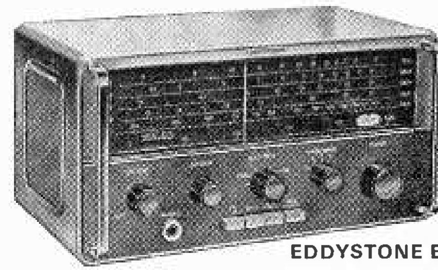

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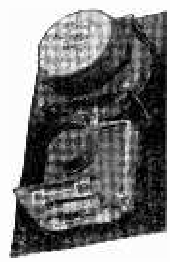

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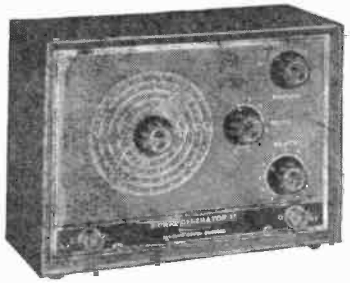

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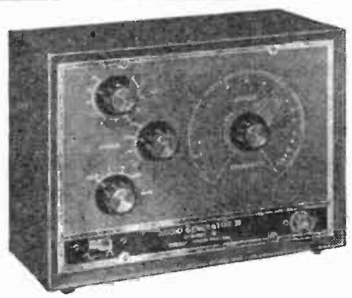

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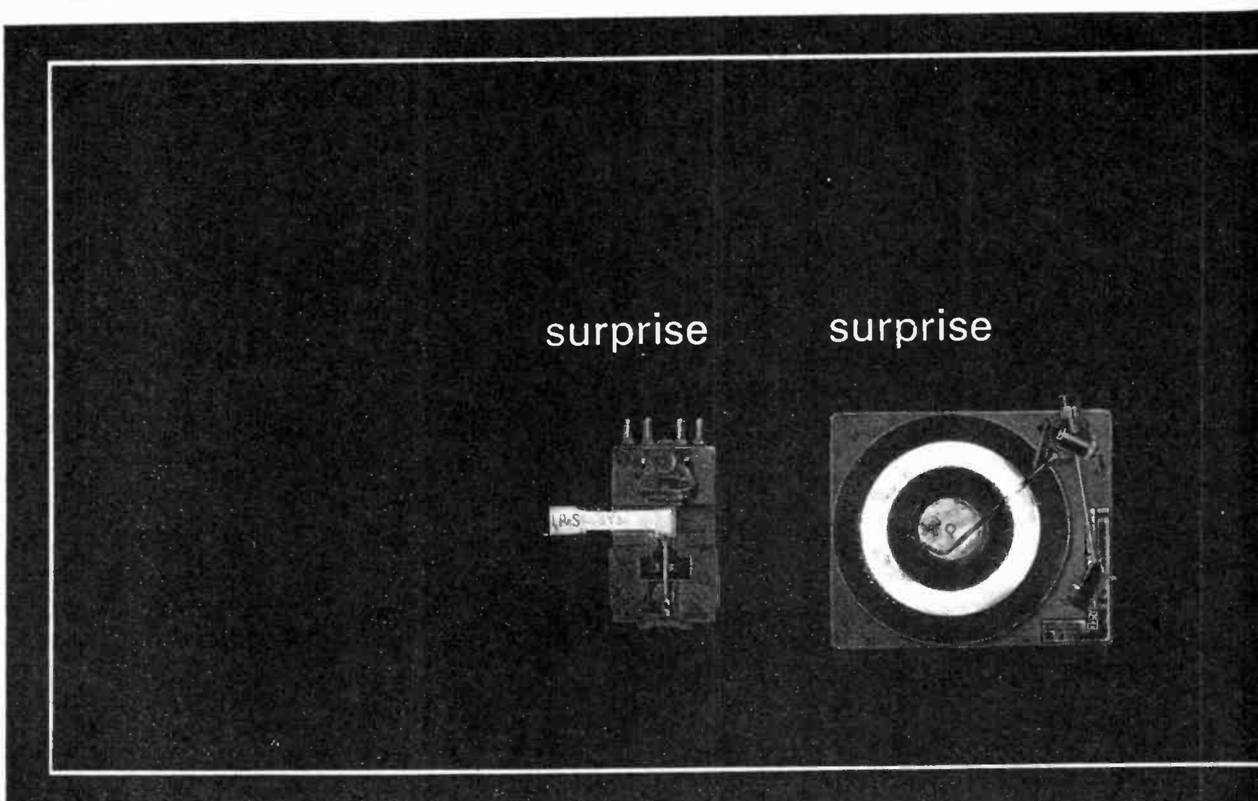

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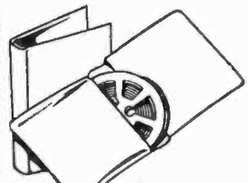

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A superbly powerful high performance instrument for the keenest enthusiasts. Provides tuning on long, medium and F.M. wavebands. Excellent sensitivity Permeability tuning on F.M. Large clear dial, A.V.C., good neg. feedback. Magic eye. 3 w. output. A.C. 200/250v. Circuit diagrams available. Aligned, tested and ready for use (Carr. and Ins. 7/6). S.A.E. brings full details. **£13.19.6**

TYGAN FRET or Vynair speaker fabric, 12 x 12in. 2/-; 12 x 18in. 3/-; 12 x 24in. 4/-, max. width 48″

BONDACOUST Speaker Cabinet Acoustic Wadding, approx. 1in. thick 18in. wide, any length cut 2/3 ft. 6/- yd.

All Sinclair kits and products in stock as advertised.

TRS RADIO

COMPONENT SPECIALISTS

Established 1946

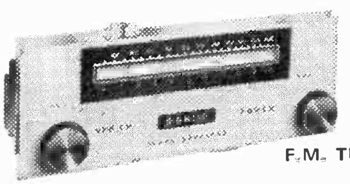
70 BRIGSTOCK ROAD, THORNTON HEATH, SURREY

Tel.: 01-684 2188. Hours 9 a.m.—6 p.m. 1 p.m. Wednesdays

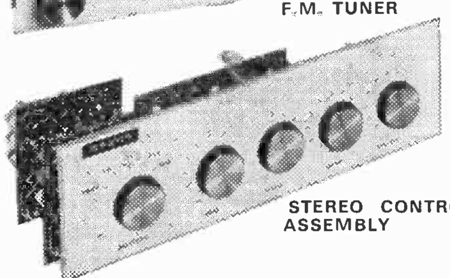
A few doors from Thornton Heath Stn. (S.R. Victoria section.)

PEOPLE PREFER MARTIN

FOR RELIABILITY, FOR QUALITY, FOR ADD-ON-ABILITY, FOR ECONOMY



F.M. TUNER



STEREO CONTROL ASSEMBLY

You can do so much with MARTIN kits. The system of using pre-fabricated transistorised units which can be interlinked in a variety of ways enables you to assemble the combination of your choice and then extend it unit by unit until you possess a full stereo gramophone and radio assembly. When new units are produced, they can be added to existing equipment very easily with the advantage that you can continue to use equipment you already have, so that your installation is always up to date. Most important of all is the power and quality which MARTIN Audiokits give you. Their sturdy construction assures compactness without sacrifice to quality or efficiency. They offer excellent value, are very easily installed and will give years of unfailing service. That is why people prefer MARTIN—it's simple to instal, good to listen to, and looks completely professional.

AMPLIFIER SYSTEMS • TUNERS • RECORDERS

MARTIN AUDIOKITS are available for Mono, and can be doubled up for stereo, or as complete stereo units. 3 ohm and 15 ohm systems are available. There is a special pre-amp for low output pick-ups and escutcheon panels to suit the arrangement you choose. The tuner is styled to match.

5-stage input Selector	£2.7.6
Pre-amp/tone controls	£3.2.6
10 watt amp. (3 ohms)	£5.12.6
10 watt amp. (15 ohms)	£6.12.6
Mains power supply	£2.15.0
FM Tuner	£12.19.3

Trade enquiries invited

From Radio and Hi-Fi Stockists

MARTIN ELECTRONICS LTD. 154/5 HIGH STREET, BRENTFORD, MIDDLESEX. *ISLeworth 1161/2*

MARTIN ELECTRONICS

154 High Street, Brentford, Middlesex

Please send Recordakit/F.M. Tuner/Audiokit Hi-Fi Leaflets. (Strike out items not wanted)

Name ....

Address ....

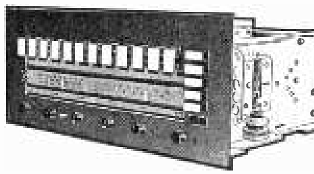
....

PW97

Lasky's Radio

SPECIAL INTEREST ITEMS!

SOLID STATE MULTIPLEX STEREO AM/FM TUNER/ AMPLIFIER CHASSIS



Model T10E—made for U.K. use by famous North American manufacturer and originally installed in De Luxe Hi-Fi consoles costing several hundred pounds. The chassis is of outstanding appearance and quality and offers many unique features plus an extremely comprehensive specification.

Features ● Separate transistorised AM and FM tuners ● 3 AM wavebands—LW, MW and Continental T.R. band ● full FM cover with 5 push button preselected stations (sep. tuning controls for AM and FM ranges) ● built in multiplex decoder with unique FMX feature which provides automatic switching from mono to stereo when stereo signal is received and vice versa ● unique split amplifier facility for simultaneous play of radio plus any other source ● channel reverse ● switched inputs for tape and auxiliaries (sep. sockets for tape in and out) ● switched extension speaker outlet ● thermal safety trip ● socket for stereo headphones.

Tech. spec.: Output 10 watts RMS per channel; output imp. 8Ω p.c.; sensitivity 50mV for 8W output at 1 Kc.; input imp. 100 KΩ p.c.; 12 unique tumbler type function controls, 8 push button wavechange and station selection controls, vol., bass, treble and balance controls, push button contour (loudness) control; illuminated tuning scale; AM ranges: MW 520-1640 Kc/s, LW 140-290 Kc/s, Continental TR 170-345 Kc/s; FM range 88-108 Mc/s with switched AFC. Operates on 200/250V A.C., 50 or 60 c/s. Size 17¼ x 8 x 12in.

LASKY'S PRICE **59 Gns** Post & Packing 20/-

A range of Hi-Fi Console Cabinets by the same famous manufacturer are available at almost ½ list price and may be seen at our Hi-Fi Audio Centres.

TWO BAND TRANSISTOR CAR RADIO BARGAIN!

THE ROYAL CR-62

A new high quality imported all transistor superhet car radio that really breaks the quality/price barrier. A unique feature of this set are the four M/W band station preselection buttons which you yourself set to your own four favourite stations—this is in addition to full M/W band cover over 535-1605 Kc/s and full L/W band cover over 150-300 Kc/s (IF frequency 455 Kc/s). Externally adjustable aerial trimmers ensure maximum output. Six transistor (including one drift type) and one diode circuit provides powerful 2W output. The set is adjustable for use on either positive or negative ground 12V systems (external line fuse fitted). Standard mounting size 6¾ x 5¾ x 2in.—front panel ½in. larger all round—finished in anodised aluminium with black push buttons. Complete with mounting brackets, full installation instructions and 2 baffle boards (for round or eliptical speaker). Fully guaranteed.

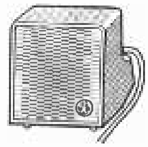
LASKY'S PRICE **£9.19.6** Post 5/-

6 x 4in. eliptical 8Ω dynamic speaker 17/6 extra—Post FREE.

SPECIAL OFFER—LOCKING CAR AERIAL Model 83003 five section 402 extention heavy chrome telescopic wing mounting type with unique locking device to protect the antenna when closed. Complete with mounting bracket, lead and plug and two "keys". **LASKY'S SPECIAL PRICE 39/6** Post Free with the Royal CR-62. Sep. Post 2/6.

MICROPHONE BARGAIN

STC MODEL 414



A high quality omni directional moving coil microphone—suitable for use with sound reinforcement and P.A. systems, tape recorders, transistor amplifiers etc. Attractive grey moulded case for free standing or hand held use—size 2¼ x 2¾ x 2¼in. Complete with 6ft. of screened cable. New and unused in makers cartons—fully guaranteed.

Type A low imp. 200Ω	Lasky's Price **£1.19.6**	Post
Type B High imp. 50KΩ	Lasky's Price **£2. 5.0**	2/-

NEW INTERNATIONAL TAPE

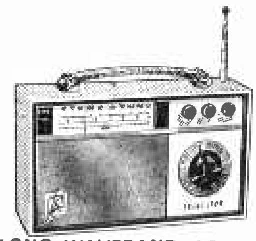
FAMOUS AMERICAN MADE BRAND TAPE AT RECORD LOW PRICES

3in. Message tape, 150ft.	2	6	5¾in. Long play, 1200ft. Acetate	12	6
3in. Message tape, 225ft.	3	9	5¾in. Standard play, 850ft. PVC	11	6
3in. Message tape, 300ft.	7	6	5¾in. Long play, 1200ft. Mylar	15	0
3¼in. Triple play, 600ft. Mylar	10	0	5¾in. Triple play, 2400ft. Mylar	45	0
4in. Triple play, 900ft. Mylar	17	6	7in. Standard play, 1200ft. Acet.	12	6
5in. Double play, 1200ft. Mylar	15	0	7in. Standard play, 1200ft. Mylar	12	6
5in. Long play, 900ft. Acetate	10	0	7in. Long play, 1800ft. Mylar	19	6
5in. Standard play, 600ft. PVC	8	6	7in. Double play, 2400ft. Mylar	26	0
5in. Triple play, 1800ft. Mylar	35	0	7in. Long play, 1800ft. Acetate	15	0
5¾in. Double play, 1800ft. Mylar	22	6	7in. Triple play, 3600ft. Mylar	50	0

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

Musicassettes—over 200 titles in stock Philips, Mercury, Fontana, C.B.S., Pye, Reprise, W.B. Send S.A.E. for full list.

CONSTRUCTORS BARGAINS



THE SKYROVER De Luxe

7 transistor plus 2 diode superhet, 6 waveband portable receiver covering the full Medium Waveband and Short Waveband 31-94M and also 4 separate switched bandspread 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. Superhet, 470 Kc/s. All Mullard Transistors and Diodes. Uses 4 U2 batteries. 5in. Ceramic Magnet P.M. Speaker. 500 mW Output. Telescopic and Ferrite Rod Aerial. Tone Control. Volume Control. Tuning Control and Waveband Selector. In wood cabinet, size 11½ x 6¾ x 3in. covered with washable material, plastic trim and carrying handle. Car aerial socket fitted.

Can now be built for **£8.19.6** Post 5/- extra

H.P. Terms: 60/- deposit and 11 monthly payments of 12/9. Total H.P.P. £10.0.3.

Four U2 batteries 3/4 extra.

Data 2/6 extra: refunded if you purchase the parcel. All components available separately.

LONG WAVEBAND COVER FOR THE SKYROVER

A simple additional circuit provides coverage of the 1100/1950M. band (including 1500M. Light programme). This is in addition to all existing Medium and Short wavebands. All necessary components with construction data.

Only **10/-** extra Post Free.

This conversion is suitable for receivers that have already been constructed.

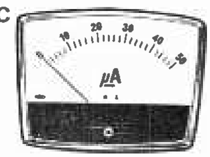
SPECIAL PURCHASE—VALVE UHF TV TUNERS

Well known British makers surplus stocks. Now available for the first time to the Home Constructors. Add 2/6 Post and Packing on each.

In metal case size 4 x 6 x 1½in. Fully tunable—complete with PC86 and PC88 valves.

LASKY'S PRICE **29/6** Without valves **7/6**

NEW! LASKY'S CLEAR PLASTIC PANEL METERS



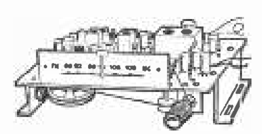
Precision made in Japan by HIOKI. Each meter boxed and fully guaranteed with all fixing nuts and washers. Sizes are of front panel. Add 1/6 Post on each.

Type KR-52 3 x 2½in. (illustrated)

1 mA DC	32/6	300 V DC	32/6
5mA DC	32/6	500μA	37/6
1mA S Meter	39/6		

Type MK-38A 2in. square		**Type KR-65** 3½ x 3in.	
1 mA DC	22/6	1 mA DC	36/-
5 mA DC	22/6	5 mA DC	35/-
300 V DC	22/6	300 V DC	35/-
55μA	27/6	500μA	42/6
1 mA S Meter	29/6	1 mA S Meter	39/6
Type MK-45A 1¾in. square		**Type MK-65A** 3in. square	
1 mA DC	25/-	1 mA DC	36/-
5 mA DC	25/-	5 mA DC	35/-
300 V DC	25/-	300 V DC	35/-
500μA	25/-	500μA	39/6
1 mA S Meter	35/-	1 mA S Meter	37/6

TRANSISTOR FM TUNER CHASSIS



Fully tunable—range 88 to 108 Mc/s. Completely wired on printed circuit. 10·3 Mc/s. IF. 6 transistors and 3 diodes. Slow motion tuning drive. Size 6½ x 4 x 2½in. Operates from any 9v. D.C. source. Full data and circuit supplied.

LASKY'S PRICE **£7.19.6** Post 5/- extra.

GORLER UT 340 FM/VHF TUNING HEART

Permeability tuned—covering 87 to 108 Mc/s. For use with one ECC85 valve. In metal case size 3 x 2¾ x 1¾in. Circuit supplied.

LASKY'S PRICE **15/11** Post 2/-. ECC85 valve 9/- extra.

TRANSISTORS

ALL BRAND NEW AND GUARANTEED

GET 81, GET 85, GET 86 2/6; 873A, 874P 3/6; OC45, OC71, OC81D 4/6; OC44, OC70, OC76, OC81 5/6; (match pair 10/6); AF117, OC200 6/6; OC42, OC43, OC73, OC82D 7/6; OC201, OC204 15/-; OC205, PC206 19/6; OC28 24/6; OC75 8/-.

TRANSFILTERS

by BRUSH CRYSTAL CO. Available from stock.

TO—O1B 465 kc/s. ± 2 kc/s.	TO—O2D 470 kc/s. ± 1 kc/s.	**9/6 each**
TO—O1D 470 kc/s. ± 2 kc/s.	TF—O1B 465 kc/s. ± 2 kc/s.	**Post 6d.**
TO—O2B 465 kc/s. ± 1 kc/s.	TF—O1D 470 kc/s. ± 2 kc/s.	

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PRACTICAL WIRELESS

VOL 43 No 5

issue 727

SEPTEMBER 1967

TOPIC OF THE MONTH

Keeping In Touch

TRADITIONALLY this space should be devoted to the burning issues of the day. In fact it is normally used not only as a platform for editorial policy but also to air subjects open to controversy.

One objective is to provide the raw material for further discussion and to this end comments sometimes scarcely disguise the tongue in cheek. This policy sometimes backfires, as witness the overseas reader whose faith in the British character sank when we spoke of sending a gunboat down the Rhine in protest against the Hertz! Then there was the reader who darkly hinted at a despotic editor campaigning against pop-pirates against the will of the otherwise 100% pro-pirate staff. So there must be no mention here of the rhino whip used to control this mutinous bunch of editorial personnel otherwise there will be a protest march on Tower House. Down you dogs!

A lesson to learn here is that it matters not only what you say—but how you say it. The only certain thing is that you will not please everyone. And the same applies, on an extended scale, to the contents of the magazine. Not only the editor, but his browbeaten staff are constantly striving for the impossibility of pleasing everyone.

How, for instance, does one cater for minority tastes without incurring the rage of those with more mundane appetites? How does one devise a succulent menu to leave most readers happily gorged? We can only hope to succeed by supplementing our own judgment with the reactions of readers. Constructive criticism, comment and suggestion are always welcome; indeed are vital. Interests and tastes change from time to time and only by keeping a finger on the pulse of our readers can we gauge our progress. That is why we value your letters.

Judging from the continued high circulation of P.W. we seem to be doing nicely—but don't let us get complacent as we sit back polishing our haloes! In the end it all comes back to the wellworn truism, that by and large you get the magazine you deserve!

W. N. STEVENS—*Editor*

NEWS AND COMMENT

CONSTRUCTIONAL

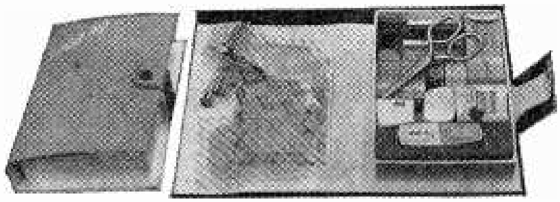
FEATURES

OCTOBER ISSUE WILL BE PUBLISHED ON SEPTEMBER 8th

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 London, W.C.2. Subscription rates, including postage: 36s. per year to any part of the world.

NEWS AND COMMENT...

FIRST AID KIT FOR THE WORKSHOP



Ever burned yourself on the soldering iron or jabbed the screwdriver into your hand? Even if you are lucky and have not, it doesn't hurt to have a first-aid kit in the workshop or shack.

Illustrated above is a compact kit measuring $6\frac{3}{4}$ x $4\frac{3}{4}$ x $1\frac{1}{2}$in. (shown closed on the left). It contains $\frac{1}{2}$oz. cotton wool, burn dressings, lint dressings, adhesive plaster, bandages, antiseptic cream, Elastoplast and a pair of scissors.

It's a good idea to slip it into your pocket if you're going mobile too, so that it doubles up as a car first-aid kit!

Price is £1, postage is free and kits are obtainable from George Bros. & Mott, Gothic Works, 1 Hainault Road, London, E.11.

TRANSISTOR PROBES AID VETS.

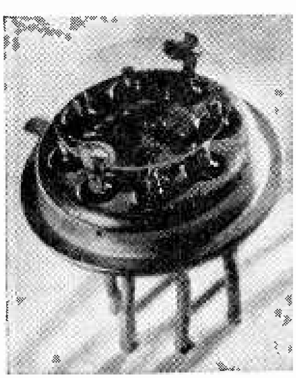
A transistorised instrument to detect metal objects which accidentally get eaten by cows with fodder, has been designed at the Yerevan Veterinary Research Centre in Russia.

The portable device locates the object precisely and measures its size. The foreign body is then promptly extracted with a flexible magnetic probe. It operates on a flashlight battery lasting for 200 hours, long enough to treat over 2,500 cows.

VHF SOUND SERVICE FROM MADDYBENNY MORE

The v.h.f. sound service from the relay station at Maddybenny More, between Coleraine and Portrush, Northern Ireland, started on June 26. The three sound programmes are transmitted on v.h.f., horizontally polarized, on the following frequencies: Northern Ireland Home Service 93·1 Mc/s; Light Programme 88·7 Mc/s; Third Network 90·9 Mc/s.

OSCILLATOR IN TRANSISTOR CAN



A micro-oscillator, type F3185, has been developed by The Marconi Company. Completely sealed inside a tiny transistor can, this unit is the smallest in the Marconi range of oscillators.

The photograph shows the micro-oscillator with the cover removed. The deposited gold electrodes on the circular crystal have been left out in order to show the micro-circuit underneath.

ELECTRONIC REFLEX CAMERA

A miniature reflex camera with electronically controlled shutter speeds, said to be the first of its kind in the world market, has gone into serial production at the Pentacon camera and cine works of Dresden, East Germany.

Trade-named Praktica Electronic, the SLR camera is equipped with an electronic plane shutter speeded from 30 full seconds to 1/500th sec., with individual settings arranged in a geometrical series. The single shutter-speed setting does not rotate during exposure and positive-action settings are provided for each speed.

The electronic circuitry is powered by a Mallory PX 21 alkali-manganese cell. A change-over switch permits the adjustment of a mechanically controlled shutter speed of 1/60th second.

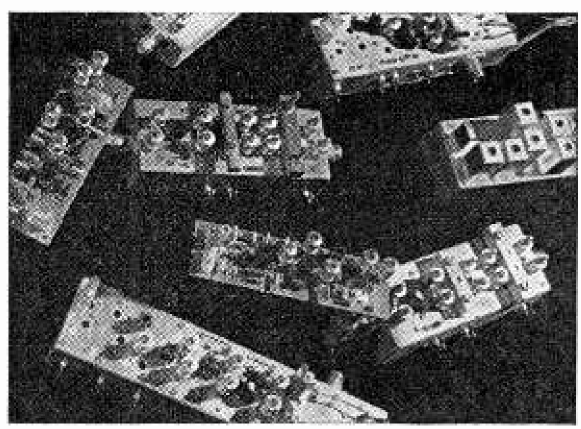
HALLICRAFTERS FROM ELECTRONIQUES

Electroniques (proprietors STC Limited) has augmented the 11,350 products it offers to radio and electronic hobbyists with a complete range of high-grade communications equipment.

An agreement has been concluded with the Hallicrafters Company of Chicago, whereby Electroniques will market the complete range of Hallicrafters radio communications products for amateur and commercial use. The agreement applies to the United Kingdom and is exclusive.

Hallicrafters amateur equipment includes high-performance receivers, transmitters and transceivers, and covers frequencies up to and including the v.h.f. bands. All apparatus is of compact, lightweight design offering the optimum performance and ease of use.

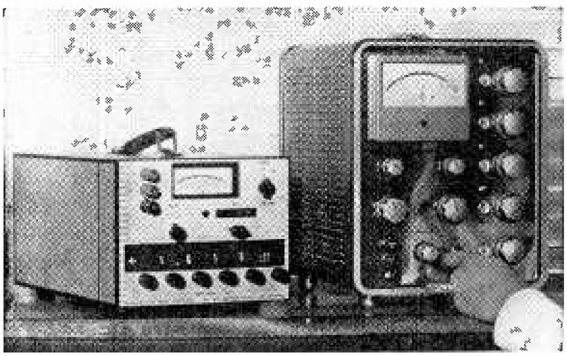
DESIGNS FOR VHF TRANSMITTERS



These v.h.f. transmitters have been designed by Mullard Applications engineers around two high-power silicon planar transistors, types BLY33 and BLY35. The circuits available are 8W, 80Mc/s a.m. transmitter; 7, 11 and 15W, 170Mc/s a.m. transmitter; 15W, 80Mc/s f.m. transmitter; 25-30W, 170Mc/s f.m. transmitter.
The supply voltage for the 25-30W transmitter is 28V. All the other designs operate from a 13·8V supply.

NEWS AND COMMENT...

ALL-GOLD INSTRUMENT INSURED FOR £4,000



One of the most expensive electronic instruments — £ for lb. — at this year's RECMF was this portable differential voltmeter (right) with a gleaming 24-carat polished front panel and gold plating throughout.

The golden instrument weighs only 24lb. but is insured for over £4,000. It was the 10,000th of its type produced by the American specialists John Fluke and took pride of place on the stand of Livingston Laboratories Ltd. of Watford, where it is being displayed alongside the first British-made equivalent off the production line (left). The home produced version is lighter and more compact than its golden U.S. forerunner, has an accuracy of 0·02% and is solid-state throughout. It is also cheaper because it attracts no duty.

MONO PICKUP DESIGN

Following the announcement by EMI Records Limited of their intention to introduce stereo-only classical LPs from July next, the following statement has been issued jointly by BREMA and the RECMF:—

> It is not practicable to specify any clear-cut performance figures for pickups and their cartridges which will be suitable for playing stereo records, but satisfactory results should be obtained if the pickup used is either one which has been designed for stereo reproduction (though it may be wired for mono) or is a type which has good vertical compliance, low mechanical resistance and a low tip-mass. Many mono pickups produced in the past will be satisfactory although they were not designed specifically for stereo; in future it is expected that most mono pickups will be suitable, and these will be identified: — 'This mono pickup will play stereo records'.
>
> Although some high-output pickups used with single-stage amplifiers may not fully meet these conditions, they may still be acceptable if it is desired only to play the record monophonically and on that particular piece of equipment. The manufacturers of the equipment should be consulted if it is desired to know whether a particular type is suitable.

THE WRONG RAY

In the caption to the photograph in Club Spot on page 219 in July issue the two Rays were transposed. Ray, the SWL is on the extreme left and Ray, G3MWF is pictured fourth from the left. Our sincere apologies to both Rays.

INTERNATIONAL MOBILE RALLY

"Keep going straight on and you can't miss us". The congenial voice boomed out of the loudspeaker in the car. The time around 1045, frequency—1950kc/s and the voice was John—GB3USA. Fifteen minutes later we were at the entrance to the United States Air Force Base, R.A.F. Alconbury and we had arrived at the Eighth International Mobile Rally organised by the Amateur Radio Mobile Society and the Third United States Air Force.

What a day. The sun blazed down and the people flocked in. Estimates reckoned some 5000 people attended and certainly by 2 p.m. the huge runway was crammed with cars six deep.

Couldn't make it? Want to know what you missed? Well the big hanger looked like the annual RSGB Exhibition, with over 70 trade stands displaying just about everything from surplus equipment sales to commercial Amateur stations. Then there was the giant tombola, the numerous competitions—even one for the children, the Mid-Anglia police who demonstrated a radar trap, and a superb demonstration of radio controlled model aircraft which did just about everything except serve hot lunches on board. A popular event with the ladies was the demonstration by Helena Rubinstein beauty experts.

Perhaps the most significant factor in the tremendous success of the Rally was the wonderful hospitality of the Americans. There was "Bob" who served the most delicious hot-dogs direct from an open barbacue; and the man in sun-glasses smoking a cigar who drove a gaily decorated "train" round the base all afternoon to give rides to the children. The "train" by the way, was brought all the way over from Mildenhall. Out on the runways and roads round the Base men in uniform with white hats and gloves gave clear directions to all newcomers and directed them to the parking runway. They were still out there when we left at 5.30 p.m. The "Talking Bird", a huge aircraft which, inside, looked like a "baddies" communications centre in a James Bond film. Special buses were laid on to take us to see the Police dog display and for those who got thirsty, there was a nice long cool drink which had been kept in huge bins crammed with ice. With so much going on no wonder we were all so reluctant to leave. The weather was superb, and at half past five the sun was still blazing to attention patiently waiting for "permission to set Sir". If you missed the rally then—"like man you goofed". See you next year?

IRISH POLICE ON THE AIR

Ultra Electronics have received an initial order worth £19,000 from the Garda Siochana (Irish Police) for their new "Cub" Pocketset.

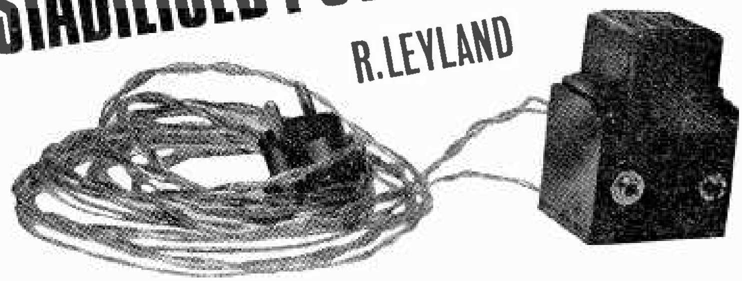
The purchase of the "Cub" by the Irish Police follows their declared policy to provide their force with the most efficient and up-to-date equipment currently available.

The equipment is already in quantity production for the Home Office and many industrial users.

Designed to meet the ever growing need for personal lightweight, 2-way radio communications equipment, the f.m. "Cub" weighs only 25ozs. It is the latest edition to the Vigilant range of portable equipment which is already used in large quantities by Police, Fire Services, public utilities and many commercial users throughout the United Kingdom and overseas.

MINIATURE STABILISED POWER SUPPLY UNIT

R. LEYLAND



CURRENTS can be provided from this 9-volt supply of up to 100mA to work radio or other transistorised circuits. The output is kept in the region of 9 volts throughout the normal current range by a series stabiliser consisting of a power transistor and a 250mW zener diode. Beyond the stabilised range, a steep fall in voltage limits the short-circuit current to about 300mA. The steeply-falling characteristic belongs to the voltage-doubler rectifier system and is levelled out initially by the action of the transistor regulator, to give an output impedance of approximately 5Ω over its linear range.

Unlike most other types of power supply, it is not immediately damaged by overloads, but a short-circuit lasting for half-an-hour or more would cause the transformer to overheat. A midget bell transformer, it has an unusually large voltage drop on load. On open circuit, the secondary voltages are 50% above the nominal values obtained at the rated 3 volt-amperes output. Choosing the 5V section, about 18 volts appears across the voltage-doubling capacitors when no load is connected to the power unit. The excess voltage is dropped across the transistor, and only about 9 volts appears at the output. This is clearly shown in the graphs, Fig. 3, of the power unit before and after stabilisation.

Zener diode

The power dissipation in the transistor is low, and the small temperature rise in normal working is confined mainly to the transformer. The zener diode also works at well below its 250mW rating. The maximum zener current (approximately 17mA) occurs when there is no load on the power unit. At output currents above 100mA, the current in the zener diode decreases to zero, stabilising action ceases, and the voltage falls.

There is an appreciable production spread in zener diodes, e.g. ± 5% or more. The nominal voltage of an OAZ207 is 9·1V, and the output should not exceed 10 volts with a diode at the upper end of the production spread. It would in fact be rather less, possibly 9·8V, owing to the base-emitter drop. A lower voltage than this could be guaranteed, if necessary, by using an OAZ206 with a nominal voltage of 8·2V.

The characteristic of any good quality zener diode shows hardly any current at voltages below the stabilised voltage, but when the stabilised voltage is reached, any further slight increase of voltage causes a large current to flow. This current is passed through a resistance in series with the diode, causing any surplus voltage to be dropped across the resistance, leaving the voltage across the zener diode almost unchanged, and only slightly higher. The zener diode is thus enabled to preserve an almost constant voltage despite large changes in the supply voltage, and in the face of variable loading. The constancy of stabilised voltage depends on the amount of resistance into which the zener diode works. Here it is a 470Ω resistance, together with the input resistance of the transistor.

The base-emitter potential difference of the transistor will be between 0·2 and 0·3V according to the emitter current. Connecting the base of the transistor to the zener diode ensures that the emitter voltage will be within a fraction of a volt of the voltage across the zener diode. As long as the zener voltage is maintained, the output will be stabilised, and when with heavier loading, the zener current approaches zero, the voltage across the zener diode and the output voltage will both fall. The transistor functions as an emitter-follower, tying the output to the reference voltage, acting as a control amplifier to minimize the difference between them. The transistor handles a heavier current than the zener diode, a low wattage type, is able to control directly, and permits some improvement in stabilisation, by enabling the resistance in series with the zener diode to have a value as high as 470Ω.

A highly stabilised supply would have an output impedance that is only a small fraction of an ohm,

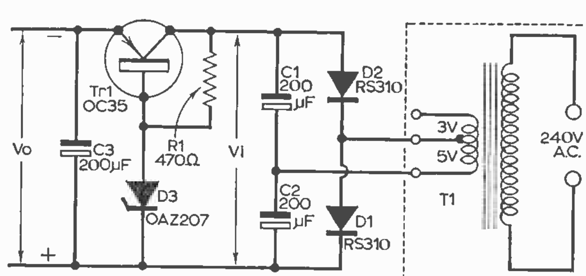


Fig. 1: Circuit diagram of the complete unit.

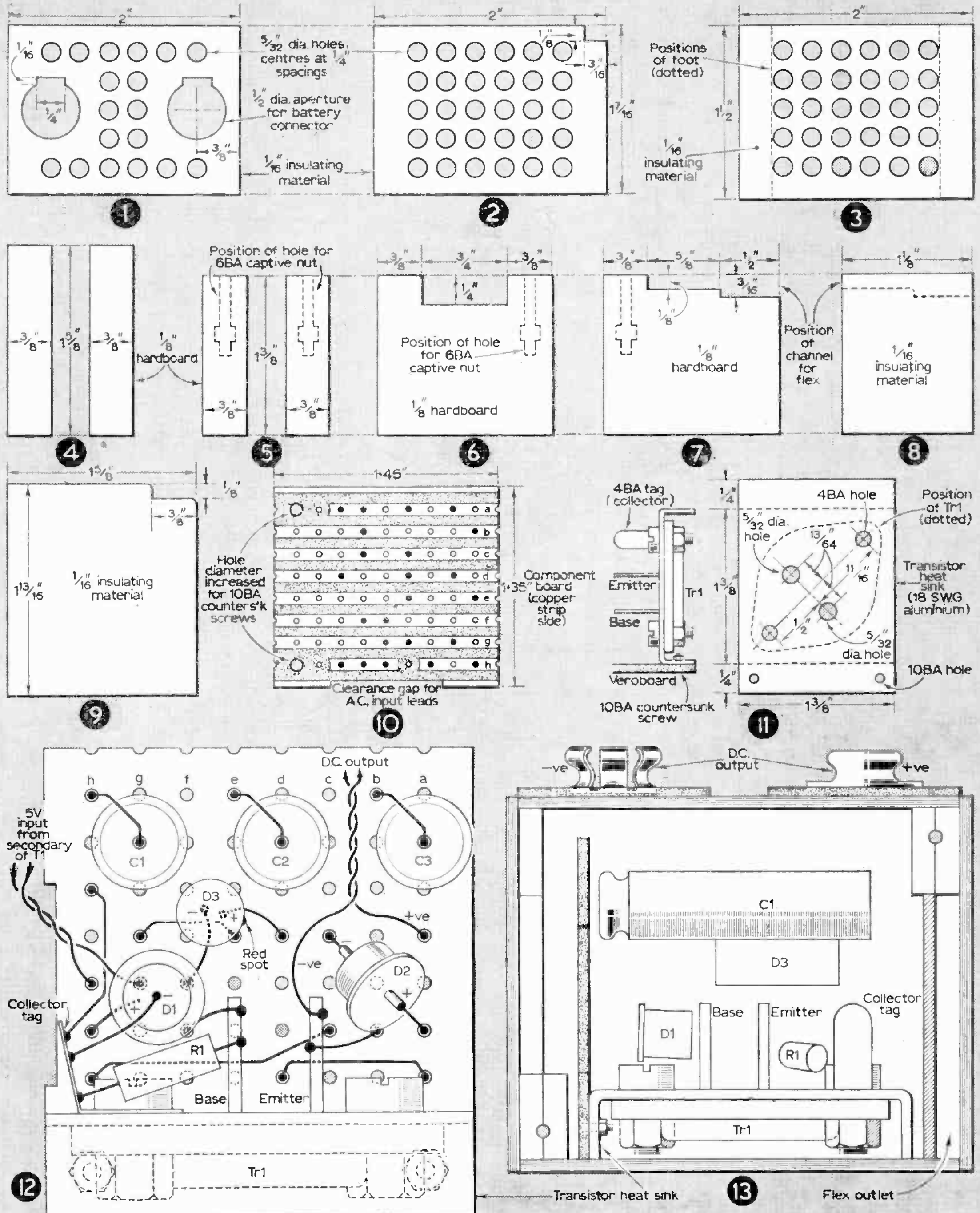


Fig. 2: Parts of the power supply box and interior wiring and layout. (1) side view, (2) opposite end, (3) bottom of box. (4) feet. (5) corner pieces, (6 & 7) inner ends, (8) flex retainer, (9) outer ends. (10) component board, (11) transistor heat sink, (12) component board wiring, (13) main component layout.

but this requires a multi-stage amplifier with temperature compensation. An output impedance of 5Ω compares quite well with that of a transistor radio battery.

Performance

After continuous working at 100mA for a long period, the only noticeable change is a small decrease in output voltage, less than 2%, due to warming up. The low output impedance and freedom from ripple make it a suitable power unit for Class B amplifiers with outputs up to 1 watt (see Fig. 3).

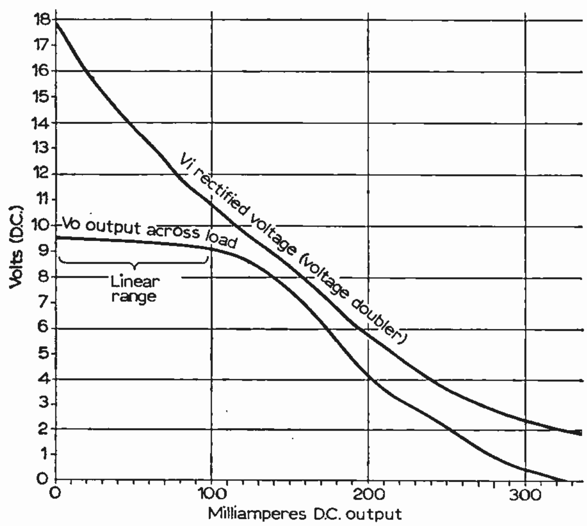


Fig. 3: Regulation curves of the power unit.

Construction

An all-insulated construction was considered necessary, with complete separation of the primary and secondary circuits. The transformer itself meets this requirement, and the other components are housed under the transformer in a box made from $\frac{1}{16}$in. insulating material, perforated with $\frac{5}{32}$in. dia. holes for ventilation. To prevent the holes in the bottom from being blocked, it is raised on feet consisting of two hardboard strips. Hardboard is also used for the inner end pieces to provide thicker edges for gluing. An impact adhesive should be used that gives strong joints without becoming brittle.

The outer ends of the box overlap the connector blocks of the transformer and at one end a flex channel is provided in the simplest manner by shaping the top of the hardboard and adding a piece of $\frac{1}{16}$in. material on the inside to form the other wall of the channel.

Twisted plastic-covered flex, with the leads separated and uncrossed, fits into this channel, and the two leads are retained individually by the bends into the connector blocks.

At the other end of the transformer, fine plastic-covered stranded wire brings the input from the 5V secondary into the box, and similar wire is used for the d.c. output connections. These connecting leads are several inches in length to enable the component assembly to be inserted easily into the box.

The output connectors are a pair of large type transistor battery press studs, glued in position over the two apertures at the front. The tags are bent back on the inside so as to remain clear of the component assembly. The d.c. leads are soldered to these bent tags in the interior.

A pair of 6BA bolts 1in. long secure the transformer on top of the box containing the other components. These screw into 6BA nuts that are imbedded in the hardboard, $\frac{1}{2}$in. from the top. To make this possible, the hardboard is thickened to $\frac{1}{4}$in. by additional corner pieces glued on the inside. The vertical holes for the 6BA bolts occur at the joins, but with care, the holes can be drilled satisfactorily. If splitting occurs, this can be remedied with further gluing.

Before the outer $\frac{1}{16}$in. material is glued on over the ends, holes are made at right angles through the doubled hardboard, $\frac{1}{2}$in. from the top, for the 6BA nuts. These holes can be made rectangular by inserting a needle file after drilling. The 6BA nut is pushed in and positioned by screwing the 6BA bolt through it from the top. The nut is then fixed with plastic wood. Finally the outer pieces are glued on.

Component assembly

The earlier type of OC35 is thicker and will not fit into this power supply, although it is otherwise suitable.

The more recent type is only $\frac{1}{4}$in. in depth (excluding the soldering pins).

The transistor is bolted on a small heat sink with 4BA nuts and bolts. A tag is fitted under the head of one of these bolts for the collection connection. The heat sink, of 18 s.w.g. aluminium, has two $\frac{1}{4}$in. flanges. To one of these a small square of Veroboard is fastened at right angles to the heat sink by a pair of 10BA countersunk bolts with nuts.

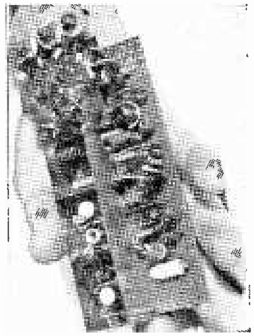
The Veroboard measures 1·45 by 1·35in. and is sawn from a larger piece. If necessary it can be filed a little at the edges to allow it to be fitted easily into the box when attached to the heat sink. A small gap is filed at the top edge to leave sufficient room for the leads to the transformer secondary.

Three breaks are made in the copper strips. Two of these are necessary to avoid contact through the 10BA bolts with the heat sink. Three jumper links of 24 s.w.g. tinned copper are added. These are inserted from the other side of the Veroboard and soldered to the respective copper strips.

Wiring the power unit presents no difficulty if the proper sequence is followed. The resistor R1 is connected between the collector tag and the base pin of the transistor. A wire is taken from the base pin to an adjacent point on the board as shown. A heat sink should be applied on the transistor pin when soldering. The emitter pin also connects to the components board, and a flying lead is taken from it for the negative d.c. output. The other leads are taken from the points on the board shown, and must be of fine flexible plastic-insulated wire to

—continued on page 343

switched fm tuner



Second and final part — by W. GROOME

Transistor lead indentification is given with the respective pictorial diagrams. The 2N2926 has a central collector lead as shown in Fig. 8 (sketch A) and this must be bent (sketch B) to suit connections for Tr5, Tr6 and (sketch C) for Tr7. Sleeving should be fitted to all transistor leads.

After careful checking the tuner may be tuned without the lid on the screened compartments. Connect dipole, 9V battery and crystal earpiece or amplifier. A rushing noise is normal in the absence of a signal and should disappear as a switched-in pre-set (TC1—TC3) is adjusted. If the entire capacitor range fails to bring in all three programmes adjust L4 by slight extension or compression to shift the resonant range. L1 and L2 are very broadly resonant and will not need adjustment at this stage, if at all, but L3 core should be adjusted half a turn at a time for every sweep with the tuning pre-set. When the three programmes have been located switch and tune all three pre-sets, then adjust L3 core for optimum performance over the band. Some adjustment of L2 (by slight extension or compression) may be necessary. Fit the screen lid and note the effect upon tuning. Adjust L4 to restore the range, a matter of a few trials before the lid is permanently attached by spot soldering in four or five places. Final adjustment is best achieved with a poor signal—from a split-flex indoor dipole, for example—so that you can tune L4 through the screen hole, and the pre-sets, for minimum background noise.

The excellent results obtained with a crystal earpiece suggest that the tuner can be used for "personal" listening, a far more enjoyable experience than plugging the earpiece into most transistor receivers. The audio output is more than ample and drives the author's 5-watt transistor amplifier (without pre-amplifier) and should therefore be enough for most fidelity needs. An output capacitor will be necessary if this protection does not exist at the input of the amplifier or pre-amplifier—up to 50μF and an appropriate working voltage for transistor equipment. The tuner requires a 9V, 11mA power supply and this can be supplied from other equipment provided the correct polarity is observed. A 12V supply (maximum) will increase the sensitivity, frequency stability and output if this is necessary. The frequency stability of the oscillator will tolerate some supply variations but cannot be expected to offset the effects of very poor regulation.

Although a single-pole three-way switch is sufficient the photographs show a three-pole type with the unused tags earthed. There seems to be a tendency for dealers to stock only three-pole types on the grounds that these will do for one-, two- or three-pole use. Again, although dealers' stocks have become largely representative of the transistor era it is by no means easy to obtain switches smaller than those that have done service in valve circuits ever since the war. Because of this supply difficulty a standard-sized component has been specified. Despite all this, the tuner is small enough to fit into most fidelity housings very easily. Perhaps, when the required small components are readily available, I will cram the entire tuner into a fag-packet!

Note. Throughout this article the term "earth" means the positive line of the tuner.

CONSTRUCTION

Divide conductors as in Fig. 2, drill screw fixing holes in first (unused) conductor and through S21. Restore continuity here with bare-wire soldered connection S20 to S22. Drill hole at P30 to pass switch bush and fit platform with pre-set capacitors, secured by fitting switch. Connect insulated wire from mid-point of Q18 and Q19 to V32. Black connection from mid-point Z21 Z22 to mid-point M25 M26 and from there to M11. Make bare connection from T to S near hole 2. Make bare connection T25 U26 V27. Turn panel plain side upwards so that M1 is top left and switch is on right, then proceed as in Table 1.

TABLE I R.F. STAGE (FIG. 4)

M2	N2	C1	
S2	Q2	R2	
S3	Q3	C3	
	N1 Q1	} L1	See Fig. 3
M5	P5	R3	
S5	—	R4	wire-to-wire with R3
S6	—	C4	wire-to-wire with R4
—	N3	Tr1	emitter
—	N5	Tr1	collector
—	P4	Tr1	base
—	S4	Tr1	screen
S7	M7	C2	wire sleeved, flat on panel
—	M6 N8	} L2	Fig. 3 Equi-distant from other components and panel edge
M10	M8	R1	Wire sleeved, bent close to resistor and panel
—	N9 P9	} C5	
T1	—	—	This screen support wire can be left until screen is fitted

Check work already done with circuit and pictorial diagrams, then turn panel, again plain side upwards, so that switch is on left and M1 is lower right. Work then proceeds generally in the direction left to right as before.

Check work thoroughly before fitting screens. The shorter screen should lie along row T. Trial fit first to mark positions of small partitions—R.F. partition to stand between rows 9 and 10 with C5 on one side

TABLE II OSCILLATOR STAGE (FIGS. 5 AND 6)

M13	P13	R6	
S13	—	R7	wire-to-wire with R6
—	—	L3	short stiff wire connection from one tag to top wire of R6. C7 aids support; no further support needed
S12	—	C7	connect to second tag on L3
M14	—	C6	negative
—	S14	C6	positive. Wire sleeved, flat on panel
M16	N16	R8	
Q16	S16	C8	
P17	—	—	wire partition support, similar to T1
—	N17, Q17	C10	to right of P17
—	Q18, S18	C9	
S19	Q19	R9	
—	N15	Tr2	collector
—	P15	Tr2	base
—	Q15	Tr2	emitter
—	S15	Tr2	screen
—	Q24, S24	C11	
—	—	—	Connect unused switch tags together and earth to S28
—	Q25	—	Insulated lead to switch selector tag. Press wire flat on panel and bend C11 clear of L4 area
M25	M23	R5	
—	N21, Q21	L4	Trial fit and bend ends to make coil stand about 3/16in. above panel, ¼in. clear of panel edge and equidistant from other components. Refer to Fig. 3, Fig. 6 and photograph
T24	—	—	Partition support wire

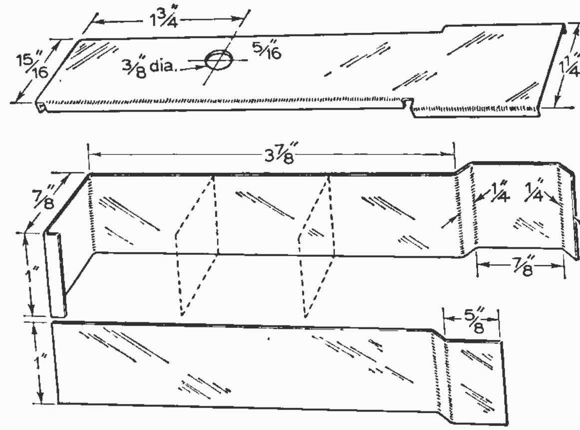


Fig. 9: Details of tinplate screens.

TABLE III I.F. STAGE (FIG. 7)

V33	X33	R10	
—	X32, W32	C13	
—	X31, V31	C12	
—	Z30	C14	negative
—	V30	C14	positive
Z27	X27	R13	
Z26	Y26	R14	
W26	W28	R11	
—	V29	Tr3	emitter
—	W29	Tr3	base
—	X29	Tr3	collector
V25	W25	R15	
U24	V24	R16	
—	U23, V23	C15	
Z22	Z24	R12	
—	Y22, W22	C16	
—	W24	Tr4	emitter
—	X24	Tr4	base
—	Y24	Tr4	collector

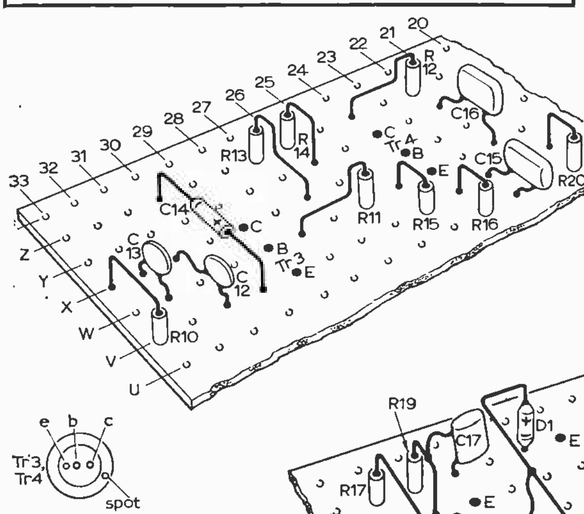


Fig. 7 (above): I.F. stage, plus underside view of XA102 transistor.

Fig. 8 (below): Discriminator and output. Sketches of 2N2926 show underside (A) as purchased, (B) joggled for Tr5 Tr6, (C) joggled for Tr7. (D) shows underside of OC71.

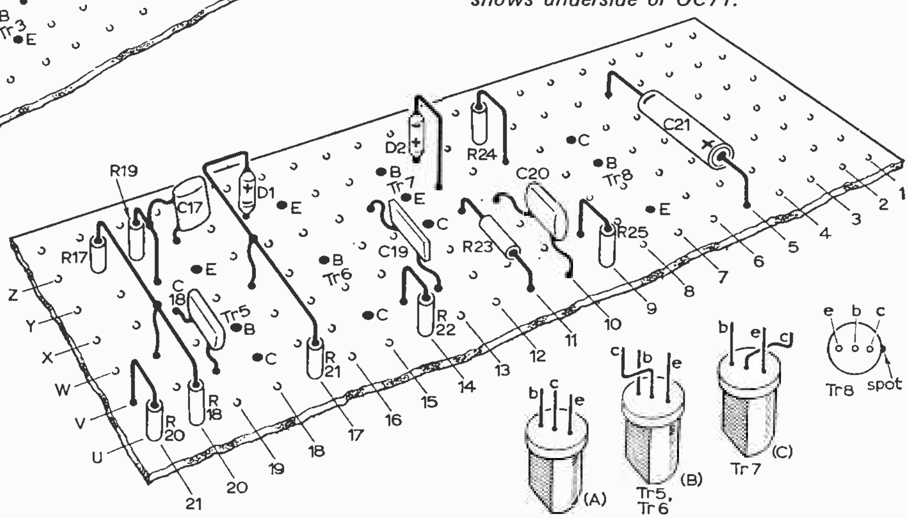


TABLE IV DISCRIMINATOR AND OUTPUT STAGES (FIG. 8)

U21	V21	R20	
U20	W20	R18	
Z20	—	R17	wire-to-wire with R18
Z19	Y19	R19	wire-to-wire with R18
Z18	—	C17	wire-to-wire with R19
—	X19 V19	C18	
—	Y18	Tr5	emitter
—	W18	Tr5	base
—	V18	Tr5	collector
U17	X17	R21	
Z16	—	D1	wire-to-wire with R21. Note polarity in Fig. 8
U14	V14	R22	
—	V13 Y13	C19	
—	Z15	Tr6	emitter
—	X15	Tr6	base
—	V15	Tr6	collector
—	U11 X11	R23	
—	U10 X10	C20	
—	Z11	Y11	D2. Note polarity in Fig. 8
—	Z12	Tr7	base
—	Y12	Tr7	emitter
—	X12	Tr7	collector
Z9	Y9	R24	
U9	V9	R25	
—	V7	Tr8	emitter
—	X7	Tr8	base
—	Y7	Tr8	collector
—	Z5	C21	negative
—	U5	C21	positive

and R1 the other, oscillator partition between rows 16 and 17 with C8 R8 on one side and C10 the other. After soldering partitions to screen attach plastic adhesive tape to areas likely to touch components when fitted, then fit screen to panel by soldering to wire supports T1 T24 F17. Attach the other (long) screen by soldering lap joint, partitions (hot iron outside, cored solder to joint inside) and a spot joint to tinplate platform near switch. Lid to be spot soldered after final tuning adjustment, or may be omitted if tuner is eventually to be fitted in a screened housing.

Connect the following leads as in Fig. 2:

Z1 negative, black flex. −9V.
S1 or T1 positive, red flex. OV.
M1 co-ax cable, core } to socket attached to
S1 „ „ braid } housing.
Y1 a.f. output, via capacitor if this is not present in a.f. equipment input.

IMPORTANT. Observe polarity when connecting to other equipment. On no account must the positive line, the screens or the aerial be allowed to contact the earth or chassis of "negative earth" equipment. Next to a battery the simplest supply is a smooth, well-regulated −9V from transistor equipment with positive earth. With negative-earth equipment connect Z1 to equipment negative line and S1 (or T1) to +9V obtained by dropper resistor or bleeder from equipment positive line. ■

ON THE SHORT WAVES

MONTHLY NEWS FOR DX LISTENERS

Times in GMT
Frequencies in kc/s

THE BROADCAST BANDS

by JOHN GUTTRIDGE

MIDDLE EAST

Egypt: *Cairo Radio* (U.A.R. Broadcasting and TV, P.O. Box 1186, Cairo) uses the new frequency of 15,050 in parallel 15,475 to carry its main Arabic programme.

Iran: *Radio Iran* (Ministry of Information, Meidan Ark, Tehran) is again using 3,780 for its home service and giving an excellent signal around 1,800. The regional station *Radio Isfahan* gives a fair signal at 1715 on 7,890.

Iraq: *Radio Baghdad* (Salihiya, Baghdad) using additional frequencies to relay home service: On 15,400 from 0930–1200 and on 11,785 0530–0700 and 1200–2200.

Lebanon: *Radio Lebanon* (Ministry of Information, Beirut) transmits in its external service as follows: 1830–2030 on 17,750; 2300–0100 17,765; 0130–0400 11,965. Some reports give this last frequency as 11,760.

Syria: *Radio Damascus* (Ommayad Square, Damascus) is relaying its home service on 17,860 at 1300–2300 and on 15,165 1900–2300. English is beamed to Europe at 1600–1700 over 15,165.

AFRICA

Algeria: *Radiodiffusion–Television Algerienne* (21 Boulevard des Martyrs, Algiers) is to start shortly using a 1,000kW long wave transmitter. This will be the first long wave transmitter in Africa.

Ghana: *Radio Ghana* (Broadcasting House, P.O. Box 1633, Accra) is actually using 9,755 instead of the announced 9,760 for its 2000-2100 English transmission.

Nigeria: *Radio Nigeria* (Broadcasting House, Lagos) is now carrying its external service over 21,645/15,255/11,715/7,275. English is at 1500–1600, 1700–1900, 2100–2200.

South Africa: *Radio South Africa* (P.O. Box 8606, Johannesburg) is once again using the 11m.b. The transmission concerned is at 1000–1455 and frequencies are 25,730/21,495/17,805/15,200. Careful tuning will bring in the home programme around 2100 on 3,250.

ASIA

Afghanistan: *Radio Afghanistan* (Ansari Watt, Kabul) has a new transmission beamed to Europe at 1100–1200 over 17,825/15,340.

China (Taiwan): *Voice of Free China* (Taipei, Taiwan) now uses 17,890/17,780/17,720/15,345/15,125/11,825/7,130 for its 0200–0350 English transmission.

India: *All India Radio* (P.O. Box 500, New Delhi) has English as follows: 2245–0015 7,235/9,615; 2245–0115 9,740/11,760; 0030–0115 11,710/15,105; 1000–1200 15,105/15,165/17,705/17,890/21,615; 1330–1500 15,375/16m.b.; 1745–2230 7,215; 1745–2030 11,620; 1745–1945 15,230; 1945–2045 9,690/11,775; 1945–2230 9,912; 2045–2230 11,755.

Indonesia: *Radio Republik Indonesia* (P.O. Box 157, Djakarta) has English as follows 1900–2000; 2330–2400 9,865; 0900–0930 11,770; 1100–1200 9,865/11,770. A new home service outlet has been noted around 1100 on 5,065.

Japan: N.H.K. (Tokyo) frequency usage for English and Japanese service is 0100–0730 15,105/15,195/15,300; 0800–0930 15,300/15,195/9,505; 1000–1330 9,505/11,815/15,300; 1400–1630 9,505/9,560/11,815; 1700–2130 9,560/11,815/15,105; 2200–0030 15,195/15,300/17,785. Transmissions are every hour on the hour and last 30 minutes except for those at 1000, 1400 and 2300 which last 90 minutes.

Pakistan: *Radio Pakistan* (Broadcasting House, Bunder Road, Karachi) has a dictation speed English news broadcast at 1335–1350 on 15,100/17,812. The U.K. English TX at 1945–2030 is now on 11,672/15,365.

NORTH AMERICA

Canada: C.B.C. (P.O. Box 6000, Montreal) has replaced 21,460 by 21,595 at 1100–1215 and 1345–2152 and has replaced 15,365 by 15,320 between 1100 and 1830.

CENTRAL AND SOUTH AMERICA

Bolivia: *La Cruz de Sur* (Cajon 1408, La Paz) is reported fair at 0200 over CP75 on 4,985.

Brazil: *Radio Exelcior* (Rua Wenceslaut Brazil 78, Sao Paula) gives fair reception at 0100 on 9,585.

Costa Rica: *Radio Popular* (Apartado 341, San José) is now using the additional frequency of 4,784.

Uruguay: *Radio Oriental* (Olimar 1364, Montevideo) is fair at 0030 on 11,735 (CXA7).

Venezuela: *Radio Maturin* (Maturin). YVQH has been noted on 5,040 with fair signals around 0100.

EUROPE

Germany: *Deutsche Welle* (Bruederstrasse 1, Postfach 344, 5 Koln) has made frequency changes in the following English TX: 1550–1620 15,275/17,880; 1900–1910 15,405/17,785.

Greece: *Voice of America* (Washington, U.S.A.) has closed its G8 Thessaloniki and Rhodes relays to avoid censorship.

U.S.S.R.: *Radio Moscow* (Moscow) now has the following European English schedule: 0700–0730 9,700/9,710/11,830/11,890/15,300/15,360; 1200–1230 11,700/11,740/11,830/15,300/17,760; 1900–1930 1,322/9,710/9,770/11,830/15,170; 2000–2030 1,383/9,710/9,770 11,830/15,170; 2100–2200 1,443/9,710/9,770/11,830/12,060; 2200–2230 1,322/1,383/1,443/9,710/9,770/11,830

Thanks go this month to G. Coyne, M. E. Terry, R. J. Warner, the International Short Wave Club, and the Swiss Broadcasting Corporation.

A SOMEWHAT controversial month with some claiming things were so bad they were going to take up chess, while others lamented that there were not enough hours on the clock to log all the DX. At '3JDG things were about half and half, but most s.w.l.'s logged my best ones anyway and threw a few more in for good measure.

From letters received it is now certain that 8R is the new prefix for VP3. I reckon all people issuing a Countries List should give away a free pen with it for all the alterations that will arise while the darn thing is still in the post. I can hardly wait for instructions to change my call to VXY7JDG. (Many a true word!)

One or two have written in to ask about a competition or a table of some sort. If there are enough takers we might try this, any suggestions as to what form it should take?

Quite a heavy postbag this month so I'll replace my muzzle and press on with what others have heard.

LOW

Nothing extra special reported on topband other than hordes of G's and quite a large number of mobiles. Eighty fared a little better but surprise surprise—forty has been given a going over. John Wresdell (Yorks), logged ZL3IJ and ZL4LM on 80 s.s.b. so the DX is about on this band. John is 13 and takes the RAE in December. (Good luck OM).

R. Iball (Notts), AR88D, 80 ft. end-fed with 35 ft. 72Ω co-ax managed these on 7Mc/s c.w.—HI7JMP, HK4AOY, KZ5FX, PY2AXZ, 3C2ATD, 6Y5RM.

Paul Baker (S. Wales), HE30, 100 ft. end-fed 30 ft. up snapped this little lot up on 7Mc/s s.s.b.—CN8AW, CN8BV, CR6IV, DJ, DL, DK, DM, EA4JV, F, HA, HB9, I1, MP4BEU, MP4TBO, OD5AR, OHØNI, OY7S, PY4FLR, PY7APS, PY7VKG, PY8QA, PZ1CF, TF2WKM, UA1KBX, UQ2KAJ, UW9AF, ZC4MO, ZD7CI, ZD8CX, 3A2CQ, 4X4VE, 9G1BF, 9H1AM, 9Q5SS. These were all received 2200-2400 GMT.

F. Simpson (Yorks), no rig quoted, must be pretty good headphones, got these on 7Mc/s phone—HK3BHV, K1GZL, K2ZKA, K4LYW, KP4CQY, PY4ND, PY7AKG, W3ADO, W4YWX, WA4MZI, WA9OIN, WB4FRL. Why is it all these stations never seem to be on forty when I listen. ('Tiz a conspiracy Jim Lad, Har that's what 'tiz).

A number of s.w.l's commented on the dozens of G stations who are about these days (and nights) on forty, so perhaps that 100kc/s will begin to buzz again. Why not give it a try this month?

HIGH

It looks like twenty is still top DX dog with fifteen and ten a close second.

David Henbry (Sussex) roamed twenty with that O-V-O of his. This is coupled into a "Joymatch" No. 2 and the antenna is a 7 ft. vertical at 30 ft. David logged these on s.s.b.—CR4BC, CR6HI, EL2AJ, HK5AZA, KG4AM, KL7EBK, KP4AXC, LU2DGO, LU9DM, MP4BEU, MP4TBO, MP4MAX, OA4MX, PZ1CF, UWØIE, VP2AA, VP6WR, VP8IU, VS9ARS, XW8CC, YS1CPI, ZD3I, ZD8RD, 5H3JR, 6O1GB, 6W8DX, 6Y5GG, 8R1S, 9G1GA, 9U5BB, 9Y4VT.

D. Fry (Glos) 52 set. λ/4 dipole (coo!), reports twenty lively especially late evenings. He scooped—HV3SJ, JA4DJO, KP4CRD, K7OEW/MM, PY1CAD, SVØWL, TI2PZ, UA3KND, UB5KIW, UWV3T, VQ9HJB, VS9MB, XW8CC, YV4QG, YV5ANF, 5A4TR, 6W8DX.

Is your name **Philip**, and do you live in the Langley Mill area of Nottingham? You've got an RX60 receiver and a 20 metre dipole in the loft, but you haven't got a second name! Anyway, on 20 a.m. and s.s.b. you logged—CE1AQ, CN8CS, CR4BC, CR6IV, CR7CH, EA8OG, EP2KW, HC1DX, HM5BF, HV3SJ, JA2BV, K8VWM/P/KG6, KA3FU, KA9LLE, KP4AST, KR6AB, KR6QG, KV4UA, LU3IQ, MP4BE, OD5EU, OY9IN, PY1CRI, PY7SM, TF2WKI, VE1AFY, VP9CP, VQ9HJB, VU2DKZ, VKØTO, VK7RE, WB2BWW, WB4BII, XW8BJ, YV3LA, ZC4TK, ZD3DM, ZD8RD, ZD9BI, ZE1AE, ZP5OG, ZS6AYI, 3A2CP, 5A1TV, 5A4TV, 5N2AB, 5R8AS, 5Z4KL, 7Q7LZ, 8R1C, 8R1S, 9H1AB, 9Q5BIG. Take a bow Philip—whoever you are.

B. Hughes (Worcs), AR88D, dipole, listened on 15 for—HK1KS, JA9BXL, KZ5AO, KV4CX, 4S7PB (Ceylon), 5R8AS, 9M2PO, 9V1NP, WAØDVT.

L. Rowland (Cheshire), 9R-59, 150ft. end-fed, switched in the b.f.o. on 15 and heard these on s.s.b. CE3DM, CN8FC, CP6GC (Bolivia), CR4BC, EL2AI, EL9A, HC1MW, HI8LAL, HK1OI, HKØAI (San Andres Is.), HP3PJ, HR1CN, IS1VAZ, JA1AEH, JA2ADH, JA3JEJ, JA4ABS, JA8BIU, KG4AN, KG6FAE (Guam), KH6BFU, KL7WAH, KR6GF (Okinawa), KP4CP, KV4CX, KZ5FW, LU1DAB, MP4MAW, OA4JR, OD5DJ, PY1TX, PY2SD, PY5BK, PY6NG, SVØWV, TI2JH, TJ1AG, TU2AY (Ivory Coast), VK4QM. VK9XI (Christmas Island), VR1AT, VS9ARS, W5PBH, W6CCP, W7MSI, YA1DAN, YN1BKC, ZB2AM, ZC4JU, ZD8CX, ZP5JB, ZS1BD, ZS4LI, ZS5NX, ZS6PZ, ZS8L, 4S7PB, 4X4BL, 5A1TV, 5A2TR, 5A3TG, 5A4TR, 5A5TV, 5H3JL, 5N2AAJ, 5Z4KK, 8R1S, 9H1AG, 9J2AB, 9L1JW, 9M2NF, 9Q5BD, 9V1FF. This is only three-quarters of the log too!

K. Jeeves (Yorks) CR70A, PC30, 80 ft. long wire, doesn't say what mode but heard these on 10—CN8BB, IT1ALG, UG6ARO, VE3FUG, VS9APW, ZE2JA, 3C3GCO, 5A1TK, 9H1X.

Signalman G. Gibson writes from Germany. He has an EC10, 50 ft. long wire, and a sharp pair of ears. On 10 a.m. he got—CT3AM, CX6AD, LU5DRC, PY2CK, PY8SV, UB5GUS, UL7OB, ZE1CS, ZE2JA, ZS2OM, 9J2DF, while on s.s.b.—CR6IV, CR7BF, EP2GI, OH2TI, PY2OY, ZD8CX, 4X4BL, 9J2VX, 9Q5DD.

D. Goodhall (Rugby), HE30, 40 ft. long wire hooked these in on ten, mostly s.s.b.—EA4JN, HG5CZ, LU3IAG, OZ6HP, PAØBK, PY2AFL, UA6JP, ZC4TY.

CONTESTS/RALLIES

This month the list includes—August 13th, Derby Mobile Rally, at Rykneld School, Derby. That's it, sorry, can't find any contest, and no sign of anything else for August. On September 2nd-3rd is the V.H.F./IARU contest. Deadline for logs is, as usual, the 20th.

LETTERS...

John Arminson Rouse — A Tribute

May I express, as a reader of PRACTICAL WIRELESS, the shock and sorrow at hearing the news of the death of Mr. John Rouse, G2AHL, who was General Manager and Editor of the RSGB. I am sure I speak for many readers, RSGB members or not, because John had a high regard for 'PW' and he and I often spoke about articles and readers' letters in it.

The much improved RSGB Bulletin, and the very fine Third Edition of 'The Amateur Radio Handbook' is seen, I know, by many more people than just RSGB members. Mr. Rouse made both these developments possible with his tremendous devotion.

We have lost a much loved worker in the field of Amateur Radio, and I for one and the small band of boys in the Radio Club I run, have lost a personal friend. We will miss his cheerful anecdotes and great encouragement.—**Ken Smith,** G3JIX (*Walthamstow, E.*17).

[*I am sure that all readers will join with myself and the PW staff in Ken Smith's tribute to the memory of John Rouse. Many of us have lost a personal friend and PW, the RSGB and amateur radio in general will sadly miss his devotion and loyalty to the cause of amateur radio. We must spare a thought, too, for the wife and daughter he left, for John was still only a young man. Amateur radio can ill-afford such tragic losses.*]—W. N. Stevens.

Why not tape them?

Whilst attempting to wind a coil on a cotton-reel which became very tedious, I sought after a faster method. I tried a sewing machine but was unsuccessful then in despair tried using a portable tape recorder. The cotton reel fitted on the rewind spool perfectly and by using a screwdriver I was able to guide the wire on to the cotton-reel while the recorder was on rewind. After a little experimenting this was found to be very much quicker and neater than winding by hand.—**S. Cooke-Willis** (*Auckland, New Zealand*).

No more excuses, please

When are these types going to run out of excuses as to why they should be exempt from the RAE and the morse test? I refer to Mr. T. Hawker's letter in the July issue, who seems to think that just because he uses radio telephones he should be given an amateur licence.

Let's put this in its right perspective, this equipment is all commercial gear which is approved by the GPO and is also crystal controlled. The only qualification to operate it being, the ability to press a button and speak the appropriate language. A child of five could do it.

He asks where is the sense in it? Maybe this question is the answer to why he failed the RAE, he may not have enough enthusiasm. After all the RAE and the morse tests are the only way in which we can weed out the person who just wants a new toy to play with, from the real enthusiast who would be a competent amateur.

When I look around at some of the Bedfast Club members, I thank God that I have got all my human faculties as I don't think I would have the drive of these less fortunate types, there are no exemptions from the rule.

I have no time at all for the anti-RAE, the anti-morse, and the citizen band brigades, if these chaps were to spend a bit more time studying for these things and less time thinking up reasons whey they should be exempt, in no time at all they would be on the air saying how easy it was.

No hard feelings old man, best of luck for the next RAE.—**R. T. A. Brown,** G3TOF, Hon. Secretary Harlow & District Radio Society (*Harlow, Essex*).

Fault-finding on a "dead" receiver

I would like to comment on the series of articles "Repairing Radio Sets" by Messrs. Hellyer and King. I was trained in HM Forces and although the equipment we use may be a lot more sophisticated, the basic principles surely still apply.

The way I was taught to fault-find on a "dead" set disagrees with the method shown in the series. I was taught to start at the a.f. end and work towards the r.f. end, by applying a suitable signal to first the speaker and then to the a.f. stages, i.f. stages and back to the r.f. stages and aerial input. The output should then be heard after each step.

If no input signal is heard, then the section in which the fault lies is the first one you have applied the signal to and obtained no output from the speaker.—**J. F. May** (*Gosport, Hampshire*).

The Author Replies:

The stage responsible for complete failure of a radio set can be located quickly by adopting one of three methods: (i) applying suitable signal in turn to the stages starting from the aerial input, (ii) as in (i) but starting from the loudspeaker and (iii) applying a modulated signal at the aerial and then tracing the signal in the set from **input to output.**

Methods (i) and (ii) can be discussed at length in terms of relative merit! If the trouble is open-circuit of the aerial coupling coil, for instance, method (ii) would take as long as method (i) would take to find an open-circuit in the loudspeaker. It is well known that HM Forces recommend method (ii); but this does not mean that the other methods are less effective. Forces equipment has to be maintained to a higher level than ordinary domestic radios, and technicians are often surrounded with test equipment designed for matching the equipment to be serviced; and each repair usually demands a stage-by-stage performance check in terms of voltage sensitivity and so forth and, as stated by Mr. May, if a common output meter is employed, then each input can immediately be translated into input sensitivity voltage.

The various methods of faulty-stage locating have not yet, in fact, been dealt with at length in the articles These are in hand for Part II, when the transistor set as a whole is put under the service microscope. The series commenced at the first stages, working to the audio section, because this is the normal direction of the signal. There was no other motive!

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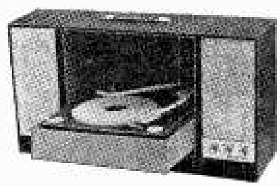

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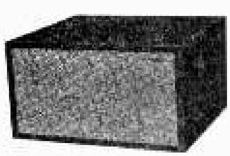

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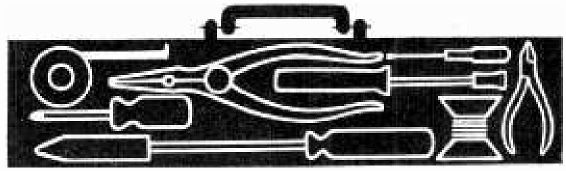


printed circuits

COPING with printed circuits is partly a matter of common sense, partly a matter of knowing how these aids to construction are designed, formed and used.

Contrary to idealist opinion, the printed circuit has not been employed—in many receivers—to eliminate the wiring. In some sets it seems to have further confused the issue. Certainly, printed circuits can make fault-finding much more difficult unless one unlearns the old procedures and gets acquainted with the new. In too many designs, the aim of printed circuit boards has been to reduce production costs, with no regard for servicing. In short—they can be a mixed blessing.

However, like the poor, they are with us—if not to stay, at least, for a very long time to come. So it behoves us to find out as much as we can about them.

★ BASIC PRINCIPLES

The technique of forming interconnecting wiring flat on a piece of insulating material began with guided missile research toward the end of World War II. Some of the insulating materials then in use were bulky, expensive and less effective than those available to us now. The principle remains the same, though the processes of manufacture have developed.

Basically, the printed circuit is a board or laminate of high quality insulant with the wiring between components and test points or connections to other parts of the equipment laid out in a pattern of thin copper strips. This copper, the foil, is bonded to the laminate and the component leads are inserted through holes and soldered to the foil. We thus have the three basic ingredients of the system, the board, the foil and the bond, to consider.

A common type of board for rigid mounting is phenolic paper laminate. This is made in various thicknesses. Alternative materials are used, particularly where some flexibility is needed, or higher voltages have to be handled, or higher currents passed than those with which we are at present concerned. Most interesting of the recent developments has been a film type of printed circuit, completely flexible, very thin and almost transparent!

A copper foil, perhaps as thin as one and a half thousandths of an inch, is bonded to the board. The method of bonding is often a trade secret, as jealously guarded as a Whitehall file, so that, after processing, the very fine lines of copper that form the circuit will not lift away from the board, especially as components are fixed and soldered.

Heat is the great enemy, and for this reason, considerably more care must be taken when dealing with printed circuits than when soldering conventional wiring. There are two danger points; first, the foil itself can lift when the bond is destroyed by heat, leaving a weak portion that may later fail; and, second, the method of construction means that components will generally be affixed by much shorter lead-out wires than with conventional wiring, and excess heat can damage small components. This last factor applies especially to transistors, of course.

★ PHOTO-ETCH METHOD

Perhaps the most popular way of making a printed circuit is the "photo-etch" method. The design for the print is carefully made—this being the foundation on which the whole process is built. Components are laid out so that the "wiring" takes the desired path, with inter-connections taking the shortest path possible, and no leads crossing where they should not!

This last apparently elementary point is vital in high frequency work to avoid instability and other undesirable effects. Anybody who doubts the importance of this preliminary planning may gain a new respect for the "back-room boys" of the electronic industry by doodling out a few simple drawings of printed circuits for his own amusement!

It is no easy matter to compress a dozen or so components in a couple of square inches, make sure that there is room to bend leads and mount them, and ensure that transistor leads do not have to cross, then draw out the maze that will eventually be the print without allowing adjacent connectors to encroach too closely. I speak with feeling!

However, assuming someone else is carrying out this tedious task, after the doodle is perfected a master drawing is prepared. This is drawn to scale, much larger than the required board, and all the details are put in, including the holes for the component wires (which appear as white circles on the black lines of the print). This "black-and-white" master drawing is photographed and the negative brought down to the actual size of the required board.

The copper foil which covers the whole board is emulsified and the negative is "printed" on to the plate by light exposure. The holes are drilled where indicated on the pattern and the printing is treated with an acid resistant chemical.

★ FIXING COMPONENTS

Then the treated board is placed in an etching bath whose solution of iron perchloride dissolves the surplus copper and leaves the printed wiring untouched. The acid resist is then cleaned away and the board made ready for soldering.

Components are fixed to the board and soldered into place—again a highly specialised process, often individual to the manufacturer. The principal methods are dipping or wave soldering. In the first method, the board, with the ends of the components crimped into place, is briefly dipped into a bath of molten solder and all the joints are made in one go. Surplus solder is shaken off and the cooled board treated with protective shellac.

The alternative method moves the board along the surface of a bath of molten solder which is made to "wave", so that the copper foil and component wires skim through the wave.

There are other techniques, such as plating of circuits, silk-screen printing, double-sided bonding, where the print is made on both sides of the board, inter-connections being achieved by soldered "collars" that go through holes in the board, and spot-soldering methods that protect the wiring and solder only the joints. The details are extremely interesting but must not concern us here, as the treatment of such circuits, for fault-finding and repair, follows much the same general pattern.

★ TRACING FAULTS

Tracing faults on printed circuit boards can be difficult. Slight cracks, invisible to the naked eye, or dry joints that present a high resistance to the low-voltage, low-current circuit and are hidden under respectable looking mounds of solder, are common troubles.

One device that can be useful is a simple length of wire terminated at each end by a sharp probe and used as a temporary shunt to "prove" suspected wiring on certain ranges of transistorised radio and tape recorders where experience had taught us open circuits through flexing could be found.

Because it is not easy to remove or disconnect components to make proving tests, a different approach to fault-finding has to be made when dealing with printed circuits. My colleague, Gordon J. King, has already had something to say on this subject, and will be underlining this point when we come to the servicing of transistorised equipment and all the special care that this entails.

For the present, let me make a few purely practical remarks about the removal and replacement of components and the treatment of printed circuits, just to lay the ground.

First, and most important, point is to keep the heat applied to the minimum. The maker of the printed circuit went to a lot of trouble to get a good bond of foil to laminate. No use our ruining this by leaving a hot iron too long at a crucial junction.

★ REMOVING COMPONENTS

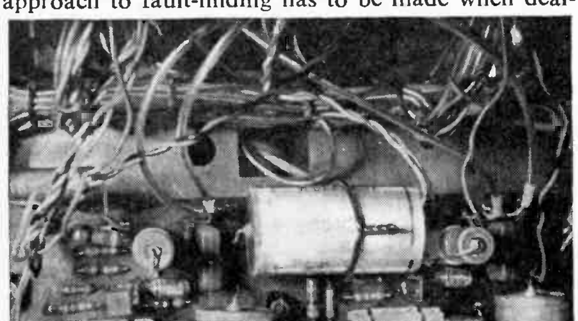
The practice of digging away at a joint to remove the end of a component wire, or the tag of a control, is one of the worst P-C offences. When removing a component whose wire end has been bent over, crimped or twisted, snip the lead *above* the board and allow the twisted end to drop away with the minimum of melting.

In many cases, even if the component is cut short, this technique will still allow enough wire end for a quick "straight-through" reconnection. If not —well, remember that the best way is to test and prove your fault first—*then* start hacking away at components.

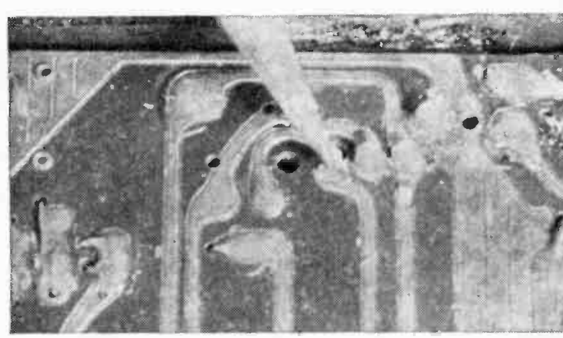
If it is essential to make proving tests at component junction points, but then by doing so the presence of the component affects the meter reading —as when a test for a leaky capacitor is spoiled by the shunting effect of a resistor—then it may be legitimate to break the circuit.

This can be done by cutting through the foil with a sharp blade, and lifting it slightly at the cut. Do not scrape and scratch a path wide enough to drive a bus through, and avoid making this type of test unless no other method avails.

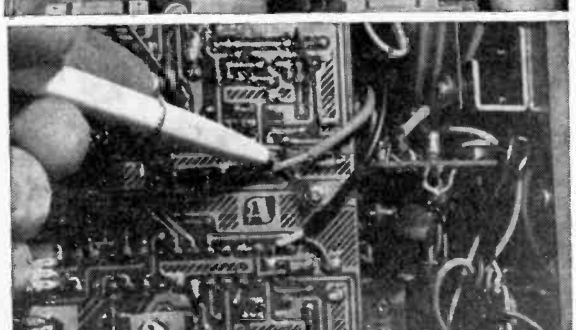
After each test, remake the broken foil with a 'bridge' of solder. (Hence the need to avoid wide



◀ *Printed circuits do not necessarily eliminate conventional wiring!*



▲ *Poor joint, where tag of potentiometer or switch is strained away from the print. Note proximity of fixing screws with printed foil; always check that insulating washers are refitted.*



◀ *Look for joints of flyleads with printed circuit.*

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2N3819	18/-	ASZ21	12/6	NKT265	9/6	OAZ224	10/-	OC201	10/-	PCC89	11/-
28002	10/6	ASZ23	30/-	NKT271	5/-	OAZ225	10/-	OC202	13/-	PCC189	11/-
28003	9/6	BC107	7/6	NKT272	5/-	OAZ242	4/6	OC203	10/6	PCF80	7/-
28004	9/6	BC108	5/-	NKT273	4/-	OAZ245	4/6	OC204	15/-	PCF86	8/6
28012	20/-	BC109	7/6	NKT274	5/-	OAZ246	4/6	OC205	15/-	PCL82	7/-
28012A	25/-	BCY31	13/6	NKT275	5/-	OAZ247	4/6	OC206	22/6	PCL83	8/6
28013	20/-	BFY17	9/6	NKT277	5/-	OAZ290	9/6	OCP71	15/-	PCL84	7/6
28013A	25/-	BFY51	8/6	NKT278	5/-	OAZ291	9/6	ORP12	8/6	PCL85	9/-
28017	15/-	BFY53	7/6	NKT279A	4/-	OAZ292	9/6	DAF91	4/6	PCL86	8/6
28018	17/6	BPY10	22/6	NKT304	8/-	OC16	20/-	DAF96	6/6	PL36	9/-
28103	20/-	BSY27	9/6	NKT352	8/-	OC19	7/6	DF91	3/-	PL81	7/-
28301	12/6	BSY51	7/6	NKT403	12/6	OC20	15/-	DF96	7/-	PL82	6/6
28320	9/-	BSY53	7/6	NKT404	12/6	OC22	10/-	DK91	5/6	PL83	6/6
28322	7/6	BSY95A	5/6	NKT453	12/6	OC23	12/6	DK92	8/-	PL84	6/6
28323	10/6	BY100	4/6	NKT452	12/6	OC24	15/-	DK96	7/-	PL500	13/6
28324	12/6	GET7	5/-	NKT675	6/-	OC25	9/6	DL92	5/-	PY32	8/6
28512	19/6	GET8	8/-	NKT676	5/-	OC26	7/6	DL94	5/9	PY81	6/-
28702	15/-	GET16	7/6	NKT677	5/-	OC28	12/6	DL96	7/-	PY82	5/6
AC107	10/-	GET20	10/-	NKT678	6/-	OC29	15/-	DY86	6/4	PY83	6/-
AC126	6/6	GET88	5/-	NKT713	7/6	OC35	12/6	EBC41	7/6	PY88	7/3
AC127	7/6	GET102	6/-	NKT773	6/-	OC36	12/6	EBC81	6/3	UBC41	7/6
AC127Z	9/6	GET103	4/6	NKT777	8/-	OC41	6/-	EBC90	4/3	UBC81	7/6
AC128	6/6	GET105	8/6	NKT0013	12/6	OC42	5/-	EBF89	6/9	UCC85	6/6
AC176	7/6	GET106	10/-	OA5	4/-	OC43	9/-	ECC81	4/-	UCH42	8/6
ACY17	8/6	GET113	5/-	OA7	4/-	OC44	4/-	ECC82	5/-	UCH81	6/3
ACY18	5/6	GET114	4/-	OA10	3/-	OC44M	5/6	ECC83	5/6	UCL82	7/3
ACY19	6/6	GET115	9/-	OA47	3/-	OC45	3/6	ECC85	5/-	UL41	8/6
ACY20	5/-	GET116	15/-	OA70	2/-	OC45M	4/-	ECF80	7/-	UL84	6/3
ACY21	6/-	GET571	5/-	OA73	2/6	OC46	5/6	ECH35	10/9	UY85	5/6
ACY22	3/6	GET872	6/-	OA79	2/6	OC70	4/-	ECH42	9/-	U25	9/6
ACY28	4/6	GET874	5/-	OA81	2/6	OC71	3/6	ECH81	5/2	U26	8/6
AD140	16/-	GET875	6/-	OA85	2/6	OC72	5/-	ECH84	8/10	5U4GB	6/6
AD149	16/-	GET880	9/-	OA86	4/-	OC73	7/6	ECL80	7/-	5Y3GT	5/-
AD161	11/-	GET882	5/-	OA90	2/6	OC75	6/-	ECL82	6/3	5Z4GT	8/-
AD162	11/-	GET883	5/-	OA91	2/6	OC76	5/-	ECL86	9/-	6F23	10/-
ADT140	15/-	GET885	5/-	OA95	3/6	OC77	8/-	EF80	5/-	6L6GC	7/6
AF102	18/-	NKT128	6/-	OA200	3/3	OC78	5/-	EF86	6/3	6SN7GTB	7/-
AF114	6/6	NKT142	8/-	OA202	4/3	OC78D	5/-	EF183	6/4	6V6GT	6/6
AF115	6/-	NKT211	6/-	OA210	7/6	OC81	5/-	EF184	6/4	6X5GT	6/-
AF116	6/6	NKT212	5/-	OA2111	9/6	OC81D	5/-	EL34	9/6	25L6GT	6/6
AF117	5/-	NKT213	6/-	OAZ200	11/-	OC81M	5/-	EL41	8/6	30C15	10/-
AF118	10/-	NKT214	4/-	OAZ201	10/-	OC81DM	5/-	EL84	4/9	30FL1	10/6
AF124	7/6	NKT216	7/6	OAZ202	8/6	OC81Z	9/-	EM84	7/-	30FL14	11/-
AF125	6/6	NKT217	8/-	OAZ203	8/6	OC82	6/-	EY51	7/-	30L15	11/-
AF126	6/-	NKT218	6/-	OAZ204	8/6	OC82D	5/-	EY86	6/6	30P12	9/-
AF127	6/-	NKT221	5/6	OAZ205	8/6	OC83	5/-	EZ40	7/6	30P19	13/-
AF139	12/6	NKT222	4/-	OAZ206	8/6	OC84	6/-	EZ80	5/-	30PL1	10/6
AF178	12/6	NKT223	6/-	OAZ207	9/6	OC122	15/-	EZ81	5/-	30PL13	12/-
AF186	17/6	NKT224	4/6	OAZ208	6/6	OC139	7/6	EZ90	4/-	35L6GT	6/-
AFY19	22/6	NKT225	3/6	OAZ209	6/6	OC140	9/6	GZ32	10/-	35Z5GT	5/6
AFZ11	17/-	NKT226	10/-	OAZ210	6/6	OC141	12/6	GZ34	10/-	50L6GT	6/6
AFZ12	12/6	NKT227	5/6	OAZ211	6/6	OC169	5/-	PC86	11/-		

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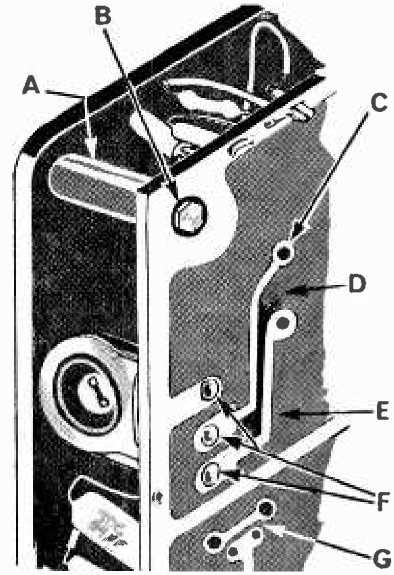


Fig. 1: Printed circuit danger spots. A—strained board where large components are fitted; B—poor return path at fixing bolt; C—end of soldered part (dry joint); D—charred board between conductors; E—lifted foil; F—control mounting; G—narrow gap between conductors. Also hairline cracks.

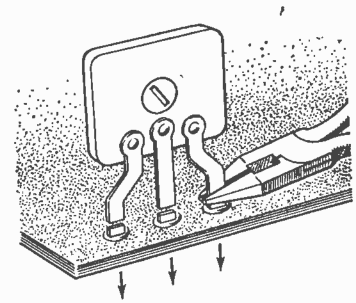


Fig. 4: Cut off lug ends and clean out holes to refit component.

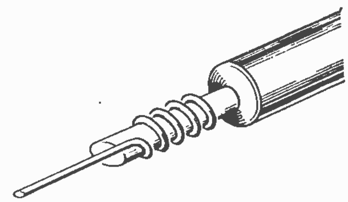


Fig. 5: Make extension "bit" to reach awkward spots. Wire can also be looped around a meter probe to gain access to remote points.

breaks—the joint is always the weakest link in the circuit.)

★ BREAKS IN PRINT

Where there are breaks in the print, as can happen when a board is flexed or a component strained, these mst be bridged strongly. If the break is the most common type, a hairline, simply scraping the foil clean at each side and soldering over the break should be sufficient. Try to avoid lifting the foil while doing so and do not apply the heat for too long. But where the break is more awkward, as, for example, when a burnout has charred adjacent regions of the board, other methods are needed.

A charred board may provide a conducting path for current, no matter how well you try to clean it. In this case, open circuit the print path at each side of the charred portion so that no current reaches it, then provide a wire link. These 'jumpers' are best fitted from existing joint to joint, rather than soldered to stretches of the foil, where the weight of the new wire may tend to lift the thin foil and break the bond.

A common place for breaks to occur is at the anchor post of a large component, such as a potentiometer or switch. The more physical movement that is applied to this portion of the circuit, the more it should receive close attention—no matter how good the print appears to the naked eye. This is where the watchmaker's glass advocated in Part 2 comes in handy.

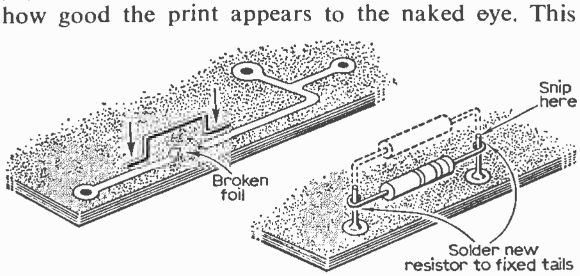


Fig. 2: Bridge joint with new section of wire. Avoid loose ends of foil and apply as little heat as possible to prevent broken ends from lifting.

Fig. 3: Solder new component to existing tail ends to avoid disturbing print.

Fitting a new component can be awkward, especially in the last-mentioned case. Even the removal of the faulty part presents a problem. The technique with multi-tagged components is to melt the solder around the tag and, as it begins to cool, brush it away.

★ SOLDER TECHNIQUE

The trick is to catch it at just the right heat when the solder brushes away in a crystalline form that will not stick to other parts of the circuit. Let it get too hot—and you will have a short-circuiting streak across adjacent foil paths; not hot enough — it merely makes an unsightly mess around the tag.

When the surplus solder has been removed, the tags may be eased gently as heat is applied until the bond on all is broken. Then it should be possible to remove the component.

Of course, the correct way is to remove this surplus solder by the proper device, such as an aspirated solder gun, which Philips patented a few years ago, and which has proved such a boon to professional service engineers. But the average chap can hardly justify the expense for the odd occasion he may need it. In this case, he should weigh the cost of a new component, make sure the part he is removing is not needed again, and destroy it to make for easy removal!

This is not so daft as it sounds. It is far easier to remove the tail end of a resistor or capacitor, or the spade end of a switch or potentiometer lug, by first cutting the component away close to the top of the board, then melting the solder at the joint and withdrawing what is left. A good pair of pointed-nosed pliers or strong tweezers aid this operation.

When replacing a component on a congested board, it may be easier to fix the new one to the existing tail ends than to clean out joint holes and perhaps have force the new part in place.

An example is the larger resistor that takes the place of the maker's special miniature type that has been proved faulty. Cut off this time with a slightly longer tail, twist the ends of the new component into anchor loops and quickly solder these to the tails.

It helps to tin the loops first, and perhaps scrape the tails to remove varnish or oxidisation. Do not apply heat too long, or the joint where the tail is fixed may be weakened. This method is especially handy where it is difficult to get at the rear of the printed circuit board.

★ REPLACING COMPONENTS

Where there is insufficient room to mount the new component, consider the ruse of standing it vertically, with one end through the nearest convenient hole from which the old one has been taken, and the other end insulated by a short length of sleeving if necessary and bent to enter the other hole. Make sure there is enough 'headroom' for the board to be remounted—it is very easy to get caught in this way.

When it is possible to get at the anchor points and completely remove the old component, the next problem is in cleaning out the holes for the new one. Again, remove as much surplus solder as possible. Remember that solder once heated, cooled and reheated is much weaker than new.

Then sharpen a match-stick or, better still, an orange-stick from her ladyship's manicure set. Use the point to delve into the hole while heat is applied. As the solder cools, it will not stick to the wood, and a good, clear hole is left.

Refitting the component is a matter of convenience and taste. It may be found helpful to bend over the ends to make a more solid joint with the foil, but usually it is better to let the solder 'dome' over the tinned end of the lead-out wire. If removal ever becomes necessary again, you can save yourself a lot of snipping and avoid ruining components by adopting this method.

Ideally, the printed circuit joints, when remade, should be treated again with varnish to prevent corrosion, oxidisation, etc, but this is a counsel of perfection—necessary on professional equipment; an added refinement at home.

★ VALVE BASES

Previously, we mentioned the device of easing out multi-tagged components by clearance of old solder.

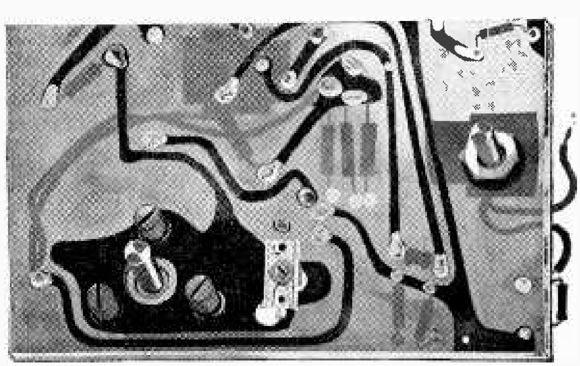


Fig. 6: A bench light can be used to aid circuit tracing—wired components will be seen "through" the panel. But avoid overheating components.

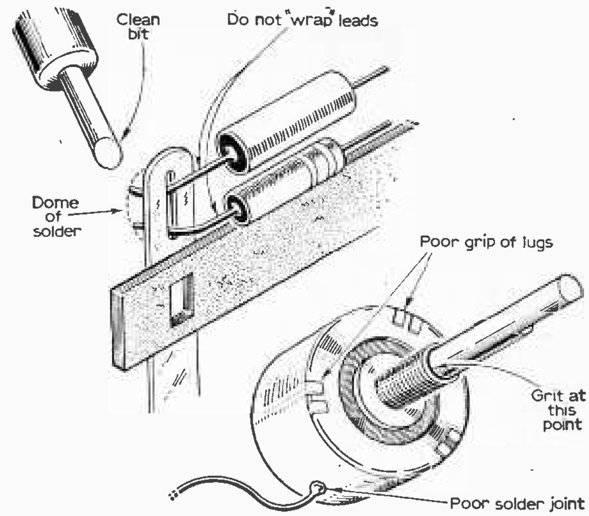


Fig. 7: Make straight joint through lug and allow solder to run on cleanly from a well-shaped iron bit.

Fig. 8: Look for poor jointing of potentiometer cases and, if necessary, make fresh chassis returns.

This may prove extremely difficult in—for example—the case of a damaged valve-base.

Here, a soldering iron that would melt all the tags simultaneously and allow us to lift the base clean away would be ideal. But as sizes of parts vary so much, marketing such a device would not be likely to excite great sales. Nevertheless, somewhat similar devices *are* on the market—but we can make our own for the odd occasion.

Use a fairly heavy gauge copper wire, bend it carefully to form a loop that touches the required joints, then bring up the end to loop in a coil around the bit of the soldering iron.

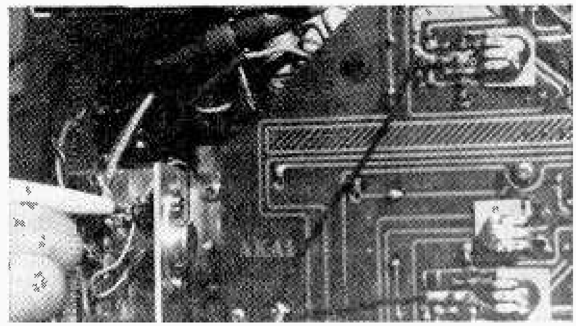
Heat is transferred from the bit to the copper wire loop and with a little practice, quite good clean removal jobs can be done. Similarly, where it is necessary to get between closely confined components, where the bit of the iron is likely to damage them, use a coiled length of copper wire, 16 or 18 s.w.g., and straighten the end to form a thin auxiliary bit.

★ SEE-THROUGH BOARD

When fault tracing, the tedious business of following twisting lines of print and identifying the components on the other side of the board, can be eased by using a light at the opposite side of the board and getting a kind of X-ray picture of the layout. Many boards of laminated phenolic construction lend themselves admirably to this practice. Older types are usually too opaque.

Often, when wiring in new components, the unavoidable difference in size and shape prevents us from following the set-maker's original layout. In these cases it is quite legitimate to make a 'suspended joint', where two components meet and are connected together. This, despite the cry of 'botchers' from so many practicing servicemen, who have been brought up on the method of ordering the exact replacement from some far-distant manufacturer and keeping the customer waiting while it is obtained.

No wonder some far-sighted firms make fortunes by marketing "general replacement" parts. (Readers who have not seen the *Electroniques* manual may perhaps be surprised to know what a very wide range is covered.)

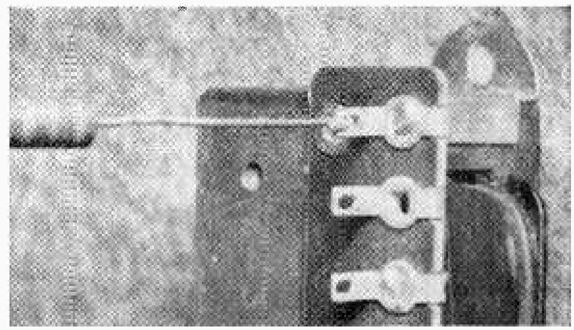


Example of typical printed circuit layout, where the output transistors are mounted on a separate sub-chassis, which acts as a heat sink. Note the use of a jumper wire for interconnection of sections of the main printed circuit.

★ ANCHOR POINTS

Making soldered joints to tags, lugs and anchor points can be difficult, and the practice of wrapping lead-out wires twice around the gasworks and home before soldering is to be deprecated. Anyone who has had to dismantle many of these joints in congested equipment, where sleeving unravels like snow in the sunshine, will sympathise with this point of view.

A wire end put through the lug and perhaps bent over slightly to aid keeping it still while soldering is all that is needed. A good soldered connection *is* a good mechanical joint. The secret is to keep your iron clean, apply the right heat for the right length of time, and use a good resin-cored solder. Not—please not—the corrosive tinman's flux that dad left in the potting shed. Solder is cheap enough, and the little extra time and care at the preparation stage saves hours of fretting later.



A simple hook is often more effective than a bulky, wrapped joint.

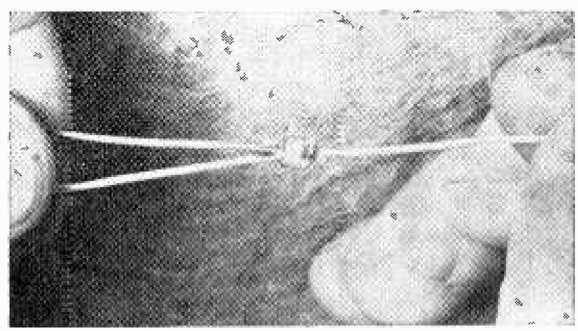
★ CLEANING

Other odd chemicals that are to be shunned are the solvents and cleaning fluids that some folk appear to have used on printed circuits. Even carbon-tetra-chloride, which has a great many cleaning and degreasing uses, and was once the standby of all who wanted to 'lubricate' a volume control, can be dangerous. Apart from its toxic effect—fumes should *never* be inhaled—it can cause many types of plastic to soften and run.

For cleaning plastics, methylated spirit is safer, and in some instances an impregnated wadding (again borrowed from her ladyship's silver or brass-cleaning cache) will give a good burnish.

But for degritting controls and for cleaning switches, the proprietary chemicals that were mentioned in Part 2 simply cannot be beaten. If they will not do the job, the control is due for replacement anyway!

Sometimes, it is difficult to get at the inside of a potentiometer to apply the cleaner. Many plastic edge-type controls, for example, appear to be completely sealed. In these cases it is quite legitimate to drill a small hole in the side casing and inject through this. After allowing the necessary evaporation time, the hole could be resealed to prevent dust entering.



Wire ends of components can be joined firmly by inserting them in a twist or coil, where size of replacements precludes exact fitting.

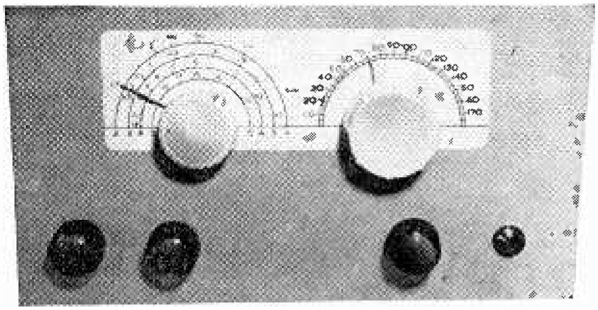
★ NOISE FAULTS

A popular place for noise faults is at the junction of spindle and bush of a 'conventional' volume control. One tape recorder manufacturer realised this very early on and provided a spring clip that separately earthed the spindle. Where movement noise is bothersome, a drop of switchcleaner run down the spindle at this point may help. Remember, only a drop—don't drown it.

Another popular place for noise to originate is at the 'earthing' point on the body of a control. This applies also to some types of switch. The connection may be firmly soldered, but if you inspect the control closely you will note that this is to a shell, and the shell makes contact with the bush by a bent-over clamp. And time and heat may have worked its insidious depredations at this point.

So clean off the control at the junction of parts and solder the contraption together. It is surprising how many hum troubles in audio equipment have been cured by this ruse.

This article concludes the first section of this series by H. W. Hellyer and Gordon J. King. The second section will begin publication in about three months time, when the emphasis will be on transistor equipment.



FOUR WAVE

R. F. G

THIS superhet receiver tunes approximately 10-600 metres in four bands. It has only three valves—frequency changer, regenerative 1·6 Mc/s i.f. amplifier and detector, and output stage. This, and the use of a panel aerial trimmer, practically removes any alignment or trimming difficulty, while providing good sensitivity. Tested at 14Mc/s, a 3μV signal at the aerial was just audible in the loudspeaker. Due to the relatively high intermediate frequency, there is good freedom from second channel interference from unwanted transmissions.

Fig. 1 is the circuit and a few points should be noted. VC1/VC2 is the ganged tuning capacitor, and though a value of about 315pF is specified a somewhat larger value can be fitted with no loss of efficiency. The one fitted had an integral ball drive, but a separate drive and scale would be in order. Trimmer TC1 serves for all oscillator coils and is left at about half capacity. The panel trimmer VC3 is then adjusted as necessary for maximum signal strength. VC4 is for bandspreading, and useful for amateur and other congested bands. A 10pF, 15pF or 20pF capacitor is most suitable. Should a 2-gang capacitor be to hand, its sections can be connected in parallel with VC1/VC2.

OSCILLATOR PADDER

Each oscillator coil requires its own padder. Range 2 is approximately 515-1545kc/s and has a 100pF padder connected to tag 2 of the holder, range 3 is about 1·67-5·3Mc/s with 350pF padder to tag 3, range 4 is 5-15Mc/s with a 1000pF padder to tag 4, and range 5 10·5-31·5Mc/s with a 2000pF padder connected to tag 6. These values are easily obtained and not exactly as specified for the coils, but are suitable with TC1 and VC3 adjusted as explained.

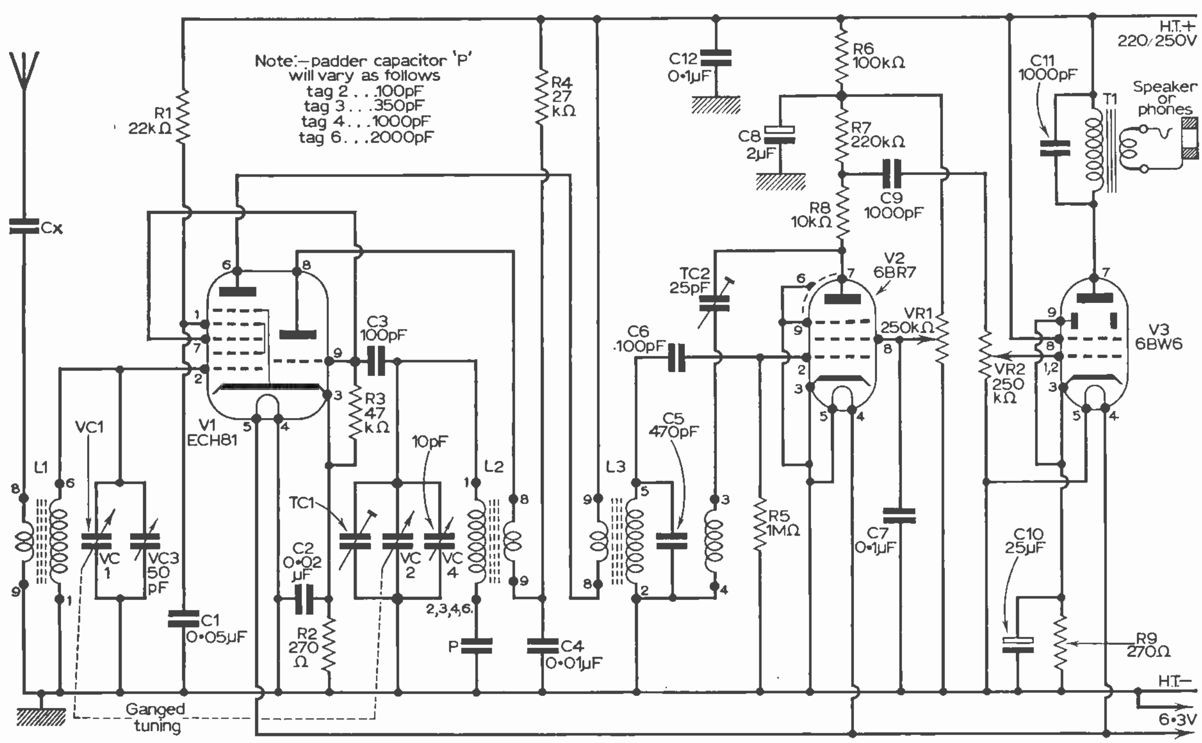
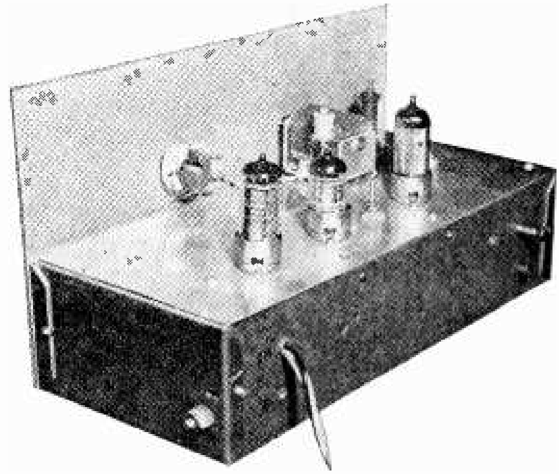


Fig. 1: Complete circuit of the receiver. The capacitor Cx is optional and is discussed in the text.

BAND SET for the novice

AHAM



REGENERATIVE I.F.

The grid circuit of V2 is permanently tuned to about 1·6Mc/s. Regenerative feedback is applied through TC2, and controlled by VR1, and as the grid circuit is not variable tuned, frequent adjustment of VR1 is not required.

With V2 somewhat below the critical point at which oscillation nearly arises, the receiver has good general sensitivity and selectivity. As VR1 is advanced a point is reached where both selectivity and sensitivity to weak signals greatly increase—this is the optimum setting of VR1 for speech and music (telephony). Turning VR1 further causes a heterodyne, and allows reception of Morse (c.w.), single sideband (s.s.b) transmissions can also be resolved with some adjustment of VR1, unless rather powerful. If too strong, reducing sensitivity with VC3 helps.

VR2 is an audio gain control, and either speaker or phones can be plugged into the panel jack. The ratio of Tr1 is not correct for phones, but as V3 can provide much more power than wanted this does not seem important. Low or medium impedance headsets are best, but high impedance phones can be approximately matched by using a second output transformer (same ratio as T1), with low impedance winding connected to the jack plug, and high impedance winding to the phones.

The receiver runs from a separate power pack. Heaters require 6·3V at 0·9A and the h.t. drain is about 50-60mA, at 220 to 250V (max).

The power pack must have a mains transformer which provides h.t. and l.t., so that the receiver is completely isolated from the mains.

Positions of valveholders and other items can be seen from Fig. 2. Chassis dimensions could be modified somewhat. The large holes are best made by drilling a small pilot hole, and using a valve-holder punch. Mark through valveholder lugs and drill $\frac{1}{8}$in. holes for 6BA bolts.

THE I.F. COIL

This is screened by the aluminium can in which it is supplied, and screening is essential. The bottom of the can is drilled to clear the threaded portion of the coil, and five small holes are also drilled $1\frac{1}{4}$in. from the bottom, so that leads may pass through as in Fig. 3. Capacitor C5 is wired across the pins inside the can.

The i.f. coil tunes about 1·4-1·7Mc/s by adjusting its core, and the best frequency is around 1·6Mc/s. A nut locks the core, as moving it alters tuning calibration. TC2 may be suspended by wiring if short, stiff leads are used.

For best results on range 5 (10·5-31·5Mc/s), leads to variable capacitors, V1, coil holders and the padder capacitor should be short and direct. The aerial socket must of course be insulated from the chassis, or an insulated flexible lead can be taken directly from tag 8.

By-pass capacitors C1, C2, C4, C7 and C12 could be modified somewhat, and the voltage rating is

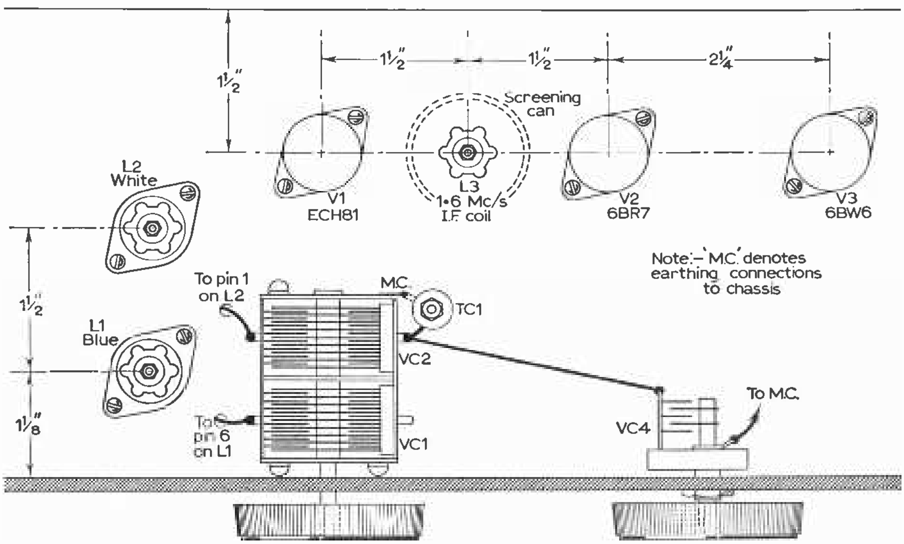


Fig. 2: Above-chassis layout and main drilling dimensions.

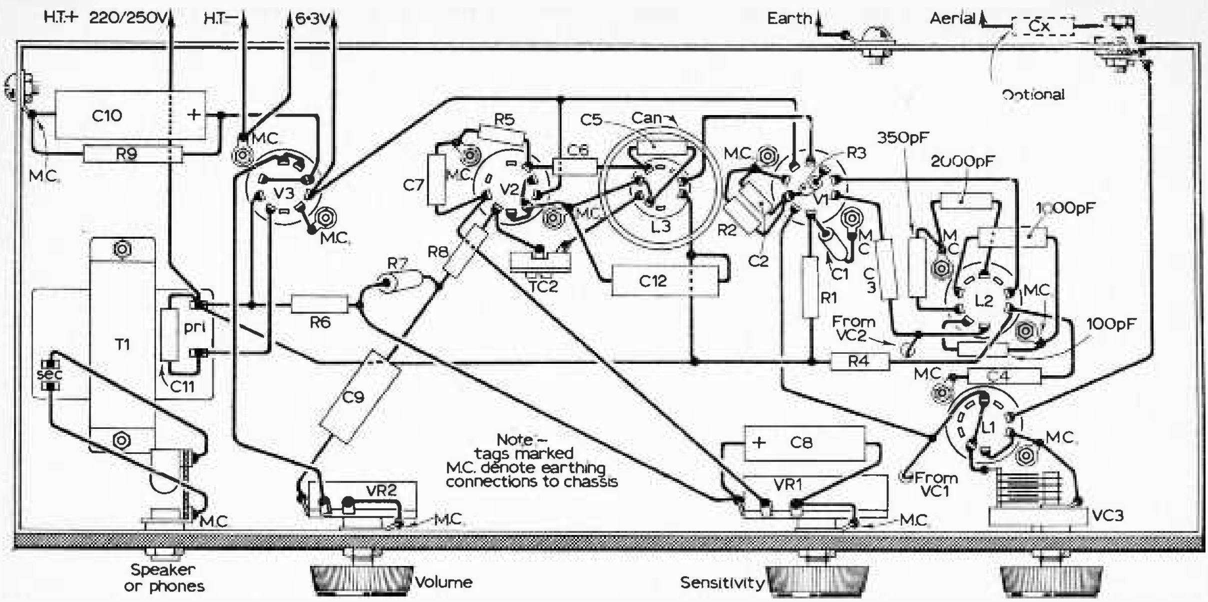


Fig. 3: Underside wiring diagram.

★ components list

Resistors:

R1	22kΩ 1W	R3	47kΩ	R5	1MΩ	R7	220kΩ	R9	270Ω 1W
R2	270Ω	R4	27kΩ 1W	R6	100kΩ	R8	10kΩ		

Capacitors:

C1	0·05μF paper	C8	2μF 250V electrolytic	VC1/VC2	315pF twin gang or similar
C2	0·02μF 150V paper	C9	1000pF mica	VC3	50pF variable
C3	100pF mica	C10	25μF 25V electrolytic	VC4	10pF variable
C4	0·01μF paper	C11	1000pF 350V paper	TC1	30pF air spaced trimmer
C5	470pF mica	C12	0·1μF 350V paper	TC2	25pF air spaced or ceramic
C6	100pF mica	Cx	25pF mica—optional	P	Padder capacitors—100pF, 350pF, 1000pF and 2000pF silver mica 10%
C7	0·1 μF paper				

Inductors:

Denco miniature dual range coils (B9A)
1 each ranges 2, 3, 4 and 5 (BLUE) aerial
1 each ranges 2, 3, 4 and 5 (WHITE) 1·6Mc/s oscillator
1 only range 3 (GREEN)
T1 45:1 50mA output transformer (2–3Ω loudspeaker)

Miscellaneous:

VR1 250kΩ linear. VR2 250kΩ log
V1 ECH81, V2 6BR7, V3 6BW6, three B9A skirted valveholders, two B9A non-skirted valveholders, chassis 12 x 5 x 3in. deep, panel 12 x 6½in., knobs, wire, etc.

unimportant, provided it is higher than the voltage present. C8 could be 8μF and C10 50μF if to hand. C9 can be 1000pF (0·001μF) to 0·01μF, but should be mica. VR2 may be 500kΩ, C11 may be 5000pF (0·005μF) or even 0·01μF.

Connections from tag 2 of V2 to C6 and R5 must be as short as possible and clear of heater wiring or hum may arise. Components and wiring associated with V2 and V3 are best close against the chassis.

ADJUSTMENTS

Insert V2 and V3 and VR2 at its maximum clockwise position. Temporarily place the aerial lead near the connection from pin 8 of the i.f. coil. Open TC2 fully, and adjust VR1 for maximum sensitivity. This is *not* the fully clockwise position, but an intermediate one giving the most suitable G2 voltage, and will be shown by maximum background noise, or possibly reception of a transmission which can be tuned in by rotating the i.f. coil core. Close TC2 until oscillation just begins, which can be prevented by turning back VR1 slightly.

If TC2 is at too high capacity, oscillation arises with a much lower G2 voltage than optimum, so sensitivity is reduced. Rotate the i.f. coil core to find a spot where no transmission is received. If a signal generator is available, this can be found near 1·6Mc/s. Otherwise adjust the core so that all the brass thread is above the chassis, then slowly screw it down until a position is found which gives no direct reception at the intermediate frequency. Such reception is untunable during normal operation of the receiver, but is avoided by screening as described, and by keeping the aerial away from C6 and associated wiring.

VR1 and VR2 should be turned back somewhat, V1 and a pair of coils inserted, with TC1 set about half closed. Any transmission tuned in should peak up for maximum volume when VC3 is rotated. VC3 should be neither fully open, nor fully closed, this giving maximum efficiency on all frequencies.

If it is found that the required trimming adjustment falls outside that available by means of VC3, towards the low frequency end of any band (VC1/VC2 closed) adjust the coil cores until this is prevented. The best position is that which allows tuning from one end of the band to the other without any need to re-adjust VC3, except for optimum possible reception of weak signals.

If a signal generator is available, band coverage can be set by rotating the cores of the oscillator (white) coils. The aerial (blue) coils are then adjusted for best results. Should VC3 need to be fully open at the high frequency end of any band, this can be corrected by slightly screwing down TC1.

If the aerial is very long, results may be improved by placing a small capacitor (Cx) in series. A 25pF or 50pF pre-set capacitor should be satisfactory, or a small fixed component can be tried. This allows the aerial circuit to tune more sharply, and avoids overloading V1 or V2 with strong signals.

For normal reception, VR1 can be placed so as to give good results, and tuning carried out with VC1/VC2. But for weak signals it will be found that critical adjustment of VC3 and VR1 makes a considerable difference.

For general short wave reception range 4 is most suitable. Range 3 includes the 1·8-2·0 and 3·5-3·8Mc/s amateur bands, and other transmissions. Range 5 covers frequencies often capable of long distance results. Range 2 permits usual medium wave coverage, if wanted. A good earth improves reception, though long distance reception is possible without an earth. ■

MINIATURE STABILISED POWER SUPPLY

—continued from page 324

enable the component assembly to drop easily into place.

★ components list

R1	470Ω ±10% ½W
C1	200μF 16V electrolytic
C2	200μF 16V electrolytic
C3	200μF 16V electrolytic
Tr1	OC35 (recent manufacture)
D1	RS310 } S.T.C. or similar silicon rectifiers
D2	RS310 } S.T.C. or similar silicon rectifiers
D3	OAZ207 9·1V 250mW silicon zener diode (Mullard)
T1	Small bell transformer with 5V tap (Friedland Lilliput)
Veroboard, battery connectors, etc.	

One of the silicon rectifiers connects at its negative side to the collector tag. The flange on each rectifier corresponds to the cathode in a thermonic rectifier and is the positive end.

A red spot on the zener diode indicates the lead that is to be connected to the positive side of the supply.

The 200μF capacitors are mounted in line with the zener diode and rectifiers on the inside between them and the power transistor. The negative lead of each capacitor is bent over and brought down the side of the capacitor so that the two leads can be inserted into adjacent holes on the board. The capacitors should be insulated with plastic sleeves. ■

EXPERIMENTERS CORNER

CONNECTOR BLOCK CIRCUITRY

J. B. WILLMOTT, A.I.P.R.E.

A PROBLEM which is very often encountered when assembling a radio receiver, amplifier or other piece of equipment, is that of quickly substituting differing values of resistors or capacitors, or making wiring alterations to one or more sections of the apparatus under construction in order to observe the effect and to achieve optimum working conditions. In the "Good Old Days" (actually a little before the writer was old enough to pursue this fascinating hobby of radio) when all components had large brass terminals and were connected up by means of thick chunks of copper wire, it was a simple matter to carry out alterations to components or wiring.

There is available to the constructor now a very suitable alternative form of "terminal" in the form of polythene connector blocks. These are available in various forms, the most popular being of 2 amp current carrying capacity, obtainable as blocks containing 2, 3, or 12 connections. Each connector comprises a small brass "coupling" into which wires can be pushed from either end, with two small grub screws provided to secure the wires. The whole is embedded in solid polythene, screw holes are provided in the polythene by means of which the blocks can be secured to any mounting surface, and as the polythene is an excellent insulator, these blocks can be secured directly to an aluminium chassis without any risk of short circuits. The "12 section" blocks can be cut with a sharp knife or razor blade to any desired length and hence the number of connector points adjusted to suit the constructor's needs of the moment.

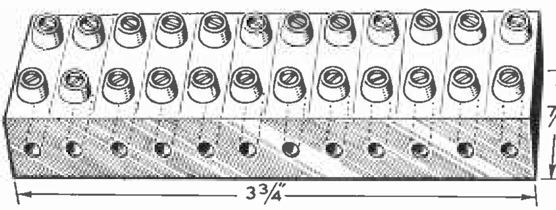


Fig 1: Typical 12-way connector block.

The obvious use for connector blocks is, of course, as a ready means of quickly connecting together the various separate units of a receiver or amplifier (where unit construction is adopted) such as the power supply unit and amplifier; provided the connections are plainly labelled on the chassis adjacent to the connector block, a ready means of feeding in heater and h.t. supplies from a power unit is provided.

A more novel use for connector blocks has

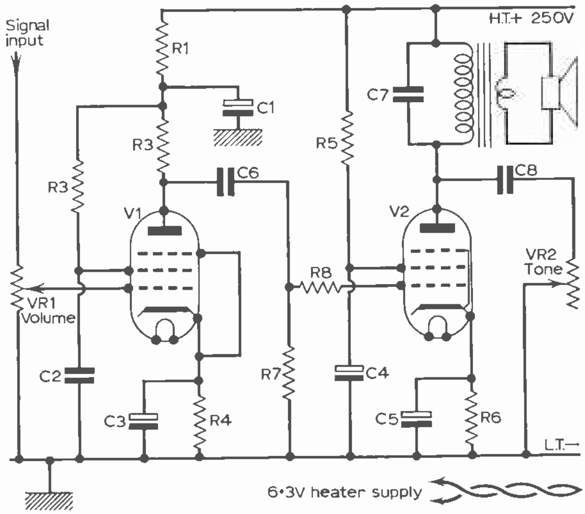
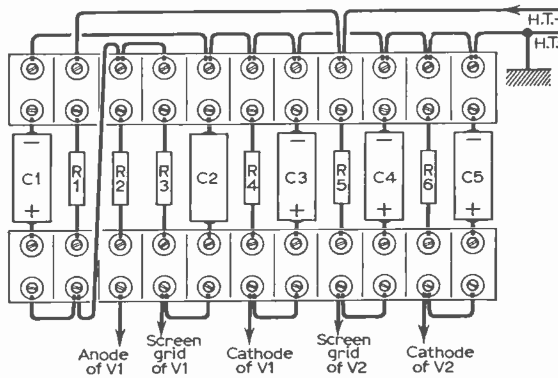


Fig 2: Theoretical circuit of simple audio amplifier

Fig 3: Suggested connector block layout of Fig 2. R7, R8, C6, C7 & C8 are not mounted on tagboard—see text.



recently been adopted by the author when constructing experimental gear; instead of using paxolin tagstrips or tagboards for securing resistors and capacitors, a double line of polythene connector blocks spaced some 1¼ in. apart forms a very effective substitute (see Fig. 3). The measurements of a 12-section connector block are 3¾in. long by ⅞in. wide, thus it is possible to place the two parallel blocks with 1¼in. clearance between them in an overall space of 2¼in., which in turn means that they can be mounted on the 2½in. deep side runner of the popular range of aluminium chassis, and leave just enough room for the external connections to the blocks without protruding above the level of the chassis walls.

Before attempting to wire up a piece of home designed equipment, work out carefully from the theoretical circuit diagram which components can be conveniently mounted on "tagboards" and hence the number of "ways" required on the tagboard(s). Remember, intervalve coupling components, grid resistors, grid stoppers and other similar signal carrying portions of a circuit should not normally be mounted on tagboards, as this introduces longer connecting leads and more risk of instability and interaction between wiring than can be tolerated. Such components should always be wired up by the shortest possible leads between the valveholders, etc. Decoupling components, bias resistors and by-pass capacitors can nearly always be mounted in groups without ill effect. A typical example is given in Fig. 2 of the circuit of a simple two-stage a.f. amplifier (no component values are given as obviously these will depend on the types of valves involved and the h.t. voltage supply available), and in Fig. 3 a suggested arrangement for mounting resistors and capacitors on a connector block "tagboard" of the type described, which it will be noted requires the use of an 11-way "board".

When the project has been completed, and found to be in working order, experiments to find the optimum value of resistors (or capacitors) can be readily carried out, changing one component at a time. For example, if one started off with R1 a 1MΩ component, the effect of altering this "up" to 1·2MΩ or 1·5MΩ, or "down" to 68kΩ or 470kΩ for example, can be tried out. It is surprising what a difference in overall performance can be made in quite a simple piece of equipment by experimenting on these lines.

The connector blocks referred to can be obtained from several component suppliers advertising in this magazine, and also in good D.I.Y. shops and some chain stores.

Lastly, whilst the remarks in this article have been primarily concerned with valve circuits, there is no reason why similar principles should not be adopted in experimental transistor work (provided space is not of prime consideration). A very quick means of "hooking up" transistors and their associated components is afforded.

One final word, whilst it is not really intended that these connector blocks should replace tagboards, etc., in permanent equipment, the author has found that provided the grub screws securing the component wires, etc., are tightened firmly home, there has been no noticeable deterioration in performance as compared to equipment wired by conventional means with 100% soldered joints, even after long periods of use. ■

Book Review

MATHEMATICS FOR RADIO AND ELECTRONIC TECHNICIANS
By Dr. -Ing Fritz Bergtold. Published by George Newnes Ltd. 304 pages. 8¼ x 5½in. Hard Covers. Price 50s.

THE title is no idle boast. Too often, books on mathematics are the stale, rehashed collections of formulæ—. . . *three men working for seventeen hours dig a trench twelve feet long by* . . . This book aims squarely at the radio and electronic technician and hits bang on target. Every example, description of method, formula or fact has a bearing on the subject.

This second edition has been re-written in consultation with practising engineers and mathematicians, particularly in semiconductor development. Thus, we find technical terms relevant to our subject continually cropping up, being explained and subsequently worked into the text. Much hard cogitation has obviously gone into such styling.

Beginning with simple equations and the technique of numbers and the use of symbols, the 24 chapters work through basic algebra, powers, curves and their uses, more detailed functions of x, logarithms, trigonometry, Fourier and other series, differentiation and integration, series, polar co-ordinates, vectors and complex calculus.

Right in the middle we find a brief refresher. Ch. 9 deals with "Some Peculiarities"—wise words of advice on the need for accuracy and the use of approximation, with handy notes on signs. The next chapter is a beautifully concise work on powers, exponents and the slide rule.

Intended as a supplement to the deeper textbooks in electronic technology, no specialist knowledge is needed. Taking the book as a course and reading for an average of a half-an-hour a day, the technician who has grown stale can refresh himself and should undoubtedly advance his knowledge at the same time.

The emphasis is on worked examples and these are directly aimed toward the student's chosen field. For the reader who thinks mathematics a dull and difficult subject, this book will come as a welcome relief.—*H.W.H.*

IN-LINE AUDIO A.G.C. UNIT

Two of the illustrations in the article describing an in-line audio a.g.c. unit, published in the July issue, were incorrect. In the circuit diagram (Fig. 2) on page 204 the emitter and collector symbols for Tr2 are reversed. The emitter should be towards the negative line as this is an n-p-n transistor, with the transformer as the collector load. The other error concerns the same transistor, but on the component layout (Fig. 3): the diagram is correct, but the letters identifying the collector and emitter are reversed.

BULB TUNING INDICATOR

A.J. McEVOY B.Sc.

FOR many years the cathode ray tuning indicator has been the accepted way of presenting visually the amplitude of signals in valve circuits. The constructor will be familiar with its use in radio sets to indicate tuning accuracy, and in tape recorders where it provides a clear warning of any overmodulation of the tape by too strong a recording signal.

The device relies on the deviation of an electron stream by a grid whose voltage depends on the strength of the signal, with the result that the pattern of the glow produced when the stream falls on a phosphor like that of a TV tube, is shifted in proportion to the signal. Such a device is obviously unsuitable for applications in transistorised circuitry, where there is no heater supply available for a filament to emit the electrons, and no high voltages to focus them into a beam. Admittedly, a few transistorised tape recorders have obtained sufficient h.t. to operate a miniature cathode ray indicator (the DM70), most manufacturers have fallen back on the use of small meters.

The circuit to be described was developed to supply the need for a low-voltage low-current visual display of signal strength without resorting to a moving-coil meter. Since any system involving cathode rays is excluded by power requirements, some other light source is necessary. Photoemissive diodes are still too expensive, though very attractive from the point of view of circuitry, so the only possibility was the old-fashioned filament bulb. A system which merely varied the brightness of a bulb would not be a definite, or even attractive, indicator, and there is the additional disadvantage that the current drawn by a bulb would be twice that of the radio or tape amplifier for which it served as indicator! It was therefore decided to develop a circuit in which the bulb would flash on and off at a rate depending on the signal strength. This holds the extra advantage that the current is reduced to a fraction of that of a continuously-glowing lamp. The familiar multivibrator circuit can be set up to switch the bulb on and off at a suitable rate, this frequency being controlled by the time constants of the R-C circuits in each leg of the device.

Circuit description

The circuit finally evolved is shown in Fig. 1. Tr2 and Tr3 will be recognised as the transistors forming the multivibrator, and it will also be noted that they are n-p-n types. Tr1, a p-n-p type, forms the resistive element in an R-C timing network with C2. The resistance to which Tr1 is equivalent, depends on the biasing current supplied at its base, which in turn is set by the input voltage applied through R1. In operation, therefore, the current available to charge C2 is the product of the bias current and the common-emitter current gain of Tr1. Therefore, the higher the bias current, the higher the charging current, and as a consequence, the shorter the time required to charge C2, and therefore the higher the repetition frequency of the multivibrator. Tr1 also functions as a buffer between the multivibrator and the signal source; otherwise there would be some direct connection between these, and as well as the reference voltage being supplied to the multivibrator, high harmonics of the multivibrator frequency, extending into and beyond the audio range, would be forced back into the reference circuit.

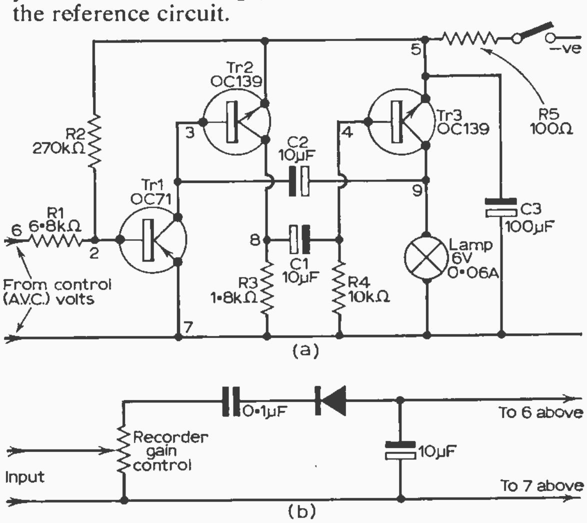


Fig. 1(a): Basic circuit of the tuning indicator unit (numbers denote tags on groupboard—see Fig. 2).
Fig. 1(b): Extra circuitry to obtain control d.c. in a tape recorder.

Most transistorised apparatus as yet available relies on germanium p-n-p transistors, and it is the positive line which is chosen conventionally as the earth line. This is the reason for the otherwise unusual choice of transistor polarities for the multivibrator transistors. The signal to be indicated will usually be small and close to the potential of the earth line of the set. It will therefore be able to control directly the bias level of Tr1 only if this is a p-n-p device. Similarly, acting as a current amplifier, Tr1 can give Tr2 the necessary forward bias only if the latter is an n-p-n unit.

Control voltage

In the above remarks and in Fig. 1, it is assumed that the signal is applied to Tr1 in the form of a d.c. voltage proportional to the strength of the audio component in the circuit. This is the case in a radio set, in which the appropriate voltage to indicate is that of the a.v.c. line. This is obtained from the d.c. component of the output from the detector diode, which is arranged to be positive-going, beyond the potential of the earth line. The first i.f. amplifier, receiving its bias current from a potential divider connected to this line, is then biased back and its gain reduced. If Tr1 is then connected through R1 to this line, it follows that, when the set tunes in a signal and the a.v.c voltage builds up, its base will go more positive, and its bias current will fall. Between collector and emitter it will then be equivalent to a larger resistor, since there is a lower current for the same applied voltage. The time constant is increased, and the frequency reduced. Visually, this means that, as a station is tuned in, the bulb will flash more slowly; if the constructor wishes, R1 may be reduced until it stops completely on the strongest local stations.

Audio equipment

It was also mentioned that the circuit is a suitable indicator for audio equipment and tape re-recorders; in these, however, there is not usually a convenient d.c. potential proportional to the volume level, analogous to the radio set's a.v.c. Fig. 1b shows the modification to the circuit of Tr1 to operate off the signal as it appears on the volume control of the recorder. According to the sense of the diode D1, the rate of flashing may be either increased or decreased. It is convenient with tape recorders to use for R1 a value of resistor which just suppresses flashing at the onset of overloading of the amplifier. This can be as clear and definite an indication as the closing of the display of a cathode ray device on a mains recorder. The constructor might choose to replace R1 with a preset potentiometer in order to achieve best results. Finally, should it happen that an indicator is required for a radio or amplifier using n-p-n transistors and a negative earth, it is only necessary to change Tr1 for n-p-n, and Tr2 and Tr3 for p-n-p types.

Construction

Construction of the indicator is simplicity itself, even for the beginner. Fig. 2 shows the arrangement of one prototype, on a ten-way group board. Even without miniature capacitors it measures only 1·5 x 1·2 x 0·5 inches. A decoupling resistor and capacitor are added in the supply line to prevent any noise from the multivibrator, blocked by the buffer action of Tr1, from entering the audio amplifier through its power supply.

The circuit diagram is numbered corresponding to the tags on the board to assist in identification of the components during construction.

One final point deserves consideration—the mounting of the indicator in the set. The lampholder—a standard m.e.s. type—is fixed at some convenient position on the front of the set, so that the bulb is visible through an aperture which, for appearance's sake, may be covered with a coloured plastic disc. However, the leads from the unit to the lamp should be twisted, in the same way as heater leads in valve amplifiers, and for the same reason, namely to prevent noise being induced into signal circuits. The location of the group board is not critical, but should clicks be heard in the speaker as the lamp flashes, the cause is probably the proximity of the multivibrator to a tuned circuit, and relocation will solve the problem. For battery economy a switch may be built in to save the 15mA. of the indicator circuit when listening for long periods to a single station. At other times the circuit is switched in, if only to serve as a dial light. ■

★ components list

Resistors

R1	6·8kΩ	R4	10kΩ
R2	270kΩ	R5	100Ω
R3	1·8kΩ		

All 10% ¼W

Capacitors:

C1 10μF 9V electrolytic
C2 10μF 9V electrolytic
C3 100μF 9V electrolytic

Semiconductors:

Tr1 OC71 general purpose p-n-p
Tr2 OC139 audio n-p-n
Tr3 OC139 audio n-p-n

Miscellaneous:

Lamp 6V 0·06A, miniature 5-way tag board, wire, etc.

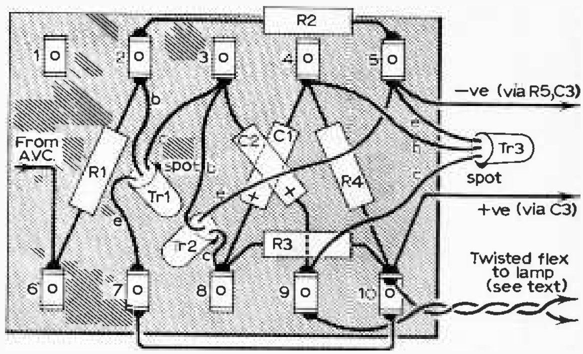


Fig. 2: Groupboard showing layout of components—note that C5/R3 are mounted externally but, this is not essential if a larger (ie. 12 or 14 way) groupboard is utilised.

practically wireless commentary by HENRY

No. 36

I'll Warrant You!

THERE is something impressively legal about the usual form of guarantee. With its archaic script, pretty red seal and clauses of small print, it is more suited to frame and hang on the wall than file in the bureau. And for all the good most of them are, they might just as well be used for decoration.

Nowadays, we are conditioned to want some sort of assurance that goods are better than we should deserve. The goggle-box nightly churns out these assurances. *"Splosh washes cleaner", "Use Rubbit for the Deep-Down-Glow", "Pablum is better than ordinary bread". But . . . Cleaner than what—sand and pebbles? What if we only want a common surface shine?* And, *surely, this* **is** *ordinary bread?*

We find the same thing in the press. The cleverer copy-writers cash in quickly with those intriguing advertisements that begin: *"Well, perhaps we DON'T make the fastest petrol . . . ."* or the intellectual ones that waffle on for half a page about something apparently irrelevant so that one congratulates oneself at the end for discovering the business of the advertiser.

So it is with guarantees. This week I broke my trusty electric shaver—trying to save the cost of a visit to the barber by cropping some of that back-growth, my wife said. She brought me a packet of emergency wet-shaving blades and stark across the inevitable plastic cocoon was the glaring red slogan, "Guaranteed".

Cropping the back-growth.

What would happen if I sent one of the treacherous things back because my pampered beard refused to succumb and supplied bloodstained skin shavings as evidence? Would the guarantee be honoured? Or would I be referred to some obscure item of small print that I had carelessly cast away with the wrapper?

This, roughly, is the position when one buys a bit of radio equipment. Twelve Months Guarantee, says the dealer, and we go off all unsuspecting. Then discover, if things go wrong, that the small print has absolved the maker from practically every hazard except an act of God.

Guarantees do not cover service charges. Time, trouble, labour, S.E.T. and other evils, make the dealer unduly avaricious. When we take our faulty radio back to his shop, he is perfectly entitled to charge a normal fee. Often he does not.

He has no hope of recouping losses from the manufacturer. Even the brand new models he has had to repair before he dare put them in his window carry no extra bonus for his service. Some makers talk airily about *"discounts covering the cost of minor adjustment,"* and we can guess what our radio repair man says about *that*. Small wonder he sometimes describes himself as the manufacturer's final inspection department.

The contractual element enters more strongly when we buy our equipment directly from source. *"Provided the card is filled in and returned within seven days."* Did we remember to date it correctly? Dare we update it, or will they check? *Can* they check?

Supposing we did remember to post the darn thing off. *"The Superspecial shall have been used strictly in accordance with the instructions."* Does that exclude the time we lent it to Aunt Mabel who had that unfortunate experience with the cat? *"The Superspecial must not have been tampered with, dismantled or subjected to misuse."*

Unfortunate experience with the cat.

And, to cap it, we are solely responsible for packing charges—and insurance, it seems. We remember what happened to that Christmas parcel; the forms we had to fill in to convince the GPO that we had not been sending contraband. We recall the tales of hijacked goods wagons, of large-scale pilfering, the Great Train Robbery, flood damage, fire . . . In the end, we probably settle for a quick repair by the little man around the corner.

But fate still dogs us. When the set comes back it bears a label: "Three Months Repairs Guarantee." We congratulate ourselves on a new lease of life and when the thing goes wrong a week later march back with confidence oozing from our ears.

How sad! The guarantee covers only the work done—and this is a different fault, to be sure. Same symptoms, maybe, but a *different* fault. *Sorry, Sir, you'll have to pay again.* But you get another guarantee.

CCTV CAMERA

Made by N.E.V. Portable, transistorised. Two models, 405 lines and 625 lines. Will work with normal T.V. receivers. Original price over £100 each. Brand new and unused. **£29.** Please specify 625 or 405 lines.

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holds 2–3in. spools. Supplied with one empty spool only. Fits the "Arrow" and several other tape recorders. **7/-** each or 3 for **£1.0.0.**

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Ideal for lighting drops, twin made by BICC. Usually 8d. yd. 100 yd. coil for **30/-**, plus 6/- postage.

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Piv	50V	100V	300V	400V
1 amp	6/6	7/6	8/6	9/6
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25 amp	30/-	35/-	47/6	60/-

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750mA.	100v.	1/3	1 Amp.	100v.	3/-
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	400v.	3/6		400v.	6/-
3A.	100v.	3/6			
	200v.	5/-	10 Amp.	100v.	9/6
	400v.	7/6		200v.	12/6
	600v.	9/6		400v.	14/6

Sub-miniature glass encased—only approx. ⅜in. long, wire ended.

400mA. 50v. 1/6 100v. 2/6 200v. 4/6

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2N1748	10/-	OA47	3/-	OC78	5/-
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AC127	9/-	OA79	2/6	OC81	5/-
ACY17	8/6	OA81	2/6	OC81D	5/-
ACY18	5/6	OA85	2/6	OC82	5/-
ACY19	6/6	OA90	2/6	OC83	5/-
ACY20	5/6	OA91	2/6	OC84	6/-
ACY21	6/-	OA200	3/3	OC139	8/6
ACY22	4/6	OA202	4/3	OC140	12/6
AF114	7/-	OC20	12/6	OC170	5/-
AF115	6/6	OC22	10/-	OC171	6/-
AF116	7/-	OC23	17/6	OC200	9/-
AF117	5/-	OC24	15/-	OC201	12/6
AF118	10/-	OC26	7/6	OC202	13/6
AF139	12/6	OC28	15/-	OC203	12/6
AF186	17/6	OC29	17/6	OCP71	15/-
AFZ12	15/-	OC35	12/6	ORP12	8/6
ASZ21	15/-	OC36	15/-	ORP60	10/-
BC107	14/6	OC42	6/6	SB078	6/6
BY100	4/6	OC44	4/-	SB305	8/6
BYZ13	7/6	OC45	3/6	SB251	10/-
MAT100	7/9	OC70	4/-	ST140	4/-
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Electronically changes speed from approximately 10 revs. to max. Full power at all speeds by fingertip control. Kit includes all parts, case, everything and full instructions. **19/6** or ready made **32/6** plus 2/6 post and insurance.

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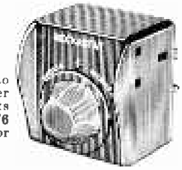
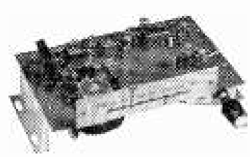
THIS MONTH'S SNIP

BECKASTAT



An Instant Thermostat. Simply push it into your wall socket and plug your fire or other appliance into it. Knob setting. Will save its cost in a season. Normally **£3.** We offer at **19/6** plus **2/-** post. When ordering state whether for 13 amp or 15 amp socket.

F.M. TUNER



of exceptional quality, giving really fantastic results with virtually no noise. Suitable for mains or battery operation. 6 transistors—three IF stages—double tuned discriminator. Complete, new, and built up all ready to work on chassis. Size 6 x 4 x 2in. with tuning scale and slow motion drive. A £12.12.0 tuner for only **£6.19.6** plus **3/6** post and ins.

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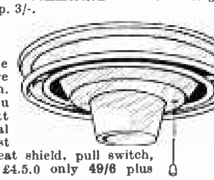
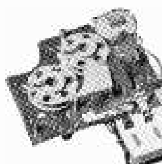
HEAT AND LIGHT UNIT



Bring luxury to your bathroom—have comforting heat where you now only have light—all the parts to build a full size (16in. diameter) model are now available—you will build it in an hour—12in. 750 watt circular silica glass encased element—opal bowl for up to 100 watt lamp—non-rust spun reflector—white enamelled base heat shield, pull switch, magnificent unit as sold normally at £4.5.0 only **49/6** plus 7/6 carr. and insurance.

BATTERY OPERATED TAPE DECK



With Capstan control. This unit is extremely well made and measures approx. 6 x 5 x 2in. deep. Has three piano key type controls for Record, Playback and Rewind. Motor is a special heavy duty type intended for operation off 4/5 volts. Supplied complete with 2 spools ready to install. Record, Replay head is the sensitive M4 type intended for use with transistor amplifier. Price **£4.15.0.** Post and insurance 4/6.

Kit of parts for switched F.M. Tuner described August/September issues **£4.15.0. P. & ins. 3/6.**

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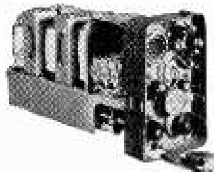
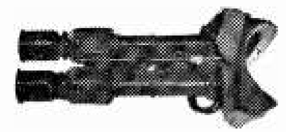


This is the 46 Receiver/Transmitter. It has a range of approx. 5 miles. Operates from dry batteries. Complete with six valves and in metal case. Size approx. 12in. x 6in. x 3¼in. Complete but less crystal, not tested nor guaranteed. **19/6** plus 7/6 post and insurance. Should not be operated as a transmitter in the U.K.

See in the Dark INFRA-RED BINOCULARS



These Infra-red binoculars when fed from a high voltage source will enable objects to be seen in the dark, providing the objects are in the rays of an infra-red beam. Each eye tube contains a complete optical lens system as well as the infra-red cell. These optical systems can be used as lenses for T.V. cameras—light cells, etc. (details supplied). The binoculars form part of the Army night driving (Tabby) equipment. They are unused and believed to be in good working order but sold without a guarantee. Price **£3.17.6,** plus **10/-** carr. and ins. Handbook 2/6.

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Designed to operate transistor sets and amplifiers. Adjustable output 6v., 9v., 12 volts for up to 500mA (class B working). Takes the place of any of the following batteries: PP1, PP3, PP4, PP6, PP7, PP9 and others. Kit comprises: mains transformer rectifier, smoothing and load resistor, 5,000 and 500 mfd. condensers. Zener diode and instructions. Real snip at only **14/6,** plus 3/6 postage.

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1μF	10 volt	4μF	4 volt	16μF	30 volt	64μF	10 volt
1μF	15 volt	4μF	12 volt	16μF	150 volt	64μF	40 volt
1μF	40 volt	4μF	25 volt	20μF	3 volt	100μF	3 volt
1μF	50 volt	4μF	100 volt	20μF	6 volt	100μF	6 volt
1μF	350 volt	5μF	6 volt	20μF	9 volt	100μF	10 volt
1·25μF	16 volt	5μF	25 volt	20μF	15 volt	100μF	12 volt
2μF	3 volt	5μF	50 volt	25μF	6 volt	100μF	15 volt
2μF	9 volt	5μF	70 volt	25μF	12 volt	150μF	12 volt
2μF	10 volt	6μF	12 volt	25μF	25 volt	150μF	25 volt
2μF	15 volt	6μF	15 volt	25μF	30 volt	200μF	3 volt
2μF	70 volt	6·4μF	40 volt	30μF	6 volt	200μF	4 volt
2μF	150 volt	8μF	3 volt	30μF	10 volt	200μF	16 volt
2·5μF	16 volt	8μF	6 volt	30μF	15 volt	250μF	2·5 volt
2·5μF	25 volt	8μF	50 volt	32μF	1·5 volt	250μF	9 volt
3μF	3 volt	10μF	6 volt	32μF	25 volt	250μF	15 volt
3μF	12 volt	10μF	10 volt	40μF	3 volt	320μF	2·5 volt
3μF	25 volt	10μF	12 volt	40μF	6·4 volt	500μF	4 volt
3·2μF	6 volt	10μF	25 volt	50μF	6 volt	640μF	2·5 volt
3·2μF	6·4 volt	12·5μF	4 volt	50μF	9 volt	750μF	18 volt
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TWO METRE TRANSMITTER

F.G.RAYER G3OGR

THE 144Mc/s amateur band covers a very wide frequency range compared with the low frequency bands, and crystal control is quite often used offering a simple means of obtaining good frequency stability. In addition to its obvious use on the 144Mc/s band, a transmitter of the kind described here may be adapted for use as a driver, with its output frequency multiplied into the 420M/cs band. The new Class B licence permits operating on frequencies above 420Mc/s without any need to pass the Morse test, call-signs being allocated in the G8 (followed by three letters) series.

Figure 1 is the circuit, V1 using an 8Mc/s 3rd overtone type crystal so that output is obtained directly on 24Mc/s. If the tuned circuit L1/VC1 is tuned for maximum output, oscillation may not recommence after switching on and off, and VC1 is adjusted slightly as necessary to correct this.

V2 triples to 72Mc/s, while V3 doubles to 144Mc/s driving the power amplifier V4 at 144Mc/s ensuring reasonable efficiency. As grid current is very important, VC2 is panel operated, and a grid current meter is included. It is possible to omit this meter, fitting a jack for an external test-meter or similar instrument. If a grid dip oscillator is available this will be very useful to check the frequencies of the various circuits before applying power. Should a g.d.o. not be to hand, tuning up can be accomplished by means of the indicating wavemeter described. Initial adjustments should be made stage by stage, and no h.t. must be applied to h.t.2 until the circuits are correctly tuned. If the coil details given are followed carefully, this should avoid any serious error such as working on the wrong harmonic. The coil details are given exactly as a guide, and this does not mean that somewhat dissimilar coils would not be satisfactory if a g.d.o. can be brought into use to adjust their frequency.

CONSTRUCTION

This is quite straightforward, with all circuits except the p.a. anode and output below the chassis. A piece of aluminium $4\frac{1}{4}$in. x $9\frac{3}{4}$in. has $\frac{1}{2}$in. flanges bent on it, and is shaped to fit as in Fig. 2. The positions of valveholders and other items on the chassis can be judged from Figs. 2 and 3.

Figure 3 is the underside of the chassis. Heater and h.t. leads run close against the chassis. All bypass capacitors are connected with very short leads.

OVERTONE OSCILLATOR

The oscillator is intended for 3rd overtone type crystals, and other crystals may not be satisfactory. With the 8Mc/s overtone crystal, the lowest frequency present is the overtone, or 24Mc/s. The output frequency of the transmitter is approximately x18 the crystal frequency, and crystals can be chosen on this basis.

The position of the tapping T on L1 considerably influences results, and will probably have to be

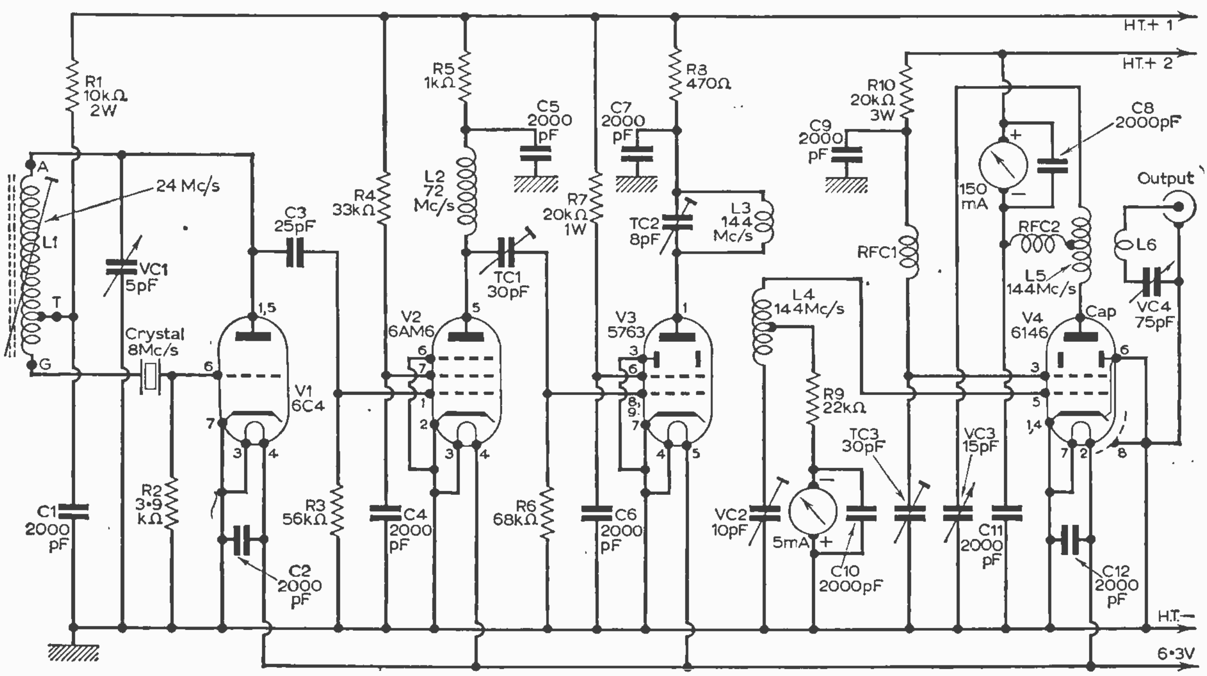

Fig. 1: Circuit diagram of the two metre transmitter.

adjusted to suit the particular operating conditions. If the tapping is too near the grid end G of L1, no oscillation will be obtained. But if the tapping is too near the anode end A, oscillation will continue at all frequencies to which L1 may be tuned. When the tapping is correctly placed oscillation arises only at the crystal overtone.

L1 is wound with 24s.w.g. enamelled wire, on a 9/32in. diameter cored former. There are 18 turns in all, with the tapping 5 turns from the grid or crystal

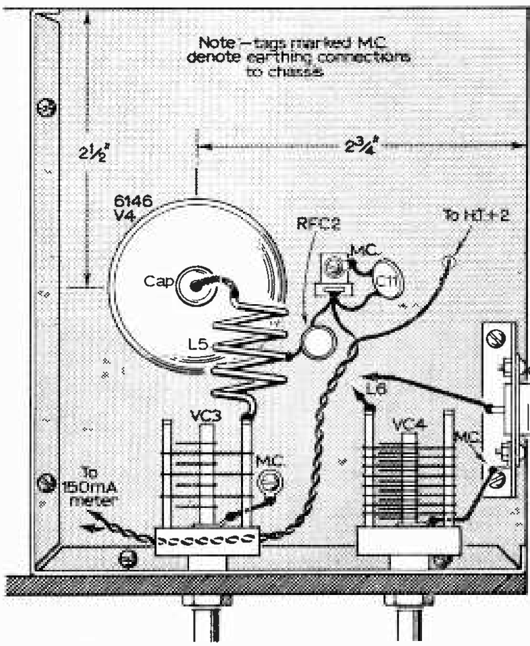

Fig. 2: Layout of the components in the p.a. compartment above chassis.

end, Fig. 4. Some adjustment of the ease with which the circuit oscillates can be made by modifying the position of the core, and restoring tuning by VC1. If a g.d.o. is available, place V1 and V2 in, and set L1 core and VC1 to give resonance on 24Mc/s. Include a meter between R1 and the h.t. line, and apply about 250-300V. Current may be around 10mA off tune, falling to 8-9mA on tune. If adjustments of VC1 and L1 core do not produce a dip in current, the circuit may not be oscillating. A receiver or sensitive wavemeter tuned to 24Mc/s will show this. Alternatively, there will be a sharp rise in current if L1 is shorted, if the circuit was oscillating. If oscillation is not obtained, tapping T may need to be a turn or so nearer A. Should these tests show the circuit oscillates, but that the frequency can be tuned by VC1, tapping T needs to be a turn or so nearer G. If a g.d.o. is not handy, use a receiver or wavemeter to make sure that L1 is not tuned to 16Mc/s or 32Mc/s in error. Some 3rd overtone type crystals will oscillate at multiples other than the one required.

When adjustment is correct, adjusting L1 or VC1 will only slightly change the frequency, due to pulling the crystal, and if L1 is put very far off resonance, oscillation will cease, as shown by a rise in anode current.

Coil L2 has 6 turns of 16s.w.g. wire, spaced to occupy ¾in., with an outside diameter of ⅝in. The shortest possible connections are used from the coil to tag 5, and from C5 to the coil and chassis.

Insert V3. Temporarily insert a meter between R6 and chassis (positive to chassis). If a g.d.o. is available, adjust TC1 until L2 is resonant at 72Mc/s. If no g.d.o. is to hand, adjust TC1 for maximum grid current through R6, this should be over 0·5mA. Check with the wavemeter that L2 is tuned to 72Mc/s, and not some other multiple. Adjustments of TC1 may seem quite flat, because it is in series with V3 grid capacity. TC1 should be at least half closed. Should L2 not tune to 72Mc/s, it must be stretched or compressed slightly.

The driver coil L3 is adjusted to 144Mc/s with the parallel trimmer TC2. L3 is 2 turns of 16s.w.g. wire, with an outside diameter of ⅝in. and turns separated to occupy 5/16in. With grid current obtained through R6 as mentioned, rotate TC2 for maximum output, as shown by a wavemeter or lamp loop. The latter can be 1 turn of insulated wire, soldered directly to a 0·06 ampere bulb. The trimmer, L3, and C7 have the shortest possible leads. If L3 does not tune to 144Mc/s, it will have to be compressed or stretched slightly.

PA GRID COIL

As stray capacity is otherwise too great for efficient working, this is series tuned by VC2. It has 5¾ turns of 16s.w.g. wire, and is ½in. long, with an outside diameter of ½in. Wire V4 holder with stout conductors (16s.w.g.) and the shortest leads possible. Take by-pass capacitor and other connections to the tags adjacent to the sockets, not to the ends of the tags. A paxolin holder of the thin type, with little solid material, was found satisfactory, and the moulded type of holder with embedded sockets should not be used. A ceramic or other low-loss holder is preferable.

Connect L4 directly from tag 5 to VC2. Cut one lead of R9 very short, and solder this to the centre of L4. Put V4 in, but be sure no h.t. is applied to anode or screen grid. L3 and L4 are closely coupled as in Fig. 3. Adjustments in all stages can now be directed towards obtaining maximum grid current. With VC2 correctly adjusted, grid current should be 2mA to 3mA. If maximum grid current is with VC2 open, stretch L4 slightly. Should maximum grid current be obtained with VC2 closed, press the turns of L4 slightly together.

All the previous trimming adjustments can be checked now, to get maximum grid current on the meter. Although L3 and L4 need to be close together, on no account must they touch. The adjustments of TC2 and VC2 to some extent depend on each other, but after these are peaked VC2 should allow ample adjustment of grid current on the meter.

PA ANODE COIL

The p.a. anode coil L5 has 4½ turns of 14s.w.g. wire wound to an outside diameter of 11/16in. The coil is ¾in. long and a ½in. flexible lead is soldered to the anode end. This can be a piece of co-axial cable outer braiding, or a number of pieces of bared flex twisted together. The other end goes directly to VC3. A 14s.w.g. wire runs from VC3 moving plates tag to chassis.

RFC2 is self-supporting and has 30 turns close wound of 22s.w.g. enamelled wire on a ¼in. diameter rod. Straighten a piece of wire and fix one

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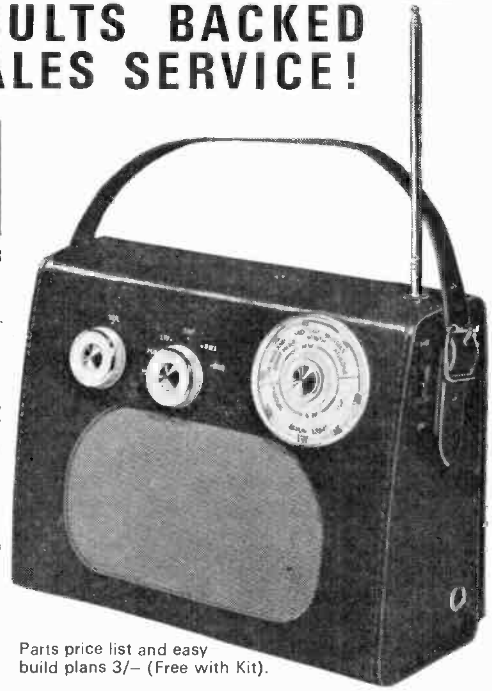

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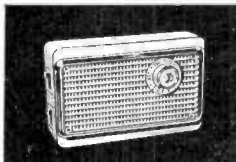

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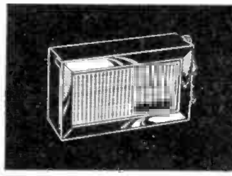

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Attractive black and gold case. Size 5½ x 1½ x 3½in. Fully tunable over both Medium and Long Waves with extended M.W. band for easier tuning of "pop" stations. All first grade components—7 stages—5 transistors and 2 diodes, supersensitive ferrite rod aerial, fine tone 3in. moving coil speaker etc. Easy build plans and parts price list. 1/6 (FREE with kit).
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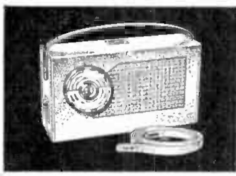

TWO WAVEBAND PORTABLE WITH 3in. SPEAKER

Handsome leather-look case size 6¾ x 3½ x 1⅞in. with gilt trim and hand and shoulder straps. Fully tunable over both Medium and Long waves. Incorporates pre-tagged circuit board, 8 stages—6 transistors and 2 diodes, ferrite rod aerial, push-pull output, wave change slide switch, tuning condenser, volume control, 3in. moving coil speaker etc. Easy build plans and parts price list 2/-. (FREE with kit).

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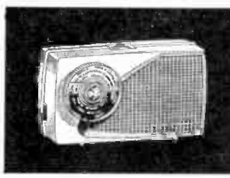

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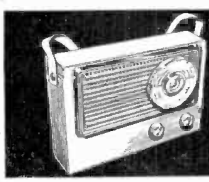

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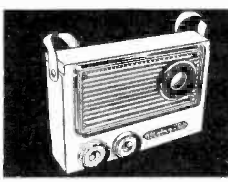

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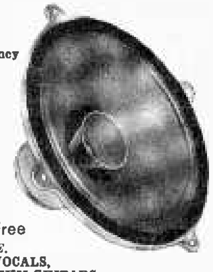

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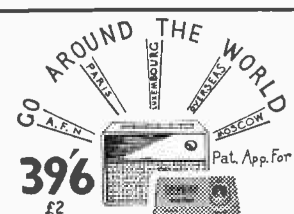

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end to some object. Wind by rotating the rod, keeping tension on the wire. Then when the rod is removed the turns will not spring out, but will remain as a solenoid. The actual tapping point is slightly off centre on the coil, as shown.

With no h.t. applied to V4 rotate VC2. A dip in grid current should be found indicating resonance for L5. If this is not found, compress or stretch L5, or check its frequency with a g.d.o. L6 is a single turn of 14s.w.g. wire, covered in stout sleeving. The co-axial socket is fixed to a bracket, and the ends of L6 go directly from this to VC4. A lead from VC4 moving plates tag runs to the socket outer member at a soldering tag.

NEUTRALISING

Series tuned screen neutralising is used, adjusted by TC3. The choke r.f.c.1 is 90 turns of 38s.w.g. wire on a 3/16in. diameter former. With TC3 fully closed, and no h.t. applied to V4, tune VC3 so that the dip in grid current mentioned is seen. Unscrew TC3 while VC3 is swung from side to side. A point should be found when the dip in grid current is much smaller, or absent and TC3 is left in this position.

PA TUNING

As a 6146 may readily draw a destructive anode current, a first test at reduced voltage is wise. Take h.t.2 to a 250V or similar supply, with a switch in circuit. A domestic lamp can be used as an artificial load. This is not ideal at 144Mc/s, and will present a much higher impedance than the usual load. A temporary loop having 2 or 3 turns of insulated wire should be made and connected by short leads to the lampholder terminals. Put this loop near L5, switch on the h.t.1 supply, and adjust VC2 for about 2mA grid current. Switch on h.t.2, and immediately rotate VC3 for a dip in anode current. If this is under about 100mA, bring the lamp loop nearer L5. With 25 watts input (100mA at 250V) a 15W lamp should light fairly brightly.

Efficiency is much higher with increased voltages. VC2 may need slight re-adjustment after

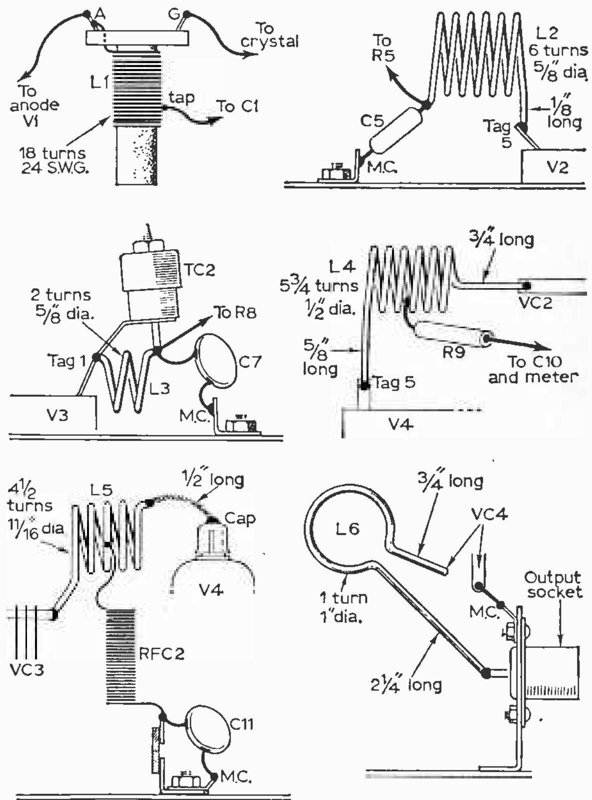


Fig. 4: Coil details. For winding instructions see text.

applying h.t. to V4. A 275V or 300V supply is recommended for h.t.l. When a lamp or other artificial load is connected to the output socket, closing VC4 from zero increases loading, but a 200/250V lamp is too high an impedance for this to be sufficient for full p.a. input.

C.W. ratings of the 6146 at 175Mc/s, are given as 140mA anode current at 320V. At 60Mc/s, ratings are 112mA at 600V. Telephony ratings are

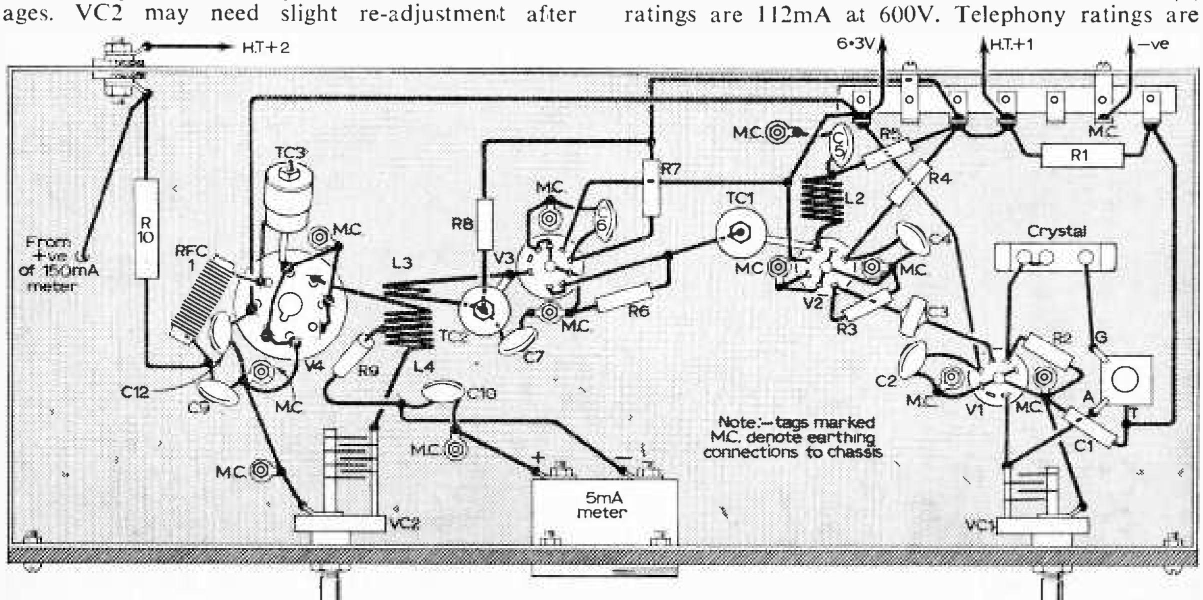


Fig. 3: Under chassis wiring diagram showing layout of components.

normally somewhat lower. In addition, the highest input ratings need ample grid drive, or full output is not obtained. In view of this, the amplifier has been operated at about 100mA anode current, from a 320V supply.

PA BIAS

The p.a. must not be operated without sufficient grid current (bias) or off resonance, or in conditions where the output obtained is so low that the anode dissipation is exceeded. With normal care, this should not be difficult. For increased output, R10 may be reduced to 16kΩ.

Point h.t.2 is supplied with modulated h.t. from the secondary of a modulation transformer. The modulator can be of normal type with a pair of 6L6 or 807 valves or similar stage delivering power about equal to half the p.a. input.

Note that the h.t. *must* be removed when changing crystals, if this is not done the valves could be permanently damaged.

WAVEMETER

If a g.d.o. or wavemeter is not available, a simple indicating wavemeter can be constructed as in Fig. 5. Provided the inductance and other details are exactly as shown, accuracy should be high enough for the various harmonic multiples to be identified. The output from the diode is taken to a test-meter or other instrument with a 1mA or similar range. The variable capacitor is fitted to a piece of insulating material, to serve as a handle and carry a card scale.

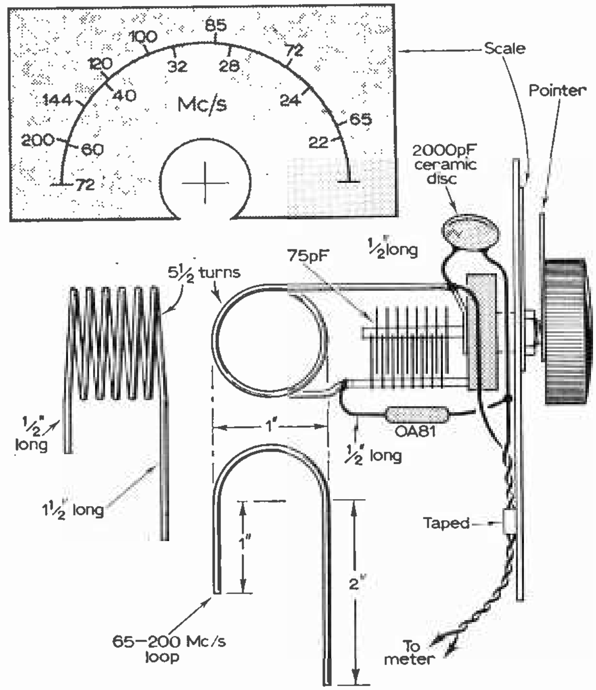


Fig. 5: Details and layout of suitable wavemeter.

For the 22-72Mc/s band, take 17½in. of 16s.w.g. wire, and straighten it. Wind 5½ turns so that the coil has an outside diameter of 9/10in. and is ½in. long, with the ends going directly to the tuning capacitor. For the 65-200Mc/s band, use 4in. of 16 s.w.g. wire. Bend this round a suitable object to form the loop as shown, and solder it to the capacitor. To cover both bands, it is necessary either to make two wavemeters, or to unsolder the unwanted coil. The wavemeter coil is loosely coupled to the appropriate transmitter coil, and tuned for maximum reading on the milliammeter.

Fixed capacitors should be of high-frequency by-

—continued on page 360

★ components list

Capacitors:

All disc ceramic except C3

C1	2000pF
C2	2000pF
C3	25pF mica
C4	2000pF
C5	2000pF
C6	2000pF
C7	2000pF
C8	2000pF
C9	2000pF
C10	2000pF
C11	2000pF
C12	2000pF

Resistors:

R1	10kΩ 2W
R2	3·9kΩ
R3	56kΩ
R4	33kΩ
R5	1kΩ
R6	68kΩ
R7	20kΩ 1W
R8	470Ω
R9	22kΩ
R10	20kΩ 3W

Variable Capacitors:

TC1	30pF Beehive	
TC2	8pF Beehive	
TC3	30pF Beehive	
VC1	5pF	air-spaced s.w. variables
VC2	10pF	air-spaced s.w. variables
VC3	15pF	air-spaced s.w. variables
VC4	75pF	air-spaced s.w. variables

Inductors:

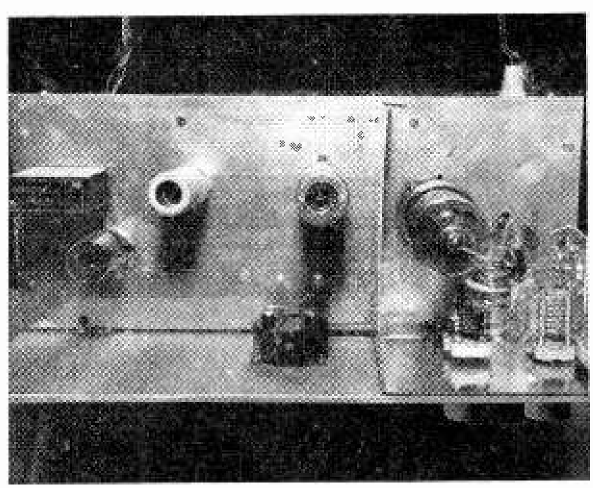
RFC1, RFC2, L1, L2, L3, L4, L5, L6 — See text and Fig. 4

Valves:

V1	6C4
V2	6AM6
V3	5763
V4	6146

Miscellaneous:

Crystal (8Mc/s 3rd overtone); two B7G skirted valve holders with cans; one B9A skirted holder with can; one octal holder; 5mA meter; 150mA meter; chassis 12 x 5 x 3in.; crystal holder; co-ax socket; four knobs; tagstrip; wire; solder etc.



Top view of the chassis showing p.a. screening.

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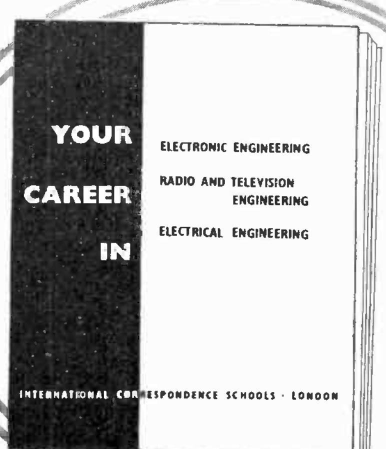

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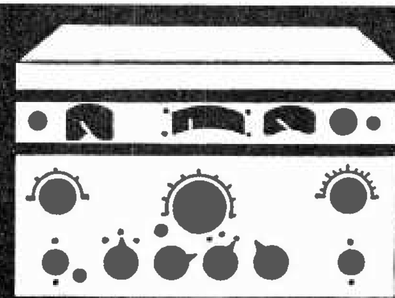


GUIDE TO SURPLUS COMMUNICATIONS RECEIVERS

K. ADKINS

PART 2

AR-8516L

This outstanding receiver, manufactured by R.C.A., is probably the last word in valve receivers. It was designed only a few years ago for marine communications, and a few of them have since become available on the amateur market. The receiver covers 80kc/s to 30Mc/s continuously, in 18 bands as follows:

1	80kc/s—200kc/s	10	12—14Mc/s
2	200kc/s—520kc/s	11	14—16Mc/s
3	520kc/s—1300kc/s	12	16—18Mc/s
4	1·09Mc/s—3·09Mc/s	13	18—20Mc/s
5	2—4Mc/s	14	20—22Mc/s
6	4—6Mc/s	15	22—24Mc/s
7	6—8Mc/s	16	24—26Mc/s
8	8—10Mc/s	17	26—28Mc/s
9	10—12Mc/s	18	28—30Mc/s

On bands 1 and 2, the receiver operates as a single superhet with an i.f. of 45kc/s. On bands 3, 4 and 5 operation is as a double superhet with i.f.'s of 455kc/s and 45kc/s. On bands 6 to 18 the receiver is a triple superhet with 2nd and 3rd i.f.'s of 455kc/s and 45kc/s respectively, and the first i.f. tunable from either 2-4Mc/s, or from 1·09-3·09Mc/s.

The valve line-up is as follows:

3BZ6	(Bands 6—18) R.F. Amplifier.
3CB6	(Bands 6—18) 1st Mixer to 2-4Mc/s or 1·09-3·09Mc/s.
3CB6	(Bands 6—18) Oscillator.
3BZ6	(Bands 6—18) I.F. Amplifier.
or	(Bands 1—5) R.F. Amplifier.
3CB6	(Bands 1—2) 1st Mixer to 45kc/s.
or	(Bands 3—5) 1st Mixer to 455kc/s.
or	(Bands 6—18) 2nd Mixer to 455kc/s.
7AU7	(Bands 1—3) V.F.O.
3CB6	(Bands 4—18) V.F.O.
3BZ6	455kc/s I.F. Amplifier.
3BZ6	455kc/s I.F. Amplifier.
3BZ6	455kc/s I.F. Amplifier.
3BE6	(Bands 3—5) 2nd Mixer to 45kc/s.
or	(Bands 6—18) 3rd Mixer to 45kc/s.
7AU7	Oscillator and crystal calibrator.
5U8	455kc/s B.F.O.
3AL5	455kc/s Detector and A.G.C.
5U8	45kc/s I.F. Amplifier.
7AU7	45kc/s B.F.O.
3AL5	45kc/s A.G.C.
1N34A	45kc/s crystal detector.
3AL5	Noise Limiter.
7AU7	A.F. Amplifier.
7AU7	Feedback Amplifier.
12CU5	A.F. Output.

Some of the valves serve more than one function.

Five positions of selectivity are available: 6kc/s, 3kc/s, 1·5kc/s, 0·8kc/s and 0·1kc/s. The 6kc/s and 3kc/s bandwidths are available only on the 455kc/s i.f. system. A mechanical filter is operative on bands 3—18. A noise limiter is included, and the a.g.c. has both fast and slow positions. An "S" meter is incorporated. C.W. receiver sensitivity for a 6dB signal plus noise-to-noise ratio is as follows:

Bands 1—2	3 microvolts
Bands 3—5	2 microvolts
Bands 6—18	1 microvolt.

Frequency drift due to changes in external environment or supply voltage is extremely low, and there is no long-term drift. The horizontal tuning scale has frequency markings at 50kc/s intervals, and a circular logging scale enables frequencies to be read to 1kc/s.

Output is arranged for high impedance phones, 3Ω speaker or 600Ω line. An output is also available at 455kc/s for FSK adaptors, etc. The receiver may be operated either from 115V a.c. or d.c., or from 230V a.c. The complete receiver weighs 91 lb, due mainly to the heavy gauge metalwork.

Modifications: It is unlikely that the performance could be improved.

Availability: As only a few of these receivers were ever released, a certain amount of difficulty may be encountered in obtaining one. Second-hand prices would probably run into three figures, although this is still a fraction of the original price. Manuals were available with the receivers.

BC453 BC454 BC455

These sets are popularly known as "Command Receivers", and were used in aircraft of the US Army. They are of totally shielded, all-aluminium, construction and are very light and compact. They were originally designed to operate from the 28 volt d.c. aircraft supply. The three receivers are identical except for their frequency coverage and i.f. frequencies, which are given below:

BC453	190-550kc/s.	I.F. 85kc/s.
BC454	3-6Mc/s.	I.F. 1415kc/s.
BC455	6-9·1Mc/s.	I.F. 2830kc/s.

Minor variations of these receivers are denoted by a suffix letter, e.g. BC453A.

These three receivers originate from a piece of equipment known as the SCR274. Another series, known as the ARC-5, contains an almost identical set of command receivers.

The command receiver has 6 valves, as follows:

Three 12SK7, one 12SR7, one 12A6, one 12K8. The circuitry includes one r.f. stage, two i.f. stages, mixer, detector, b.f.o. and audio. A 28 volt dynamotor power supply is incorporated. In its original form, the command receiver has output for 300 or 4,000Ω headphones. The circuitry does not usually incorporate a.g.c., but it is believed that a few command sets in the ARC-5 series do have this feature.

The size of the command receiver is 5in. x 8in. x 12in., and its weight is only about 6 lb.

Modifications. The command receiver has become very popular both in the USA and in this country, mainly because of its cheapness and small size. It is not normally used on its own as a communications receiver, but is used in conjunction with v.h.f. coverters, or as a second i.f. channel for another communications receiver. It is admirably suited for both of these functions, after a certain amount of modification.

The first and obvious modification is to replace the 28 volt dynamotor with an a.c. power supply. It is possible to mount an a.c. power supply on the chassis in the position formerly occupied by the dynamotor, although reasonably small components must be used. The unit must supply 250V at 50mA. The valve heaters were originally wired for 25·2 volts, and must be rewired for operation from the more usual heater voltage supplies.

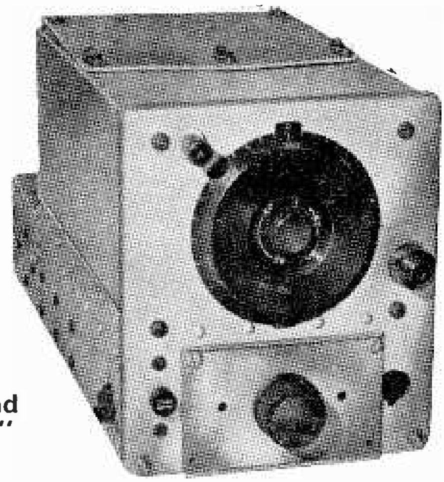
For loudspeaker operation, the output transformer must be changed, and it will probably be necessary to provide more audio power.

Few controls are provided and it will be necessary to modify the panel in order to allow for the mounting of the additional controls provided by the electrical modifications.

Other popular modifications include the addition of a noise limiter; and the replacement of the 12SK7 valves with 12SG7's in order to improve gain.

The BC453 version is normally employed as a second i.f. channel. It is set up to receive the i.f. signal from the main receiver, and then amplifies this signal at 85kc/s, at which frequency it is possible to obtain adequate selectivity for operation in the most crowded of bands.

The BC454 and BC455 versions are normally employed as single i.f. channels v.h.f. converters.



"Command Receiver"

Availability. Unlike the majority of the other receivers dealt with in this guide, the command receiver seems to come on to the surplus market in a steady trickle, rather than in batches. They are doubtless much more readily available in the United States. It is usually possible to hunt one down in the West End, as most retailers seem to hold a small supply of them at one time or another. The position is almost certain to become more difficult in the future.

Prices range up to a maximum of £4 or £5, depending on condition. The writer was lucky enough to obtain two of them, two or three years ago, for 2s. 6d. each! (In grade 3 condition, of course).

Command receivers can quite easily be obtained on the second-hand market, and here one has the advantage that the receiver has probably already been modified, although perhaps not to the purchaser's satisfaction.

Command receiver manuals are not widely available, and indeed are not generally considered necessary owing to the numerous modifications to this receiver published in the amateur radio press in the last ten years or so.

To be continued

TWO METRE TRANSMITTER

—continued from page 356

pass type, and sufficient voltage rating. When the p.a. is operated from a modulator, C11 should be rated at more than *twice* the h.t. voltage. A 1kV disc ceramic capacitor is ideal, but a mica capacitor can be used, and the value may be reduced to 1,000pF. The variable capacitors VC1, VC2 and VC3 can be modified somewhat, to use 7·5pF, 10pF, or similar components. Much larger values, such as 25pF or 50pF, are not suitable. The minimum capacity is too great, and adjustment too difficult. The capacity of some surplus miniature short wave tuning capacitors can easily be reduced by taking off plates. VC should be rated at twice the h.t. voltage or more, so needs double plate spacing.

Various combinations of inductance and capacity will reach the resonant frequency required in each stage. But with L3 in particular, output rises when TC2 is at quite low capacity, so the coil may be compressed slightly if needed.

CW WORKING

Cathode keying of V4, suitable for lower frequencies, cannot be used. However, the screen grid supply to V3 can be keyed, and bias applied through L4 so that the input to V4 does not exceed 20 watts during key up intervals. In this case R9 should be reduced to 2·2kΩ, and the negative bias taken to positive on the 5mA meter. Bias from a small power pack delivering some 40V or so is most convenient, with a potentiometer to allow voltage adjustment. A check should then be made with no drive so that V4 d.c. input (voltage x current) is not over 20W for the anode and 3W for the screen grid.

During phone or c.w. working, the p.a. must be so coupled and loaded that the d.c. input does not exceed by more than 20W the r.f. output obtained. In the absence of bias from a power pack or battery, R9 must be 22kΩ. ■

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EBF89	5/9
EBL21	10/3
EC52	4/3
EC53	12/6
EC54	6/-
EC70	4/9
EC86	11/6
EC88	10/6
EC91	4/-
EC92	6/6
ECC31	15/6
ECC32	4/6
ECC33	29/1
ECC34	29/6
ECC35	4/9
ECC40	9/6
ECC81	3/6
ECC82	4/6
ECC83	4/6
ECC84	5/6
ECC85	5/-
ECC88	7/-
ECC189	9/-
ECC804	9/6
ECC807	19/9
ECF80	7/-
ECF82	6/9
ECF86	8/6
ECF804	24/-
ECH3	23/3
ECH21	9/6
ECH33	22/8
ECH35	6/-
ECH42	8/9
ECH81	5/-
ECH83	7/-
ECH84	6/6
ECL80	6/-
ECL82	6/3
ECL83	9/-
ECL84	12/-
ECL85	11/-
ECL86	7/9
ECLL800	23/9
EF22	6/6
EF36	3/-
EF37A	7/-
EF39	5/-
EF40	8/9
EF41	9/-
EF42	3/6
EF50	2/6
EF54	6/-
EF80	4/6
EF83	9/9
EF85	4/6
EF86	6/3
EF89	4/9
EF91	3/3
EF92	2/6
EF97	8/-
EF98	9/-
EF183	6/3
EF184	5/9
EH90	7/6
EL32	3/-
EL33	12/-
EL34	9/6
EL35	10/-
EL36	8/9
EL37	16/6
EL41	8/-
EL42	7/6
EL81	8/-
EL83	6/9
EL84	4/6
EL85	7/6
EL86	8/-
EL91	2/6
EL95	5/-
ELL80	13/-
EM71	14/-
EM80	5/9
EM81	6/9
EM84	6/-
EM85	11/-
EM87	6/6
EY51	5/6
EY81	7/-
EY83	9/-
EY84	9/6
EY86	5/9
EY87	5/9
EY88	7/6
EY91	3/-
EZ35	5/3
EZ40	6/-
EZ41	6/6
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FW4/500	6/6
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GZ30	7/6
GZ32	9/-
GZ33	12/6
GZ34	10/-
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H30	5/-
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HL2	7/6
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HL23DD	5/-
HL41	3/9
HL41DD	19/6
HL42DD	8/-
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IW3	5/6
IW4/350	5/6
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KBC32	20/5
KF35	12/6
KL35	11/6
KLL32	21/7
KT2	5/-
KT8	15/-
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KT36	29/1
KT41	19/6
KT44	5/9
KT61	12/-
KT63	4/-
KT66	16/6
KT74	12/6
KT76	7/6
KT88	27/6
KTW61	4/3
KTW62	12/6
KTW63	4/-
KTZ41	6/-
L63	4/6
LP2	9/6
MHD4	7/6
MHLD6	12/6
ML6	6/-
MS4B	20/5
MSP4	12/6
MU12/14	4/-
MX40	12/6
N37	23/3
N78	38/4
N108	26/7
N339	25/-
P41	3/6
P61	2/6
PABC80	7/6
PC86	8/6
PC88	8/6
PC95	6/9
PC97	5/9
PC900	8/-
PCC84	5/6
PCC85	6/9
PCC88	10/6
PCC89	9/9
PCC189	8/3
PCF80	6/3
PCF82	6/-
PCF84	8/-
PCF86	8/-
PCF801	8/6
PCF802	9/6
PCF805	9/6
PCF806	11/6
PCL81	9/-
PCL82	6/3
PCL83	8/6
PCL84	7/-
PCL85	8/3
PCL86	8/-
PCL88	13/3
PEN45	7/-
PEN45DD	19/6
PEN46	4/-
PEN383	9/6
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PENA4	19/6
PEN/DD 4020	17/6
PFL200	13/6
PL33	9/-
PL36	9/-
PL38	19/9
PL81	6/9
PL81A	6/9
PL82	5/9
PL83	6/-
PL84	6/3
PL500	13/6
PM84	9/3
PX4	14/-
PY32	8/6
PY33	8/6
PY80	5/-
PY81	5/-
PY82	5/-
PY83	5/6
PY88	7/3
PY800	6/-
PY801	6/-
PZ30	9/6
QP21	5/-
QQVO3/10	30/-
QS75/20	10/6
QS150/15	9/6
R10	15/-
R11	19/6
R12	5/6
R16	34/11
R17	17/6
R18	9/6
R19	6/9
R52	7/6
RG1/240A	65/-
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SP13C	12/6
SP42	12/6
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TH30C	14/6
TH233	6/9
TP22	5/-
TP25	5/-
TP2620	7/6
TY86F	11/10
UABC80	5/3
UAF42	7/9
UB41	10/6
UBC41	6/6
UBC81	6/6
UBF80	5/6
UBF89	5/9
UBL21	9/-
UC92	5/6
UCC84	8/-
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UCF80	8/3
UCH21	9/-
UCH42	8/6
UCH81	6/-
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UF41	7/9
UF42	4/9
UF80	6/9
UF85	7/3
UF86	9/-
UF89	5/6
UL41	8/9
UL46	9/6
UL84	5/6
UM80	5/-
UR1C	6/6
UU5	7/-
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UU12	4/3
UY1N	10/3
UY21	9/-
UY41	5/6
UY85	4/9
U10	9/-
U12/14	7/6
U16	15/-
U17	5/-
U18/20	6/6
U19	40/-
U22	5/9
U25	11/-
U26	8/6
U31	6/3
U33	13/6
U35	16/6
U37	34/11
U45	15/6
U50	5/-
U52	4/9
U76	4/6
U78	3/6
U101	19/6
U107	17/6
U191	10/-
U251	9/-
U281	8/9
U282	12/3
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U329	9/-
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U404	6/-
U801	18/-
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VMP4G	17/-
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VP2B	9/6
VP4	14/6
VP4A	14/6
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VP41	5/-
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X63	7/6
X64	5/6
X65	5/6
X66	7/6
X76M	7/9
X78	26/2
X79	40/9
X81M	29/1
X101	29/1
X109	26/-
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AF116	3/-
AF117	4/-
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AF126	7/-
AF127	3/6
AF139	27/6
AF178	13/6
AF179	13/6
AF180	18/6
AF181	14/-
AF186	20/-
AFZ12	5/-
ASY27	10/-
ASY28	8/-
ASY29	10/-
AY100	26/-
BA115	5/-
BA116	9/-
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BCY12	5/-
BCY33	5/-
BCY34	5/-
BCY38	5/-
BCY39	5/-
BC107	10/-
BFY50	5/-
BFY51	5/-
BFY52	5/-
BY100	3/6
BY101	11/6
BY105	11/6
BY114	8/-
BYZ12	7/6
BYZ13	7/6
CG12E	4/-
CG46H	4/-
GD3	6/6
GD4	6/6
GD5	5/6
GD6	5/6
GD8	4/-
GD9	4/-
GD10	4/-
GD11	4/-
GD12	4/-
GD14	10/-
GD15	8/-
GD16	4/-
GET102	8/6
GET103	4/6
GET104	12/-
GET105	18/-
GET111	15/6
GET113	5/-
GET114	4/6
GET115	17/-
GET116	12/-
GET118	7/6
GET119	7/6
GET573	12/6
GET587	12/6
GET872	10/-
GET873	5/-
GET874	23/6
GET887	7/6
GET882	10/-
GET889	7/6
GET890	7/6
GET896	7/6
GET897	7/6
GET898	7/6
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GEX35	4/6
GEX36	10/-
GEX45/1	7/-
GEX55/1	15/-
GEX64	11/6
GEX66	15/-
GT3	5/-
M1	2/10
M3	2/10
OA5	5/6
OA10	6/6
OA70	3/-
OA73	3/-
OA79	3/-
OA81	2/-
OA85	3/-
OA86	4/-
OA90	3/-
OA91	3/-
OA95	2/-
OA182	3/-
OA200	3/-
OA202	2/-
OA210	9/6
OA211	13/6
OAZ200	12/-
OAZ201	10/6
OAZ202	9/-
OAZ203	9/6
OAZ204	9/-
OAZ210	7/-
OAZ205	9/-
OC16/OC16W	35/-
OC19	25/-
OC22	5/-
OC23	7/-
OC25	7/-
OC26	5/-
OC28	5/-
OC29	16/6
OC30	8/-
OC35	10/-
OC36	10/-
OC38	12/6
OC41	5/-
OC42	6/9
OC43	12/6
OC44	3/-
OC44PM	8/3
OC45	2/6
OC45M	8/-
OC46	3/-
OC65	22/6
OC66	25/-
OC70	3/-
OC71	2/6
OC72	2/6
OC73	16/-
OC74	8/-
OC75	2/-
OC76	3/-
OC77	4/-
OC78	3/-
OC78D	3/-
OC79	8/-
OC81	2/3
OC81D	2/3
OC81M	5/-
OC82	2/3
OC82D	2/6
OC83	3/-
OC84	4/-
OC123	4/6
OC139	12/-
OC140	19/-
OC169	4/-
OC170	2/6
OC171	4/-
OC172	4/-
OC200	6/6
OC201	23/-
OC202	23/-
OC203	12/6
OC204	10/6
OC206	10/6
OC812	8/-
OCP71	27/6
ORP12	15/-
TS2	12/6
TS3	15/-
SX641	10/-
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XA103	15/-
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MAT101	8/6
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AF114	4/-
AF115	3/-
AF116	3/-
AF117	4/-
AF118	3/6
AF119	3/6
AF178	10/-
BSY95A	5/-
OC22	5/-
OC23	10/-
OC25	8/-
OC26	5/-
OC28	5/-
OC35	5/-
OC41	2/6
OC42	2/6
OC71	2/6
OC72	2/6
OC73	5/-
OC81	2/6
OC81D	2/6
OC83	4/-
OC139	2/6
OC140	5/-
OC170	3/-
OC171	4/-
OC200	5/-
OC201	8/-
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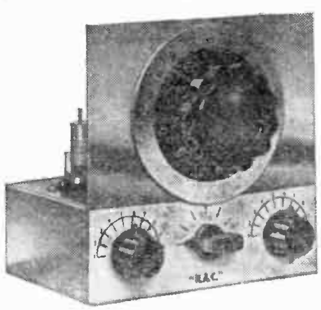

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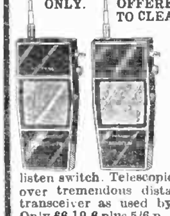

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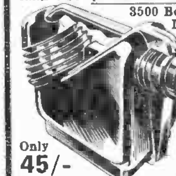

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CLUB SPOT

No. 17 CRAY VALLEY RADIO SOCIETY

G3RCV

THE Cray Valley Radio Society was founded in 1946 to provide a focal point for Radio Amateurs and Short Wave Listeners living in the vicinity of Cray Valley, a district covering Eltham, Sidcup, Bromley, Orpington and the Crays. Membership now consists of over 40 licensed operators and nearly 20 Short Wave Listeners drawn from a wide variety of trades, professions and students.

Early licences

The Society is proud to include among its members, four operators, G2HP, G2MI (who is President and a member of the RSGB Council), G2WI and G2ZI, all licensed in the earliest days of Amateur Radio.

There is no doubt that QUA, the Society's newsletter, does a great deal to keep members in touch. This is published regularly each month, the present editor being G3DNC. Contributions from members are always welcome and usually make up a satisfactory proportion of the contents, varying from technical articles to miniature masterpieces of doggerel.

Meetings

The Society meets twice monthly. On the first Thursday in the month at the Congregational Church Hall, Court Road, Eltham, London S.E.9 the meeting is usually devoted to a technical lecture or feature. The second meeting, held a fortnight later at All Saints Church Hall, Bercta Road, New Eltham, London S.E.9 is usually a "natter-nite" because past experience has shown that members seldom have enough opportunity at the principal meeting to say all that they want to in the limited time available for conversation. It is hoped to alter the meeting night for this event in due course so that those members who find Thursdays inconvenient will at least be able to attend some of the meetings.

Until a few years ago there was little or no interest in contest operating but in the last three years, the Society has participated in both h.f. and v.h.f. contests with varying degrees of success. In an attempt to co-ordinate the efforts of individual members, G3VLT has taken on the job of Liaison Officer and hopes to produce improved results.

Members at the 1966 NFD. From the left they are: Chris, G3VLT; Alan, G3ANK; Bill, G2AQB; and Dave, G3RGS.

Balance of activities

One problem which must be common to many Societies is that of getting a reasonable balance of activities. This particular aspect has recently engaged the attention of the Cray Valley management committee to the extent of sending a questionnaire to all members and it is hoped that the future programmes based on suggestions received will be to their liking.

Society net

The Society runs a net on Top Band on Fridays at 21.00 hours and there is also a rival, though none the less popular, net on four metres at 20.00 hours on Tuesdays. The Top Band net has proved a valuable source of publicity for attracting new members who, by this means, often first learn of the club's existence.

Activity weekends are held at intervals, mainly with the object of giving other amateurs an opportunity of qualifying for the Cray Valley Award. Particulars of this are obtainable by sending a stamped addressed envelope to G3MCA.

No permanent QTH

One big handicap that has not yet been overcome is the lack of a permanent headquarters where gear can be installed and aerials erected. The Society looks forward to the day when this object can be achieved.

WVC award

The Society award a certificate to any licensed amateur who can give proof of two-way communication, any mode, any band. To gain the number of points pertaining to his locality, e.g., G stations require 15 points, European stations require 10 points and DX stations require 5 points.

One point is given for contacting each Society member and three points for contacting the Society Station, G3RCV. Net QSO's are void. Log extract, certified by two other licensed amateurs, or QSL's and 5 I.R.C. (or 2s. 6d.) to G3MCA.

To gain the required points, G3RCV need not be QSO'd. GM, GD, GC, GI and GW stations count as European.

The present committee includes G3JJC (Chairman) G3VLX (Secretary) and G3TCC (Treasurer). Anyone interested in joining will be welcome at any meeting: alternatively they can contact the secretary at 850-6945, evenings or weekends, or write to G3VLX, 234 Halfway Street, Sidcup, Kent.

LETTERS...

A book reviewed

The notice of Donald Smith's *ABC's of Electronic Test Equipment* by "HWH" in the June number conveys so little of interest that one wonders why the work was noticed at all; the space might well have been given to better use. What does "HWH" expect for 16/- — a tome covering the entire field of test instrumentation in such detail that low-grade technicians can make their own in their garden sheds, from parts bought at "junk shops"? Has "HWH" spent a whole day at, say, the recent RECMF show at Olympia. Has he examined the shelves of books on electronics in his local public library? Above all, has he himself written any books on electronics, and is he really familiar with the problems of publishers to-day? If "yes" to all queries, I am surprised and annoyed by his notice of this unimportant but harmless enough book, which may be best left for technicians to discover for themselves without his hostile remarks. For my part, I want information about more important practical books.—**W. H. Cazaly.**

[*We, too, would love to see more useful books, but can only review those sent. To ignore those that dissatisfy makes a mockery of the task reviewers set themselves.*

ABC's of Electronic Test Equipment *falls awkwardly between two stools. It would have been more interesting (though even less useful) if it merely listed the available test gear seen at the recent RECMF Exhibition. It would have been more useful if it had continued as it began and developed its theme of basic design. But to omit so much fundamental information that even we "low-grade technicians" could not use it to work in our garden sheds certainly merited some adverse comment.*

There are indeed many books on the public library shelves—this reviewer has written a few himself, Mr. C., and is aware of the blood and sweat they entail. The few that deal with test instruments are either very expensive or narrowly specialised. I feel sure the Editor would be delighted to give space to a review of any work that deserved the attention of his faithful band of practical readers]—H.W.H.

Infinite baffle mods

I note with interest G. R. Fletcher's article "Idea for an Infinite Baffle" published in the April edition of P.W.

Whilst commending the scheme from the technical (and domestic) point of view, I should like to suggest certain slight modifications: (1) the chimney can resonate like a closed organ pipe. Although the fundamental will almost certainly be too low in pitch to be noticeable (18c.p.s. for a 30-foot chimney), the even harmonics emitted could produce devastating coloration.

(2) Front-to-back standing waves, reflected by hard materials such as firebrick, could present problems.

(3) The presence of a large lintel close to the rear face of the speaker cone causes "tunnel effect"—i.e. more coloration.

These effects can be remedied in the following ways:

(1) The chimney should be blocked above the speaker to make a rigid airtight seal. The height of the chamber so formed is not critical, but should not be made a multiple of either major horizontal dimension. Mr. G. A. Briggs recommends ratios of—1 : 1·25 : 1·6 or 1 : 1·6 : 2·5—to minimise coloration.

The roof of the chamber should ideally be brick or concrete, but wood at least ½in. or preferably 1in. thick could be substituted. Wood faced on the upper side with heavy unglazed ceramic tiles would be a good compromise.

(2) The whole cabinet should be lined on the inside with absorbent: a good thick layer of fluffy soot would help considerably.

(3) Bricks close to the speaker should be bevelled away:

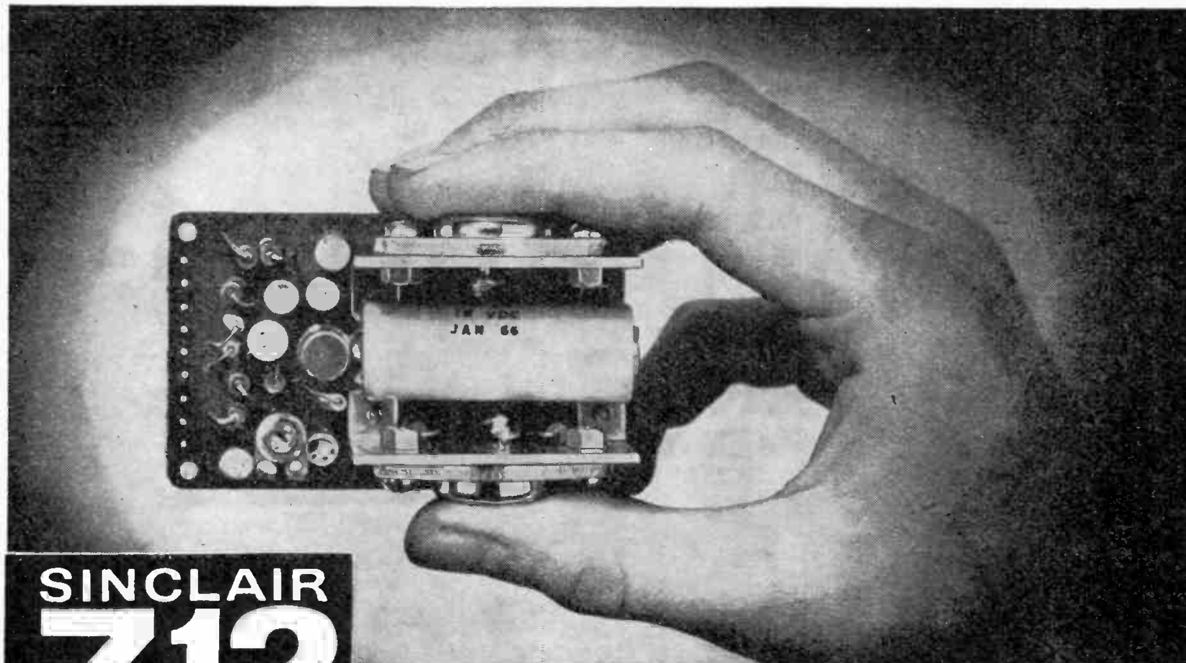
The author's precaution of pushing newspaper wads up the chimney has probably saved him from the worst effects of column resonance—the pads will form an acoustic filter.

In conclusion—Good luck, Mr. Fletcher—an excellent idea.—**W. S. Lymath**, Engineer, Rank Wharfedale Ltd. (*Bradford, Yorkshire*).

Veteran valve identity

I wonder if you or your Correspondent P. J. Plater, of Wallington, Surrey (June '66) can help me with the valve line up of a veteran Burndept 285.

As he says the valve identity marks do get lost, and this veteran was doing nicely, when it spluttered and stopped. I found that the ancient electrolitic was leaking and had evidently eaten through a lead to earth, but I cannot decide which of two tags it belongs to, till I know the identity of the output valve.—**W. M. Mackenzie** (*Gosport, Hampshire*).



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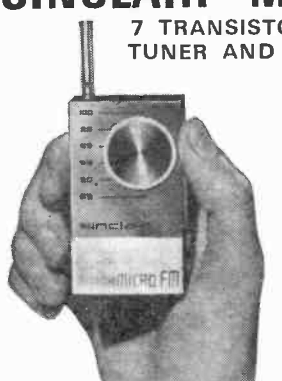

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P. & P. all the above 3/- each

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(continued)

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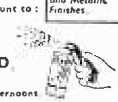

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WITH DATA

3/- each. OC44, OC45, OC70, OC71, OC81, OC81D, OC200, GET16, GET20.

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All volts between 3.9v. and 26v. ¼w 3/6 each, 1.5w 5/- each, 7w 6/- each.

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TRANSMITTING VALVES, 813 or 4B13, also 811-G.B., 3 Guildford Close, West Worthing, Sussex. Worthing 6151.

(continued on next page)

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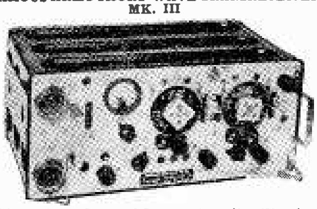
JOHN'S RADIO (Dept. B)
OLD CO-OP, WHITEHALL ROAD, DRIGHLINGTON, BRADFORD

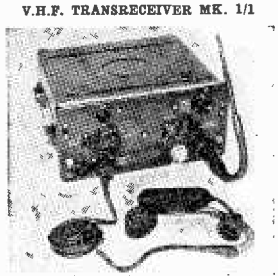
FAMOUS ARMY SHORT-WAVE TRANSRECEIVER MK. III



This set is made up of 3 separate units: (1) a two valve amplifier using a 6V6 output valve; (2) (some only, not built in the very latest models) a V.H.F. transreceiver covering 229–241 Mc/s using 4 valves; (3) the main short wave transmitter/receiver covering in two switched bands, just below 2 Mc/s–4½ Mc/s, and 4½ Mc/s–8 Mc/s (approx. 160–37·5 metres) using 9 valves. For R.T., C.W. and M.C.W. The receiver is superheterodyne having 1 R.F. stage, frequency changer, two I.F. (465 Kc/s) signal detector, A.V.C. and output stage. A B.F.O. included for C.W. or single side-band reception. T.X. output valve 807, other valves octal bases. Many extras, e.g. netting switch, quick flick dial settings, squelch etc. Power requirements LT 12 volts, HT receiver 275 volts D.C. HT transmitter 500 volts D.C., size approx. 17½ x 7½ x 11ins. Every set supplied in new or as new condition in carton with book including circuits, only **£4.10.0d.**, or Grade 2 slightly used **50/-** carriage both 15/-.

A FULL KIT of brand new attachments for this set including all connectors, control box, headphones and mike, aerial tuning unit, co-axial lead etc. at only **45/-** carriage 5/-. WE MAKE A MAINS 200/250 VOLT POWER UNIT in louvred metal case to plug direct into set power socket to run (1) receiver, 70/- post 5/- (2) TX and RX, **£6.10.0** post 7/6d. (3) 12 Volt DC P.U. for receiver, **50/-** carriage 5/-. A charge of **10/-** to unpack and test the receiver of these sets is made only if requested.

V.H.F. TRANSRECEIVER MK. 1/1



This is a modern self contained tunable V.H.F. low powered frequency modulated transreceiver for R.T. communication up to 8–10 miles. Made for the Ministry of Supply at an extremely high cost by well known British makers, using 15 midget B.G. 7 valves, receiver incorporating R.F. amplifier. Double superhet and A.F.C. Slow motion tuning with the dial calibrated in 41 channels each 200 Kc/s apart. The frequency covered is 39 mc/s–40 mc/s. Also has built-in Crystal calibrator which gives pips to coincide with marks on the tuning dial. Power required L.T. 4½ volts, H.T. 150 volts, tapped at 90 volts for receiver. Every set supplied complete with valves and crystals. New in carton, complete with adjustable whip aerial, and circuit. Price **£4.10.0** carriage 10/-. Headset or hand telephone **30/-**. Internal power unit stabilised for 200/250 volts A.C. input **£6.10.0** extra.

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NEW CONDITION HIGH QUALITY
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Bargain 13/-, Post Paid
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Speakers, Ex T.V. 5 inch rnd. **3/6.** 6 x 4 **3/6.** Min. post **2/6.**
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Fireball tuners, less cover can **9/-.**
Ekco line O/P Trans, U26 type **35/-**, post paid,
Push Button tuners, using 30L15 and 30C15 valves, rectangular buttons **27/6**, post paid.
Postage on valves 6d, over three, post paid.
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150 NEW ASSORTED Capacitors, Resistors, Silvered Mica, Ceramic, etc. Carbon, Hystab, Vitreous, ½-20 watt, 12/6. Post Free. WHITSAM ELECTRICAL, 18 Woodrow Close, Perivale, Middlesex.

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Guaranteed six months. Postage 4d.

DCC90	4/6	EF91	2/6	EL91	2/-	PL81	6/9
DF91	2/-	EF92	2/-	EY86	6/-	PL83	6/-
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ECC81	3/-	EF95	3/6	PCC89	8/9	PY801	6/-
ECC82	4/-	EF98	7/-	PCF80	6/6	U25	11/-
ECC83	4/3	EF183	6/-	PCF82	6/6	6BH6	4/-
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ECF82	6/9	EL84	4/6	PCL85	8/3	85A2	5/-
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500mA rects.—800 PIV **3/-**, 600 PIV **2/9**, 400 PIV **2/3**, 200 PIV **2/-**, 100 PIV **1/9**. Si transistors, 200 MHz, 300 mW **1/9**. SCR's 5 & 10 Amp.—stocks limited—5 for **£1**. Mic 45 **19/6**, Mic 40 **15/-**, Mic 60 **22/6**. Replacement universal xtal. cartridges.
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25/- post free

Consisting of 9 x 3in. chassis, Con Strips, Resistances

2–OC29s 2–OC35s

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These are a 6 valve plus rectifier Long, Med and S.W. Rx covering S.W. 6 to 18 Mc/s 50 to 16 meters, fitted internal speaker, sks for phones, slow motion drive, supplied ready to work for 230v mains.
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Contains C.R.T. type VCR97 green screen med persistence, 16 octal valves C.R.T. Fil trans, Focus, Brill and Gain controls fitted. Also 12 pots, Mu Metal shield, Slow motion dial 50:1, 2 x 500 Pf tuning conds, 100 Kc crystal unit, 2 x Slow motion drives, Yaxley and Key swts etc. In good condition with outer cover size 9 x 12 x 18in.
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APQ-43 I.F. Strips
These are a 30 Mc/s 10 Mc/s bandwidth I.F. strip using the following valves: 6AK5x7, 6AG7, 12AU7, 6AL5, in good condition.
Price: **£2.2.6.** plus 4/6 carr.
APQ-43 Prea Amps to match above **25/-** plus 3/6 post. B.N.C. and Power plugs to fit above **2/6** each.

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These are a portable test osc intended to work off 6v D.C. The 261 covers 175 to 305 Mc/s and the 266,95 to 180 Mc/s. These units are directly calibrated, no xtals are required. O/P is modulated with variable freq osc. A small Ae system is supplied. Overall size 7 x 8 x 16in. with circ, good condition.
Price: Either type **£3.5.0.** plus 10/- carr. Or **£6.0.0.** per pair carr. paid.

R.F. Amplifier No. 4
This is the V.F.O. and P.A. section of the Army No. 53 Tx, this unit covers the freq range 1.2 to 17.5 Mc/s in 4 bands and uses the following valves: Osc VT501, Buffer VT501, Driver 807, P.A. Two 813s, Bias rect 6X5, Voltage stab VS110x2. The following controls and meters are fitted: V.F.O. tuning by a large directly calibrated dial, Driver tuning, Grid drive P.A. tuning, Ae coupling, Ae loading, Meters P.A. grid current, P.A. An current, Ae current, Ae C/O relay is fitted. Heater and bias supplies are contained within unit. The following ext supplies are required: E.H.T. 1.5 Kv at 300 Ma, 400v at 100 Ma, 230v A.C., 12v D.C. The O/P of the unit is 250 watts with one 813 removed and the 1.5 Kv reduced. This will bring it down to 150 watts. I/P. Unit is intended to work into dipole Ae. Supplied new and crated with circ.
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Rx. Unit Type ARR-2
These are a small airborne Rx tuning the band 234 to 258 Mc/s and are intended to receive A.M. modulated sub carrier transmissions and in their present form are unsuitable for normal use. These Rx can, however, be modified to work on 2 meters, i.e. they can be made to tune the band 125 to 150 Mc/s, modification details and circ diagrams are supplied with Rx. The following valves are used: 6AK5x3, 9001x7, 12A6. The O/P is for low res h/phones. The small size of these, i.e. 5½ x 4½in. front, 11in. deep, makes them well suited to mobile use. To carry out successfully the mods to these a Sig Gen or Test Osc is required. Supplied in new condition.
Price: **£3.10.0.** plus 6/- post.

Test Set Type 253
These are a test osc covering 20 to 88 Mc/s in 4 bands, and are for 230v mains supply. A large vernier dial is fitted, 2 Mc/s xtal is fitted for checking calibration, Noise diode with 50 Ma meter is also fitted for noise checks, R.F. signal is modulated with low freq xtals. Supplied with cal charts, used condition. These units were used for checking the R.F. 24/27 units.
Price: **£3.5.0.** plus 10/- carr.

Portable Gieger Counters
These are a 4 valve unit with CV2247 pick up tube, meter indication .1 to 10 Milli Rongtens, sockets for phones or counter, supplied in waterproof carrying case size 10 x 10 x 8in. These units normally work off 2–150v dry batteries. These are not available but they can be operated off a 300v P.U. Supplied new and tested.
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These are a 4-channel unit operating in the freq range 38 to 42 Mc/s. They req 90/1.5v carbon mike and low res phones. They use 14 miniature valves, weight 6lbs., size 5½ x 3½ x 9½in. Good condition with circ.
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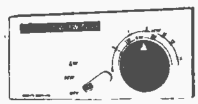

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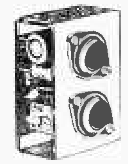

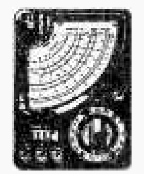

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2	Sil. Rects. 5A 400 PIV Stud Type	15/-
2	Germ. Power Trans. OC28/29	15/-
1	10A Sil. Stud Rect. 800 PIV	15/-
1	Tunnel Diode AEY11 1050 Mc/s STC	15/-
2	2N2712 Sil. Epoxy Planar HFE225 max.	15/-
1	2N1257 PNP Sil. Planar TO–5 can	15/-
1	Sil. Power Trans. NPN 2S721 85W	15/-
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1R4	6/-
1R5	6/-
1S4	5/-
1S5	4/6
1T4	3/-
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1U4	5/-
1U5	6/-
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1X2B	7/-
2C26A	7/-
2C34	7/6
2C40	65/-
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2CW4	12/-
2D21	6/-
2E26	22/6
3A4	4/-
3A5	7/-
3AV6	6/6
3B7	5/-
3B28	40/-
3D6	4/-
3Q4	7/-
3Q5GT	6/6
3S4	5/-
3V4	6/-
4B32	80/-
4E27	60/-
4THA	8/-
4TSP	8/-
4X150A	100/-
5R4GY	9/-
5U4GB	6/6
5U8	8/-
5V4G	8/6
5Y3GT	5/-
5Z3	7/6
5Z4G	7/-
6/30L2	8/6
6A8	8/-
6AB4	6/6
6AB7	4/-
6AC5GT	10/-
6AC7	4/-
6AF4	10/-
6AF6G	11/-
6AG5	2/6
6AG7	6/-
6AH6	10/-
6AK5	5/-

6AK6	7/6
6AL5	3/-
6AM6	4/-
6AM8	8/-
6AN8	10/-
6AQ4	5/-
6AQ5	5/6
6AR5	6/-
6AR6	6/-
6AR8	17/6
6AS5	5/-
6AS6	6/-
6AS7G	15/-
6AT6	4/6
6AU6	5/6
6AU8	9/-
6AV5GTA	11/-
6AV6	5/-
6AW8A	12/6
6B4G	17/-
6B8	7/-
6B8G	2/6
6BA6	4/6
6BA7	15/-
6BE6	4/6
6BF6	6/-
6BF7	15/-
6BG6G	16/-
6BH6	7/6
6BJ6	7/6
6BK4	22/6
6BK7A	9/-
6BL7GTA	10/-
6BN6	7/6
6BQ7A	7/-
6BR7	11/-
6BR8	5/-
6BS7	17/-
6BW6	7/-
6BW7	10/-
6BZ6	6/-
6BZ7	11/-
6C4	3/6
6C5	8/-
6C5GT	6/-
6C6	4/-
6C31	12/-
6CB6	5/-
6CD6GA	17/-
6CG7	10/-
6CH6	6/-
6CL6	9/-
6CU6	11/-
6CW4	12/-
6CY5	8/-
6CY7	11/-
6D4	15/-
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6E5GT	8/-
6EA8	11/-
6F1	14/-
6F4	30/-
6F5G	8/-
6F6G	5/-
6F7	5/-
6F8G	5/-

6F11	6/-
6F12	4/-
6F13	6/6
6F14	15/-
6F15	11/-
6F17	6/-
6F18	7/6
6F23	10/-
6F24	12/-
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6J7	9/-
6J7G	5/-
6K6G	6/-
6K7GT	5/-
6K8	8/-
6K8G	4/-
6L6GC	7/6
6L7	5/-
6L17	9/-
6L18	6/-
6LD20	5/-
6N7GT	7/-
6P25	12/-
6P28	12/6
6Q5G	15/-
6Q7	7/-
6Q7G	6/-
6SA7	7/-
6SC7	9/-
6SF5	8/-
6SF7	7/-
6SG7	6/-
6SH7	4/-
6SJ7	7/-
6SK7	6/-
6SK7GT	4/6
6SL7GT	6/-
6SN7GT	5/6
6SQ7	7/-
6SR7	7/-
6T8	6/6
6U8	7/6
6U8A	9/6
6V6GT	6/6
6X4	4/-
6X5GT	5/6
6Y6G	9/-
7AG7	7/-
7B6	11/-
7B7	7/-
7B8	8/-
7C5	11/-
7C6	6/6
7C7	5/-
7H7	8/-
7S7	22/-
7Y4	8/-
7Z4	6/-
9BW6	7/-
10C2	13/-
10D1	7/-
10F1	9/-
10F3	8/-
10F9	10/-
10F18	9/-

10L1	7/6
10P13	15/-
10P14	15/-
11D3	7/-
11D5	7/-
12AC6	8/-
12AD6	9/-
12AE6	7/6
12AL5	7/-
12AQ5	7/-
12AT6	5/-
12AT7	4/-
12AU6	6/-
12AU7	5/6
12AV6	5/6
12AV7	8/-
12AW6	20/-
12AX7	6/-
12AY7	10/-
12B4A	9/-
12BA6	6/-
12BE6	5/6
12BH7	6/-
12BY7	10/-
12C8	4/6
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12K7GT	7/-
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12Q7G	4/-
12SA7	7/-
12SC7	4/-
12SG7	5/-
12SH7	4/-
12SJ7	4/-
12SK7	5/-
12SL7GT	7/6
12SN7GT	7/6
12SR7	5/-
14S7	18/-
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20F2	13/-
20L1	13/-
20P1	12/-
20P3	12/-
20P4	13/-
25L6GT	6/6
25Z4G	8/-
25Z5	8/-
25Z6GT	11/-
28D7	7/-
30A5	7/-
30C1	6/3
30C15	11/6
30C17	11/6
30C18	11/-
30F5	10/-
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30L15	15/-
30L17	15/-
30P12	9/-
30P16	7/-
30P18	6/6
30P19	13/-
30PL1	15/-
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35A3	10/-
35A5	10/-
35B5	12/-
35C5	6/6
35D5	12/-
35L6GT	6/-
35W4	4/6
35Z3	10/-
35Z4G	4/-
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35Z5GT	5/6
42	6/-
431U	8/-
50A5	12/-
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50C5	6/-
50CD6G	27/6
50L6GT	6/-
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53KU	12/6
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75C1	13/-
80	6/-
83A1	12/-
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85A3	5/6
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90CG	25/-
90CV	25/-
117N7	30/-
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150B3	8/-
211	30/-
807	9/-
811	40/-
812A	55/-
815	35/-
832	20/-
837	17/6
866A	14/-
884	15/-
955	3/-
956	2/-
957	5/-
958A	4/-
959	8/-
991	7/-
1267	20/-
2050	12/-
5642	11/-
5651	7/6
5654	8/-

5670	10/-
5686	25/-
5749	10/-
5751	12/-
5763	10/-
5814A	10/-
5965	5/-
6060	5/-
6080	25/-
6146	25/-
6159	32/-
6197	20/-
6203	32/-
6293	60/-
6360	30/-
6939	45/-
7360	30/-
7551	30/-
7586	22/6
7895	22/6
9002	5/6
9003	9/-
9005	15/-
AC2PEN DD	10/-
AC/HL/DD	8/-
AC/HL/DDD	10/-
AC/TH1	8/-
AC/VP2	15/-
AR8	6/-
ARP12	3/6
ATS25	9/-
AW6	5/-
AZ11	6/-
AZ12	9/-
AZ31	9/-
AZ41	7/-
CBL31	15/-
CCH35	10/-
DA90	4/-
DAC32	7/6
DAF40	10/-
DAF91	4/6
DAF92	6/-
DAF96	6/6
DC90	7/-
DCC90	7/-
DF33	8/-
DF64	5/-
DF91	3/-
DF92	2/6
DF96	7/-
DH63	6/-
DH101	7/6
DK32	8/-

DK40	11/-
DK91	6/-
DK92	8/-
DK96	7/-
DL33	6/6
DL35	5/-
DL66	20/-
DL68	10/-
DL69	12/6
DL91	5/-
DL92	5/-
DL93	4/-
DL94	6/-
DL95	7/-
DL96	7/-
DM70	5/6
DY30	8/-
DY86	6/6
DY87	7/-
E80F	20/-
E80CF	27/6
E88CC	12/6
E90CC	10/-
E92CC	7/-
E180CC	8/-
E180F	17/6
E182CC	23/-
EA50	2/-
EABC80	6/6
EAC91	4/-
EAF42	8/6
EBC33	7/-
EBC41	8/6
EBC81	6/3
EBC90	4/6
EBC91	5/-
EBF80	7/6
EBF83	8/-
EBF89	7/-
EBL31	20/-
EC86	12/-
EC88	11/-
EC90	2/6
EC91	5/-
EC92	6/6
ECC33	15/-
ECC34	10/-
ECC35	17/-
ECC40	9/6
ECC70	15/-
ECC81	4/-
ECC82	5/-
ECC83	6/-
ECC84	6/6
ECC85	5/-
ECC86	7/-
ECC88	8/-

ECC91	3/6
ECC189	11/-
ECC804	10/-
ECC807	13/6
ECF80	7/-
ECF82	7/6
ECF82	12/-
ECF86	9/6
ECH35	11/-
ECH42	9/6
ECH81	5/3
ECH83	7/6
ECH84	9/-
ECL80	7/-
ECL81	7/6
ECL82	6/3
ECL83	9/6
ECL84	12/-
ECL85	11/6
ECL86	9/-
EF9	10/-
EF36	5/-
EF37A	8/-
EF39	6/-
EF40	9/-
EF41	8/6
EF42	11/-
EF52	8/-
EF54	6/-
EF55	8/-
EF80	5/-
EF83	10/-
EF85	6/6
EF86	6/3
EF89	5/6
EF91	4/-
EF93	4/6
EF94	5/6
EF95	5/-
EF96	2/6
EF97	10/-
EF183	6/6
EF184	6/6
EF804	21/-
EF811	12/-
EF812	10/-
EF814	12/-
EH90	7/6
EK90	4/6
EL22	15/-
EL33	12/6
EL34	9/6
EL35	5/-
EL36	8/6
EL38	17/6
EL41	8/6
EL42	7/6

EL81	9/-
EL82	8/-
EL83	7/-
EL84	4/3
EL85	7/6
EL86	8/-
EL90	5/6
EL91	2/6
EL95	5/-
EL360	22/-
EL821	6/-
EL822	16/-
ELL80	13/-
EM34	13/-
EM35	8/-
EM71	12/6
EM80	7/-
EM81	7/-
EM84	7/-
EM85	11/-
EM87	7/-
EMM803	10/-
EN31	15/-
EN91	6/-
EN92	6/-
EY51	7/-
EY81	7/-
EY83	9/-
EY84	9/6
EY86	6/6
EY87	8/-
EZ22	6/-
EZ35	5/6
EZ40	7/6
EZ41	8/-
EZ80	5/-
EZ81	5/-
EZ90	4/-
GS10H	40/-
GTE175M	12/-
GU50	35/-
GZ30	7/6
GZ32	10/-
GZ34	10/-
GZ37	12/-
HABC80	8/-
HBC90	5/-
HBC91	5/6
HF93	6/-
HF94	6/-
HL2	4/-
HL2K	4/-
HL23	6/-
HL23DD	6/-
HL41	4/-
HL42DD	8/-
HL92	6/6
HL94	7/-
HL132D	4/-
HL133DD	10/-
HN309	15/-
HY90	4/6
KT2	7/-
KT32	6/6
KT36	17/6
KT41	7/6
KT44	5/-

KT45	15/-
KT66	16/-
KT67	45/-
KT76	8/-
KT88	23/-
LP2	7/-
ME1401	20/-
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MH41	9/-
MHL4	5/-
MS/PEN	8/-
MS/PENT	10/-
N78	16/-
PABC80	7/6
PC86	11/-
PC88	11/-
PC97	7/6
PC900	9/-
PCC84	5/6
PCC85	7/-
PCC89	11/-
PCC189	11/-
PCC805	11/-
PCC806	11/-
PCE800	10/6
PCF80	6/3
PCF82	6/6
PCF87	11/6
PCF800	10/-
PCF801	9/6
PCF802	9/6
PCF805	11/-
PCF806	12/-
PCF808	12/-
PCL80	10/6
PCL81	9/-
PCL82	7/-
PCL83	8/6
PCL84	7/6
PCL85	9/-
PCL86	8/6
PCL88	10/6
PCL800	12/-
PCL801	10/6
PEN25	5/-
PEN45	7/-
PEN45DD	12/-
PEN46	6/-
PEN220A	7/-
PEN383	10/-
PEN384	7/-
PEN453DD	10/-
PENA4	7/6
PF86	7/6
PF818	10/-
PFL200	14/-
PL36	9/-
PL38	16/-
PL81	6/6
PL82	7/-
PL83	6/6
PL84	6/6
PL302	13/-
PL500	13/6
PL504	14/-

PLL80	10/-
PT15	15/-
PX4	20/-
PX25	15/-
PY31	5/-
PY32	8/6
PY33	8/6
PY80	5/6
PY81	6/-
PY82	5/6
PY83	6/-
PY88	8/-
PY301	11/-
PY800	6/-
PY801	6/-
PZ30	8/6
QP21	5/-
QP25	5/-
QP230	5/-
QQVO2-6	45/-
QQVO3-10	30/-
QQVO6-40	90/-
QS83/3	7/6
QS92/10	4/-
QS95/10	5/6
QS150/15	8/-
QS1200	10/-
QS1202	8/6
QS1203	8/6
QS1215	12/-
QVO3-12	10/-
QVO5-25	9/-
R1	8/-
R2	8/-
R10	15/-
R18	7/6
SP2	4/-
SP41	5/-
SP61	4/-
SU45	15/-
SU2150A	12/-
TP22	7/-
TP25	5/-
TP2620	7/6
TT21	35/-
TZ40	40/-
U10	8/-
U12/14	8/-
U17	5/-
U18/20	8/6
U19	40/-
U21	7/-
U22	6/-
U25	12/6
U26	12/6
U27	7/6
U37	20/-
U50	5/-
U52	6/6
U70	4/6
U76	4/-
U78	4/-
U81	10/-
U191	11/-

U193	7/-
U251	6/-
U281	12/-
U282	12/-
U301	11/-
U403	7/-
U404	5/-
U801	17/-
UABC80	5/3
UAF42	9/-
UB41	10/-
UBC41	8/-
UBC81	8/-
UBF80	6/6
UBF89	7/-
UBL21	10/-
UC92	6/-
UCC84	9/-
UCC85	6/6
UCF80	9/6
UCH21	9/6
UCH42	9/-
UCH43	8/-
UCH81	6/3
UCL81	9/-
UCL82	7/3
UCL83	9/-
UF9	10/-
UF41	8/-
UF42	9/-
UF43	8/-
UF80	7/-
UF85	7/6
UF86	9/-
UF89	7/-
UL41	9/-
UL84	6/6
UM4	10/-
UM80	5/-
UM81	10/-
UU5	8/-
UU7	10/-
UU8	7/-
UU9	7/-
UU10	8/-
UY1N	9/-
UY21	9/-
UY41	6/6
UY82	9/6
UY85	6/-
VP23	3/6
VP41	5/-
VU39	8/-
W81M	6/-
W107	7/-
W729	10/-
X76M	7/6
XC12	6/6
XC15	4/6
XC16	7/-
Y63	8/-
Y65	5/-
Z22	5/6
Z62	5/-
Z63	9/-
Z66	10/-
Z759	23/-
Z803U	15/-
Z900T	13/-

TRANSISTORS

OC16	25/-
OC23	15/-
OC24	17/6
OC25	9/6
OC26	8/-
OC28	12/6
OC29	14/9
OC35	12/6
OC36	12/6
OC42	5/-
OC43	9/-
OC44	5/-
OC45	4/6
OC70	5/-
OC71	5/-
OC72	5/-
OC73	9/-
OC75	6/-
OC76	6/-
OC77	8/-
OC78	5/-
OC78D	5/-
OC81M	5/-
OC8DM	5/-
OC83	5/-
OC84	5/-
OC122	14/-
OC139	8/-
OC140	10/-

OC141	22/6
OC170	6/-
OC171	6/-
OC200	7/6
OC201	17/6
OC202	13/6
OC203	10/6
OC204	15/-
OC205	15/-
OC206	22/6
AC107	10/-
AC125	6/6
AC126	6/6
AC127	6/6
AC128	8/-
AC176	7/6
ACY17	8/6
ACY18	5/6
ACY19	6/6
ACY20	5/-
ACY21	6/-
ACY22	5/-
AD140	16/-
AD149	16/-
AF102	18/-
AF114	8/-
AF115	7/-
AF116	7/-

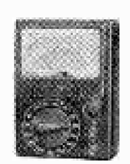
AF117	6/-
AF118	14/-
AF124	9/-
AF125	8/6
AF126	8/-
AF127	8/-
AF178	12/6
AF186	15/-
AFY19	22/6
AFZ11	17/-
AFZ12	12/6
ASY26	6/6
ASY28	6/6
ASZ20	7/6
ASZ21	15/-
BCY33	8/-
BCZ11	10/6
BFY50	6/6
BFY52	6/6
BSY26	8/6
BSY28	9/6
BSY65	8/6
GET103	5/6
GET104	8/-
GET106	16/-
GET113	5/-
GET114	4/-
GET115	8/6

GET116	12/-
GET872	7/3
GET875	9/6
GET880	12/-
MAT101	8/6
MAT120	7/9
MAT121	8/6
V30/30P	20/-
2G309	5/-
2G371A	5/-
2G381	5/-
2G403	6/-
2N410	3/6
2N412	3/6
2N697	13/-
2N706	3/4
2N753	6/6
2N756	6/6
2N1132	27/-
2N1134	37/-
2N1304	6/-
2S002	20/-
2S003	20/-
2S004	20/-
2S005	50/-
2S006	20/-
2S012	140/-
2S018	60/-

THYRISTORS

3/40, 400 p.i.v. 3 amp, stud mounted. Gate voltage 3·0v. at 20mA max 7/6
BLUE SPOT, 200 p.i.v. 5 amp, stud mounted. Gate voltage 3·25v. at 120mA max 12/6
GREEN SPOT, 400 p.i.v. 5 amp, stud mounted. Gate voltage 3·25v. at 120mA max 17/6

MULTIMETERS



TYPE MF 15
A.C. and D.C. voltage ranges: 0-10-50-250-500-1000V.
D.C. current ranges: 500µA-10-100mA.
Resistance ranges: 100MΩ-1MΩ. The meter is also calibrated for Inductance (10-1000H), capacity (0.6µF) and output level measurements. Sensitivity 2000Ω V. Accuracy ±2.5% for D.C. and ±4% for A.C. measurements.
Dimension: 5¼ x 3⅞ x 1⅛in. Price £3.3.0.

Type 108-IT: 24 range precision portable meter. 5000 o.p.v. D.C. Volts: 2.5-10-50-250-500-2500V. A.C. Volts: 10-50-100-250-500-2500V; D.C. current 0.5-5-50-500mA Resistance 2000-20,000 ohms; 2-20 megohms. Power output calibration in A.C. for 600 ohms line. Complete with prods and batteries, £5.5.0. P. & P. 5/-.

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ATTENTION — SALE

Sale of second-hand test equipment, Oscilloscopes, various Units, Chassis, Sub-assemblies, Relays, certain types of surplus Valves, etc., will take place at 44A Westbourne Grove, W.2, on Saturday, 30th September. Stocks must be cleared at *any* price.

ONE DAY ONLY

From 9 a.m. till 6 p.m.

PRACTICAL WIRELESS *blueprints*

The following blueprints are available from stock. **Descriptive text is not available** *but the date of issue is shown for each blueprint. Send, preferably, a postal order to cover cost of the blueprint (stamps over 6d. unacceptable) to Blueprint Department, Practical Wireless, George Newnes Ltd., Tower House, Southampton Street, London, W.C.2.*

Blueprint	Date	Price
The Strand Amplifier; The PW Signal Generator	(Oct. 1962)	5/-
The Berkeley Loudspeaker Enclosure; The Luxembourg Tuner	(Dec. 1962)	5/-
The PW Troubadour; The PW Everest Tuner	(June 1962)	7/6
The PW Britannic Two; The PW Mercury Six	(May 1962)	6/-
Beginner's Short Wave Two; S.W. Listener's Guide	(Nov. 1963)	5/-
PW "Sixteen" Multirange Meter; Test Meter Applications Chart	(Jan. 1964)	5/-
The Celeste 7-transistor Portable Radio; The Spinette Record Player	(June 1963)	5/-
Transistor Radio Mains Unit; 7 Mc/s Transceiver	(June 1964)	5/-
The Citizen	(December 1961)	5/-
The Mini-amp	(November 1961)	5/-
The Beginner's Short Wave Superhet	(Dec. 1964)	5/-
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Electronic Hawaiian Guitar	(June 1965)	5/-
Progressive SW Superhet	(February 1966)	5/-
Beginner's 5-Band Receiver; Home Intercom Unit	(Dec. 1966)	5/-

★ PLEASE NOTE THAT WE CAN SUPPLY NO BLUEPRINTS OTHER THAN THOSE SHOWN IN THE ABOVE LIST. NOR ARE WE ABLE TO SUPPLY SERVICE SHEETS FOR COMMERCIAL RADIO, TV OR AUDIO EQUIPMENT. ★

PRACTICAL WIRELESS *query service*

Before using the query service it is important to read the following notes:

The PW Query Service is designed primarily to answer queries on articles published in the magazine and to deal with problems which cannot easily be solved by reference to standard text books. In order to prevent unnecessary disappointment, prospective users of the service should note that:

(a) We cannot undertake to design equipment or to supply wiring diagrams or circuits, to individual requirements.

(b) We cannot undertake to supply detailed information for converting war surplus equipment, or to supply circuitry.

(c) It is usually impossible to supply information on imported domestic equipment owing to the lack of details available.

(d) We regret we are unable to answer technical queries over the telephone.

(e) It helps us if queries are clear and concise.

***(f)* We cannot guarantee to answer any query not accompanied by the current query coupon and a stamped addressed envelope.**

QUERY COUPON

This coupon is available until 8th September, 1967 and must accompany all queries in accordance with the rules of our Query Service.

PRACTICAL WIRELESS, SEPTEMBER 1967

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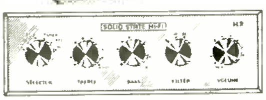

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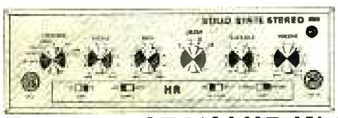

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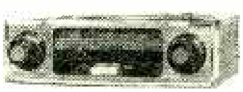

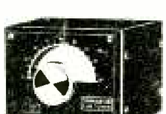

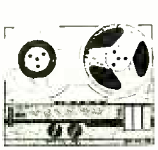

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